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# A comparison of Video Modeling and Pivotal Response Training to teach pretend play skills to children with Autism Spectrum Disorder☆

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A B S T R A C T

This study aimed to directly compare the effectiveness of Pivotal Response Training (PRT) and Video Modeling (VM) in the acquisition and generalization of scripted play verbalizations and actions as well as the use of novel statements or actions in both the training and generalization settings. All five participants were exposed to both conditions and were randomly assigned to the sequence of treatment conditions: participants in Sequence 1 received Condition 1 (VM) followed by and Condition 2 (PRT); participants in Sequence 2 received Condition 2 followed by Condition 1. Results showed a significant increase in the number of play actions for both the PRT and VM conditions in the training environment, with greater increases evident as a result of PRT. Significant increases were also found in the number of play actions in PRT compared to VM in the generalization environment.



Autism Spectrum Disorder (ASD) is a pervasive developmental disorder which is characterised by social difficulties, communicative limitations, and a restricted range of interests and behaviors. The DSM-IV-TR specifies that communication difficulties include a delay in or absence of spoken language, imitation, and pretend play deficits (American Psychiatric Association, 2000). Impairment in play skills is a well-documented feature of ASD. Children with ASD demonstrate limited appropriate use of toys and have specific impairments in symbolic and sociodramatic play (Baron-Cohen, 1987; Stahmer, 1995). Children with ASD rarely engage in creative, spontaneous play activities exhibited by typically developing peers. Rather, they often engage in repetitive and ritualistic actions with toys. They may use toys in a stereotyped manner or line toys up by shape or colour (Paterson & Arco, 2007; Stahmer, 1999). Instruction in play skills is an important aspect of instruction for children with ASD as it facilitates social integration and has been correlated with improvements in language, social skills and general cognitive functioning (Bates, 1979; Dauphin, Kinney, & Stromer, 2004; Sigman & Ungerer, 1984). Play facilitates the acquisition of many aspects of language, including nonverbal cues, turn taking, joint attention, regulation of behavior through requesting, and other social behaviors (Terpstra, Higgins, & Pierce, 2002).

Lifter, Sulzer-Azaroff, Anderson, and Cowdery (1993) highlighted the importance of considering the developmental appropriateness of a play activity when teaching play skills to preschool children with ASD. Results indicate that children consistently demonstrate more acquisition and generalization of the developmentally appropriate activity when the developmental readiness of the child is considered. In a similar study Stahmer (1995) found that children with autism and

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typically developing children of the same language ability performed similarly, when instructed to play symbolically. These results indicate that the level of language skills and developmental levels are important to consider when teaching play skills (Terpstra et al., 2002).

Play behavior in typically developing children emerges in a developmental sequence (Lifter, 2000). Initial instances of play emerge during the first year of life in the form of sensorimotor play (MacDonald, Clark, Garigan, & Vangala, 2005). Sensorimotor play involves the simple manipulation of the toy. By the end of the first year infants begin to combine objects in relational play. Following on from this the child develops more sophisticated play skills during the second year of life. This progression sees the development of pretend play. Pretend play consists of two subcategories: functional and symbolic play. It is during the development of this type of imaginative play that children with ASD experience the greatest difficulty. Functional play emerges first and involves the use of toys in a conventional manner (e.g. using a bottle to feed a doll or putting a toy car in a garage) (Ozonoff & South, 2001). By 18–20 months symbolic play emerges in typically developing children. This consists of reality-oriented play or simple pretense. The child responds to an object's actual properties or expresses knowledge of its conventional use by animating a toy figure or transforming an object (Wolfberg, 1995).

Research has shown that children with ASD may learn to engage in higher levels of play, such as symbolic play. Lewis and Boucher (1988) and McDonough, Stahmer, Schreibman, and Thompson (1997) found that symbolic play can be elicited both verbally and through modeling. A variety of behavioral techniques have been implemented to establish, increase, and improve play skills in children with ASD (Stahmer, Ingersoll, & Carter, 2003). Two methods which have appeared prominently in the research literature are Pivotal Response Training and Video Modeling.

Schreibman (1988) and Koegel and Egel (1979) believe that children with autism have deficits in spontaneous play, during free play settings, that are not as a result of a complete inability to play. Rather, this deficit may be as a result of the fact that children with ASD find play difficult, thus leading to repeated failure during previous attempts. They believe that repeated experiences of failure result in frustration and the child may develop a lack of motivation to play (Stahmer, 1999).

Early research indicates that increasing the motivation of the child has dramatic effects on a child's rate of learning (e.g., Koegel & Mentis, 1985). Pivotal Response Training (PRT) is one such technique which has been developed to increase motivation and enhance generalization in children with ASD (Koegel, O'Dell, & Koegel, 1987). PRT allows the child to choose the activity and provides systematic reinforcement of the child's behavior for all correct responses and appropriate attempts to respond (Stahmer, 1999).

Research on PRT has found increases in social behaviors such as positive responding following training. PRT has been widely used to increase motivation to acquire language skills in children with ASD (Koegel et al., 1989). More recently the technique has proved to be extremely successful in teaching play skills to children with ASD. The success of PRT has been noted at various levels of play skills teaching: manipulative play (Stahmer & Gist, 2001); symbolic play (Stahmer, 1995); and sociodramatic play (Thorp, Stahmer, & Schreibman, 1995). Similarly, generalization of play skills to new toys and new adults as well as the maintenance of the skills over time has been found following PRT (Stahmer, 1995).

In recent years Video Modeling (VM) has emerged as an effective instructional technique to teach play skills to children with ASD. VM is a teaching technique which focuses on learning through observation and imitation of others, that typically involves presenting a videotaped sample of a model engaging in a series of scripted actions and/or verbalizations (Hine & Wolery, 2006). The videotaped model is shown two or three times to the participant (Charlop-Christy, Le, & Freeman, 2000) and subsequently the participant is presented with identical materials and provided with the opportunity to imitate the model. Research by Charlop-Christy et al. (2000) directly compared VM with in vivo modeling and found that children had faster acquisition and better generalization in the VM condition. Similar research by Charlop-Christy and Daneshvar (2003) replicated these findings and found that the skills were maintained over long periods of time. Stahmer et al. (2003) found that VM may be beneficial for children who initially avoid interactions, who present with limited reinforcers to use in more traditional behavioural teaching techniques. Additional advantages included that VM focuses on the visual skills of children with autism rather than the social context that occurs during in vivo modeling. Therefore, this increases the predictability and controllability of the model, which makes learning easier for children with autism as it allows extraneous features to be filtered out (Hine & Wolery, 2006).

Video Modeling interventions can include any number of components but generally involve the following: (a) edited images of appropriate or new behaviour shown on a monitor to a child, (b) repeated clips of the behaviour shown to the participant, (c) discrete practice sessions or role-playing of the new skills, (d) assessment of skill generalisation (e.g. probes across settings, people or materials) and (e) periodic review of tapes, if needed (Hine & Wolery, 2006). Reinforcement has on occasion been used in conjunction with Video Modeling, however, a number of studies have shown that prompting and reinforcement were not necessary for acquisition to occur (Charlop-Christy et al., 2000; D'Ateno, Mangiapanello, & Taylor, 2003; MacDonald et al., 2005; Nikopoulos & Keenan, 2004; Reagon, Higbee, & Endicott, 2006).

Video Modeling has been used to teach: conversational exchanges to children with ASD (Charlop & Milstein, 1989); play-related statements towards siblings (Taylor, Levin, & Jasper, 1999); generalization of toy play (Paterson & Arco, 2007); complex play sequences to a preschoolers (D'Ateno et al., 2003); social initiations (Nikopoulos & Keenan, 2004); pretend play skills to a student with autism with a sibling as model and play partner (MacDonald et al., 2005; Reagon et al., 2006); and play games such as 'tag', 'red rover', and card games (Charlop-Christy et al., 2000).

The purpose of the current study was to directly compare the effectiveness of PRT and VM in the acquisition and generalization of scripted statements and actions as well as the use of novel statements or actions in both the training and generalization settings. These two procedures were selected due to their prominence in the literature in teaching play skills to children with autism. PRT represents a longstanding multi-component intervention including modeling, reinforcement, and enhancing motivation whereas VM represents a more modern technique using visual cues through digital media. The aim of this study is to compare two contrasting approaches by comparing the naturalistic behavioural strategies of PRT which focuses on the child's motivation and naturally occurring contingencies to the more structured teaching approach of VM which focuses on the predictability and repeated presentation of target behaviours, for teaching independent play skills to children with Autism Spectrum Disorder.

## 1. Method

### 1.1. Inclusion criteria for participation and measures

Inclusion criteria were set to ensure that the participants had adequate language ability to commence instruction in pretend play skills. All participants were required to have a similar language ability to typically developing children age two years of age given that it is in the second year of development that pretend play skills emerge. Secondly, measures of autism severity and play skills were taken to verify that there were no differences between the participants on these variables prior to treatment.

*Language assessment*. The Verbal Comprehension and Naming Vocabulary subscales of the BAS-II (Elliott, Smith, & McCulloch, 1996) were administered to each participant to assess receptive and expressive language abilities. The BAS-II is a battery of tests of cognitive abilities, which index educational achievement. It is suitable for use with children and adolescents from 2 years 6 months to seventeen years, eleven months. These scales allow the calculation of an age equivalence score. The floor scores for age equivalence of 2 years and 6 months or below are: Verbal Comprehension (ability score 10–86) and Naming Vocabulary (ability score 10–65). This scale is validated on a British population and has been used in a wide range of diagnostic contexts and as an aid in identification, classification and selection of children with learning difficulties (Elliot, 1983, 1986).

*Autism severity*. The Autism Behavior Checklist (ABC; Krug, Arick, & Almond, 1978) was administered to the participant's classroom instructor to assess the participant's level of autism. The ABC is part of a broader tool, the Autism Screening Instrument of Educational Planning (ASIEP) (Kurg et al., 1978). It is designed to identify children with autism within a population of school-age children with severe disabilities, and can be used with children as young as 3 years of age. The ABC consists of a list of 57 questions based on the atypical behavior characteristics of children suspected of having autism. The questions are divided into five categories: sensory, relating, body and object use, language and social and self help. The respondent provides yes or no responses to each question and the participant receives a score of 1–4 for yes responses. The ABC accurately identifies 92% of children with autism presenting with overall scores equal to or greater than 49 points (Marteleto & Pedromonico, 2005).

*Play skills*. The Preschool Play Behavior Scale (PPBS; Coplan & Rubin, 1998) is a teacher rating scale designed to assess the multiple forms of young children's solitary behaviours. The PPBS is an 18 item rating scale which evaluates social and non-social behaviors during peer play. This scale consists of items for five play factors including; reticent behavior, solitary-passive behavior, solitary-active behavior, social play and rough and tumble play. Each item is rated on a five point Likert scale to determine how often the participant typically engages in the behaviour (never, hardly ever, sometimes, often, very often). To score the measure, the relevant items for each factor are summed to provide the participant with a score for each of the five factors. The PPBS was administered to the participant's classroom instructor to assess social play behavior. The internal consistency of this scale is above .80.

### 1.2. Participants

All 5 participants had an independent diagnosis of Autistic Disorder (AD) which met the criteria outlined in the DSM-IV-TR, by an Irish Clinical Psychologist independent of the study.

Participant 1 was a boy aged 3 years ten months at the time of the study. He had a Developmental Quotient of 85, as measured by the Bayley Scale of Infant Development-revised (Bayley, 1993) by an Irish Clinical psychologist independent of the study. Participant 1 had an autism severity rating of 83 as measured by the Autism Behavior Checklist (ABC; Kurg et al., 1978) which was completed by a staff member who had known the participant for a minimum of at least six months. Participant 1 attended an Applied Behavior Analysis preschool, and had an expressive vocabulary age equivalent of 3 years and 1 month (ability score 74), as measured by the Naming Vocabulary subscale of the British Ability Scales (BAS II; Elliott et al., 1996) and a receptive vocabulary age equivalent of 2 years 7 months (ability score 88), as measured by the Verbal Comprehension subscale of the BAS II, which was administered by the experimenter prior to commencing the study. Participant 1 utilized three- to four -word sentences to request (e.g. I want train) and three word sentences to label items (e.g. It's a ball). Participant 1 engaged in solitary play which was off a constructive, exploratory and functional nature. Participant 1 was scored on the PPBS for Solitary passive play, Solitary active play, Social play, and Rough and tumble play (17, 9, 15, and 5 respectively).

Participant 2 was a boy aged 6 years and 1 month at the time of the study. He had an IQ test score of 55, as measured by the Wechsler Preschool and Primary Scale of Intelligence 3rd Edition (WPPSI-III; Wechsler, 2002) by an Irish Clinical Psychologist independent of the study. Participant 2 had an autism severity rating of 72 as measured by the ABC, which was completed by a staff member who had known the participant for a minimum of at least six months. He was characterised by his teacher and family as socially unresponsive. Participant 2 attended an Applied Behavior Analysis preschool, and had an expressive vocabulary age equivalent of 3 years and 1 month (ability score 74), as measured by the Naming Vocabulary subscale of the BAS II and a receptive vocabulary age equivalent of 2 years 6 months (ability score 66) as measured by the Verbal Comprehension subscale of the BAS II, which was administered by the experimenter prior to commencing the study. Participant 2 utilized three- to four -word sentences to request (e.g. I want juice please), and three word sentences to label items (e.g. It's a car). Participant 2 refrained from engaging in play activities when presented with the opportunity, he remained unoccupied or observed other children playing. Participant 2 was scored on the PPBS for Solitary passive play, Solitary active play, Social play, and Rough and tumble play (4, 2, 6, and 2 respectively).

Participant 3 was a boy aged 5 years and 8 months at the time of the study. He had an IQ test score of 59, as measured by the Stanford-Binet Intelligence Scales 5th Edition (Roid, 2003) by an Irish Clinical Psychologist independent of the study. Participant 3 had an autism severity rating of 74 as measured by the ABC which was completed by a staff member who had known the participant for a minimum of at least six months. Participant 3 attended an Applied Behavior Analysis preschool, and had an expressive vocabulary age equivalent of 3 years and 4 months (ability score 78), as measured by the Naming Vocabulary subscale of the BAS II and a receptive vocabulary age equivalent of 3 years 4 months (ability score 102), as measured by the Verbal Comprehension subscale of the BAS II, which was administered by the experimenter prior to commencing the study. Participant 3 utilized full sentences to request (e.g. I want the airplane please) and used three- to four- word sentences to label items (e.g. It's a brown dog). Participant 3 engaged in solitary play which was off a constructive, exploratory and functional nature. Participant 3 was scored on the PPBS for Solitary passive play, Solitary active play, Social play, and Rough and tumble play (15, 6, 14, and 3 respectively).

Participant 4 was a boy aged 5 years 6 months at the time of the study. He had an IQ test score of 104, as measured by the Stanford-Binet Intelligence Scales 5th Edition (Roid, 2003) by an Irish Clinical Psychologist independent of the study. Participant 4 had an autism severity rating of 93 as measured by the ABC, which was completed by a staff member who had known the participant for a minimum of at least six months. Participant 4 attended an Applied Behavior Analysis preschool, and had an expressive vocabulary age equivalent of 3 years and 7 months (ability score 83), as measured by the Naming Vocabulary subscale of the BAS II and a receptive vocabulary age equivalent of 3 years 1 month (ability score 97), as measured by the Verbal Comprehension subscale of the BAS II, which was administered by the experimenter prior to commencing the study. Participant 4 utilized full sentences to request (e.g. Can I have a drink of juice please) and used three- to four- word sentences to label items (e.g. It's a white bus). Participant 4 engaged in solitary play which was off a constructive, exploratory and functional nature. He was characterized by his teacher as not engaging in group play settings. Participant 4 was scored on the PPBS for Solitary passive play, Solitary active play, Social play, and Rough and tumble play (15, 3, 10, and 2 respectively).

Participant 5 was a boy aged 4 years 6 months at the time of the study. He had an IQ test score of 72, as measured by the BAS by an Irish Clinical Psychologist independent of the study. Participant 5 had an autism severity rating of 50 as measured by the ABC, which was completed by a staff member who had known the participant for a minimum of at least six months. Participant 5 attended an Applied Behavior Analysis school, and had an expressive vocabulary age equivalent of 4 years and 4 months (ability score 92), as measured by the Naming Vocabulary subscale of the BAS II and a receptive vocabulary age equivalent of 2 years 6 months (ability score 80), as measured by the Verbal Comprehension subscale of the BAS II which was administered by the experimenter prior to commencing the study. Participant 5 utilized six- to seven -word sentences to request (e.g. I want the big red cup please) and three- to four- words to label items (e.g. It's a tall tree) but presented with difficulty in the use of pronouns (e.g. mine/yours). Participant 5 engaged in solitary play which was off a constructive, exploratory and functional nature. He was characterised by his teacher and family as socially unresponsive. He is reported to have spent free-play sessions sitting alone manipulating objects. Participant 5 was scored on the PPBS for Solitary passive play, Solitary active play, Social play, and Rough and tumble play (9, 3, 6, and 3 respectively).

### *1.3. Experimental design*

All participants were exposed to both conditions: Condition 1 (Video Modeling) and Condition 2 (Pivotal Response Training). Assignment to the sequence of conditions was necessary to ensure that the presentation of the training procedures were presented in a counterbalanced fashion to minimise carry over effects. Participant names were written on paper and chosen at random. Participants 1, 2, and 3 were assigned to Condition 1 first followed by Condition 2 (Sequence 1), while Participants 4 and 5 were assigned to Condition 2 first followed by Condition 1 (Sequence 2).

### *1.4. Settings and training materials*

Training took place in a room in the participants' school. The generalization setting was the play area of the participant's own classroom. Video models were acquired from the New England Centre for Children (NECC). NECC provide a play curriculum which instructs children with ASD to acquire play skills according to the typical developmental sequence. The curriculum provides a wide range of video models suitable for all levels of play development including toy construction, simple toy play, pretend play, and socio-dramatic play. The video models provide an appropriate model of play actions and verbalizations which can be imitated using identical toys. One video model was selected per participant, to be used during the study.

The VM training toys were identical to those in the video model (e.g. a circus by Fisher Price® Little People). Training toys for PRT were toys identified to be preferred by the participant (e.g. Barney zoo, Peppe Pig Playground Pals, etc.). All toys were acquired for the purpose of the study and were novel to all the participants at the outset of the study.

### 1.5. Video measures

Each participant was videotaped before treatment (Baseline probe) and after each treatment (follow-up probes). The video taping took place in both the generalization and training settings, with the participant and the experimenter present. These video segments were 4 minutes in duration. All probe sessions were videotaped. The toys used during videotaped sessions were the toys used during play skills training. No other toys were available. Data were collected on the duration of interaction with toys, the number of play actions and verbalizations appropriate to the play theme.

### 1.6. Dependent measures

The participants' responses were scored from video footage taken during baseline and follow-up probes. The number of verbalizations and play actions, as well as scripted and unscripted play actions and verbalizations were scored for all sessions. The dependent measures were the duration of interaction with toys, the number of scripted and unscripted play verbalizations during VM and the number of play verbalizations during PRT as well as the number scripted and unscripted play actions during VM and the number of play actions during PRT.

The duration of interaction with toys was defined as the duration in which the participant used an object in a manner for which it was intended, where one response lead to or preceded another in the accomplishment of some project or task. For example, pushing a police car while making an appropriate car sound.

Play actions were defined as motor responses which resulted in a change in the environment (e.g. pushing a car, or moving a character to another location) which were appropriate to the context of the toy and context. Scripted play actions were defined as motor responses that matched the actions of the video model and resulted in the same change in the environment as seen in the model. Unscripted play actions included actions which were not modelled in the video script but which were appropriate to the context of the toy.

Play verbalizations were defined as any verbalization which was appropriate to the play context and included statements made by the figurines or sounds associated with their actions. Scripted verbalizations were defined as those verbalizations that matched those from the video model. A verbalization was scored as a scripted verbalization if the participant verbally stated all of the words in the script from the video model. In addition, verbalizations that were similar to the modelled response but not identical were also scored (e.g. for participants who typically only used three to four word sentences, verbalizations which included three- to four-word statements were accepted). This included the substitution or omission of a word (e.g. 'Wee, it's scary!' instead of 'Wee, this is scary'). Unscripted verbalizations were any play related phrases presented in a full sentence which were appropriate to the context (e.g. 'This car goes fast!') However, the occurrence of verbal statements in the absence of related play actions, such as talking about objects not in view or unrelated to play or making sounds with no corresponding play action, were not recorded as appropriate play. Similarly, repetitions of prior verbalizations were not scored.

During VM and PRT training sessions data was gathered on each participants responses. During VM data was gathered on play actions and play verbalizations. Play actions were defined as motor responses that matched the actions of the video model and resulted in the same change in the environment as seen in the model. Play verbalizations were defined as those verbalizations that matched those from the video model. A verbalization was scored as a scripted verbalization if the participant verbally stated all of the words in the script from the video model. In addition, verbalizations that were similar to the modelled response but not identical were also scored (e.g. for participants who typically only used three to four word sentences, verbalizations which included three- to four-word statements were accepted).

During PRT data was gathered on independent play actions, prompted play actions, independent play verbalizations and prompted play verbalizations.

Independent play actions were defined as independent motor responses emitted by the participant which resulted in a change in the environment (e.g. pushing a car, or moving a character to another location) which were appropriate to the context of the toy and context. Prompted play action were defined as a motor response emitted by the participant which was modelled by the experimenter, this resulted in imitation by the participant which resulted in a change in the environment.

Independent play verbalizations were defined as any verbalization which was appropriate to the play context and included statements made by the figurines or sounds associated with their actions. A prompted play verbalization was scored if the participant verbally stated all of the words modelled by the experimenter. In addition, verbalizations that were similar to the modelled response but not identical were also scored (e.g. for participants who typically only used three to four word sentences, verbalizations which included three- to four-word statements were accepted).

### 1.7. Baseline

Baseline measures were obtained prior to play skills teaching. The experimenter administered the standardized assessments to the participant and the PPBS and ABC were administered to classroom instructors. Baseline video probes were also obtained. The experimenter entered the room with the participant. The toys were arranged on the floor in the middle of the room. The materials available consisted of the toys used in the play skills training conditions. The session began with the experimenter instructing the participant to 'Go and play'. The experimenter stood behind the participant, and did not provide any additional instructions, reinforcement, prompts or corrections during baseline. The participant was given 4 minutes of free play with the toys. If the participant tried to leave the area before the 4 minutes finished, they were redirected back to the play materials. Data were collected on the duration of interaction with toys, the number of play actions and verbalizations appropriate to the play theme. Baseline probes were taken in the training and generalization settings.

### *1.8. Play skills training*

*Video Modeling.* Video Modeling consisted of: (a) edited images of new behaviour shown on a monitor to a child, (b) repeated clips of the behaviour shown to the participant, (c) discrete practice sessions of the new skills, and (d) assessment of skill generalisation (e.g. probes across settings). The participant entered the training setting with the experimenter. The training setting included a television located on a small table and a chair approx. 3 feet from the screen; the toy required for training was situated on the floor in the centre of the room. Treatment sessions were conducted twice daily. Participants received a maximum of two sessions per day, until criteria were achieved. The participant was instructed to 'Watch the T.V.'. The participant was shown the video model twice. The video model consisted of a video segment, 1 and a half minutes in duration, and consisted of twelve actions and verbalizations which were made by animal figurines (e.g. Action: Move through curtains, Verbalization: "Step right up to the world's most amazing animal show").

Following this the participant was instructed to 'Go and Play'. The participant did not receive instructions, prompts, or reinforcement during play. The participant was allowed 4 minutes to play. During play the experimenter gathered data on the number of scripted actions and verbalizations. The Video Modeling training continued until the participant reached mastery criterion. Mastery criterion was the emission of 90% of the scripted actions and verbalizations demonstrated by the video model. Training was discontinued following 10 sessions if none of the scripted actions or verbalizations were recorded, or following 15 sessions during which the 90% criterion was not achieved.

*Pivotal Response Training.* The participant entered the training setting with the experimenter. The training setting was the same as that used for Video Modeling. The toys required for training were situated on the floor in the centre of the room. Each child was presented with three toys during each PRT session. Toys for each child were selected based on an informant-based preference assessment carried out by the class teacher. Treatment sessions were conducted two to three times daily for half hour sessions, until 10 hours of training was achieved. Training was carried out in accordance with the Pivotal Response Training manual by Koegel et al. (1989). The treatment was modified to use symbolic pretend play as the target behavior instead of language. Thus, the experimenter required the participants to engage in symbolic play in order to gain access to the toys.

The following parameters were emphasized during treatment: (a) the experimenter presented toys according to the participant's selection of a preferred toy (by eye gaze, touching, or verbal request); (b) the toys were varied frequently, according to the participant's interest, thus ensuring motivation and enhanced performance of the participants; (c) the experimenter used turn taking with the toys to provide models of symbolic play actions and verbal statements, this also enabled the experimenter to control the pace of training; (d) if the participant failed to respond, the experimenter played with the toy and modelled the response again; (e) reinforcement was provided for both exact imitation of the experimenter model or an approximation of the modelled behavior; (f) the participant's response was reinforced with the opportunity to play with the toy and receipt of praise; (g) play at lower levels (e.g., functional play) was interspersed with symbolic play to ensure success for the participant, to increase variation in play style and to reduce stereotyped play; and (h) as the participant improved with symbolic play, he was expected to engage in more complex play. During play the experimenter gathered data on the number of actions independent or prompted and the number of verbalisations independent or prompted.

### *1.9. Follow-up probes*

Follow-up probes were obtained following the student achieving mastery criterion on each method of play skills training or reaching criterion to have training discontinued. Follow-up probes were similar to baseline probes. The experimenter entered the room with the participant. The toys were arranged on the floor in the middle of the room. The materials available consisted of the toys used during play skills training. During PRT follow-up probe only toys from the PRT sessions were available. Similarly, during VM follow-up probes only the toy from the VM sessions was available. The session began with the experimenter telling the participant to 'Go and play'. The experimenter stood behind the participant, and did not provide any additional instructions, reinforcement, prompts or corrections during baseline. The participant was given 4 minutes of free play with the toys. If the participant tried to leave the area before the 4 minutes finished, they were redirected back to the materials. Data were collected on the duration of interaction with toys, the number of play actions and verbalizations appropriate to the play theme. Follow-up probes were recorded in the in the training and generalization settings.

### *1.10. Interobserver agreement*

Interobserver agreement was determined by having a second observer, who independently and simultaneously recorded the frequency of duration of interaction with toys, as well as the number of play verbalizations and actions during Video

Modeling and pivotal response probes. Interobserver agreement was calculated by dividing the total number of agreements by the total number of agreements and disagreements and multiplying by 100. Interobserver agreement was conducted for 50% of all probe sessions, with a mean agreement of 98.4% and a range of 91–100%.

## 2. Results

### 2.1. Preliminary analysis

Independent *t*-tests were conducted to examine differences between participant's baseline assessments of age, IQ, verbal comprehension and naming vocabulary, level of autism severity and the five types of play measured using the PPBS: reticent play, solitary-passive play, solitary-active play, social play, and rough and tumble play. For participant characteristics see Table 1.

No significant difference was found between age, IQ test scores, verbal comprehension, naming vocabulary and autism severity ratings for participants in Sequence 1 (Condition 1 followed by Condition 2) and Sequence 2 (Condition 2 followed by Condition 1. Similarly, no differences were found between reticent play, solitary-passive play, solitary-active play, social play, and rough and tumble play for participants in both sequences. Correspondingly, the results indicate that there were no significant differences in baseline measures between participants in Sequence 1 and Sequence 2 prior to play skills training.

All participants successfully completed 10 hours of PRT carried out in 20 half hour sessions. Participant responding during PRT is presented in Fig. 1. Each Video Modelling session lasted approximately 8 minutes. Criterion for Video Modeling was set at 90% and was achieved by Participants 1 and 4 (see Fig. 2), following 80 minutes of VM. Training for Participants 2, 3 and 5 was discontinued having failed to reach the pre-determined criterion. Training for participant 2 was discontinued following 10 sessions (80 minutes of VM) with 0% acquisition of scripted actions and verbalizations. Training for Participants 3 and 5 was discontinued following 15 sessions (120 minutes of VM) without reaching the required 90% criterion. The highest rate of correct responding during Video Modeling for Participants 3 and 5 was 37% and 79% respectively (see Fig. 2).

### 2.2. Play skills training

Four paired samples *t*-tests were conducted to compare baseline and follow-up probe scores for the number of play actions and verbalizations in both training and generalization environments for PRT. Similarly, four paired sample *t*-tests were conducted to compare baseline and follow-up probe scores for the number of play actions and verbalizations in both training and generalization environments for VM. Fig. 3 displays the number of actions and verbalizations emitted by each participant during baseline and follow-up probes for both VM and PRT.

Means, standard deviations and mean differences of the number of actions and verbalizations in baseline and follow-up probes for PRT and VM in both the training and generalization environments are presented in Figs. 4 and 5.

*Pivotal Response Training.* A paired samples *t*-test compared the number of PRT baseline and follow-up probe actions in the training environments. Results indicate a significant difference between the number of play actions between baseline and follow-up probes in the training environment, $t\,(4) = -6.86$, $p = .002$. A second paired samples *t*-test compared the number of PRT baseline and follow-up probe verbalizations in the training environment. Results found that no significant difference existed between the number of play verbalizations between baseline and follow-up probes in the training environment, $t\,(4) = -1.98$, $p = .119$. The third paired samples *t*-test compared the number of PRT baseline and follow-up actions in the generalization environment. Results indicate a significant difference in the number of play actions between baseline and follow-up probe actions in the generalization environment, $t\,(4) = -5.46$, $p = .005$. The final paired samples *t*-test compared the number of PRT baseline and follow-up verbalizations in the generalization environment. Results found no statistical significance between the number of play verbalizations between baseline and follow-up probes in the generalization environment, $t\,(4) = -2.64$, $p = .058$.

*Video Modeling.* A paired samples *t*-test compared the number of VM baseline and follow-up probe actions in the training environments. Results indicate a significant difference between the number of play actions between baseline and follow-up probes in the training environment, $t\,(4) = -3.14$, $p = .035$. A second paired samples *t*-test compared the number of VM baseline and follow-up probe verbalizations in the training environment. Results showed that no significant difference

**Table 1**
Baseline scores of participant characteristics including age, IQ test score, expressive language, receptive language and level of autism severity. Sequence 1 entailed Video Modeling followed by Pivotal Response training. Sequence 2 entailed Pivotal Response Training followed by Video Modeling.

| | Age | IQ test score | Age Equivalence | | Autism severity | Sequence |
|---|---|---|---|---|---|---|
| | | | Expressive language | Receptive language | | |
| Participant 1 | 3:10 | 85 | 3:1 | 2:6 | 83 | 1 (VM/PRT) |
| Participant 2 | 6:1 | 50–55 | 3:1 | 2:6 | 72 | 1 (VM/PRT) |
| Participant 3 | 5:8 | 59 | 3:4 | 3:4 | 74 | 1 (VM/PRT) |
| Participant 4 | 5:6 | 104 | 3:7 | 3:1 | 93 | 2 (PRT/VM) |
| Participant 5 | 4:6 | 72 | 4:4 | 2:6 | 50 | 2 (PRT/VM) |

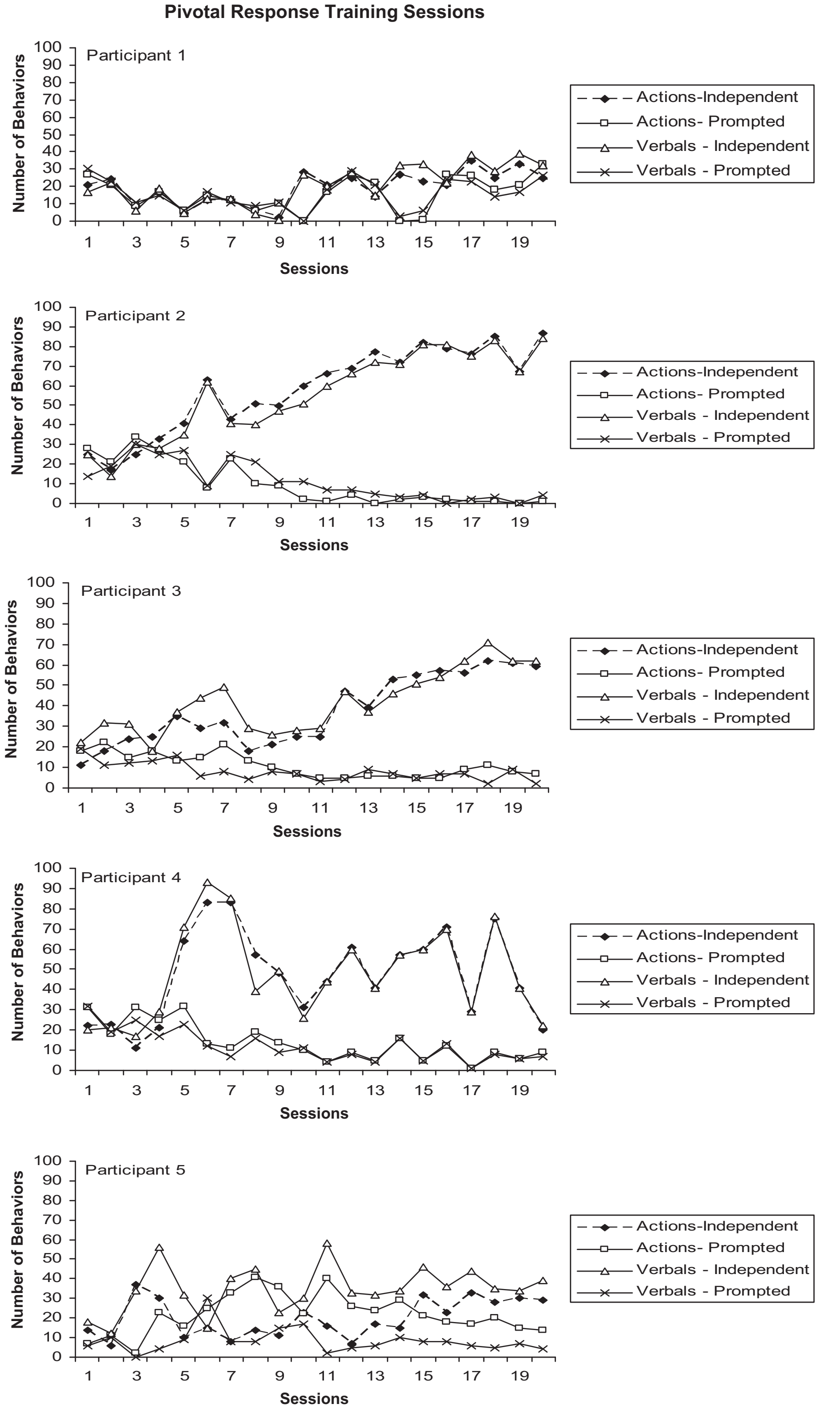


**Fig. 1.** Participant's independent responses to experimenter models for both play actions and verbalizations during Pivotal Response Training.

between the number of play verbalizations between baseline and follow-up probes in the training environment, $t(4) = -2.23$, $p = .089$. The third paired samples $t$-test compared the number of VM baseline and follow-up actions in the generalization environment. Results indicate that there was no significant difference in the number of play actions between baseline and follow-up probes in the generalization environment, $t(4) = -2.15$, $p = .098$. The final paired samples $t$-test compared the number of VM baseline and follow-up verbalizations in the generalization environment. Results showed no statistical significance between the number of play verbalizations between baseline and follow-up probes in the generalization environment, $t(4) = -2.18$, $p = .094$.

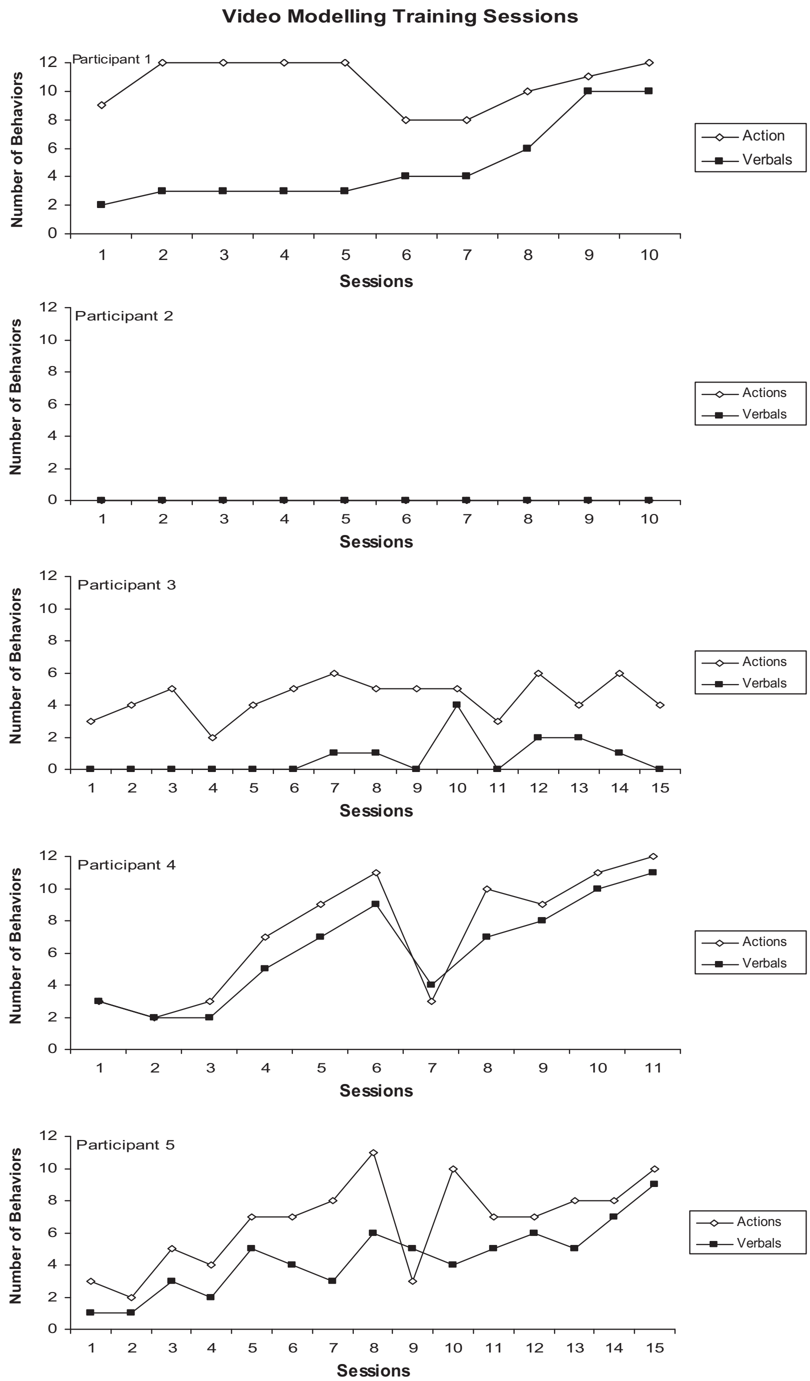


**Fig. 2.** Participant's correct responses of scripted actions and scripted verbalizations during Video Modeling.

*Duration of interaction with toys.* Two paired samples *t*-test were carried out to compare the differences in the duration of interaction with training toys following PRT and VM training. A paired samples *t*-test compared the differences in mean duration of interaction with training toys in baseline and follow-up probes for VM. Results found no significant difference between the duration of interaction with the toys in baseline and follow-up probes, $t(4) = -.310$, $p = .772$. Similarly, a paired samples *t*-test compared the differences in mean duration of interaction with training toys in baseline and follow-up probes for PRT. Results found no significant difference between the duration of interaction with the toys in baseline and follow-up probes, $t(4) = -1.00$, $p = .374$.

*Comparison of PRT and VM.* Further to the analysis carried out to compare differences between baseline and follow-up probes an additional four paired *t*-test were carried out the investigate differences in the number of play actions and

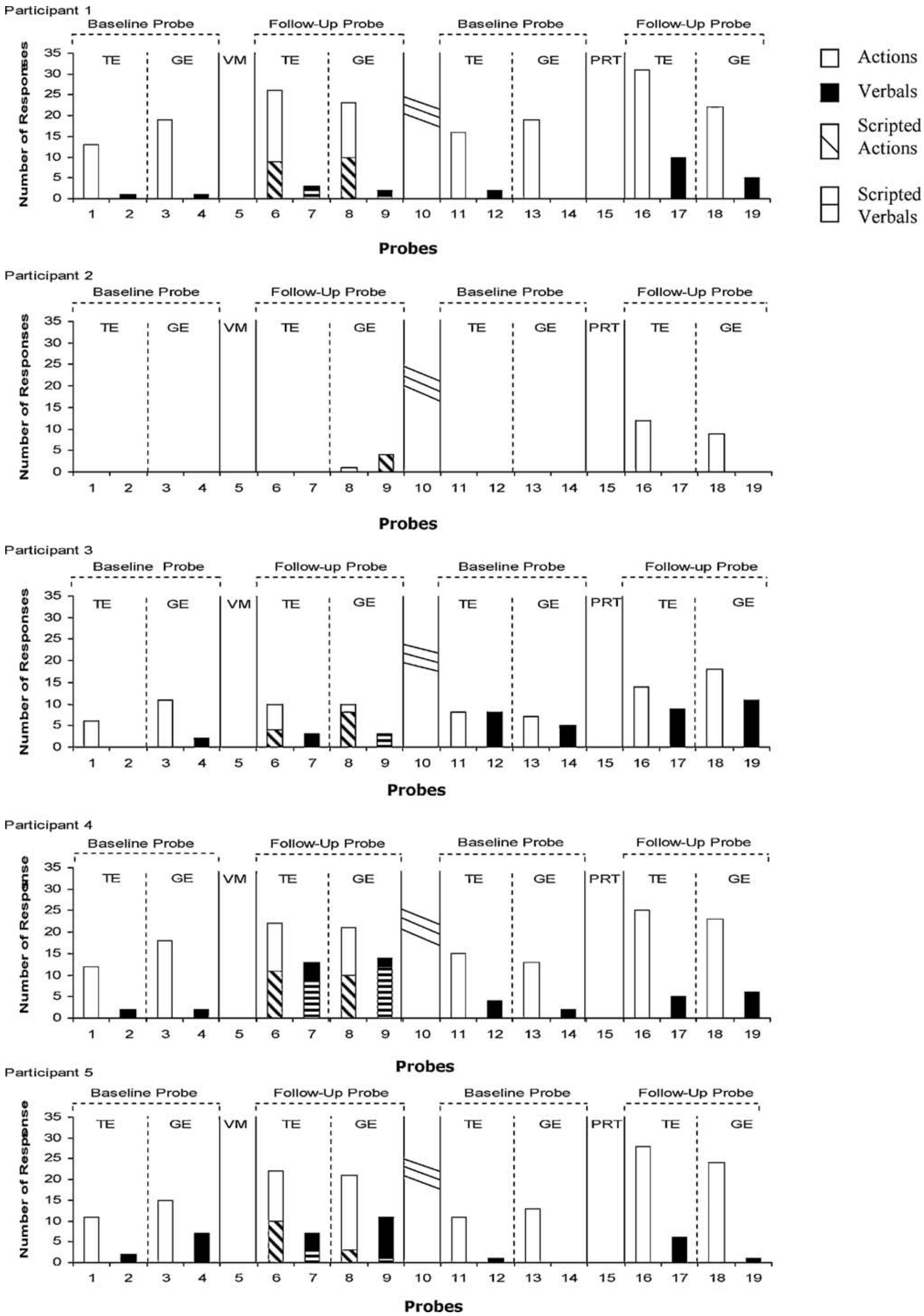


**Fig. 3.** The number of play actions, scripted play actions, play verbalizations and scripted play verbalizations emitted during baseline and follow-up probes following Video Modeling (VM) and Pivotal Response Training (PRT) in both the training environment (TE) and generalization environments (GE).

verbalizations between Pivotal Response Training and Video Modeling. For this analysis the mean differences in the number of play responses between baseline and follow-up probes were used for each participant. Fig. 3 shows the number of baseline and follow-up actions and verbalizations emitted by each participant.

A paired samples *t*-test compared the mean differences in the number of play actions between PRT and VM in the training environments. Results indicate that there is no significant difference between the number of play actions between PRT and VM in the training environment, $t(4) = 1.91$, $p = .129$. A second paired samples *t*-test compared the mean differences in the number of play verbalizations between PRT and VM in the training environment. Results found that no significant difference existed between the number of play verbalizations between PRT and VM in the training environment, $t(4) = -.466$, $p = .666$.

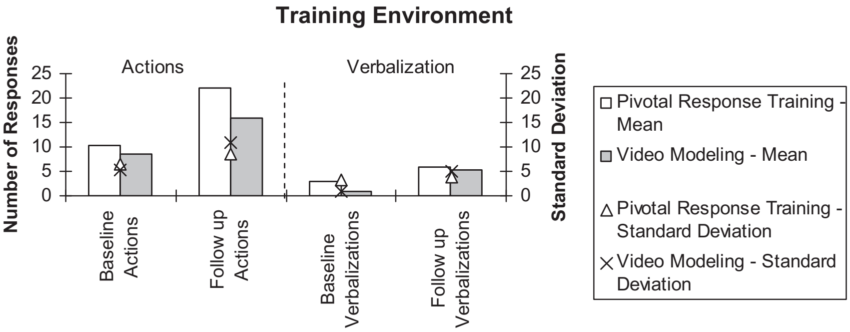


**Fig. 4.** The means, standard deviation for play actions and verbalizations in both baseline and follow-up probes for Pivotal Response Training (PRT) and Video Modeling (VM) in the training environment.

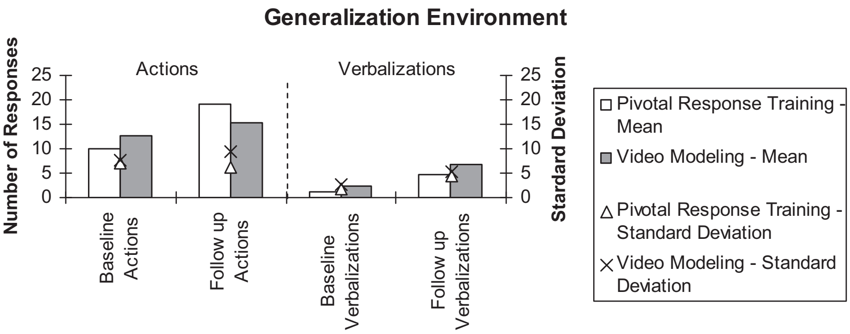


**Fig. 5.** The means, standard deviation for play actions and verbalizations in both baseline and follow-up probes for Pivotal Response Training (PRT) and Video Modeling (VM) in the generalization environment.

The third paired samples *t*-test compared the mean differences in the number of play actions between PRT and VM in the generalization environment. Results indicate that there was a significant difference in the number of play actions between PRT and VM in the generalization environment, $t\ (4) = 3.09$, $p = .037$. It was found that PRT resulted in a statistically significant greater number of play actions in the generalization environment compared to VM. The final paired samples *t*-test compared the mean differences in the number play verbalizations between PRT and VM in the generalization environment. Results found no statistical significance between the number of play verbalizations between PRT and VM in the generalization environment, $t\ (4) = -.383$, $p = .721$.

To conclude eight independent *t*-tests were carried out to compare if participants responding differed depending on whether they received Sequence 1 or Sequence 2. The eight independent *t*-tests compared the mean differences of play actions and play verbalizations in Pivotal Response Training and Video Modeling in both the training and generalization environments. All 8 independent *t*-test were non-significant which indicates that the sequence of treatment had no effect on the number of play actions or verbalizations emitted by participants.

## 3. Discussion

Results of the current study found that children with ASD who have sufficient language skills can increase their pretend play skills through Pivotal Response Training and Video Modeling. The results show that Pivotal Response Training had a significant increase in the number of play actions emitted by the participants in the follow-up probe compared to the baseline probe in the training environment. In this condition participants showed a mean difference between probes of 11.6 actions. Correspondingly, analysis of Video Modeling found that there was a similar significant increase in the number of play actions emitted by participants in the follow-up probe compared to the baseline probe in the training environment. However, this increase was smaller in magnitude with a mean difference between probes of 7.6 actions. In the generalization environment it was found that Pivotal Response Training also had a significant increase in the number of play action emitted by the participants in the follow-up probe compared to the baseline probe, with an increase of 9.2 actions. However, this was not found for Video Modeling. Neither Pivotal Response Training nor Video Modeling condition showed a significant increase in the number of play verbalizations emitted in training or generalization environments. Finally, in a comparison of the mean differences between Pivotal Response Training and Video Modeling a significant difference was found between the number of play actions emitted by participants in the generalization environments. Results show that Pivotal Response Training resulted in a significantly greater number of play actions than Video Modeling.

These results support earlier findings that Pivotal Response Training can result in increases in social behaviors such as play skills (e.g., Stahmer, 1995). Stahmer (1995) found that Pivotal Response Training lead to generalization of play skills to new toys, adults and settings, as well as the maintenance of the skills over time. Thus, these findings are in accordance with Koegel et al. (1987) and Stahmer (1995) indicating that Pivotal Response Training is an effective method for increasing motivation and enhancing generalization in children with ASD by reinforcing correct responses and appropriate attempts to respond.

The current study was the first direct comparison of Pivotal Response Training and Video Modeling. However, previous comparison studies have been conducted by Charlop-Christy et al. (2000) and Charlop-Christy and Daneshvar (2003) to directly compared Video Modeling with in vivo modeling. Both studies found that children showed faster acquisition and better generalization in the Video Modeling condition. This study also found that Video Modeling led to a significant increase in the number of play actions emitted by participants following training in the training environment. However, in contrast to these findings the current study found no significant increase between the number of play actions or verbalizations emitted by participants from baseline to follow-up probes in the generalization environment.

In much of the previous research on Video Modeling (e.g., Charlop-Christy & Daneshvar, 2003; Charlop-Christy et al., 2000) researchers refer to the faster acquisition achieved by Video Modeling. From the research carried out it is clear that Video Modeling was successful at increasing the number of play actions emitted by participants in the follow-up probe in the training environment. Similarly, it is noted that Video Modeling training is short in duration, with videotaped models being brief and easy to implement, therefore this may be an advantage within a classroom setting. However, it must be noted that the 90% criterion for Video Modeling was only successfully completed by two of the five participants. In contrast, all participants completed the 10 hours of Pivotal Response Training. The implementation of Pivotal Response Training was found to be more time consuming than Video Modeling as sessions were a half-hour in duration.

The current research aimed to directly compare the effectiveness of Pivotal Response Training and Video Modeling in the acquisition and generalization of play actions and verbalizations. The current findings indicate that both Pivotal Response Training and Video Modeling were effective at increasing play actions in the training environment, with greater mean differences resulting from Pivotal Response Training. Similarly, a significant increase in the number of play actions in the generalization environment was only evident from Pivotal Response Training.

One limitation of the current study was that a criterion for discontinuation had to be set for the Video Modeling training. A second limitation of the study was that no criterion was set for Pivotal Response Training. The findings from the present study raise some suggestions for possible future research. Primarily, more comparison studies should be carried out to verify the findings of the current study. In the current study the two interventions required varying durations of input. Future research could examine if generalization was correlated with duration of intervention by comparing the same duration of intervention under both conditions. Similarly, future research could investigate why comparable increases in play verbalizations were not observed in accordance with increases in play actions, as well as looking at the complexity of play. The current study compared Pivotal Response Training and Video Modeling in the teaching of pretend play skills, future research could investigate these two teaching methods on various levels of play skills (e.g. toy construction or socio-dramatic play). Similarly, future research could examine the combined effectiveness of the use of these intervention (e.g. by using Video Modeling to teach initial object manipulation and then using Pivotal Response Training to establish generalization.

To conclude, Pivotal Response Training and Video Modeling were both found to be effective means of increasing pretend play actions in children with ASD. However, Pivotal Response Training showed a greater increase in the number of play actions observed. In addition, Pivotal Response Training showed significant increases in generalization as well as in the training environment. The current findings add to the success of Pivotal Response Training in teaching play skills at various developmental levels to children with ASD.

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