TEACHING A CHILD WITH AUTISM TO IMITATE IN NATURAL CONTEXTS USING VIDEO MODELING

by

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ABSTRACT

Imitation is a core deficit often observed in children diagnosed with autism. Video modeling has been shown to be effective for teaching children with autism a variety of skills, but there is little research demonstrating the effectiveness of this technique with core skills such as imitation. The purpose of this study was to examine the effectiveness of a video modeling intervention to teach a preschool-age child with autism to imitate novel and acquired actions (with and without objects) in natural contexts (i.e., songs and toy play activities). A general case approach was used to examine the instructional universe of common preschool songs in order to select the exemplars that were most likely to facilitate generalization. In addition to video modeling, additive components that included highlighting the critical features of the video examples and prompting/fading were required to demonstrate a functional relationship. Experimental control was evident in a multiple baseline design across three imitation activities. The results are discussed with reference to previous research, future research directions, and implications for practice in educational settings.

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CHAPTER 1

Review of the Literature

Imagine walking into a preschool classroom where a teacher and class of young children are engaged in a circle time activity. To begin, the teacher sings a song. The young children in the classroom are smiling and laughing as they participate in the song by imitating the motor actions of the teacher in front of them. One child, however, is not involved or participating in this interaction. This young child has autism and, although he has been explicitly taught to perform imitative behaviors when presented with the clear instruction “Do this,” he rarely imitates the actions of others in natural settings and in activities such as circle time. Without this ability, the child misses out on much of the social, communication, and language learning that is available to his peers.

This thesis describes a research study designed to explore the effectiveness of a video modeling intervention to teach generalized imitation skills in a child with autism. In this chapter, I will provide an overview of the Pervasive Developmental Disorders, the role of imitation in typically developing children, the role and nature of the imitation impairment in ASD, the importance of generalized imitation, and intervention approaches (including video modeling) for addressing the imitation impairment in autism.

Pervasive Developmental Disorder (PDD)

The Pervasive Developmental Disorders (PDD), also known as Autism Spectrum Disorders (ASDs), are neurobiological disorders that are evident early in children’s development and affect development across the life span. It is difficult to make broad generalizations about individual children with ASD as these children vary widely in their abilities. However, children diagnosed with an ASD generally show impairment in three main areas of functioning: communication; social interaction; and repetitive and stereotyped patterns of behavior, interests, and activities. Although, research indicates that the difficulties these children experience originates in the central nervous system, there is no known cause for the ASDs at the present time. Currently, it is estimated that 58.7 per 10,000 children are diagnosed with one of the ASDs (Chakrabarti & Fombonne, 2005).

Treatment and Prognosis

Children with ASD who are identified early and begin receiving early intensive intervention at a young age show the best developmental outcomes (Turner, Stone, Pozdol, & Coonrod, 2006). Educational treatments based on the principles of applied behavior analysis are the most commonly implemented interventions. However, biological treatments (e.g., medication) may be helpful in alleviating some symptoms of ASD in order to help these children function more effectively. In a follow-up study of adolescents and adults diagnosed with an ASD in the 1960s, 1970s, and 1980s, negative outcomes were reported for the majority (78%) of participants with regard to independent functioning (Billstedt, Gillberg, & Gillberg, 2005). Those who had higher IQ scores and used phrase speech to communicate at age 6 showed the most positive adult outcomes.

There are five different disorders included under the broad category of ASD: Autistic disorder (more commonly called autism), Asperger syndrome, Childhood Disintegrative Disorder, Rett syndrome, and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS).

Autistic Disorder (Autism)

Autism is the most well-known and most-studied of the ASDs. For a diagnosis of autism, the Diagnostic and Statistical Manual of Mental Disorders (4th edition; text-revision) (DSM-IV-TR; American Psychiatric Association, 2001) requires six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):

1. Qualitative impairment in social interaction, as manifested by at least two of the following:

a) marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expressions, body postures, and gestures to regulate social interaction

b) failure to develop peer relationships appropriate to developmental level

c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)

d) lack of social or emotional reciprocity

2. Qualitative impairments in communication as manifested by at least one of the following:

a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)

b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others

c) stereotyped and repetitive use of language or idiosyncratic language

d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

3. Restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:

a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus

b) apparently inflexible adherence to specific, nonfunctional routines or rituals

c) stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)

d) persistent preoccupation with parts of objects

In addition, there must be delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play. Finally, Rett's Disorder or Childhood Disintegrative Disorder should not be a more appropriate diagnosis.

Prevalence. Autism was first identified over 60 years ago (Kanner, 1943). Current prevalence estimates are that between 22/10,000 (Fombonne & Chakribarti, 2005) to 25/10,000 children (Baird et al., 2006) have autism. This prevalence rate is higher than the rates reported previously. It is unknown whether this increase is due to improved diagnostic tools, broadening criteria for diagnosis, or actual increased incidence (Baird et al., 2006). The incidence of autism is four times higher in boys than in girls (Fombonne, 2005).

Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS)

PDD-NOS is another disorder under the umbrella of ASD. According to the DSM-IV-TR (American Psychiatric Association, 2001), a diagnosis of PDD-NOS is assigned when there are impairments in the areas of social interaction, and communication, and when restricted interests or repetitive behavior and activity patterns are observed, but the symptoms do not meet the criteria for one of the other ASDs. The current prevalence estimate for PDD-NOS is 20.8/10,000 children (Fombonne, 2005).

Imitation in Typically-Developing Children

Imitation occurs when "an individual observes a model and then matches the model's behavior by acting similarly under similar conditions" (Cooper, Heron, & Heward, 1987, p. 365). Young children learn and acquire new behaviors by observing the behavior of other people around them (Bandura, 1977). Children then acquire and master these behaviors through imitation (Meltzoffe & Moore, 1983; Uzgiris, 1981). Imitation serves important social and cognitive functions for developing children. Socially, infants and young children begin to learn about and engage in reciprocal social interactions by imitating the behaviors of people around them (Stone, Ousley & Littleford, 1997). Piaget (1969) has suggested that imitation is also the beginning of symbolic representation (i.e., a cognitive function) in young children, and is thus associated with language development (Snow, 1989). Clearly, learning to imitate the behavior of a model is an important learning process for young children and is considered a core skill upon which additional learning is built (Bandura, 1963, 1977).

In typically developing children, imitation skills begin to emerge at birth. According to Piaget (1969), children first begin to imitate their own gestures immediately after they are repeated by adults. Next, children begin to imitate actions that are already in their repertoires and are initiated by adults. Later on, children imitate novel adult actions that involve visible body parts; it is at this point that true imitation can be said to occur. After this, children learn to imitate actions (e.g., blowing, smiling) with non-visible body parts (e.g., their mouths and faces). At this point, children have usually acquired generalized imitation skills, because they can perform novel actions in novel contexts with novel models. In the final stage of development, children engage in deferred imitation, defined as "imitation which starts after the disappearance of the model" (Piaget, 1969, p. 53). Piaget claims that this is the beginning of representational thought in children, which is closely related to language acquisition.

Imitation in Children with ASD

Children with ASD typically display deficits in the area of imitation (Dawson & Adams, 1984; Rogers, 1999; Rogers, Hepburn, Stackhouse, & Wehner, 2003). This deficit extends to the imitation of both adults and peers (Peck, Apolloni, Cooke, & Raver, 1978). The imitation deficits often observed in young children with ASD may underlie their other social and communication deficits (Rogers & Pennington, 1991). For example, deficits in imitation performance may be at the core of difficulties with joint attention (Rogers et al., 2003).

One type of imitation that has received considerable research attention in ASD is motor imitation. In the literature, motor imitation is described in two ways: imitation with and without objects. Children with ASD perform better on imitation tasks that involve objects than those that involve body movements alone (DeMyer et al., 1972; Snow, 1989). This might be explained by the presence of the object, which acts as a visual cue for the desired motor action. Stone et al. (1997) concluded that imitation of body actions and imitation of actions with objects are each independently predictive of later aspects of children's development. Because of this, intervention programs for children with ASD often focus on the acquisition of both types of motor imitation skills early on.

Most of the ASD research in the area of imitation as a predictor for later skills has focused on language development. Research has shown that different types of imitation (e.g., imitation of body actions, imitation of actions with objects) are associated with different abilities in later development. For example, imitation of body movements predicts expressive language skills, and imitation with objects is associated with play skills (Stone et al. 1997). Research on the prelinguistic predictors of language in young children with ASD has demonstrated that motor imitation both with (Charman et al., 2003; McDuffie, Yoder & Stone, 2005; Stone & Yoder, 2001) and without objects (Stone et al., 1997; McDuffie et al., 2005; Stone et al., 2001) predicts later language production, even after controlling for initial language level. Recently, Toth, Munson, Meltzoff, and Dawson (2006) also investigated variables that effect the nature and course of language development in children with ASD. They found that both immediate imitation and joint attention were associated with language abilities in children aged 3-4 years; and that language development and production in children aged 4 and 6.5 years were best predicted by early play skills with toys and by deferred imitation skills. Thus, research in the area of motor imitation demonstrates strong evidence that both immediate and delayed imitation skills are important targets in early intervention programs for young children with ASD because of their relation to future language and communication development (Toth et al., 2006; McDuffie et al., 2005).

Nature of the Imitation Deficit

Although research supports the importance of the imitation deficit in children with ASD, the nature of this deficit is not clear. A number of hypotheses have been proposed in this regard. Some have received more support and attention than others, and some theorists have combined hypotheses to better account for the imitation deficit as well as other core deficits observed in children with ASD (Rogers & Pennington, 1991).

Biological. Several researchers have examined the imitation deficit in children with ASD from a biological perspective. DiPelligrino, Fadiga, Fogassi, Gallese, and Rizzolatti (1992) discovered that F5 neurons (also called “mirror neurons”) in macaque monkeys were activated when they observed a human performing a meaningful action. Subsequently, Iacoboni et al. (1999) used functional magnetic resonance imaging (fMRI) to observe brain activity in humans and found that F5 neurons were activated when they observed motor actions being performed by adult models as well as when they observed the motor actions of others and subsequently imitated them. Two specific areas of the brain showed increased activity during imitation performance – Broca’s area in the left inferior frontal cortex and another region in the right superior parietal lobe. These studies suggest that there may be a biological basis to the ability to imitate and that neurological factors may be related to impairments in this regard as well.

Physical. Research also suggests that at least some children with ASD have impairments in general motor functioning (Manjiviona & Prior, 1995). An impairment in the ability to plan and perform motor actions in general might explain some of the difficulty children with ASD have in imitating the motor actions of others. However, the evidence to date is not strong enough to allow this hypothesis to account for the pervasive imitation deficit seen in children with ASD (Rogers et al., 2003).

Cognitive. Some theorists have described the imitation deficit in ASD in terms of its cognitive aspects. For example, Rogers, Bennetto, McEvoy, and Pennington (1996) proposed that children with ASD have memory impairments that are associated with deficits in imitation. However, the results of their study indicated no differences between children with ASD and control subjects who were typically developing with regard to the ability to remember actions over time. Smith and Bryson (1994) also focused on cognitive theories to explain the nature of the imitation deficit in children with ASD. They argued that imitation problems may be related to information-processing impairments that affect the children's ability to achieve internal representations of the movements they seek to imitate. If this is the case, many of the later problems that arise from the imitation deficit (e.g., delays in language development or difficulty using language in social ways) may stem from problems with how imitative motor actions are internally represented at a very basic level. Although this theory appears to be plausible, little research exists to support it at the present time.

Social. Rogers and Pennington (1991, 1999) used a social paradigm to explain the imitation deficit in ASD. They suggested that early imitation skills are responsible for the formation of representations of both the self and others, and that these representations enable children to coordinate and integrate various aspects of social behavior. Figure 1 depicts the interplay between imitation and other aspects of social behavior.

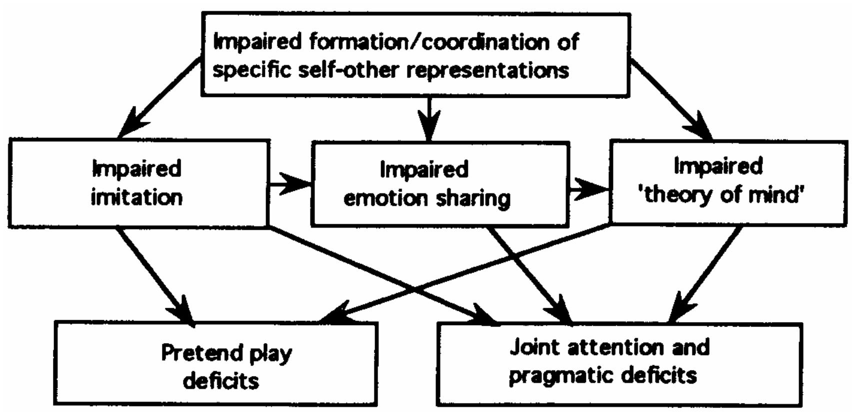

Figure 1. The Intersubjectivity Theory of the Primary Deficits in Autism (Rogers & Pennington, 1991, p. 152)

In this Figure, Rogers and Pennington (1991) identified three main social aspects that are impaired in ASD (i.e., imitation, emotion sharing, and theory of mind) and suggested that all three deficits stem from a core deficit in the formation and coordination of self-other representations. This, in turn, leads to impairments in pretend play, joint attention, and the pragmatic aspects of language. This is currently the predominant model used to explain the relationship between imitation and impairments in other areas for children with ASD.

Summary. Theories about the mechanisms that underlie the motor imitation deficit observed in children with ASD are complicated and inconclusive at the present time. Smith and Bryson (1994) suggested that the social and cognitive theories, which are most often-cited, may not be mutually exclusive and perhaps should be combined to present a more comprehensive explanation for the imitation deficit. However, for the time being, conclusions regarding the nature of the imitation deficit observed in children with ASD are elusive. Research in this area is warranted in order to develop earlier detection of autism-specific imitation deficits and to develop more effective interventions that target the nature of this important problem.

Imitation Interventions

Interventions focused on teaching young children with ASD to imitate come from two different paradigms: a behavioral model and a developmental model. Each approach differs in the context in which the instruction is applied, and both have advantages and disadvantages.

Behavioral. The behavioral model assumes that children with ASD have difficulty acquiring skills in natural contexts and applies principles of learning theory to teach them to copy the actions of a model (Lovaas, 1987). This approach is also referred to as discrete trial training (DTT), in which the child acquires motor imitation skills through instruction in a highly-structured, adult-directed teaching sessions (Lovaas, 2003). In typical DTT, the adult and child sit across from one another in chairs. The adult then delivers a clear instruction (e.g., “Do this!”) and models an action. Full physical prompts are used initially to help the child imitate the model, and are then faded to less-directive physical prompts as the child displays increased accuracy. Reinforcement (e.g., access to food or a preferred toy) is delivered contingent on the child’s performance of the imitative behavior and may be unrelated to the behavior itself. Each new imitative behavior is taught in a set of discrete trials until the child accurately performs the behavior (i.e., imitating the model) without prompting with 80% accuracy over three sessions. Once a number of imitative actions are mastered, they are then targeted randomly until the child demonstrates accuracy in this context as well. Imitation skills are usually taught early in an intervention program for young children with ASD, since they are prerequisites to acquiring more complex behaviors (Lovaas, 2003).

Developmental. According to developmental theory, infants first become interested in performing motor actions when the actions they perform are imitated by an adult (Quill, 2000). Infants then engage in back-and-forth imitative exchanges with the adult. Imitation can be taught to children with ASD in the context of such unstructured, child-initiated, turn-taking interactions. The developmental model takes into account the child's motivation by taking advantage of teaching opportunities that are embedded into naturally occurring activities and routines throughout a child's day. Quill (2000) suggested that imitation can be taught in the context of numerous musical and movement activities that are highly motivating. By imitating the child's actions, the adult provides clear and predictable models and encourages initiation of further interactions.

Generalized Imitation

The ultimate goal of imitation training is to facilitate stimulus generalization across different stimuli (i.e., actions, people, settings, conditions, etc.). For example, if a child has learned to imitate clapping in a structured context when asked to "Do this," stimulus generalization has occurred when he or she can also imitate clapping with a different person, in a different room or location, and/or when given a different instruction (e.g., "Copy me" or "Do the same as I do"). It has also occurred when a child who has learned to imitate clapping can also imitate other actions without training (e.g., waving, knocking on a table, etc.).

Many children with ASD have difficulty with stimulus generalization (Drasgow, Halle, & Ostrosky, 1998; Dunlap & Johnson, 1985; Lancioni, 1982). Skills that do not generalize are said to be under strict stimulus control. Stimulus control occurs when "a behavior is emitted more often in the presence of the discriminative stimulus than during its absence" (Cooper et al., 1987, p. 299). As noted previously, structured DTT procedures are often used to facilitate the acquisition of a repertoire of imitation skills. However, generalization does not usually occur naturally when DTT strategies are used; thus, DTT strategies are usually combined with other instructional techniques to promote generalization (Steege, Mace, Perry, & Longenecker, 2007; Weiss, 2005). For example, Garcia, Baer, and Firestone (1971) used DTT to teach children with autism to imitate movements across three different response topographies: a) small motor movements (i.e., hand movements), b) large motor movements (i.e., gross motor actions involving standing or walking), and c) short vocal responses. They found that, for all four children, generalization of imitative actions occurred within but not across response topographies; for example, when the children were taught to imitate small motor movements, generalization occurred to other small motor movements but not to either large motor movements or vocal responses. Several years later, Young, Krantz, McClannahan, and Poulson (1994) also used DTT to investigate generalized imitation in children with ASD across three response classes: a) vocal sounds, b) toy play, and c) pantomime-type responses. Their results confirmed Garcia et al.'s results that the children developed generalized imitation skills within but not across response classes. Together, these studies suggest that there are predictable limits to generalized imitation following DTT instruction, for many children with ASD. In light of this, researchers have proposed a number of solutions to deal with the generalized imitation deficit.

Solutions to the Generalized Imitation Deficit

A 1977 review paper by Stokes and Baer was influential in bringing the issue of generalization to the forefront of teaching and education. They suggested that generalization is not a passive phenomenon that occurs naturally after initial instruction. Rather, they urged teachers to program generalization into all educational interventions, rather than relying on a "train and hope" approach. Stokes and Baer proposed eight suggestions for facilitating the generalization of skills during instruction.

Sequential modification. In an effort to produce generalization, some studies incorporate a sequential modification strategy. When generalization fails to occur across settings, the same instructional techniques that were used successfully in the original instructional setting are applied to the generalization setting. For example, if a child learns to wash her hands independently at home but fails to do so at preschool, her teacher might implement the same prompting strategies and response contingencies at school that are used at home. In a recent review of generalization of social skills interventions, Bain, Rheames, Ju Lee, and McCallum (2003) found that this was the most frequently used strategy for facilitating generalization.

Introduce natural maintaining contingencies. Introducing learned behavior to natural maintaining contingencies is the most reliable method to program for generalization (Stokes & Baer, 1977). With this strategy, behaviors are selected and taught so that their performance is likely to encounter naturally-occurring reinforcers in natural contexts. For example, if a child with ASD learns to imitate a greeting response (e.g., waving, saying "hello," etc.), it is likely that this behavior will be met with positive social attention from other children and from adults across environments. Of course, a "down side" to this approach is that some responses are more easily maintained by natural reinforcers than others, so this strategy cannot be used in all situations.

Train loosely. Another way to program for generalization during the training of a skill is to teach flexibly, by "randomly varying noncritical aspects of the instructional setting within and across teaching sessions" (Copper, Heron, & Heward, 2007, p. 633). For example, with regard to imitation instruction, a teacher might vary the instructions she uses (e.g., "Do this," "Watch me and do what I do," etc.), the instructional location, the grouping arrangements (e.g., 1:1, 2:1, small group, etc.), and the reinforcers, right from the beginning of instruction. Little research is available on this generalization strategy, probably because researchers are required to maintain strict experimental control over relevant variables (Stokes & Baer, 1977). However, this strategy makes intuitive sense, especially when it is desirable for a new behavior to take place under a wide range of conditions.

Use indiscriminable contingencies. A behavior is more likely to occur in conditions in which it will be reinforced. Intermittent schedules of reinforcement make reinforcement unpredictable and thus make behavior more durable, enhancing performance. Stokes and Baer (1977) noted that this might be an inefficient teaching strategy at the outset of instruction, but that its later advantage with regard to generalization may make it more efficient, in the end. As an alternative, they suggested that initial instruction could be paired continuous reinforcement until the skill is well-established, with intermittent reinforcement then introduced gradually to enhance generalization.

Program common stimuli. In order for responses to occur in both training and generalization settings, some researchers have arranged for both settings to contain common stimuli that are related to the response across settings. For example, some researchers have used peers in the training setting (e.g., a special education classroom) who are also available in the generalization setting (e.g., a regular preschool classroom) (Stokes and Baer, 1977). Others have used the same physical stimuli (e.g., the same table and chairs) in both training and generalization settings to program for generalization (Rincover & Koegel, 1975). This strategy has an obvious disadvantage, in that it can be difficult to ensure that the common stimuli will always be available in the environments where the behavior change is required. Thus, the common stimuli should be as naturally-occurring and salient as possible, so that they achieve discriminative control over performance of the behavior across settings.

Mediate generalization. This strategy requires that children be taught responses that are useful for solving problems in many different types of situations. For example, in functional communication training, children are taught to communicate messages that are directly related to the function of a problem behavior. These communicative messages (e.g., "I need a break"), which can easily be used across settings, are likely to generalize to novel situations in which the same function is required (Durand & Carr, 1991) Self-management (e.g., self-recording on-task behavior) and self-reinforcement have also been demonstrated to be effective in maintaining and generalizing behavior changes (Koegel & Koegel, 1990).

Train to generalize. In this generalization technique, reinforcement is delivered for novel responses. This technique is most effective for responses that develop along a generalization gradient (Stokes and Baer, 1977). An example of training to generalize was provided by Goetz and Baer (1973), who taught children to build specific structures (e.g., a tower, a house) with blocks. They then provided reinforcement in the form of social praise whenever the children built novel structures (e.g., a bridge, a car). The children quickly began to use their blocks to construct structures that were increasingly more novel.

Train sufficient exemplars and general case instruction. Stokes and Baer (1977) suggested that training sufficient exemplars is one of the most commonly-used strategies for generalization as well as one of the most successful. Training sufficient exemplars requires the use of a variety of stimulus examples from the beginning of instruction; exactly how many exemplars are required will depend on the type of task, the child's learning history, and his or her experience with a particular task. For example, when teaching children with ASD to imitate actions in songs, a teacher would first consider all of the actions that will be needed for successful participation. Then, the teacher would teach the child to imitate as many of those actions as necessary until generalization to untaught actions is achieved.

In addition, a general case analysis can be added to this strategy to maximize the likelihood that generalization will occur. General case analysis "is a systematic method for selecting teaching examples that represent the full range of stimulus variations and response requirements in the generalization setting (Cooper et al., 2007, p. 628). Such an analysis has the potential of increasing the efficiency of generalization with regard to the number of teaching examples that are required in training. A classic example of general case analysis was reported by Sprague and Horner (1984), who used this strategy to teach high school students with moderate and severe handicaps to use vending machines. The authors identified various types of vending machines that the adults might encounter, and then identified all of the relevant stimuli and different responses that would be required to use each of the vending machines independently. The participants in this study were trained on the fewest number of vending machines that sampled the entire range of stimuli and responses needed to represent all of the variations. The authors demonstrated that general case analysis was a useful strategy for programming for stimulus and response generalization.

From this brief review, it is clear that numerous strategies are available for enhancing generalization. In a recent review, Bain et al. (2003) concluded that research employing these strategies has become more sophisticated and that research on both successful and unsuccessful instances of generalization is increasingly reported. Instructional approaches that combine several of Stokes and Baer’s (1977) strategies are also required, to maximize generalization efficiency and effectiveness. One such approach is video modeling.

Video Modeling

Video modeling takes place when the child “observes a videotape of a model engaging in a target behavior and subsequently imitates” (Charlop-Christy, Le, & Freeman, 2000, p. 537). Video modeling has been used to teach children with autism a variety of skills, including self-help skills (Lasater & Brady, 1995, Schreibman, Whalen, & Stahmer, 2000), language skills (Maione & Mirenda, 2006; Nickopoulos & Keenan, 2003; Sherer et al., 2001; Taylor, Levin, & Jasper, 1999), perspective-taking skills (Charlop-Christy & Daneshvar, 2003), play skills (D’Ateno, Mangiapenello, & Taylor, 2003; Reagon, Higbee, & Endicott, 2006), and academic skills (Kinney, Vedora, & Stromer, 2003).

Three types of models have been used in this research: peers, adults, and the target child him- or herself. In a systematic review, Delano (2007) found that adults were used as models in 5 (42%) of the 12 studies that used models others than the participants themselves, and peers were used as models in 7 (58%) of these studies. However, in 6 of the 7 studies that involved peers as models, the peers interacted with adults rather than with other peers. Other video modeling interventions have used the target child him- or herself as a model (e.g., Nikopoulos & Keenan, 2003). In these interventions, children view themselves on videotape performing the target behavior. Recently, some researchers have also used videotaped examples that are recorded from the child’s point of view to teach a specific skill (Hine & Wolery, 2006).

Techniques that incorporate video technology may be effective for children with ASD for a variety of reasons. First, it is easy to incorporate this unobtrusive method into alreadyexisting interventions (Thiemann & Goldstein, 2001). Second, video modeling has been shown to be effective with children with ASD in a wide range of environments (e.g., Lasater & Brady, 1995; Sherer et al., 2001). Third, the equipment required for video modeling has become increasingly less expensive and more available in recent years (Schreibman et al., 2000). Fourth, children with ASD are often visually oriented and find watching videos to be highly engaging (Lasater & Brady, 1995). Fifth, video modeling allows an instructor to focus on a specific target skill, highlight the environmental cues relevant to its performance, and decrease distracting stimuli (Charlop-Christy & Daneshvar, 2003). Finally, video modeling may help to compensate for deficits in receptive language that are commonly seen in children with ASD because of its visual nature (Schreibman et al., 2000; Sherer et al., 2001).

Despite these advantages, video modeling has not been used to address the core deficits in ASD, with the exception of perspective-taking. Perspective-taking is the ability (a) to understand that another person's thoughts and beliefs may differ from one's own, and (b) to use this understanding to explain and predict behavior (Sigman & Capps, 1997). Children with ASD have been shown to have significant difficulty taking others' perspectives, a phenomenon known as "mind-blindness" (Baron-Cohen, Leslie & Frith, 1985).

Two video modeling studies have been conducted to teach perspective-taking skills to children with ASD (Charlop-Christy & Daneshvar., 2003; LeBlanc et al., 2003). In both studies, children with ASD watched videotapes of adults completing false-belief tasks (Baron-Cohen et al., 1985) and subsequently explaining the strategies they used to solve the problems. Then, the children were presented with similar false-belief tasks and asked questions about them. The authors reported that, following the video modeling intervention, all of the children with ASD were able to respond to the questions about false-belief tasks accurately. Generalization to novel false-belief tasks was also assessed in both of the perspective-taking studies. LeBlanc et al. (2003) and Charlop-Christy Daneshvar (2003) both found evidence of generalization, which they attributed to the training of multiple exemplars during instruction.

Both of these studies suggest that video modeling may be effective in teaching children with ASD to compensate for skills in core deficit areas. However, this instructional technique has not been used to teach imitation skills to children with ASD to date. The reason for this is somewhat obvious: imitation skills are a prerequisite for video modeling, since the learner must be able to imitate the model in order to benefit. However, once a basic imitative repertoire has been achieved through either behavioral or social/developmental instructional techniques, video modeling may be useful for the purposes of generalization. It makes sense to use video technology to facilitate the generalization of an acquired skill for several reasons. First, video modeling can be used to introduce children to naturally maintaining contingencies. The children may be self-reinforced by reciting comments and performing behaviors observed in the videotape (Charlop-Christy & Daneshvar, 2003). Second, watching a videotape to acquire a new skill is less structured than traditional 1:1 teaching, and can thus be seen as an example “training loosely” (Charlop-Christy & Keslo, 1997). Third, video modeling provides an efficient way to train multiple exemplars of the target behavior to facilitate generalization. Both Charlop-Christy and Daneshvar (2003) and Maione and Mirenda (2006) found that three exemplars were sufficient to demonstrate generalization in children with ASD. The purpose of this study was to investigate the potential of video modeling in this regard.

Research Questions

This study addressed the following questions:

1. Is there a functional relationship between video modeling instruction and an increase in novel (i.e., untrained with DTT) imitation behaviors during probe sessions that involve gross motor games, finger play songs, and toy play with objects?
2. Is there a functional relationship between video modeling instruction and an increase in acquired imitation behaviors (i.e., trained with DTT) during probe sessions that involve gross motor games, finger play songs, and toy play with objects?
3. Is there a functional relationship between video modeling instruction and a generalized increase in imitation behaviors (either previously trained or untrained) during probe sessions that involve gross motor games, finger play songs, and toy plays that were not observed via video modeling? If so, did the specific imitation behaviors that were included in video modeling increase more than those that were not?
4. Is there an association between video modeling instruction and an increase in novel and/or acquired imitation behaviors during gross motor games, finger play songs, and toy play with objects with a novel adult, in a novel environment?

This investigation is unique in that it is the first to apply video modeling to the core imitation impairment in a child with ASD. In addition, the study incorporated strategies that include training loosely, training multiple exemplars, and general case analysis to enhance generalization of imitation skills in a young children with autism.

CHAPTER 2

Method

Approval for this study was obtained on May 22, 2007 from the Behavioral Research Ethics Board of the Office of Research Services and Administration at the University of British Columbia (Appendix A).

Participant Recruitment

The participant was recruited through the Family Centred Practices Group (FCPG), a program in Vancouver, BC that provides support for young children with ASD and their families. The behavioral consultants at FCPG were informed about the study by the researcher and were given information about the purpose of the research, the basic procedures involved, and the selection criteria required for participation. The behavioral consultants then discussed the study with the individual families they were supporting and provided interested families with a letter of invitation (Appendix B). Families who contacted the researcher after receiving the letter received additional information about the study purpose, procedures, and timeline. One family agreed to participate and signed the consent form (Appendix C). The child of the consenting family was then screened by the researcher to determine if he met the selection criteria.

Participant

Peter was 4 years 4 months old when the study began. He was diagnosed with autism at the age of 2 years 11 months following a multidisciplinary assessment at a private clinic in Vancouver, British Columbia. He is the youngest child in a middle-class Caucasian family and has two older sisters, who are twins. For the duration of the study, in addition to the one year prior to it, Peter participated in a home-based treatment program based on applied behavior analysis. He received an average of 15-20 hours of 1:1 structured teaching weekly during this time. In addition, he attended preschool four mornings per week for 2 hours each session. Preschool did not take place between June 15, 2007 and Sept. 10, 2007 (during which the majority of the study took place). Beginning Sept. 10, 2007, Peter attended preschool in the afternoons.

Peter had made significant gains in many areas through his in-home treatment program, but demonstrated significant difficulty imitating others outside of the structured teaching sessions in which imitation skills were initially taught. Peter was able to imitate actions in the context of a discrete trial teaching (DTT) session with the instruction “Do this!” and responded well to prompts and positive social praise from adults to imitate actions presented in this context. However, without this structure and specific instructions to imitate the model, the number of actions Peter imitated significantly decreased and he became disengaged from this type of interaction with others.

Peter met all of the criteria set out at the beginning of the study: (a) during a motor imitation assessment, he imitated 41 out of 70 actions correctly over 3 consecutive trials (see Appendices D and E for a list of assessment items), (b) according to parent reports and researcher observations, he was unable to imitate motor actions in unstructured contexts such as preschool circle time and informal song times; (c) he had an interest in watching TV and/or videotapes and was able to attend to TV/videotapes for at least 10 minutes at a time, and (d) he was able to attend to play activities for at least 5 minutes at a time.

Language assessment. Prior to the study, the Preschool Language Scale, 4th edition (PLS-4) (Zimmerman, Steiner, Pond, 2002) was used to assess Peter’s receptive and expressive language abilities. This assessment was administered by an evaluator with experience testing children with ASD. Overall, Peter's age equivalent score on the PLS-4 was 1 year 11 months. Specifically, he scored an age equivalent of 1 year 5 months on the receptive language component and 2 years 7 months on the expressive language component.

Setting and Interventionists

The probe sessions, video modeling sessions, and generalization probe sessions all took place in Peter's home. Probe sessions took place in the same room as his ongoing early intervention program sessions (i.e., the play room in the basement), either on the floor or at a child-size table, depending on the activity. Video modeling sessions occurred in the living room or office/computer room, both of which were equipped with a DVD player. Finally, two generalization probe sessions were meant to simulate a preschool setting in that there was a new adult model performing the actions and the sessions took place in a new location. This phase took place in the living room of the family home because Peter's preschool was closed during the summer months when data were collected.

All probe sessions were directed by the researcher, with Peter's mother also present. The researcher followed a predetermined protocol for each probe session during the study (Appendix F). The video modeling sessions were directed and supervised by one of the child's parent(s) or by the researcher. The researcher provided training to the parents regarding how to conduct the video modeling sessions and provided them with a video modeling session protocol (Appendix G). An adult who had experience working with children with ASD was trained to conduct the final generalization probe sessions.

Selection of Songs, Games, and Toys

General Case Analysis

As discussed in Chapter 1, a general case analysis was used to identify representative activities that provided examples of the universe under investigation – in this case, imitative gross motor songs and finger play songs. For the general case analysis, an internet search of children's song and game websites was first conducted to compile a list of common gross motor songs and finger plays that occur in preschool settings. Then, staff at four different preschools were asked to add additional games and songs that were common in their preschools but not found in the internet search. This song list was then emailed to 12 behavioral consultants at the FCPG and two parents of preschool-aged children, who were asked to add additional games and songs to the list. Consultants were also asked to identify which activities on the list they had observed being used in the preschools they visited regularly. Six consultants and both parents responded.

Once a comprehensive list of games and songs was compiled, those that included specific directions to imitate actions were eliminated. For example, the popular preschool song, "If You're Happy and You Know It…" was eliminated because it contains explicit instructions before each motor action (e.g., "clap your hands," "stamp your feet," etc.). However, songs such as "Wheels on the Bus" were retained because they do not contain such directives; rather, they require children to imitate actions rather than to respond to verbal commands.

Individual general case matrices were created for all of the remaining gross motor and finger play actions involved in each activity (Appendices H and I). Gross motor songs for the study were selected based on their popularity (i.e., the number of consultants who endorsed each song as common in preschool settings), the number and variety of actions included, and whether a song was typically sung while standing or sitting. For gross motor songs: (1) *Head and Shoulders*; (2) *Wheels on the Bus*; and (3) *Slippery Fish* were selected using these criteria. Together, these three songs covered the largest percentage of actions (67%) and included both sitting and standing options. For finger plays, (1) *Open Them, Shut Them*; (2) *Five Green and Speckled Frogs*; and (3) *Itsy Bitsy Spider* were chosen as the three examples. These songs covered 71% of the actions in the universe of finger plays and included both standing and sitting options.

Selection of Toy Play Activities

After interviewing preschool staff from four different preschools about the types of activities available during free play time at preschool, a list of toys and possible imitative responses associated with each was compiled. General case analysis was not used to choose toy play activities because the actions required for playing with toys vary widely with little overlap. Three toy play activities, (1) caring for a baby doll; (2) playing with a carnival play set; (3) playing with a construction play set, were chosen for use in the study. These activities were chosen based on practicality (i.e., the play materials were already available) and also because they represent the type of toy play activities with the most varied actions across those commonly seen in preschools.

Selection of Generalization Probe Examples

Two generalization probe examples for each imitation activity (i.e., gross motor songs, finger plays, and toy play activities) were selected. The gross motor and finger play generalization probe examples were chosen from the general case analysis because they were also highly popular songs and contained many of the actions that were present in the video model examples. The gross motor generalization probe examples were *Rolly Polly* and *Zoom, Zoom, Zoom*; and the finger play generalization probe examples were *Where is Thumbkin?* and *Twinkle, Twinkle Little Star*. The toy play activities for the generalization probe examples (i.e., play doh and car garage) were chosen because they represented toy play activities commonly seen in preschools, according to preschool staff and behavioral consultant reports.

Materials

Videotapes

Nine videotaped examples (three for each of gross motor songs, finger plays, and toy play activities) were developed for use in this study. The videotapes consisted of three adults (one adult model directing the activity and two adult participants) participating in songs and toy play activities that involved imitation of the target motor actions. The adult model sang each song or played with each toy while modeling the associated motor actions during the video examples, and the two participants imitated all motor actions correctly. The participants did not speak or sing during the videos, in order to emphasize the actions they were imitating. There was an identical number of both different actions and total actions across all three exemplars for each condition (see Appendix J).

Measurement

Dependent Measures

The dependent variable measured in this study was the child's imitation score for each target motor behavior. The scoring system used in the study was adapted from the Multidimensional Imitation Assessment (Lowe-Pearce & Smith, 2000). Each motor behavior was scored on a scale of 0 = no response (i.e., failure to imitate); 1 = emerging response with no imitation (i.e., the child does something in response to the model, but it is not the same action as the one that was modeled); 2 = emerging response involving partial imitation (i.e., the child attempts to perform the action; the response is similar in form to the modeled action, but is not an exact imitation); and 3 = exact imitation (i.e., the child performs the action exactly as the model had performed it). A coding key describing the exact actions to be imitated was created prior to the beginning of the study (Appendix K).

All motor actions were categorized as either acquired or novel. The motor actions were categorized on the basis of Peter's performance during the pre-assessment (Appendices D and E). Acquired actions were defined as motor actions that he had mastered previously and performed consistently in DTT contexts. Novel actions were defined as motor actions he did not have in his repertoire at the beginning of the study, even in DTT contexts. The performance accuracy of both acquired and novel actions was scored across both video model examples as well as generalization probe examples.

Design

A multiple baseline design across three imitation activities was used to assess the effects of the intervention. The multiple baseline design consisted of four or five phases for each activity, depending on the activity. The first activity (i.e., gross motor songs) and the second activity (i.e., finger plays) each included five phases: baseline (A), video modeling (B), video modeling + highlighting the critical features of the video model examples (C), video modeling + highlighting + in-vivo prompting + reinforcement (D), and a generalization probe phase (E). The third activity (i.e., toy play) included four phases: baseline (A), video modeling (B), video modeling + highlighting the critical features of the video model examples + in-vivo prompting (D), and a generalization probe phase (E).

The intervention phases were introduced for each activity in a lagged fashion consistent with a multiple baseline design (Barlow & Hersen, 1984; Kazdin, 1982). The multiple baseline design was appropriate in this study because it was anticipated that learning would occur. The stability of baseline measures was established for each activity prior to implementing the intervention phase. Probe sessions designed to examine generalization to novel songs and toy play activities occurred throughout the study during sessions 5, 12, 16 or 17 (varied by type of activity), 21, 25, and 27. Probes to examine generalization to a novel teacher and setting took place during sessions 26 and 27.

Procedures

Probe Sessions

The purpose of the probe sessions was to assess the occurrence of the imitation behaviors across phases. Throughout baseline, intervention, and generalization phases, probe sessions were held in Peter's home 1-3 times a week. The researcher set up a video camera to record each probe session. During these sessions, Peter, his mother, and the researcher engaged in the relevant activities for each condition. No imitation training was provided to the parent participating in the study, except for general directions to model the actions of the researcher and to refrain from prompting the target child. The activities and toys were only available to the participant during probe sessions. The order of activities was counterbalanced across sessions, to control for an order effect.

At the start of each probe session, Peter and his mother were told, "Let's sing/play (activity)" and directed to the first activity scheduled for that day. The researcher performed all of the actions in the song and toy play activities according to the probe session protocol (see Appendix F). When the activity was completed, the child and parent were directed to move onto the next imitation activity, until all the activities were completed for that day. No prompts or reinforcement were provided to either of the participants during the probe sessions (except in the prompting + reinforcement phase). If Peter left the probe session area before the song or toy play activity was completed, he was redirected back to the activity and instructed, “Let’s finish the song” or “Play with (activity).” If Peter left the area again, the activity was terminated. This occurred only once, during a generalization probe session.

The probe sessions were videotaped from at least 3 meters away in order to simulate a natural setting of children’s play and interaction within the targeted activities. The video camera was located in a corner of the room, and was positioned there during the probe sessions prior to the start of the study in order to reduce reactivity. Data were coded from the probe session videotapes by the researcher. The occurrence of target behaviors for each activity were scored from the point when the gross motor, finger play, or toy play activity began (i.e., when the child was positioned for the activity and the researcher began to sing or play) to the point when the song or toy play activity was completed.

Baseline (A)

During baseline, Peter and his mother were instructed to imitate the actions in the songs and/or toy activities, as described previously. No video modeling occurred during baseline. All baseline probe sessions were videotaped. The duration of each probe session was approximately 20-25 minutes, and contained a consistent number of actions during each activity. Once a stable baseline was established for the first activity, the intervention phase was initiated for that activity.

Video Modeling Intervention (B)

During this phase, daily video modeling sessions occurred, during which Peter watched three video examples of the gross motor songs, finger plays, and toy play activities, depending on the lag of the multiple baseline design. The video examples consisted of three adults singing the songs and playing with each set of play materials, as described previously. Each video modeling session became longer in duration as additional lags were added to the multiple baseline; for example, for the first activity (gross motor songs), three videotaped examples were viewed; but once the second activity (finger plays) was introduced, three more examples were added, and so forth. Video modeling sessions were held once per day at a time that was convenient for the family throughout the study, except on days when probe sessions also occurred. On these days, the video modeling sessions occurred between 30 to 60 minutes prior to the probe session followed by a neutralization activity (i.e., an activity with no relation to the imitation activities that occurred in the probe session following the video model presentation).

Video modeling sessions were supervised by Peter's parent(s) or the researcher, who ensured that he sat and watched the entire videotape. Prior to the first video modeling session, the researcher cued Peter to watch the people in the videotape singing and playing and pointed out the critical features (e.g., "Look, they are doing the same thing as the teacher") on 3 to 4 occasions in order to highlight the behaviors of interest (see Appendix L for a script of this interaction). Following this initial brief explanation, no further explanations were provided to the child regarding the videotapes, and the researcher, parents, or siblings did not talk to him about the videos either during or after the video viewing.

Video Modeling + Highlighting (C)

After three sessions of video modeling for all three imitation activities, there was no evidence of any increase in Peter's performance of the target imitation actions. Hence, highlighting the critical features of the video model examples was added to the intervention in order to provide additional information to Peter with regard to the target behavior.

Peter's parents were trained to implement the highlighting component to the video modeling sessions at home. They followed the steps of the video viewing protocol (Appendix G). During this phase, Peter was shown the video model examples during the video modeling sessions (as described previously), and the parent made additional comments to Peter about what the people were doing in the video while he was viewing the examples. The parent(s) were trained to make comments such as: "Look, the people are watching the teacher and doing the same thing. Good for them!"; "That was great copying. He/she did the same actions as their friend. That's great singing/playing with friends!"; and "They are doing the same things the teacher is doing with her hands. That looks like fun!" The parent(s) made one comment during each example of the three imitation activities in the video.

Video Modeling + Highlighting + Prompting/Reinforcement (D)

With the addition of highlighting the critical features to the video modeling sessions, there was still no increase in Peter's imitation of the target actions during probe sessions. Hence, in-vivo prompting and reinforcement was added to the probe sessions to facilitate the performance of imitation behaviors in this context and to help Peter make the connection between the video model examples and the probe sessions. During this phase, the researcher provided verbal instructions to Peter at the beginning of the imitation activities. The researcher said, "We are going to sing/play (activity). You can watch me and do the same thing, just like in the play video." During the probe activities, the researcher encouraged Peter to perform the modeled action associated with that song/activity by saying, for example, "Come on Peter. You can do it!" Initially, a greater number of prompts were provided at the beginning of the phase during each activity. Reinforcement (in the form of social praise) was also delivered to Peter when he imitated the actions during this phase. The researcher reinforced specific behaviors (i.e., imitating the modeled actions) by saying things like, "Great job Peter, you did the same as me!" Reinforcement for individual imitation behaviors was faded during this phase and delivered only when the entire song or activity was completed. The prompts were also faded over time, requiring 2 sessions (toy play) to 7 sessions (gross motor) per condition. Before all prompts were withdrawn, Peter was able to maintain a stable rate of imitation performance for the duration of probe sessions.

Generalization Probe Phase (E)

Generalization probe data were collected during sessions 26 and 27. During this phase, video modeling continued to take place, and Peter did not have access to the experimental materials except during the two generalization probe sessions. Generalization probe sessions took place with a new adult model and in an untrained setting (i.e., the living room of the family home). These probe sessions were videotaped, and conducted in the same manner as during baseline and intervention, except that the new adult model directed these sessions. There was no prompting during the generalization probe sessions. During these sessions, the researcher coded data on the occurrence of the imitation behaviors from the video tapes, as discussed previously.

Data Coding

Training

The researcher trained a research assistant (RA) who was blind to the purpose of the study to record occurrences of the target imitation behaviors (Appendices M & N - data sheets). The RA was trained with the scoring procedures described previously. Videos from baseline sessions and the videotapes of the child performing the target actions in a structured DTT context were used during the training. In addition, the RA was provided with a scoring manual containing operational definitions, examples and non-examples of the target behaviors, and a scoring protocol (Appendix O). Initial training was provided in a 3 hour session. The RA achieved 90% interobserver agreement (compared to researcher codings) over three practice coding sessions.

Inter-rater Reliability

The researcher scored each probe session from videotapes using a data sheet (Appendices M & N). To ensure that data collection was performed accurately, the RA scored videotapes of 35.7% of the probe sessions, across all phases. Reliability checks occurred randomly during baseline, intervention, and generalization probe conditions. Inter-rater reliability was calculated by dividing the total number of agreements by the total number of agreements plus disagreements and multiplying by 100%. Agreement was defined as both observers coding the targeted imitation action with same number (i.e., 0, 1, 2, or 3); disagreements were defined as the two observers scoring the same action with a different number. The mean inter-rater agreement for acquired and novel actions across all target imitation activities was 94.3% (gross motor songs: 96.5%, finger plays: 95.9%, toy play: 90.7%). The mean inter-rater agreement for acquired and novel actions across all generalization activities was 92.4% (gross motor songs: 92.4%, finger plays: 94.6%, toy play: 90.4%). Across all activities, reliability scores ranged from 73.3% to 100%. The researcher reviewed videotapes to resolve disagreements. Table 1 shows a summary of the reliability scores for all imitation activities.

Table 1

Summary of Inter-rater Reliability Data Across and Dependent Variables (Means and Ranges)

		Activity		
Dependent variable		Gross motor songs	Finger plays	Toy play
Target Imitation Actions (Video Model Examples)	Acquired	M = 96.97%	M = 95.9%	M = 91.1%
	Actions	(93.9% - 100%)	(88.1% - 100%)	(84.4% - 100%)
	Novel	M = 96.1%	M = 95.9%	M = 90.4%
	Actions	(86.4% - 100%)	(85.7% - 100%)	(84.6% - 100%)
Generalization Probe Actions	Acquired	M = 83.3%	M = 92.1%	M = 92.9%
	Actions	(73.3% - 93.3%)	(84.2% - 100%)	(85.7% - 100%)
	Novel	M = 93.2%	M = 94.4%	M = 87.0%
	Actions	(90.9% - 95.5%)	(94.4% - 94.4%)	(85.7% - 88.2%)

Treatment Fidelity

Videotape viewing. In order to ensure that the videotape viewing protocol (Appendix G) was followed correctly, a measure of treatment fidelity was included in the study. Peter's parents were asked to complete a form that specified the steps required for videotape viewing and to record the duration of time Peter watched the videotape examples each day. Peter's parents also recorded data on the number of times Peter left the videotape viewing area and/or stopped watching the video, the number of prompts needed to encourage him to sit and watch, and the neutralization activity in which Peter engaged on days when probe sessions occurred directly after video modeling sessions (see Appendix P).

To examine treatment fidelity reliability, the researcher observed 14% of the video modeling sessions and independently coded the accuracy of each step of the video viewing protocol. Treatment fidelity reliability for video viewing was calculated by dividing the total number of steps completed accurately by the total number of accurate plus inaccurate steps multiplied by 100%. Reliability was 100% throughout the study. In addition, treatment fidelity was 100% throughout the study with regard to the steps in the video viewing protocol. Peter never left the video viewing area and always watched the entire video of the imitation activities. During a few video modeling sessions, Peter had to be verbally reminded to watch the video and he would begin commenting on the video and looked away from the screen. Peter engaged in a variety of neutralization activities after the video viewing before probe sessions (e.g., looking at books, doing puzzles, gross motor physical play, etc.).

Probe sessions. A second measure of treatment fidelity with regard to the probe sessions was also included in this study. The researcher directed each probe session and co-observed each generalization probe session. After viewing the videotapes of each session, she indicated whether or not she followed each step of the probe session protocol (see Appendix F). To assess treatment fidelity reliability, a RA independently viewed 32% of the videotapes as well and scored whether or not the steps of the probe sessions were completed accurately. Treatment fidelity reliability was calculated by dividing the total number of steps completed accurately by the total number of accurate plus inaccurate steps and multiplying by 100.

Reliability was 100% for all the probe sessions. Treatment fidelity for the steps outlined on the probe session protocol was also 100%.

Data Analysis

To assess the impact of the intervention, visual inspection was used. The impact was assessed by examining the changes in the mean frequencies of the target behaviors across phases and by critically analyzing the level, trend, and variability of the data both between and within phases. A careful analysis of these basic properties of the data allowed for a reliable determination of experimental control.

CHAPTER 3

Results

Overview

In the context of gross motor songs, finger play songs, and toy play activities with objects, the goals of this study were to determine whether the use of a general case analysis and video modeling with a child with autism would result in a(n)

a) increase in novel (i.e., previously untrained with DTT) imitation behaviors,
b) increase in previously-acquired imitation behaviors (either trained or untrained with DTT),
c) generalized increase in imitation behaviors (either previously trained or untrained) that were not observed in video model examples,
d) increase in novel and/or acquired imitation behaviors with a novel adult, in a novel environment.

The data were analyzed using visual graphs for each activity, as is typical in single-subject research. These analyses suggest that the video modeling intervention alone was not responsible for a significant increase in imitation behaviors across the three activities. However, the combination of video modeling + highlighting + prompting/fading + reinforcement appears to have been responsible for a significant increase in imitation behaviors across the three imitation activities. Specifically, the percentage of imitation behaviors scored as 2 or 3 (i.e., imitated partially or imitated accurately) increased above the level initially observed in baseline. Figure 2 displays these results.

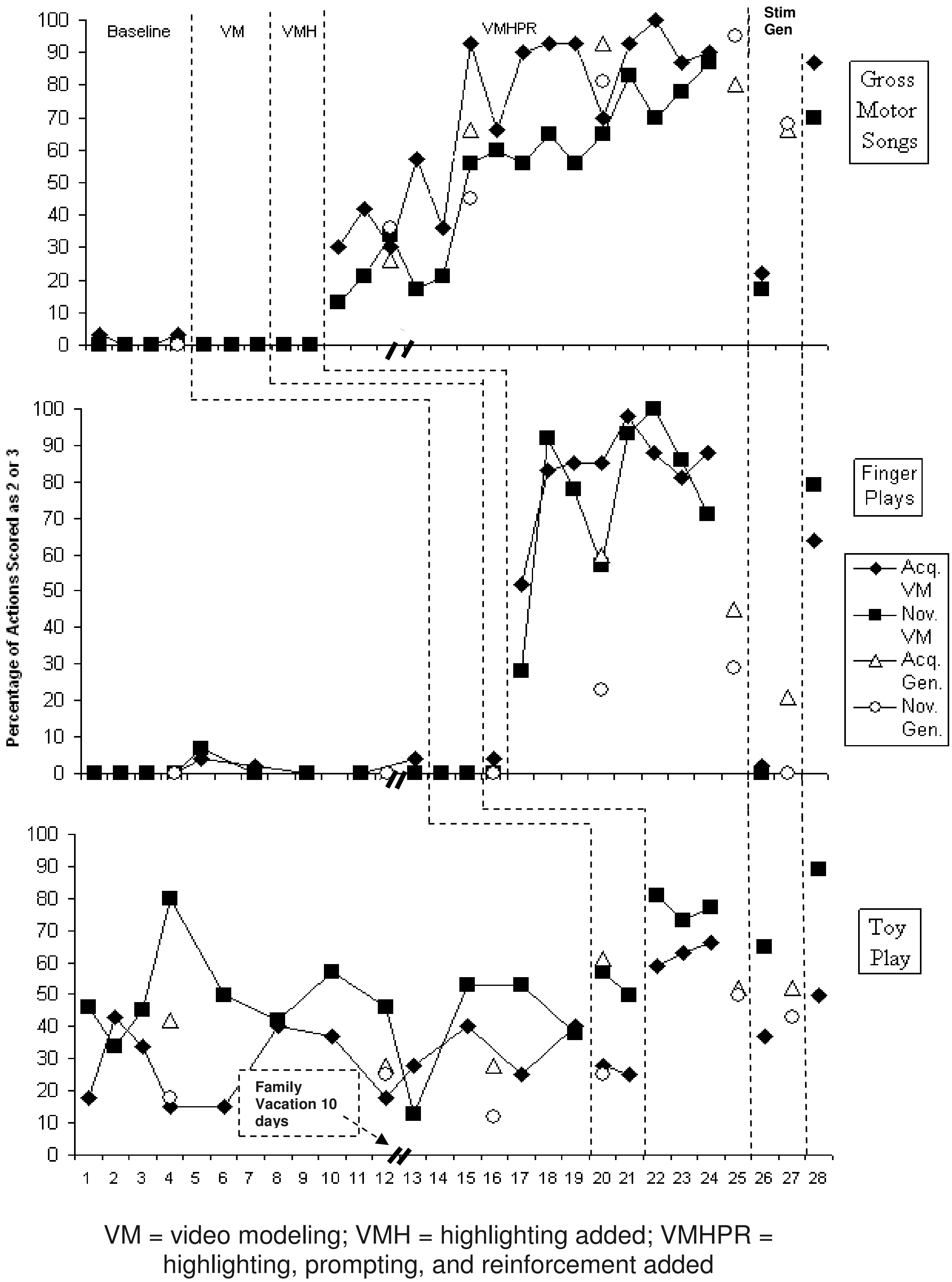

Figure 2. Results for gross motor, finger play, and toy play activities

Novel Imitation Behaviors

Question #1: Is there a functional relationship between video modeling instruction and an increase in novel (i.e., untrained with DTT) imitation behaviors during probe sessions that involve gross motor games, finger play songs, and toy play with objects?

According to the rules of multiple baseline design, a functional relationship is established when changes in the dependent variable occur only when the independent variable is implemented (Kennedy, 2005). From a visual inspection of Figure 2, it is clear that, for novel imitation behaviors, a functional relationship was not established either with the video modeling intervention alone or when highlighting was added. However, a clear change in level and trend was observed when video modeling + highlighting + prompting/fading + reinforcement was introduced sequentially in a lagged fashion across the three different imitation activities. Thus, a functional relationship was established under this condition. Figure 2 and Table 2 summarizes the data for the percentage of novel actions scored as 2 or 3 (imitated partially or accurately) for the three types of activities. The data in this table will be referenced in the sections that follow.

Table 2

Summary of Percentage of Actions (Means and Ranges) Scored as 2 or 3 Across all Imitation Activities

Phase	Acquired (Video modeling)			Acquired (Generalization)			Novel (Video modeling)			Novel (Generalization)		
	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play
Baseline												
Mean	1.5	1.25	33.1	0	0	32.7	0	0.9	46.4	0	0	18.8
Range	0-3.0	0-4.0	20.6-44.1			28.6-42.9		0-7.1	29.2-79.2			12.5-25.0
VM only												
Mean	0	0	30.9	n/a	n/a	61.9	0	0	48.0	n/a	n/a	25.0
Range			29.4-32.4						44.0-52.0			

Table Continues

Table 2. (continued)

Phase	Acquired (Video modeling)			Acquired (Generalization)			Novel (Video modeling)			Novel (Generalization)		
	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play
VM + highlighting												
Mean	0	4.0	n/a	n/a	0	n/a	0	0	n/a	n/a	0	n/a
Range												
VM + H + prompt/fade												
Mean	72.3	80.4	61.8	66.3	52.5	52.4	53.2	76.0	78.0	64.5	26.5	50.0
Range	30.3-100	52.4-97.6	52.9-67.6	26.7-93.3	45.0-60.0		13.0-87.0	28.6-100	72.0-84.0	36.4-95.5	23.5 29.4	

Table Continues

Table 2. (continued)

Phase	Acquired (Video modeling)			Acquired (Generalization)			Novel (Video modeling)			Novel (Generalization)		
	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play	Gross motor	Finger play	Toy play
Generalization												
Mean												
Range	22.6	2.4	41.2	66.7	21.1	52.4	17.4	0	60.0	68.2	0	43.8

Gross Motor Songs

Baseline. During gross motor baseline, there was a stable trend and a mean percentage of 0% of imitated actions scored as 2 or 3 during probe sessions. This stability was achieved in 4 sessions.

Video modeling. Following implementation of the gross motor songs video model examples, there was no change in the level or trend with regard to the percentage of imitative behaviors scored as 2 or 3; the mean percentage of actions with scores in this range remained at 0%. The data showed no variability compared to baseline.

Video modeling + highlighting. Following the addition of highlighting for gross motor songs, no change in level or trend was demonstrated. The mean percentage of actions scored as 2 or 3 remained at 0%.

Video modeling + highlighting + prompting/fading + reinforcement. Following the implementation of the prompting/fading + reinforcement component, there was an immediate change in the level and trend with regard to the mean percentage of imitation behaviors scored as 2 or 3 during gross motor songs. The mean percentage rose from 0% in the preceding three phases to 53.2% during this phase. The data showed some variability, but a consistent, increasing trend and level over baseline was evident. In-vivo prompts were faded over seven sessions, and the mean percentage of imitation behaviors was maintained at a significantly higher level than during baseline.

Finger Plays

Baseline. During baseline, a mean percentage of 0.9% was demonstrated for imitation during finger plays. The level and trend was consistent (with the exception of probe session 5 which showed that 7.1% of novel actions were scored as 2 or 3). The baseline phase for finger plays occurred over 13 probe sessions.

Video modeling. Following introduction of the video modeling intervention, no significant change was demonstrated between the baseline and the video modeling phase. Across 2 sessions, the mean percentage of actions scored as 2 or 3 was 0%. The data showed no variability and was the same as shown in baseline.

Video modeling + highlighting. Once again, the highlighting component failed to result in a change in either the level or trend, compared to previous phases. During a single session of video modeling + highlighting in finger plays, the percentage of imitation behaviors scored as 2 or 3 was 0%.

Video modeling + highlighting + prompting/fading + reinforcement. Following the addition of prompting/fading + reinforcement, there was an immediate change in the level and trend compared to the data observed in all three of the previous phases. Across 8 sessions, the mean percentage of novel finger play actions scored as 2 or 3 was 76.0%. There was some variability in the data, but overall they showed an increasing trend and a level that was significantly increased compared to the mean percentage at baseline. In-vivo prompts during this phase were faded over five sessions, and the change in level was maintained in the absence of these prompts.

Toy Play

Baseline. Baseline data for the toy play activities occurred over approximately 2 months and, with the exception of probe sessions 4 and 13, variability was minimal. Figure 3 shows the split middle line of progress for novel imitation behaviors during baseline for toy play activities. This line demonstrates that only slight drift in an increasing direction occurred in this phase. There was only one probe session (#4) where the percentage of actions scored as 2 or 3 was 79.2%, which was similar to levels observed in the intervention phase (discussed later). The mean percentage of novel actions scored as 2 or 3 for the data in the first half of Figure 3 was 45.5% and the mean percentage for the second half was 47.3%, with an overall mean of 46.4%.

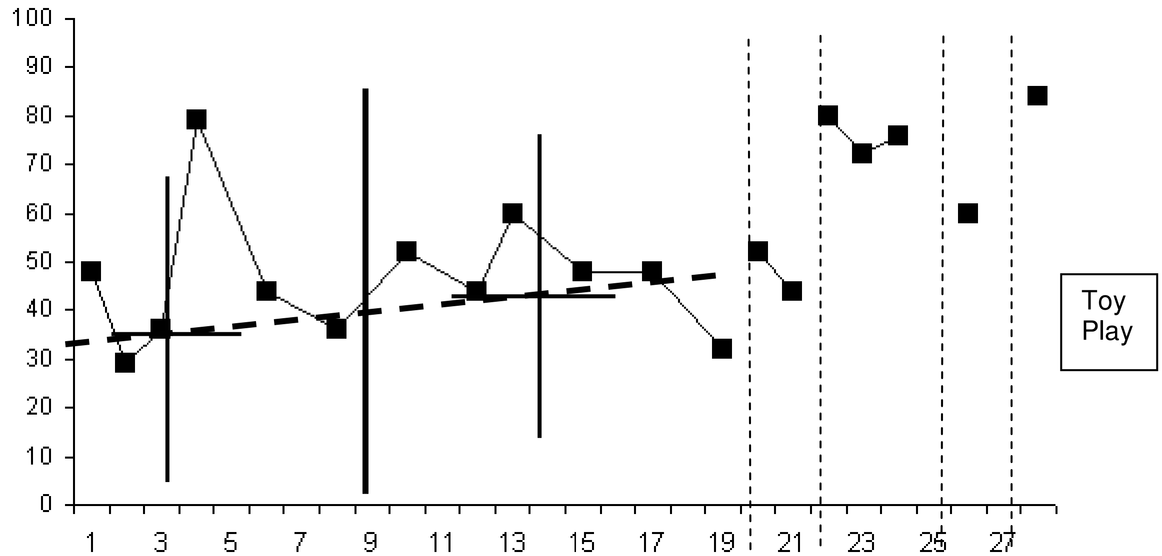

Figure 3. Split middle line of progress for novel actions during toy play.

Video modeling. Following introduction of the video modeling intervention, there was a change between the last data point in baseline and the first data point following intervention. However, there was a decreasing overall trend and no apparent change in level over the two sessions. The data showed some variability, with a mean of 48.0%, almost the same as in baseline. Because the two previous imitation activities demonstrated no change in the target behavior with the addition of highlighting to the video modeling intervention, a decision was made to move immediately to the video modeling + highlighting + prompting + fading + reinforcement phase.

Video modeling + highlighting + prompting/fading + reinforcement. Following implementation of the additional intervention components, there was an immediate change observed in the level of the mean percentage of novel actions imitated during toy play activities. Across three sessions, the mean percentage was 78.0%, which was markedly higher than the mean percentage demonstrated in baseline (46.4%). There was little variability in this phase and stability in trend and level was achieved across three phases. Prompts during this phase were faded over two sessions and the high percentage of novel imitation behaviors was maintained.

Acquired Imitation Behaviors

> Question #2: Is there a functional relationship between video modeling instruction and an increase in acquired imitation behaviors (i.e., trained with DTT) during probe sessions that involve gross motor games, finger play songs, and toy play with objects?

In a multiple baseline designs, the independent variable is introduced sequentially in a lagged fashion. A functional relationship is established when changes in the dependent variable occur only when the independent variable is implemented in the baseline in which it is implement, but changes are not observed in the other baselines (Kennedy, 2005). From a visual inspection of Figure 2, it can be seen that, for acquired imitation behaviors, a functional relationship was not established with the video modeling intervention alone or when highlighting was added. However, there was a clear change in level and trend when video modeling + highlighting + prompting/fading + reinforcement was introduced at different times into the three different imitation activities. Thus, there was evidence of a functional relationship in this condition. Figure 2 and Table 2 display the data for the percentage of acquired imitation behaviors scored as 2 or 3 across gross motor songs.

Gross Motor Songs

Baseline. During baseline, there was a stable level and no trend in the mean percentage of acquired imitative behaviors scored as 2 or 3. The mean percentage was 1.5%. There was slight variability in the data, but stability was achieved over four sessions.

Video modeling. Following introduction of the gross motor songs video model examples, no change was observed in the level or trend with regard to the mean percentage of acquired imitation behaviors performed by the participant from baseline data. Across three probe sessions, stability was maintained with a mean percentage of 0%.

Video modeling + highlighting. Following implementation of the video modeling + highlighting phase, there was no change in the level or trend of the previous phases. The mean percentage during this phase (0%) was lower than that in baseline (1.5%).

Video modeling + highlighting + prompting/fading + reinforcement. Following the addition of these multiple components, there was a dramatic change from the last data point in the previous phase and the first data point in the video modeling + highlighting + prompting/fading + reinforcement phase. The trend in this phase increased steadily and achieved stability at a high level around probe session 16. The mean percentage of acquired imitation behaviors scored as a 2 or 3 was 72.3%. Prompts were gradually faded out and reinforcement was thinned out over seven probe sessions. The level remained significantly higher than baseline even with the fading of prompts and immediate reinforcement.

Finger Plays

Figure 2 and Table 2 displays the data for the percentage of acquired imitation behaviors scored as 2 or 3 across finger plays.

Baseline. During baseline, a stable trend and level were demonstrated with regard to the percentage of acquired imitation behaviors performed. The mean percentage during was 1.3%, with little variability across 13 sessions. Because baseline data was stable, the video modeling phase was implemented.

Video modeling. Following implementation of the video modeling intervention, no change was observed in the mean percentage of acquired imitation behaviors scored as a 2 or 3 between the video modeling phase (0%) and baseline (1.3%). A stable trend and level were demonstrated that was less than that shown in baseline, so an additional component of highlighting was added to the video modeling intervention.

Video modeling + highlighting. During a single probe session following the addition of the highlighting component to the intervention, the mean percentage of acquired imitation behaviors scored as 2 or 3 increased to 4.0%. However, this is not a dramatically different level than that observed in baseline (1.3%), so it was considered to be about the same as baseline.

Video modeling + highlighting + prompting/fading + reinforcement. During this phase, prompting (verbal encouragement) and reinforcement (social praise) were added to the intervention. Following implementation of these additional components, the trend and level increase dramatically. The mean percentage of acquired imitation behaviors scored as 2 or 3 was 80.4%, significantly higher than baseline (1.3%) with some variability. Prompts were faded over five sessions and the level of acquired actions scored as 2 or 3 remained high without prompting and immediate reinforcement.

Toy Play

Figure 2 and Table 2 displays the data for the percentage of acquired imitation behaviors scored as 2 or 3 across toy play activities.

Baseline. Baseline data during toy play activities over a 2 month period reflected some variability. Figure 4 shows the split middle line of progress for acquired actions during this phase, which shows slight experimental drift in an upward direction. The mean percentage of acquired actions scored as 2 or 3 for the data in the first half of Figure 4 was 30.4% and the mean percentage for the second half was 35.8%, with an overall mean of 33.1%.

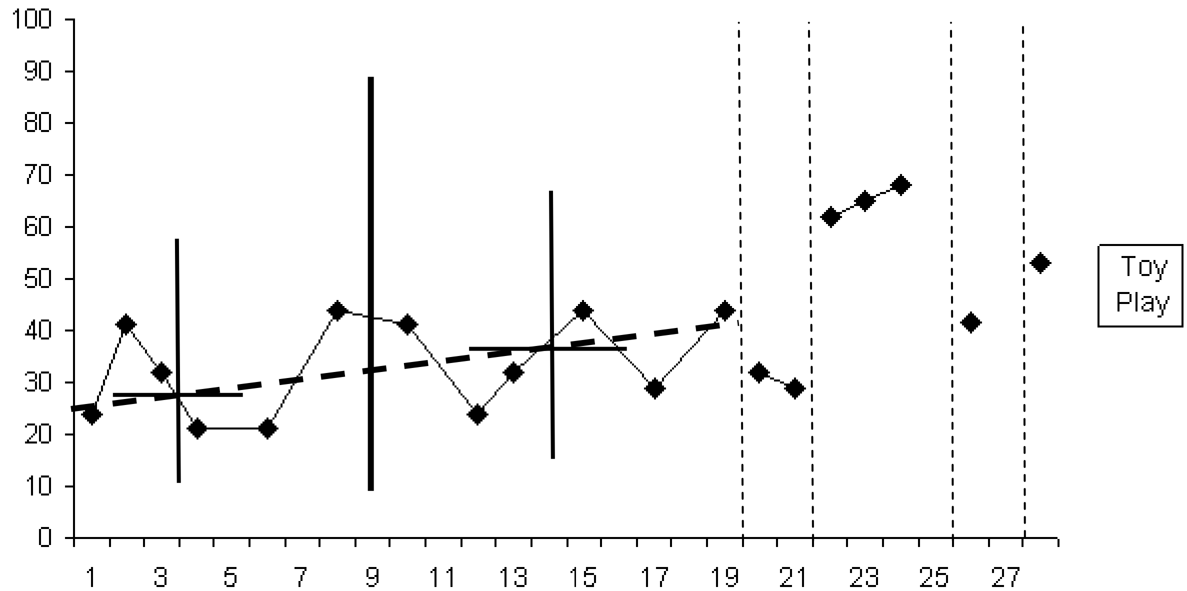

Figure 4. Split middle line of progress for acquired actions during toy play

Video modeling. Following implementation of the toy play video model examples, there was a decreasing trend and almost no change in level over two sessions. The data showed some variability, with a mean of 30.9%, almost the same as in baseline (33.1%). Because the two previous imitation activities demonstrated no change in the target behavior with the addition of highlighting to the video modeling intervention, a decision was made to move immediately to the video modeling + highlighting + prompting + fading + reinforcement phase.

Video modeling + highlighting + prompting/fading + reinforcement. Following implementation of the additional components, there was an immediate change observed in the level of the mean percentage of acquired actions imitated during toy play activities. Across three sessions, the mean percentage was 61.8%, which was significantly higher than the mean percentage demonstrated in baseline (33.1%). There was little variability in the data, but there was an increasing trend and level across the three probe sessions. The prompts for this activity were faded over two sessions in this phase.

Generalization to Novel Songs and Toys

Question #3: Is there a functional relationship between video modeling instruction and a generalized increase in imitation behaviors (either previously trained or untrained) during probe sessions that involve gross motor games, finger play songs, and toy play that were not observed via video modeling? If so, did the specific imitation behaviors that were included in video modeling increase more than those that were not?

Generalization probes related to this question occurred during probe sessions 5, 12, 15 or 16, 20, 25, and 27. As depicted in Figure 2, it appears that there was a generalized increase in imitation behaviors (acquired and novel) during probe sessions across all three activities. More specifically, it appears that, as the imitation behaviors from the video model examples increased, the imitation behaviors from the generalization examples followed a similar pattern and also increased across all the types of imitation activities.

Gross Motor Songs

The mean percentages of imitation behaviors (novel and acquired) for the gross motor songs generalization probe examples are represented in Table 2. It is clear that there is an increasing trend in these data points. During the first generalization probe session, the percentage of imitative behaviors was 0%. The following four generalization probe sessions took place following the implementation of the video modeling + highlighting + prompting/fading + reinforcement phase. The mean percentage of imitation behaviors (acquired and novel) scored as 2 or 3 was 65.4% (acquired: 66.3%, novel: 64.5%). The generalization probe data show an increasing trend and demonstrate a clear change in level across these four generalization probe sessions, compared with the generalization probe session that occurred in baseline.

Finger Plays

The data for finger plays is shown in Table 2 and figure 2. For this imitation activity, two generalization probe sessions took place in baseline. The mean percentage of imitative behaviors scored as 2 or 3 during baseline was 0% for both acquired and novel actions. The next generalization probe session took place during the video modeling + highlighting phase. The percentage of acquired and novel imitation behaviors scored as 2 or 3 during this session was also 0%, the same as during baseline. The final two generalization probe sessions took place during the video modeling + highlighting + prompting/fading + reinforcement phase. The mean percentage of novel actions scored as 2 or 3 was 26.5%, while the acquired actions scored as 2 or 3 in the generalization probe examples was 52.5%. The acquired actions imitated in the generalization probe examples show a decreasing trend, while the novel actions imitated in these examples show an increasing trend across the two generalization probe sessions in this phase. However, the level of both the acquired and novel actions in the generalization probe examples demonstrates a clear change in level from data in the previous phases, showing a generalized increase in imitation behaviors in this activity with examples not observed in the video model examples.

Toy Play

Data for the acquired and novel actions imitated during the toy play activities are displayed in Figure 2 and Table 2. During this activity, 3 out of 5 of the generalization probe sessions took place in baseline. The mean percentage of novel actions scored as 2 or 3 during baseline was 18.8%, while the mean percentage of acquired actions was 32.5%. The fourth generalization probe session took place during the video modeling phase of this activity. The percentages of imitation behaviors partially or accurately imitated was 25.0% (novel) and 61.9% (acquired), which was higher than during baseline. The final generalization probe took place during the video modeling + highlighting + prompting/fading + reinforcement phase of the toy play activity. The percentages of novel and acquired imitation behaviors scored as a 2 or 3 for this last session were 50.0% (novel) and 52.4% acquired, which was markedly higher level than that observed in baseline. Overall, across all five generalization probe sessions, there was an increasing trend in both the novel and acquired actions scored as a 2 or 3, suggesting a generalized increase in imitation behaviors during toy play activities.

Imitation Behaviors Observed and Not Observed in Video Model Examples

With regard to generalization, the study also asked whether or not the imitation behaviors observed in the video model examples increased more than those that were not observed, when these actions were performed during generalization probe examples. Figure 2 and Table 3 shows the data that relate to this specific question.

Table 3

Summary of Gross Motor and Finger Play Actions Imitated during Generalization Probe Sessions That Were and Were Not Present in the Video Model Examples

	Generalization Probe Session				
Activity	Session 1	Session 2	Session 3	Session 4	Session 5
Gross motor songs					
% VM	0	32.1	53.6	92.1	89.2
% No VM	0	33.3	55.6	100	88.9
Finger plays					
% VM	0	0	0	60.9	43.5
% No VM	0	0	0	13.3	26.7

Gross motor songs. During five generalization probe sessions for gross motor songs, both the percentage of actions that were observed and those that were not observed in the video model examples increased, to approximately the same degree. This was contrary to what was expected—namely, that the observed actions would increase more than those that were not observed.

Finger plays. For finger plays, the data in Figure 2 and Table 3 demonstrate that the generalization probe example actions observed in the video model examples increased more than those that were not observed, which was the pattern predicted at the beginning of the study.

The actions for the toy play activities are not displayed because, as discussed previously, there were almost no shared actions among the five different toy play activities.

Generalization to a Novel Teacher and Setting

Question #4: Is there an association between video modeling instruction and an increase in novel and/or acquired imitation behaviors during gross motor games, finger play songs, and toy play with objects with a novel adult, in a novel environment?

Gross Motor Songs

The data for gross motor songs are shown in Figure 2 and Table 2. The mean percentages of novel imitation behaviors scored as 2 or 3 during the generalization phase was: 17.4% (novel, video model examples) and 68.2% (novel, generalization probe examples). These percentages represent an increase from the mean percentages at baseline, which was 0% for both. For acquired imitation behaviors scored as 2 or 3 during stimulus generalization, the percentages were: 22.6% for acquired actions from video model examples and 66.7% for acquired actions in the generalization probe examples. The percentages are significantly higher than percentages observed during baseline for these acquired actions (1.5% for video model examples and 0% for generalization probe examples).

Finger Plays

Figure 2 and Table 2 show the mean percentages of acquired and novel imitation behaviors scored as 2 or 3 from video model and generalization probe examples. There was no change in the percentages of either acquired imitation behaviors (2.4%, almost the same as baseline) or novel imitation behavior (0%). However, there was a slight increase in acquired imitation behaviors for the generalization probe examples, where the percentage of these actions scored as 2 or 3 was 21.1% compared to 0% in the baseline phase. Overall, there was little evidence of generalization in this condition.

Toy Play

The generalization data for acquired and novel actions during video model and generalization probe examples is shown in Figure 2 and Table 2. A clear pattern was demonstrated during this phase for toy play. During both video model and generalization probe examples, there was an increase in both acquired and novel imitation behaviors scored as 2 or 3 compared to the mean percentages observed in baseline. For acquired actions in the video model examples, the mean percentage of these actions scored 2 or 3 was 33.1% in baseline, but increased to 41.2% during the generalization phase. For the acquired actions in the generalization probe examples, the mean percentage in baseline was 32.7% and rose to 52.4% during probe sessions with a novel adult in a novel environment. The same trend was demonstrated for novel actions in video model examples (baseline = 46.4% and stimulus generalization = 60.0%) and novel actions in generalization probe examples (baseline = 18.8% and stimulus generalization = 43.8%).

Summary of Results

Visual inspection of the data revealed that, for all three of the target activities, there was no increase in the mean percentage of acquired and/or novel actions or generalization probe examples following implementation of the video modeling intervention alone. In addition, after the addition of the highlighting component to the video modeling intervention in the gross motor songs and finger plays, there was still no change in the data. However, following the implementation of the video modeling + highlighting + prompting/fading + reinforcement phase, an immediate and substantial increase was observed in the percentage of acquired and novel actions imitated during video model and generalization probe examples.

Other findings that emerged from the visual analysis were that, for gross motor songs, there was consistently a higher percentage of acquired actions imitated, as predicted. For finger plays, these data were more variable; and for toy play activities, a higher percentage of novel actions were imitated in response to the video model examples. In addition, visual analysis demonstrated that there was limited evidence of generalization during probe session that took place with a novel adult in a novel setting.

The first research question examined whether a video modeling intervention using multiple exemplars was effective in increasing the percentage of novel actions imitated during probe sessions that involve gross motor songs, finger plays, and toy play with objects. For two of the activities (gross motor songs and finger plays), the increase was immediate and dramatic, following the introduction of the video modeling + highlighting + prompting/fading + reinforcement intervention. For the third activity (toy play), this change was also demonstrated following the introduction of additional intervention components; however, this was less dramatically than the first two activities. These results provide evidence to support a functional relationship between the dependent variable (novel actions imitated) and the video modeling intervention combined with additional components (highlighting + prompting/fading + reinforcement).

The second question this study examined was whether video modeling instruction would lead to an increase in the percentage of acquired actions imitated during probe sessions that involved gross motor songs, finger plays, and toy play activities. For all three imitation activities, visual analysis established that the percentage of acquired actions scored as 2 or 3 increased to levels significantly higher than baseline following the addition of highlighting + prompting/fading + reinforcement was added to the video modeling intervention. These results demonstrate clearly that a functional relationship did exist between an increase in this dependent variable (i.e., acquired actions) and the implementation of video modeling plus the additional intervention components.

The third question addressed whether or not the intervention would be associated with a generalized increase in imitation behaviors during probe sessions that involved gross motor songs, finger plays and toy play activities that were not observed via video modeling instruction. The multi-element component was associated with an increase in the percentage of acquired and novel actions imitated during these generalization probe examples across all three imitation activities. In addition, the study asked whether the observed actions (novel and acquired) would increase more than those that were not observed during generalization probe examples. The data revealed that, for finger plays, the observed actions did increase more than those that were not observed via video modeling. For gross motor songs, the opposite effect was observed; that is, the actions that were not observed increased more than those that were.

The fourth and final question of the study asked whether or not there was an association between video modeling instruction and an increase in imitation behaviors during probe sessions directed by a novel adult in a novel setting. For two of the three activities (gross motor songs and toy play), the data revealed that generalization to new stimuli did occur at a low rate, as evidenced by the performance of imitation behaviors (acquired and novel) during video model and generalization probe examples at higher levels than during baseline.

CHAPTER 4

Discussion

Previous research on video modeling instruction suggests that it is an effective, evidence-based strategy to facilitate the acquisition of skills (Bellini & Akullian, 2007). The present study is a unique contribution to this growing body of research on video modeling because it examines the specific effects of video modeling instruction on the generalized imitation skills of a child with autism in natural activities. For 2 of the 3 activities, it was clear that the video modeling intervention by itself did not have an effect on the participant's performance of motor actions modeled be the adult "teacher." For the third activity, toy play with objects, this demonstration was less clear. For all three imitation activities, when additional intervention components (i.e., highlighting, prompting/fading, and reinforcement) were added to the video modeling intervention, a clear change in the participant's behavior was observed. These additional components were required for the intervention to be successful.

Combining video modeling instruction with other intervention strategies is common. In a meta-analysis by Bellini and Akullian (2007), 65% of 23 video modeling interventions included additional components to increase effectiveness. Previous research shows mixed results in this regard (Delano, 2007). Some studies have reported some positive results when no additional intervention components are added to the video modeling intervention (e.g., D'Ateno, Mangiapanello, Taylor, 2003; MacDonald, Clark, Garrigan, Vangala, 2005). D'Ateno et al., 2003 and MacDonald et al. 2005 examined social-communicative and play behaviors in children with ASD. The researchers found that, with the video modeling intervention alone, there were significant increases in participants' scripted responses (verbal and motor behaviors) acquired from the video model examples. However, there were no increases observed in the participants' unscripted or novel behaviors. Other studies have demonstrated the necessity to use video modeling instruction combined with other strategies (e.g., video feedback, reinforcement, self-monitoring, etc.) to acquire, maintain, and generalize skills. For example, Apple, Billingsley, and Schwartz (2005) added a reinforcement and/or a self-management component to video modeling in their study, with positive results demonstrating an increase in the compliment-giving behavior of children diagnosed with ASD. Maione and Mirenda (2006) demonstrated that video modeling alone may be sufficient to increase peer-directed social language behaviors of a child with ASD during play activities; but in one of the activities in this study, it was necessary to add in vivo prompting to video modeling as well. In her review of video modeling interventions, Delano (2007) suggested that, in order for video modeling to result in maximally efficient skill acquisition, it may need to be combined with additional strategies. As with other teaching strategies utilized for children with developmental delays, combining video modeling instruction with additional teaching procedures appears to strengthen the connection between what the child observes in the videotape and the actual context in which the skill is performed by the trainee.

Acquired and Novel Imitation Behaviors

In the present study, Peter showed a substantial increase in the percentage of actions (both acquired and novel) imitated during both songs and toy play activities when additional intervention components were implemented. As discussed previously, acquired actions refer to those that Peter was able to imitate consistently in a structured DTT context, based on a pre-intervention assessment; while novel actions were those that he did not imitate consistently during the pre-assessment. Although there was variability in the extent to which novel and acquired imitative actions increased across the three activities, positive results were seen across both types of actions. In the following sections, the results for each imitation activity will be discussed in terms of the novel and acquired actions imitated by the participant.

Gross Motor Songs

During the baseline phase, Peter performed almost none of the actions (either acquired or novel) that were performed by the video model, even though he had demonstrated some of the actions in a structured DTT context during the pre-assessment. However, both acquired and novel imitation behaviors increased at a steady rate once the VM+H+P+R condition was implemented. Because the percentage of novel actions Peter imitated increased to equal percentages as the performance of acquired actions, it appears that Peter learned to perform the novel imitation behaviors by viewing the video model examples. He was not able to perform these imitation behaviors during the pre-assessment DTT sessions, but was able to perform them after viewing the videotapes.

Finger Plays

During finger plays, the percentage of novel and acquired actions that Peter imitated was approximately equal. Interestingly, novel actions increased more rapidly during this condition. These results are somewhat surprising given that the imitation behaviors included in this condition were more challenging because they involved fine rather than gross motor hand movements. However, according to typical development, at 42-48 months of age, preschool children should be able to imitate finger plays in which both hands perform the same action; by 48-54 months, they can imitate finger plays in which each hand performs a different action; and by 48-54 months, they can imitate complex motor activities in both songs and games (Johnson-Martin, Hacker, & Attermeier, 2004). Peter was 56 months by the end of the study; thus, his ability to imitate fine motor actions was developmentally appropriate.

As with gross motor songs, it appears video model examples of the finger play songs facilitated the learning of the novel fine motor body movements. Because Peter was not able to perform the novel actions during either the pre-assessment or baseline, and only performed the imitation behaviors during the intervention phase, it appears that he learned these actions from observing the video model examples.

Toy Play

Peter demonstrated relatively better performance of toy play imitation behaviors during baseline, and this is not surprising in light of previous research. Children with ASD have been shown to perform better on imitation tasks that involve objects than on those that involve body movements alone (DeMyer et al., 1972; Snow, 1989).

During the toy play activities (including during baseline), more novel than acquired actions were imitated during toy play activities. Peter even began to imitate some actions that were not imitated consistently in the structured DTT context of the pre-assessment once the study began but prior to the video modeling intervention. As discussed previously, the baseline data did show a slight upward drift for the toy play activities. After calculating a split middle line of progression, it was found that: (a) for novel imitation behaviors, a mean of 45.5% were imitated in the first half of the baseline probes, while a mean of 47.3% were imitated for the second half; and (b) for acquired imitation behaviors, a mean of 30.4% of actions were imitated in the first half of probe sessions and a means of 35.8% were imitated in the last half. Thus, although minimal, it should be noted that there was a minor baseline "drift" for both novel and acquired actions in the toy play activities.

This minor baseline drift can be explained in several ways. First, a close examination of the toy play actions revealed that only 6/17 actions were categorized as novel. Of these 6 actions, only 4 were assessed as completely novel (i.e., over three pre-assessment trials, no imitations occurred), while the other 2 were imitated during 1/3 of the pre-assessment trials, with partial accuracy. Thus, since a very small number of actions were truly novel for the toy play activities, small fluctuations in the number of behaviors that were imitated correctly affected the overall percentages more easily. Second, the pre-assessment was the first time Peter had come into contact with the toys used during these activities. He was interested in exploring these novel materials and was less attentive to the task of imitating even when the toys were presented in this structured context; this may have affected the pre-assessment results. Third, the isolated actions performed with the toy play materials during the pre-assessment might not have made functional sense to Peter until they were performed in the context of playing with all of the materials together in a contextualized way during probe sessions. Perhaps, he was more likely to imitate the actions during probe sessions because the actions made more sense to him in this context. Finally, multiple probe trials were conducted for the toy play activities during baseline. Each time Peter came in contact with toys during a probe session he became more familiar with them and with the actions that were being performed with them. Therefore, his performance of these actions (i.e., the accuracy of his imitations) may have improved because of repeated practice with the materials, resulting in the slight drift observed in baseline. In retrospect, the inclusion of fewer probe sessions during this prolonged baseline might have decreased the possibility of drift.

Generalization

The research questions in this study examined two aspects of stimulus generalization in order to address concerns about limited research in this regard. Bellini and Akullian (2007) found that, of the 23 studies in their video modeling meta-analysis, only 7 included measures of generalization. A discussion of the results related to generalization during this study is below.

Generalization to Novel Songs and Toys

Generalization to novel song and toy stimuli was clearly demonstrated during this study in the gross motor and toy play activities, with a weaker demonstration during finger plays. Peter demonstrated generalization because he imitated a number of actions during songs that were not included as video model examples. The actions for gross motor songs and finger plays were chosen because they were representative of actions across the instructional universe of common preschool songs. It was hypothesized that Peter would imitate actions in new gross motor songs and finger plays because he had observed these actions in the video model examples that were chosen through the general case matrices. In fact, this was the case for both gross motor songs and finger plays, though to different degrees. By the end of the study (i.e., generalization probe session 5) Peter imitated 89.2% of the actions he had observed in the video model examples in the context of the generalization probe example songs (all of which were selected from the general case matrices). For finger play generalization examples, Peter imitated 43.5% of the actions that he had observed in the video models. This demonstrates that the examples chosen for the video model examples were effective in facilitating generalization to novel preschool songs containing the same actions with out additional teaching, prompting, or reinforcement.

Generalization to a Novel Teacher and Setting

Generalization to a novel teacher and setting occurred to a lesser degree than did generalization to novel song and toy stimuli. Peter imitated some novel and acquired actions when a novel adult directed probe sessions in a new setting. However, the percentage of actions imitated during these generalization probes (mean = 33.0%) was much lower than the percentage performed in the initial probe context (mean = 61.2%).

These results make sense in light of the fact that no strategies to facilitate generalization to novel people and settings (Stokes & Baer, 1977) were included in the intervention. Future research should examine the effectiveness of programming specific generalization strategies in combination with video modeling to facilitate the generalization of skills to such novel stimuli. For example, it might be beneficial to incorporate strategies such as sequential modification into a video modeling intervention, so that the same contingencies and prompting strategies that are present in the generalization setting are also implemented in the training setting. Strategies such as training loosely and programming common stimuli, in which specific features of the intervention are systematically varied from the outset, may also be useful to facilitate this type of generalization. More research is needed to examine the effectiveness of specific strategies to facilitate the generalization of skills taught through video modeling instruction.

Limitations

External Validity

One limitation of the results presented in the present study is common to a disadvantage of single subject research in general. This intervention was implemented with one child with unique learning and performance characteristics; however, the effects may not be the same in children displaying different abilities and characteristics. As with best practice for all interventions, the individual characteristics of the child must be considered in order to design the most effective intervention or combination of interventions. Thus, this type of intervention might be successful with children with ASD who have similar abilities and characteristics as Peter, but not with those with different skill profiles.

Multiple Treatment Interference

This study examined the systematic implementation of additive intervention components with video modeling instruction. Additive interventions were necessary to observe changes in the participant's behavior across the three imitation activities. However, it is possible that these additive procedures resulted in multiple treatment interference as a threat to internal validity. Multiple treatment interference refers to "the confounding effects of one treatment on a subject's behavior being influenced by the effects of another treatment administered in the same study" (Cooper, Heron, & Heward, 2007, p. 196). In the present study, video modeling alone; video modeling combined with highlighting; and video modeling combined with highlighting, prompting, fading and reinforcement were introduced in a specific order. Hence, is not possible to ascertain which specific components affected the results. For example, none of the phases examined the percentage of actions Peter imitated correctly with prompting, fading, and reinforcement alone. Thus, one might ask if Peter would have performed the target imitative actions without video modeling, if only these strategies had been implemented.

Additional research is needed to examine the multiple treatment effects more carefully. For example, one could design a study that employs a multiple baseline design across activities with two participants. For the first participant, prompting, fading, and reinforcement could be introduced first, to examine the effect of this treatment alone. Depending on the effect, video modeling could then be added. For the second participant, the opposite would occur: video modeling would be introduced first, with prompting, fading, and reinforcement added if necessary, as in the present study. This design would help to clarify the components required to create the most effective and efficient video modeling intervention package.

Generalization & Maintenance

Some limitations should also be discussed with regard to generalization and maintenance. First, no formal maintenance data were collected with this participant because of time and logistical constraints. However, according to an anecdotal report from Peter's mother 6 weeks after the completion of the study, Peter maintained his imitative behaviors at home during songs with his siblings and during his behavioral intervention sessions. A meta-analysis of video modeling research suggests that video modeling demonstrates moderate effectiveness with regard to the maintenance of skills taught (Bellini & Akullian, 2007). These authors found that 18 of the 23 studies they reviewed included measures of maintenance.

Second, although generalization was observed for some of the imitation activities, probes in this condition were not conducted in the actual environment for which the intervention was designed -- Peter's preschool – because of logistical constraints. To examine this informally, the researcher observed Peter during preschool circle time approximately 6 weeks after the conclusion of the study during which he participated in one song (*Open Them, Shut Them*). Peter participated in approximately 50% of the actions during this song. Peter's mother also reported that Peter often enjoys listening to children's music from CDs with his sisters at home and consistently participates by performing the actions in the songs when they are modeled by his siblings. These anecdotal reports suggest that generalization did occur in relevant environments aside from that used for the probe sessions.

Educational and Future Research Implications

Prompting

In this intervention, prompts were faded over 2 – 7 probe sessions for all of the imitation activities. Gross motor songs required the most number of probe sessions (7 sessions) before fading was accomplished, while toy play activities required the least (2 sessions). This may have occurred because gross motor songs was the first condition in which video modeling was implemented, according to the multiple baseline design. Thus, it was new to Peter and required higher levels (i.e., a longer duration) of prompting to facilitate his independence within this activity. Toy play activities were the last condition, so Peter already had prior experience with prompting and reinforcement procedures from the two previous imitation activities. This may have facilitated a more rapid learning curve and allowed for more rapid prompt fading.

In addition, from a developmental perspective, children learn to imitate actions with objects before they learn to imitate body movements (DeMyer et al., 1972; Snow, 1989). Because the toy play activities involved the manipulation of objects (i.e., play materials), it makes sense that this type of motor imitation would be acquired with less prompting than imitation of body movements (e.g., gross motor songs or finger plays). Overall, it is clear that, although adult prompts were required for all three imitation activities to varying degrees, they were able to be faded quite quickly, which demonstrates the efficiency of the use of this type of intervention in educational contexts. Future research should examine the relative effectiveness and efficiency of additional prompting and fading strategies (e.g., gestural or physical prompts, time delay procedures, etc.)

Generalization to Novel Adults and Settings

The generalization of skills is a challenge faced by many professionals designing treatments for children diagnosed with ASD. It is not surprising that there was little generalization to a novel adult and setting observed during the current study; as discussed previously, no systematic strategies were included to facilitate this type of generalization. Stokes and Baer (1977) presented a number of recommendations to promote the generalization of skills.

Additional research is needed to determine which of these strategies are likely to be most successful and easy to incorporate into video model interventions to facilitate stimulus generalization. Stimulus generalization is an important component of any educational intervention and crucial to the functional use of the skill(s) in a variety of contexts.

Identifying Components of the Instructional Universe to Design Interventions that Facilitate Generalization Across Novel Actions

The general case analysis used in this study was an important factor in facilitating generalization to novel songs and toys. The general case approach is a potentially effective and efficient way for professionals to teach specific skills and to facilitate generalization of these skills to other aspects of the instructional universe. It is also provides both goals and directions to interventionists from the outset of interventions, and avoids teaching skills in a haphazard fashion. General case analysis does require additional time and energy during the planning phase an intervention, but in the long run it is likely to result in more beneficial, effective, and efficient outcomes. Few recent studies have utilized the general case approach in practical contexts, and additional research is needed in this regard.

Ease of Use, Flexibility, and Reinforcement

Video modeling instruction is potentially a very beneficial teaching technique for families and/or professionals in the field of education. Although some technical expertise is required to create, edit, and view the video model examples, the equipment and materials required (e.g., video camera, video player, etc.) are becoming increasingly available at a reasonable cost. This type of equipment is also becoming more available in schools and can be utilized with children of varying ages.

In this study, adult models who were unfamiliar to the participant were used in the video model examples. Many families and professionals using this instructional technique will find that it requires a minimal amount of time and it is easier to use adults in the video rather than peers that are a similar age to the participant. Overall, video modeling interventions are efficient to create; flexible based on the needs of the child and skill(s) to be taught; and most importantly, effective in teaching children with ASD targeted skills.

In addition, children with ASD often find it reinforcing to watch video tapes. Peter was interested and motivated to watch the video model examples on a daily basis. He was very attentive to the videos. It is interesting to note that Peter often focused on the “teacher” in the videos, rather than the “children.” He would often comment on the teacher’s color of clothing and other features. During probe sessions, Peter would sometimes talk about the videos as well, saying things like “Play construction…like play video!” Interestingly, Peter did not appear to be inherently reinforced by participating in the songs. Rather, he appeared to be highly reinforced by the social praise he received to reinforce the imitation of actions during the imitation activities. His smiling throughout the probe sessions and video modeling sessions clearly demonstrated that it was an enjoyable and positive experience. In addition, as noted previously, anecdotal reports by his mother following the study indicate that he is now more reinforced by the actual participation in circle time activities at home. Thus, the intervention may have contributed to more positive interactions with his siblings because they are now more aware of how to engage him to participate in an activity (toy play or song) at home and may also be more reinforced by interacting with him as well.

Future research in this area should examine the role of reinforcement as it [pertains to generalization, in particular. It appears from anecdotal reports that Peter's imitation skills were generalized and maintained in other contexts (e.g., preschool, play with siblings, etc.) by naturally maintaining contingencies. Additional research should look at programming strategies into the video modeling intervention to more efficiently and systematically facilitate this type of generalization.

Summary

The present study has made some unique contributions to research in the area of special education and interventions for young children diagnosed with ASD. First, this was the first video modeling study to examine generalization systematically. Second, this was the first time a general case approach was used to select the best examples to teach during video modeling. And third, this one of the few studies that applied video modeling instruction on a core deficit in children diagnosed with ASD. In fact, it is the first study to use video modeling to teach generalized imitation skills to a child with ASD. The results will be beneficial to other professionals interested in using video technology to teach children with autism a variety of skills. The current study also represents an important starting point for future research in this area.

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Appendix A

Behavioral Research Ethics Board Certificate

Vickie.ethics 01/02/08 12:11 PM

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - FULL BOARD

PRINCIPAL INVESTIGATOR:	INSTITUTION / DEPARTMENT:	UBC BREB NUMBER:
Pat Mirenda	UBC/Education/Educational & Counselling Psychology, and Special Education	H07-00849

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
N/A	N/A

Other locations where the research will be conducted:
the participant's home

CO-INVESTIGATOR(S):
Victoria Kleeberger

SPONSORING AGENCIES:
N/A

PROJECT TITLE:
Teaching Children with Autism to Imitate in Natural Contexts Using Video Modeling

REB MEETING DATE:	CERTIFICATE EXPIRY DATE:
May 10, 2007	**May 10, 2008**

DOCUMENTS INCLUDED IN THIS APPROVAL: **DATE APPROVED: May 22, 2007**

Document Name	Version	Date
Protocol:		
Research Proposal	N/A	April 26, 2007
Consent Forms:		
Confederate Consent Form	2.0	May 15, 2007
Participant Consent Form	2.0	May 15, 2007
Assent Forms:		
Sibling Assent Form	1.0	May 16, 2007
Advertisements:		
Recruitment Notice	2.0	May 15, 2007
Other Documents:		
FCPG Agency Approval Letter	N/A	April 26, 2007

The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board and signed electronically by one of the following:

Dr. Peter Suedfeld, Chair
Dr. Jim Rupert, Associate Chair
Dr. Arminee Kazanjian, Associate Chair
Dr. M. Judith Lynam, Associate Chair
Dr. Laurie Ford, Associate Chair

file:///Users/pmirenda/Desktop/Vickie.ethics.webarchive Page 1 of 1

Appendix B

Participant Recruitment Letter

The University of British Columbia

OPPORTUNITY TO PARTICIPATE IN A RESEARCH PROJECT FOR FACILITATING THE GENERALIZATION OF IMITATION SKILLS IN CHILDREN WITH AUTISM!!!!!

My name is Vickie Kleeberger and I am a graduate student at the University of British Columbia. I have worked in ABA programs with children with autism for over 4 years, and I have noticed that many children are able to develop imitation skills in a structured context, but often have difficulty generalizing these imitation skills to more natural activities. For my thesis, I will be conducting a study to determine the effectiveness of a video modeling intervention for facilitating the generalization of imitation skills of children with autism spectrum disorders in song and toy play activities. The intervention will involve having the child with autism watching short videotapes of adult models engaged in various song and toy play activities. Then, he or she will participate in these activities with a parent or sibling (brother or sister), using the same songs and toys as in the videotapes. The play sessions will be videotaped and the videos will be used to record data on target imitation behaviors.

I am hoping to recruit one child between 2 and 5 years old who has been diagnosed with autism, Asperger's Syndrome, or pervasive developmental disorder. To qualify for this study, the child must

- have the ability to imitate gross motor and fine motor actions and actions with objects in a structured context, but have difficulty imitating motor actions in natural play activities
- have an interest in watching TV or videotapes for 10 minutes at a time, and have a VCR or DVD player and T.V. available at home
- have the ability to attend to a preferred play activity for at least 5 minutes,
- have a parent or sibling (brother or sister) available who can participate in probe sessions in the home, and
- have an adult (parent) who is willing to supervise video viewing and follow the research protocols for doing so.

The research will take place in the child's home. The intervention requires that probe sessions occur for approximately 15-20 minutes, 1-3 times per week for 6-8 weeks. In addition, the child will be asked to watch videotaped play sessions for approximately 10 minutes per day for several weeks. There are no foreseeable risks to the participant with autism or to his/her sibling or parent. Potential benefits include improved generalization of imitation skills with peers and information about the efficacy of video modeling as an intervention for other children with autism spectrum disorders.

If you are interested in having your child participate, please contact me directly at 604-836-4308, or vkleeber@interchange.ubc.ca. Alternatively, you may contact my advisor, Dr. Pat Mirenda, at (604) 822-6296 or pat.mirenda@ubc.ca. I hope that you will assist me in my study. Thank you for your time!

Appendix C

Parent and Participant Consent Form

Informed Consent Form (Participant and Parent)

Teaching Children with Autism to Imitate in Natural Contexts Using Video Modeling

Principal Investigator
Pat Mirenda, Ph.D., Professor (Faculty Advisor)
Department of Educational Psychology and Counseling Psychology, and Special Education (ECPS), Faculty of Education, University of British Columbia
(604) 822-6296

Co-investigator
Vickie Kleeberger, Graduate Student (Masters)
Department of Educational Psychology and Counseling Psychology, and Special Education (ECPS), Faculty of Education, University of British Columbia
(604) 836-4308
Research for the fulfillment of degree requirements for the Masters of Arts degree. Ms. Kleeberger will use the data from this project for her thesis (public document)

Purpose of the Study

The purpose of the study is to investigate the effectiveness of a video modeling intervention for increasing generalized imitation skills in children with autism. Your child is eligible to participate because he or she is diagnosed with an autism spectrum disorder and is able to imitate a model in a structured context, yet has difficulty performing imitative behaviors in natural contexts (i.e., activities such as songs and toy play activities).

Study Procedures and Time Commitment

The study will focus on increasing the generalized imitation skills in children with autism in natural contexts. The intervention will include video modeling and probe sessions with a parent or sibling and the researcher. Probe sessions will be videotaped, and the investigator will use these videotapes to record data on your child's imitative behaviors.

The research will take place in your home in a place and at a time that is convenient to you and your child. Your child will be required to watch a 3-9 short videotape examples every day for 6-7 weeks (approximately 10 minutes per day), under your supervision. The videotapes will depict two adults engaged in various song and play activities that your child enjoys. Your child will also be required to participate in short probe sessions with you or a sibling, 1-3 times per week for 6-8 weeks (approximately 15 minutes per session). You or a sibling of the child will be required to participate the probe sessions. During the probe sessions, the researcher will sing songs and play games and toys with your child with autism and with you or the child's sibling. The probe sessions will be videotaped.

There are no foreseeable risks to you or to your child with autism. The expected benefits include improved imitation skills for your child in naturally-occurring activities, and increased knowledge about the usefulness of video modeling as an effective intervention for children with autism spectrum disorders.

Confidentiality
All information from this research will be kept strictly confidential. Your child will not be identified by name in any reports of the completed study. All data records and videotapes will be kept on a password-protected computer disk or in a locked file cabinet and destroyed 5 years after the end of the study. Only the principal investigator, the co-investigator, and one research assistant will have access to the data.

Contact
If you have any questions or would like more information about this project, you may contact either Vickie Kleeberger at (604) 836-4308 or Dr. Pat Mirenda (604) 822-6296. If you have any concerns about your child's treatment or rights as a research participant, you may contact the Director of the UBC Office of Research Services and Administration at (604) 822-8598.

Consent
I understand that my participation in this study and that of my child is entirely voluntary. I or my child may refuse to participate or may withdraw from the study at any time without jeopardy to the services my child is currently receiving from the Family Centred Practices Group or to my future relationship with the University of British Columbia.

Please check ✓ below:

☐ I have received a copy of the consent form.

Please check ✓ one box below:

☐ **I consent** to my participation and that of my child with autism in this study.
☐ **I do not consent** to my participation or that of my child with autism in this study.

If you consent to participate in this study, please print your name and that of your child and sign the appropriate section below.

______________________________	____________________
Child's name (please print)	Date
______________________________	____________________
Parent/Guardian's name (please print)	Date
______________________________	____________________
Parent/Guardian's signature	Date

Appendix D

Pre-Assessment Items: Video Model Examples

DATA SHEET-Pre-Assessment-Video Model Examples

Date: ____________________________ Rater: ________________________________

	Gross Motor Songs						
	Action	Data			Summary		Additional Comments
					Aquired	Novel	
Head and Shoulders	Head						
	Shoulders						
	Knees						
	Toes						
	Eyes						
	Ears						
	Mouth						
	Nose						
Wheels on the	Roll hands						
	Move on Back						
	Crying						
	Ssshhhh						
Slippery Fish	Slippery Fish						
	Oh no (hands to cheeks)						
	Clap						
	whale (arms out)						
	Shark (hands above head-point)						
Gross Motor Actions TOTALS:							
	Finger Plays						
Open Them, Shut Them	hands open						
	hands shut						
	Clap						
	Fold Hands						
	Creep fingers						
	eating (tap chin)						
	hands behind back						
Itsy Bitsy Spider	Spider						
	Rain (wiggle fingers)						
	arms out						
	Sun (hands above head-circle)						

5 Frogs	5						
	eating (touch chin)						
	rub tummy						
	1						
	4						
	3						
	2						
	Shut hands						
	Finger Play Action TOTALS:						
	Toy Play Activities						
Baby Doll	feed baby						
	hug baby						
	kiss baby						
	rock baby						
	burp baby						
Carnival Set	person in						
	person out						
	turn with thumb (bugs)						
	turn top (airplanes)						
	turn wheel (ferris wheel)						
	wave person						
Construction Set	push tractor						
	block in						
	lift scoop						
	lower scoop						
	mix cement (turn)						
	walk person						
	Toy Play Action TOTALS:						

*** Do not assess the actions that are shaded. These actions have been assessed previously in the assessment. Indicate whether they are novel acquired based on this previous assessment.

Appendix E

Pre-Assessment Items: Generalization Probe Examples

DATA SHEET- Pre-Assessment-Generalization Examples

Date: ________________________ Rater: ____________________________

	Gross Motor Songs						
	Action	Data			Summary -	Summary +	Additional Comments
Rolly Polly	Roll hands						
	arms up						
	arms out						
	Touch toes						
	clap						
	fold hands						
Zoom, zoom, zoom	Brush palms						
	'Come here' gesture						
	5						
	4						
	3						
	2						
	1						
	arms up						
Gross Motor Actions TOTALS:							
Finger Plays							
Where is Thumbkin?	hands behind back						
	thumb up						
	wiggle fingers						
	1 (pointer finger)						
	2						
	4						
	5						
	pinkie up						
Twinkle, Twinkle Little Star	Hands open						
	Hands shut						
	Point to self						
	Point away from self						
	Hands above head (circle)						
	Thumb & index finger together						
Finger Play Action TOTALS:							

Toy Play Activities							
Playdoh	roll playdoh						
	thumb in playdoh						
	roll ball						
	shape cutter						
	cut playdoh (knife)						
	cut playdoh (scissors)						
	push playdoh (tube)						
Car Garage	car down ramp						
	car up ramp						
	crash cars						
	person in						
	drive car (push car)						
	car in elevator						
	elevator up						
Toy Play Action TOTALS:							

*** Do not assess the actions that are shaded. These actions have been tested previously in the assessment. Indicate whether or not they are novel or acquired based on the previous assessment.

Appendix F

Probe Session Protocol

Date:____

Activities for Today:

Activity #1:	Activity #2:	Activity #3:
1.	1.	1.
2.	2.	2.
3.	3.	3.

Preparation:

☐ Check date and top of sheet to determine order of play activities for the day.

☐ Set up video camera on the tripod. Put the video camera on the duct tape marked for the specific activity (approximately 6 feet from the first play activity). Put the tape in. Focus the video camera on the area of the first activity.

☐ Prepare play materials – Take the play materials out of the bags and put together any required pieces.

☐ Take the baby dolls out of the bag and set up in a specified location.

☐ Take the third toy play activity (carnival set or construction set to be decided with participant) out of the box and set up all the materials on a table. Be sure to place the figurines near the other play objects.

☐ Double check the schedule to make sure that the order of activities for the day is correct on this sheet.

☐ Check the video camera. Make sure it is focused on the first activity.

☐ Make sure to have the child use the bathroom before beginning of the probe session.

☐ Go back to the camera. Begin recording.

Activity 1:

☐ Tell children, "Today we are going to play/sing (first activity), then (second activity), and last (last activity)." And show the child the visual schedule.

☐ Check that the video camera is focused on the child and parent, and that it is recording.

Appendix F (continued)

- [ ] Then tell them, “Let’s play/sing (first activity)” and direct them over to the activity using gesture prompts and possibly 1-2 verbal prompts (e.g. “sit down here” or “play (activity) on the floor”).

- [ ] **Do not give any additional prompts during the songs or play.**

- [ ] If either the participant leaves the play area for more than 20 seconds before the end of the activity, redirect him back to the activity and say “Play/sing (activity) with (parent).” If the child leaves the area again for longer than 20 seconds, consider the activity over and instruct the child to sing/play the next activity.

- [ ] If the child leaves the play area, stop the activity. Restart the activity and continue from where you left off when the child returns or is prompted to return.

- [ ] If the child attempts to interact with you during the session, say, “Time to play/sing with (parent).” If the child persists (e.g. needs help with something), provide help without saying anything.

Activity 2:

- [ ] When the first activity is completed, prompt the children to move to the second activity. Say, “(activity) is all done. Let’s play/sing (activity).” Do not ask the children to put the toys away from the first activity if applicable.

- [ ] Move the video camera to the duct tape mark for the second activity. Make sure it is still on and recording, and focus it on the second activity.

- [ ] Check that the video camera is focused on the children and that it is recording.

- [ ] **Do not give any additional prompts during songs and play activities.**

- [ ] If the participant leaves the play area for more than 20 seconds before the end of the activity, redirect him back to the activity and say “Play/sing (activity) with (parent).” If the child leaves the area again for longer than 20 seconds, consider the activity over and instruct the children to sing/play the next activity.

- [ ] If the child leaves the play area, stop the activity. Restart the activity and continue from where you left off when the child returns or is prompted to return.

Appendix F (Continued)

☐ If the child attempts to interact with you during the session, say, "Time to play/sing with (parent or sibling)." If the child persists (e.g. needs help with something), provide help without saying anything.

Activity 3:

☐ When the second activity is completed, prompt the children to move to the third activity. Say, "(activity) is all done. Let's play/sing (activity)." Do not ask the participants to put the toys away from the first activity if applicable.

☐ Move the video camera to the duct tape mark for the third activity. Make sure it is still on and recording, and focus it on the third activity.

☐ Check that the video camera is focused on the children and that it is still recording.

☐ **Do not give any additional prompts during play.**

☐ If the participant leaves the play area for more than 20 seconds before the end of the activity, redirect him back to the activity and say "Play/sing (activity) with (parent)." If the child leaves the area again for longer than 20 seconds, consider the activity over and tell the child that they are "all done playing."

☐ If the child leaves the play area, stop the activity. Restart the activity and continue from where you left off when the child returns or is prompted to return.

☐ If the child attempts to interact with you during the session, say, "Time to play/sing with (parent or sibling)." If the child persists (e.g. needs help with something), provide help without saying anything.

☐ When the song or play activity is completed, prompt the participants to stop the current activity and let them know they are finished playing. Say, "(activity) is all done. All done playing today."

Final Steps:

☐ Stop recording. Rewind the tape in the video camera.

☐ Remove the tape and write the date, time started, and time ended on the tape label.

☐ Turn off the video camera.

Appendix F (Continued)

☐ Hook up the power cord to the video camera, and plug it in so that the battery charges for the next session.

☐ Put the tape in the “PROBE SESSION VIDEOS” folder of the binder

☐ Clean up the play activities. Put all materials as they were (in all containers) and put boxes away. Make sure toys are clean (remove excess play doh, etc.) and get ready for next session. Store the boxes in the researcher’s bag as these will be taken from the home and brought for the next probe session.

Appendix G

Video Viewing Protocol

VIDEO VIEWING PROTOCOL

Date:____

Imitation Activities to be shown: ☐ Gross Motor Songs ☐ Finger Plays ☐ Toy Play

☐ Show the tape within an hour of the Probe Session, if there is one planned for the day.

☐ Get the DVD from the plastic folder in the black thesis binder. Begin filling out the data sheet with the activities to be shown for that day.

☐ Put chair in front of T.V. in living room (approximately 4-5 feet from the T.V.)

☐ Put the video in the DVD player. Make sure it is cued up at the beginning.

☐ Call Peter. Tell him/her to sit in the chair. Tell him/her, "Time to watch the play video."

☐ Play the DVD.

☐ **For the GROSS MOTOR SONGS and FINGER PLAYS:** Highlight the critical features of the video to Peter during DVD viewing. Make at least one comment for each video model example.
- Example statements:
    - "Look the people are watching the teacher and doing the same thing. Good for them!"
    - "The people in the video are doing the same actions as the teacher is in the songs. That looks like fun!"
    - "That was great copying. He/she did the same actions as their friend. That's good singing/playing with friends."
    - "These people are doing a great job of watching the teacher and doing the same thing. We can do the same thing as teachers too!
    - "We are watching people singing, playing and doing the same things their teacher is doing. They are doing a good job!"

☐ **For the TOY PLAY ACTIVITIES** continue to play the DVD with no additional commenting

☐ If Peter attempts to interact with you during the viewing, point to the T.V., and tell him "Time to watch the video."

☐ If Peter gets up from the chair, verbally prompt him to sit down and watch the video.

- ☐ If Peter leaves the area, pause the tape, tell Peter to return, then begin tape where it left off.
- ☐ When the tape is finished, tell Peter, "All done watching videos."
- ☐ Stop the DVD immediately after the last activity (or it will play again from the beginning), and take it out.
- ☐ Put the tape in the plastic folder in the black thesis binder so it is ready for the next viewing.
- ☐ If a probe session is planned for the day, have Peter engage in a neutralizing activity (e.g., a different toy or activity not related to the imitation activities) before the probe session.
- ☐ Complete the video viewing data sheet

Appendix H

Gross Motor Songs General Case Analysis Matrix

SONGS	**Sitting (I) or Standing (A)**	Roll Hands	Thumb up; point back	Clap	Crying action	Tap Table	Finger to lips (sshh)	Arms out	Arms up	Fold hands	Jump	'oh no' (Hands to cheeks)	shark action	Fish action	Touch floor	Scolding action	1-5 on fingers	Palms open in front of self	Brush palms together	Hands on hips	Bend body	Touch head	Touch Should	Touch Knees	touch toes	touch Eyes	Cover Ears	Touch Mouth	Touch Nose
Head & Shoulders (6)	**A**																					**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Wheels on the Bus (5)	**I**	**X**	**X**		**X**		**X**																						
Bingo (5)	**I**			**X**																									
Rolly Polly (5)	**I**	**X**		**X**				**X**	**X**	**X**																			
Zoom… (5)	**A**								**X**								**X**	**X**											
Teapot (5)	**A**							**X**												**X**	**X**								
Slippery Fish (4)	**I**			**X**				**X**				**X**	**X**	**X**															
5 Monkeys (4)	**A**										**X**				**X**	**X**	**X**					**X**							
Pat a Cake (3)	**A**	**X**		**X**		**X**												**X**											
Row Boat (3)	**I**							**X**																					
Bubble gum song (3)	**I**			X				**X**																					
Bridges Falling Down (3)	**A**							**X**							**X**														

Appendix I

Finger Plays General Case Analysis Matrix

SONGS	Sitting or Standing	Thumbs up	1 (index finger)	2: 2 fingers up	3	4	5	Rub tummy	Eating	Make fists	Open hands (palms up)	Clap	Creep fingers	Hands behind back	Thumb and Index finger tips together	Wigglefingers	Hands out to side	Hands above head (circle)	Point to self	Point away from self	Cup hands	Fist to hand	Squeeze toes/ fingers	Squish Palms	Wipe hands
Open Them, Shut Them (6)	**I**								**X**	**X**	**X**	**X**	**X**	**X**											
Twinkle Little Star (6)	**I**									**X**	**X**				**X**				**X**	**X**					
Little Bunny Foo Foo (6)	**I**			**X**																	**X**	**X**			
Where is Thumbkin ? (5)	**I**	**X**																							
5 Green & Speckled Frogs (5)	**I**		**X**	**X**	**X**	**X**	**X**	**X**	**X**																
Itsy Bitsy Spider (5)	**I**														**X**	**X**	**X**	**X**							
This Little Piggy (3)	**I**													**X**									**X**		
Bumble Bee Song (3)	**I**										**X**										**X**			**X**	**X**

Appendix J

Different Actions Associated with Imitation Activities

Finger Plays	**Gross Motor Songs**	**Toy Activities**		
Open Them…, 5 Frogs, Itsy Bitsy	**Head & Shoulders, Wheels on the Bus, Slippery Fish**	**Baby Doll**	**Carnival Set**	**Construction Set**
- Hands open - Shut hands - Clap - Fold hands - Creep fingers - Eating - Hands behind back - Spider - Rain (wiggle fingers) - Wash out - Sun - 1 - 2 - 3 - 4 - 5 - rub tummy	- touch head - touch shoulders - touch knees - knees toes - touch eyes - touch ears - touch mouth - touch nose - roll hands - move on back - crying - sshh - fish - clap - whale - shark - oh no!	- feed baby - hug baby - kiss baby - rock baby - burp baby	- put person in (carnival rides) - take person out - crank ferris wheel - turn top - turn wheel - twist person (“bye”)	- push digger - put brick in digger - lift scoop up - push scoop down - walk person - mix cement (turn handle)

Appendix K

Action Coding Key

ACTION	DESCRIPTION
Gross Motor Songs	
touch head	Both hands are raised to the top of head; tap head. Arms are out to sides; elbows are bent.
touch shoulders	Both hands are raised to tap shoulders; arms are out to the side perpendicular to body.
touch knees	Hands extended out in front of the body; palms down; tap knees
touch toes	Body is bent; arms are extended and hands are reached down parallel with legs to tap toes.
touch eyes	Arms are bent and are oriented toward the face; palms facing in. Hands are open; cover both eyes with both hands.
touch ears	Both hands are open and oriented towards the side of the head; elbows are bent. Cover ears
touch mouth	One hand is open and raised to orient towards mouth; touch lips with fingertips.
roll hands	Arms raised; palms closed, facing down. Forearms and hands move in a circular motion around one another.
move on back	A fist is made with one hand; palm facing inwards; thumb pointing up. Raise arm, bent at the elbow so that the thumb is pointing behind, over shoulder.
crying	Fists are made with both hands; palms facing down. Arms are raised and hands are oriented up towards the corners of the eyes. Short up and down motions are made with hands.
ssshhh	A fist is made with the hand; index finger is extended to make a point. Index finger is raised and placed on lips.
fish	Hands are open, facing inwards. Palms are together and pushed forward in a waving motion.
clap	Hands are open, facing inwards. Palms are clapped together, then pushed away.
whale	Arms are out to the sides; elbows bent; perpendicular to the body. Hands are made into fists. Move arms up and down in opposing directions.
shark	Both hands are raised above the head; elbows bent. Hands are placed on top of head; palms together facing one another to create a point.
oh no!	Arms are raised oriented towards the face. Palms are open; touch both cheeks. Open mouth.
Arms up	Arms are fully extended raised above the head.
Arms out	Arms are fully extended out to the side of the body
brush palms (zoom)	Hands are open, facing inward and fingers are pointing up. Hands brush together in an up and down motion.
moon	Hands are touching above head; hands are in a circle around head.
Finger Plays	
hands open	Arms raised; hands at eye level. Palms open facing outwards away from the body.
shut hands	Arms raised; hands at eye level. Palm facing outwards away from the body; hands in a fist
clap	Hands are open, facing inwards. Palms are clapped together, then pushed away.
fold hands	Hand are folded: fingers are laced together, palms together facing inwards. Hands are placed together in lap or on table.
creep fingers	Left arm is extended in front of body. Index and middle of right hand walk up left arm, starting at forearm; moving up.
eating	One hand is open and raised to orient towards mouth; touch lips with fingertips.
hands behind back	arms extended and hands are put behind the back

	spider	Put index finger to the thumb of the opposite hand, then switch. Walk fingers up (alternating) while raising arms.
	rain	Raise both arms above head; palms open and facing down. Move both hands down slowly wiggling fingers
	wash out	Hands together, palms facing in to start. Push hands away from eachother palms facing the flop. Hands are moved out to the sides, palms facing out. One smooth motion is made.
	sun	Hands are touching above head; hands are in a circle around head.
	1	Hand is in a fist and index finger is extended pointing up.
	2	Hand is in a fist; index and middle fingers are extended up.
	3	Thumb and pinky finger pressed together facing palm of hand; index, middle, and ring finger are extended up.
	4	Thumb facing in towards palm of hand; index, middle, ring, and pinky fingers are extended up.
	5	Hand is open, all fingers are extended, palm is facing out.
	rub tummy ("yum, yum")	Hand is open, palm facing toward the body; hand is moving in a circular motion rubbing stomach.
	Thumbs up	Fists are closed and thumbs are extended upwards.
	wiggle fingers	Extended fingers are moved quickly (wiggled).
	point to self	Index finger is extended and pointing inwards toward chest
	point away from self	Index finger is extended and pointing away from the body
	diamond	Index finger tips and thumb tips from both hands are put together in a diamond shape. A fist is made with the three remaining fingers.
Toy Play with Objects		
PLAYDOH	**roll playdoh with roller**	Hold the ends of the roller with both hands. Roll the roller away from the body flattening playdoh.
	shape cutter	place cutter on top of flat playdoh and push down with open hand
	make a ball	Hold playdoh between hands, palms facing in. Move hands in opposite circular directions to roll a ball with playdoh.
	thumb in playdoh	Hand is in a fist, thumb is extended and pushed down into the playdoh.
	push playdoh through shape tube	Hold shape tube with one hand, push extended piece of the shape tube to push playdoh out.
	cut playdoh	Hold play knife in one hand and cut a piece of playdoh.
BABY	**feed baby**	Hold baby in one arm facing up. Hold the bottle in the other hand and orient the bottle towards the baby's mouth.
	hug baby	Hold baby upright close to the chest; cross arms over baby and squeeze.
	kiss baby	Hold baby upright with both hands. Bring baby's head up and kiss the baby's head.
	rock baby	Hold underneath the baby with both arms. The baby is facing up. Move arms side to side rock baby.
	burp baby	Hold baby upright close to chest with one arm. With the other hand lightly pat baby's back 5 times.
CARNIVAL	**person in**	Pick up person figurine and place the person inside the vehicles (e.g., airplanes, horses, ferris wheel cars)
	crank ferris wheel	Place an open hand on the top of the ferris wheel and turn to the side.
	person out	Pick up person (figurine) from the vehicle where the person was placed with one hand.
	turn top	On airplane toy, hold the top and turn.
	turn wheel	On the horse ride toy, turn the wheel on the left hand side of the toy with the thumb.
	person leaves	Holding person figurine in one hand twist the person from side to side by turning

		the wrist.
CONSTRUCTION	**push digger**	Hold the digger in one hand and push it sideways along the table
	brick in	Pick up the brick and place it into the scoop of the digger.
	lift up scoop	With one hand, lift the scoop of the digger up
	scoop down	With one hand, push the scoop of the digger down, so that it is resting on the table
	mix cement	With one hand, turn the barrel of the cement mixer from side to side.
	walk person	Hold the figurine in one hand, lift the person up off the table and then down again in a forward motion.
CAR GARAGE	**crash cars**	Hold two cars (one in each hand), push them along the table toward eachother so that they touch.
	person in car	Pick up a figurine and place it in the toy car.
	car up ramp	Push car up the ramp of the car garage; from the bottom to the top
	car down ramp	Hold onto a car with one hand and push it down the ramp of the car garage
	get gas	Take out the fuel pump and put it into the hole in the toy car
	in elevator	push car on the table into the elevator
	elevator up	With one hand, turn the handle on the elevator until it gets to the top

Appendix L

Initial Video Viewing Script and Data Sheet

Date	Time	Supervised by	Explanation of target behaviors	Explanation of playing and talking	Duration of Video	Number of times child left area	Number/type of prompts needed to watch	Additional Comments
			Have child sit in comfortable location (chair in front of T.V.) Say, "Time to watch a video. We are going to watch people singing playing and doing the same things their friends are doing." **Said this: Y or N**	Say, "Let's watch the people playing and singing." **Said this: Y or N** Turn on video. Point out people playing. Say, "Look they are playing/singing (activity)." **Said this: Y or N** Point out people doing the same as the model. Say, "That was great copying. He/she did the same actions as their friend. That's good singing/playing with friends." **Said this: Y or N** Point out two more occasions of people imitating the model. **1. Y or N** **2. Y or N** When video is finished, say "We can copy our friends and do the same actions." **Said this: Y or N**				

Appendix M

Probe Session Data Sheet

DATA SHEET-Probe Sessions-Video Model Examples

Date: ___________________________ Rater: ________________________________

	Gross Motor Songs							
	Action	Score				Summary 0+1	Summary 2+3	Additional Comments
Head and Shoulders	Head							
	Shoulders							
	Knees							
	Toes							
	Eyes							
	Ears							
	Mouth							
	Nose							
Wheels on the	Round & Round							
	Move on Back							
	Crying							
	Ssshhhh							
Slippery Fish	Slippery Fish							
	Oh no							
	Clap							
	whale (arms out)							
	Shark							
Gross Motor Actions TOTALS:								
Finger Plays								
Open Them, Shut Them	hands open							
	hands shut							
	Clap							
	Fold Hands							
	Creep fingers							
	eating (tap chin)							
	hand behind back							
Itsy Bitsy	Spider							
	Rain							
	wash out							
	Sun							
5 Frogs	5							
	eating							

	rub tummy							
	1 1 (Continued)							
	4							
	3							
	2							
	Shut hands							
Finger Play Action TOTALS:								
Toy Play Activities								
Baby Doll	feed baby							
	hug baby							
	kiss baby							
	rock baby							
	burp baby							
Carnival Set	person in							
	crank ferris wheel							
	person out							
	turn top (airplanes)							
	turn wheel (bugs)							
	wave person							
Construction Set	push digger							
	brick in scoop							
	lift scoop up							
	scoop down							
	mix cement (turn)							
	walk person							
Toy Play Action TOTALS:								

Appendix N

Generalization Probe Example Data Sheet

DATA SHEET-Probe Sessions-Generalization Examples

Date: ________________________ Rater: ____________________________

	Gross Motor Songs							
	Action	Score				Summary 0+1	Summary 2+3	Additional Comments
Rolly Polly	roll hands							
	Clap							
	Arms out							
	Arms up							
	Touch Toes							
	Fold Hands							
Zoom, zoom, zoom	Brush palms							
	Hands above head (circle)							
	5							
	4							
	3							
	2							
	1							
	Hands above head (point)							
Gross Motor Actions TOTALS:								
Finger Plays								
Where is Thumbkin?	hands behind back							
	Thumbs up							
	Wiggle fingers							
	index finger up (1)							
	tall man (2)							
	ring man (4)							
	pinkie up							
	family (5)							
Twinkle, Twinkle	open hands							
	shut hands							
	point to self							
	point away from self							

	hands above head (circle)							
	thumb & index finger together							
Finger Play Action TOTALS:								
Toy Play Activities								
Baby Doll	roll ball							
	stick thumb in							
	roll playdoh							
	shape cutter							
	cut with knife							
	push tube toy							
Car Garage	crash cars							
	person in car							
	drive car							
	car up ramp							
	car down ramp							
	in elevator							
	elevator up							
	get gas							
Toy Play Action TOTALS:								

Appendix O

Scoring Procedures

STEPS IN SCORING:

1. Put video in VCR – make sure it is at the beginning of the tape.

2. Get out the data sheet and a pen.

3. Have scoring definitions and the action coding key available.

4. Write the current date where indicated on the data sheet.

5. Begin to play the videotape.

6. After each imitation behavior is performed by the model and subsequently responded to by target child, score whether the behavior was a 0, 1, 2, or 3. Refer to the definitions regularly.

7. Pause/rewind/rewatch the video as needed.

8. Total the number of imitation behaviors scored as 0 and 1 and the total number of imitation behaviors scored as 2 or 3 across all the imitation activities.

SCORING DEFINITIONS
(adapted from MIA scoring manual; Lowe-Pearce & Smith, 2005)

Motor Actions With and Without Objects
3 = Exact Imitation
- The child shows an exact imitation of the behavior the adult has modeled (see the Action Coding Key for exact imitation)

2 = Emerging Response involving Partial Imitation
- The child attempts to perform the imitation behavior, but does not complete it
- The child's postures are similar in form, but do not meet "exact" imitation criteria
- The child uses the object in a similar way as the model, but does not the "exact" imitation criteria (e.g., the child bangs the playdoh on the table instead of making a ball with the playdoh as modeled)

1 = Emerging Response with No Imitation
- The child performs some behavior in response to the model, but the behavior does not resemble the behavior that was demonstrated by the model
- The child uses the object in some way in response to the model, but the child uses the object for some other purpose than the demonstrated action (and the action the child performs does not meet the previously described 2-point criterion)

0 = No Response
- Failure to imitate
- Negative behaviors (e.g., crying) in response to the behavior performed by the model

Appendix P

Video Viewing Data Sheet

Date	Time	Supervised by	Examples Watched (Write activity, and circle number of examples watched per activity)	Duration of Video	Number of times child left area	Number/type of prompts needed to watch	Neutralization Activity Peter engaged in (on days Probe Session occurred)	Additional Comments
			Activity:___________ Examples: 1 2 3 Activity:___________ Examples: 1 2 3 Activity:___________ Examples: 1 2 3					
			Activity:___________ Examples: 1 2 3 Activity:___________ Examples: 1 2 3 Activity:___________ Examples: 1 2 3					
			Activity:___________ Examples: 1 2 3 Activity:___________ Examples: 1 2 3 Activity:___________ Examples: 1 2 3					
			Activity:___________ Examples: 1 2 3 Activity:___________ Examples: 1 2 3 Activity:___________ Examples: 1 2 3					