INTRODUCTION
Parents and educators recognize that children can learn a wide variety of skills by observing the actions of others. Specific skills are often taught to children by demonstrating an action that the child is to perform [e.g., how to dry himself with a towel, throw a ball, use a vending machine]. More generalized skills such as social interactions, following classroom routines, or playing games are also often learned by watching what others do in certain situations. When children are unsure of how to respond, one of the most effective courses of action is to watch what others are doing and respond in a similar fashion.

Professionals and theoreticians in the field of child development are in agreement about the importance of children learning skills by observing the actions of others (Bandura, 1962; Bijou, 1993; Bijou & Bear, 1965; Piaget, 1962). However, researchers also note that merely observing the actions of others is not sufficient to result in skill acquisition. To acquire skills, an individual must be able to imitate the observed actions [that is, duplicate the behavior modeled by others] (Catania, 1972) and discriminate the appropriate conditions for use of the skills (Brown, Brown, & Poulson, 2008).

Parents understand the importance of their children being able to observe children who are exhibiting appropriate behavior and communicating and socially interacting well with their peers and teachers. Thus, parents of children with an autism spectrum disorder (ASD) often wish to include their children in educational settings with typically developing children to enable exposure to models of appropriate language and social behavior. The hope is that the child with autism will learn how to participate in educational activities, communicate, and socially interact with other children. For a child to learn from appropriate models, however, the child must be able to both attend to the actions of others and imitate them. Without the ability to watch and replicate others’ actions, a child will not be able to learn the many critical skills that are being modeled by others.

Unfortunately, many children with autism often don’t pay close attention to the critical aspects of the actions carried out by individuals who are performing a task. A child may have numerous models of actions that could be useful in learning a wide variety of skills, but if the child doesn’t pay attention to those actions, the learning opportunity will be missed. Moreover, even if children are observing appropriate models, they still will not learn the skills if they haven’t learned to imitate sequences of actions. Thus, it is important to ensure that children are able to both pay attention to the actions of others and replicate those actions in a very precise manner.

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Children with autism are likely to benefit from a well-established generalized imitative repertoire. The development of a wide range of imitative skills, therefore, should be included in children’s intervention programs.

IMITATIVE SKILLS: WHAT THE RESEARCH SHOWS

Researchers have documented that the ability to imitate the actions of others emerges at an early age for typically developing children (Gopnik, Meltzoff, & Kuhl, 1999; Meltzoff & Moore, 1999; Poullson & Kymissis, 1988; Poullson, Kyparissos, Andreatos, Kymissis, & Parnes, 2002), and develops in complexity over the first two years of life (Hanna & Meltzoff, 1993; Kuczynski, Zahn-Waxler, Radke-Yarrow, 1987; Masur & Ritz, 1984). The development of the imitative repertoire has a major influence on the development of language skills (Charman, 2006; Masur, 2006; Meltzoff & Grönqvist, 1993; Nadell, Guérini, Pezé, & Rivet, 1999), social interactions with peers (Nadel & Peze, 1993; Wolfberg, 2003), the development of joint attention (Slaughter & McConnell, 2003; Tomasello, 2001), and the sharing of experiences and emotions (Stern, 1983).

Many studies have demonstrated that there is an imitation deficit in children with autism (see Rogers & Williams, 2006 and Williams, Whiten, & Singh, 2004 for reviews; Perrla et al., 2008; Stiegltiz Ham, Corley, Rajendran, Carletta, & Swanson, 2008; Thurm, Lord, Lee, & Newshaffer, 2007; Vanvuchelen, Roeyers, & De Weerdt, 2007; Vivanti, Nadig, Ozonoff, & Rogers, 2008). Studies have found that children with autism do not perform imitation tasks as well as either typically developing peers or children with other developmental delays (Abrahamsen & Mitchell, 1999; Charman et al., 1997; Curcio, 1978; Dawson & Adams, 1984; Dawson, Meltzoff, Osterling, & Rinaldi, 1998; DeMeyer et al., 1972; Jones & Prior, 1985; Heimann & Ullstadius, 1999; Rogers, Hepburn, Stockhouse, & Wehner, 2003; Stone, Ousley, & Littleford, 1997). These findings suggest that there is an imitation deficit specific to autism. Some researchers believe that this particular deficit is, in fact, one of the core features of an ASD (Schreibman, 2005).

Impaired language development also is a hallmark of ASDs. As already noted, imitation skills are essential for the development of language. McDuffie and colleagues (2005) found that imitation abilities were prelinguistic predictors of vocabulary in young children with autism. Greater imitation skills have been associated with higher language skills in both typical and nontypical populations in multiple studies (Charman et al., 2003; Stone et al., 1997; Stone & Yoder, 2001; Thurm et al., 2007).

It is interesting to note that the imitation skills of a child diagnosed with ASD prior to commencement of early intervention programs have been shown to predict responsiveness to the intervention. In some studies, children with ASD were more likely to attain higher levels of development if they had already developed some imitative skills prior to the implementation of early intervention services (Sallows & Graupner, 2005; Weiss, 1999). Similarly, Ben-Itzchak and Zachor (2007) found that after controlling for students’ IQ, imitation and receptive language skills were the only variables differentiating between high-performing and low-performing children with autism after one year of applied behavior analysis (ABA) early intervention. Thus, it would appear that children with autism are likely to benefit from a well-established generalized imitative repertoire. The development of a wide range of imitative skills, therefore, should be included in children’s intervention programs (Rogers & Vismara, 2008).

Numerous studies have demonstrated that children with autism who possess some preexisting imitative skills can go on to develop a wide range of skills using imitative models. Examples include:

- Teaching peer imitation skills to preschool children with autism using an established imitation repertoire and adult-led teaching sessions (Carr & Darcy, 1990)
- Teaching children with autism to imitate their peers’ play actions with toys (Tryon & Keane, 1986)
- Using imitative prompts to teach a child with autism to tact (i.e., expressively label) common objects using sign language (Parlington, Sundberg, Newhouse, & Spengler, 1994)
- Using an imitation-based intervention to develop and use spontaneous gestures in young children with autism (Ingersoll, Lewis, & Kroman, 2007)
- Teaching children with autism to engage in play using imitative models (Ingersoll & Schreibman, 2006)

Almost all of these interventions have used professionals to develop the imitative skills; in only a few studies have parents also been taught how to further their child’s imitative skills (Ingersoll & Gergans, 2007; Risley, 1968).

Several other topics are relevant to a discussion of children with autism and development of imitative skills:

1 Development of initial imitative skills: Although the development of initial imitative skills is frequently included as a component of early intervention programs for young children with ASD, there is still a lack of research focusing on how to teach imitation skills to children who lack any baseline skills. The limited research relevant to the development of initial imitative skills is based on small sample sizes, and it reports on the development of only a small number of imitative responses (specific actions that replicate the actions of others). Furthermore, although there are some reports of response generalization (the child being able to imitate untrained actions as a result of the imitation training), there is a deficiency of research pertaining to the most effective methods to develop a well-generalized repertoire of imitation skills in students with ASD (Accardo, 2004; Ingersoll & Schreibman, 2006; Lovaas, Freitas, Nelson, & Whalen, 1967; Metz, 1965; Ryan, 2007).

2 Groups of imitative skills: Applied and experimental analysis of imitative responding indicates that imitation is not a single set of skills (Baer & Deguchi, 1985; Baer, Peterson, & Sherman, 1967; Baer & Sherman, 1964; Poullson et al., 2002; Young, Krantz, McClannahan, & Poullson, 1994). A child’s ability to imitate simple gross motor actions does not ensure that he or she...
Given that imitative skills are essential to a child’s development, parents and educators need to know what constitutes an adequate set of imitative skills and need to have the teaching skills to help children acquire a well-developed imitative repertoire.

3. **Range of imitative skills targeted for intervention**

Program guides intended to help practitioners design instructional programs for children with autism or other developmental delays typically include recommendations for the development of imitative skills (Kent-Udolf, 1974; Leaf & McEachin, 1999; Lovaas, 1981; Maurice, Green, & Luce, 1996; Rogers & Dawson, 2009; Partington, 2006). Many of these guides provide specific teaching recommendations about the types of skills to include in such interventions, and some provide details on how to teach the skills (Striefel, 1974). For children to have a well-generalized imitative repertoire, they must be able to imitate a wide variety of types of actions. When we reviewed the types and examples of imitative skills included in 38 research articles and program guides (Partington & Partington, 2008), we found that many of these sources included fewer than 10 imitative responses (for example, Charman et al., 1997; Slaughter & McConnell, 2003), and only five sources included at least 80 specific responses (Baer et al., 1967; Beadle-Brown, 2004; Leaf & McEachin, 1999; Metz, 1965; Partington, 2006). To accurately compare the variety and types of imitation skills that can be imitated by both typically developing children and children with autism, a larger number and broader range of imitative skills must be investigated.

**GAPS IN RESEARCH AND PRACTICE**

Although research clearly demonstrates that children with autism have deficits in imitating others, there continues to be a significant lack of information about how parents and educators can develop an effective set of imitation skills in both the home and school environments. Moreover, most available studies have been conducted in research rather than natural settings using a limited number of participants and studying a very small range of imitative behaviors. Given that imitative skills are essential to a child’s development, parents and educators need to know what constitutes an adequate set of imitative skills and need to have the teaching skills to help children acquire a well-developed imitative repertoire. Although we would expect the development of these skills to be a significant focus of children’s individualized education programs (IEPs), a review of most IEPs indicates that learning objectives to develop imitative skills—skills that are critical to the development of many other important skills—are often absent.

We present the following two small case studies as initial investigative efforts to address practical issues related to developing an effective imitative repertoire for children with ASD. The first case study sought to identify the imitative skills of typically developing preschool children. The second case study investigated the effects of having special education classroom staff provide specific instruction to develop imitative skills in children with a diagnosis of ASD in a public school classroom.

**CASE STUDY 1: MEASUREMENT OF THE IMITATIVE SKILLS OF TYPICALLY DEVELOPING CHILDREN**

**METHODS**

**Participants:** Typically developing children (N = 4) ranging in age from 37 to 56 months participated in the study. The girls we call Karen (age 3 years and 1 month) and Iris (age 3 years and 4 months) attended the same preschool. Lance (not his real name), a 4-year-old boy, and Jasmine (not her real name), a 4-year-and-8-month-old girl, were not enrolled in any preschool at the time of this study. All four participants were reported to be in good health, and neither the parents nor preschool staff nor their physicians had concerns related to the children’s development.

**Instrument:** The study used the Partington Imitation Skills Assessment (PISA), a tool we developed to address the need for a comprehensive assessment that measures the diverse types of imitative skills reported in the literature (Partington & Partington, 2008). The assessment contains a total of 108 tasks that are grouped into one of the 12 different domains shown in Table 1. In this study, some PISA tasks were presented such that children could see the model while they were performing the task (such as raising and holding arms over head), while other tasks required children to provide an imitative response after the model had presented the activity (for example, watching the model tap a tambourine three times and then imitating the tapping).

**Table 1.**

<table>
<thead>
<tr>
<th>Partington Imitation Skills Assessment domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Simple imitation with objects</td>
</tr>
<tr>
<td>2. Arm and hand gross motor movements</td>
</tr>
<tr>
<td>3. Static versus kinetic movements</td>
</tr>
<tr>
<td>4. Gross motor actions with legs</td>
</tr>
<tr>
<td>5. Hand fine motor movements</td>
</tr>
<tr>
<td>6. Head and mouth movements</td>
</tr>
<tr>
<td>7. Sequences of actions</td>
</tr>
<tr>
<td>8. Facial expressions</td>
</tr>
<tr>
<td>9. Actions with vocalizations</td>
</tr>
<tr>
<td>10. Imitations with body movement</td>
</tr>
<tr>
<td>11. Imitation of models presented in a mirror</td>
</tr>
<tr>
<td>12. Imitative models presented at a distance</td>
</tr>
</tbody>
</table>

**Setting and materials:** The study was conducted at either the child’s preschool or house. In both situations, the child and researcher sat on a couch behind a child-size table. Only toys that pertained to the study were in the room. These toys included two tambourines, two drumsticks, a book, two wooden cubes, a small plastic container, a toy dump truck, and a cardboard box that was cut to resemble a garage. The researcher recorded the accuracy of the child’s responses on the PISA task list.
Procedures: The child was required to make eye contact with the researcher before the latter demonstrated the task for the child to imitate. Once the child was visually attending to the researcher, the child was given an instruction to imitate an action (e.g., “Can you do this?” “Do this,” or “Do what I do.”) followed by modeling the action(s) to be imitated. The child was allowed five seconds to provide a response. We then scored the response as being correct, incorrect, an approximation, or a non-response if the child failed to respond to the instruction within the five seconds following the modeled action. If the child accurately imitated the model, the researcher presented the next task. If the child did not respond, imitated incorrectly, or only made an approximation on the first presentation, the instruction was repeated and the second attempt scored. After the researcher scored the second attempt, he then proceeded to the next imitative task regardless of whether or not the child correctly imitated the model. Children received feedback in the form of praise throughout the assessment (such as, “Awesome job [name of child],” “Nice,” “Wow, great job!” and “Wow, you’re a superstar!”).

Measures and analysis: We recorded the total number of first-trial correct imitative responses, approximations, errors, and non-responses on the PISA for each child. Additionally, we calculated the total correct responses, approximations, and non-responses following the second presentation of the task after a non-correct first-trial response. The percent of correct responses that occurred on the first presentation of the task and following the second presentation were then calculated.

RESULTS
The study’s results indicate that typically developing children ranging from 37 to 56 months of age display a high level of imitative ability. The percent of correct responses on the first presentation of the model ranged from 77% to 96% (see Table 2). Furthermore, all of the children’s scores increased when the responses were scored as correct on the second attempt for those items missed on the initial presentation. When allowed to attempt the tasks a second time, the range of correct imitative responses increased to 87% to 97%. The time required to complete the entire imitation protocol ranged from 23 to 28 minutes, with an average of 26.5 minutes per participant.

There were relatively few actions that the children were unable to imitate. The most frequent types of errors occurred on tasks that required the children to imitate an action after it was modeled (such as touching four items in sequence or imitating a series of motor movements after the model had demonstrated them), moving a foot to point the toes up and down, moving a foot from side to side, imitating specific facial expressions, and carrying out actions with a concurrent vocalization.

DISCUSSION
The results from this study demonstrate that by around age three, typically developing children can imitate a substantial range of actions; by four years of age, children are able to accurately imitate a substantially larger range of actions. Our study also indicates that typically developing children from three to four years of age can imitate actions and provide accurate responses even after the model is no longer present. The four children in the study were able to complete an average of approximately four to five imitative responses per minute for the duration of the assessment.

Typically developing children demonstrated the ability to imitate a wide variety of imitative skills without any previous structured teaching. Their performance on the broadly scoped PISA demonstrates that typically developing children can fluently imitate a large number of actions within a 20- to 30-minute time period and can do so when provided with only social reinforcement. Furthermore, even when children were unable to imitate an action or series of actions on the first attempt, they were often able to imitate those same actions when provided with one additional demonstration. The study’s findings may be useful in determining the level of imitative skills important for children with ASD to be able to fully participate in a wide range of activities with typically developing peers.

CASE STUDY 2: SYSTEMATIC INSTRUCTION OF ImitATION SKILLS TO YOUNG STUDENTS WITH AUTISM

METHODS
Participants: Children who had previously been diagnosed with ASD and attended a special education classroom in a public school (N = 3) participated in this study. The children were from four to five years of age, with mixed socioeconomic status and different ethnicities (i.e., Asian, Caucasian, and African-American). The participants did not have any formal imitation training prior to the study. At baseline, Luke (not his real name) was 4 years 4 months old, could talk, had about 100 words in his verbal repertoire, frequently used two-word phrases, had been receiving autism intervention services for two years, and had been receiving discrete trial training (DTT) for five months. [DTT is a teaching methodology that breaks skills into small component areas that can be quickly presented; the responses can be prompted, corrected, or reinforced immediately.] Lisa (not her real name) was 5 years and 5 months old, did not speak, used a mixture of sign language and some vocalizations to communicate, and had been receiving services for ASD for one and a half years and DTT for four months. Steve (not his real name) was 4 years and 11 months old, could talk, had about 150 words in his verbal repertoire, frequently

| Table 2. Number and percent of correct items scored on the Partington Imitation Skills Assessment for typically developing children |
|-----------------|-----|------|---------|-------|------|------|
| Child     | Age | Minutes | Items given | # Correct initial | % Correct initial | # Correct 2nd | % Correct 2nd |
| Karen     | 3-1 | 25     | 107        | 92                | 86               | 103            | 96           |
| Iris      | 3-4 | 28     | 104        | 80                | 77               | 90             | 87           |
| Lance     | 4-0 | 23     | 108        | 104               | 96               | 104            | 96           |
| Jasmine   | 4-8 | 27     | 108        | 104               | 96               | 105            | 97           |

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used three-word phrases, and had been receiving autism intervention services for over two years and DTT for 4 months.

Prior to being selected to participate in this study, the children’s imitative skills were measured on the PISA. Each participant scored well below the scores of the typically developing three-to-four-year-old children who participated in the first study (see Figure 1). Whereas the number of correct responses demonstrated by the typically developing children on the first presentation of the task ranged from 80 to 104 correct imitative responses, the pre-intervention scores for the children with ASD ranged from 36 to 72 correct responses on the same measure. Thus, the imitation skills of the three subjects selected to participate in this study were below the lowest score of any of the younger typically developing children from the first study.

**Table 3.** The Brief Imitation Skills Assessment items

<table>
<thead>
<tr>
<th>Task</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Four actions after model</td>
</tr>
<tr>
<td>2.</td>
<td>Block in cup and pencil under book (model present)</td>
</tr>
<tr>
<td>3.</td>
<td>Touch nose at 10 feet away</td>
</tr>
<tr>
<td>4.</td>
<td>Clap 1 vs. 3 times</td>
</tr>
<tr>
<td>5.</td>
<td>Static vs. kinetic: palms together vs. clapping</td>
</tr>
<tr>
<td>6.</td>
<td>Arms out in front and fingers spread</td>
</tr>
<tr>
<td>7.</td>
<td>Wink</td>
</tr>
<tr>
<td>8.</td>
<td>Sour face</td>
</tr>
<tr>
<td>9.</td>
<td>Fingers interlaced</td>
</tr>
<tr>
<td>10.</td>
<td>Two actions after model</td>
</tr>
<tr>
<td>11.</td>
<td>Array 3: stack blocks (original model absent)</td>
</tr>
<tr>
<td>12.</td>
<td>Cup over; pencil in cup; book open; block on book</td>
</tr>
<tr>
<td>13.</td>
<td>Three actions after model</td>
</tr>
<tr>
<td>14.</td>
<td>One arm out to side</td>
</tr>
<tr>
<td>15.</td>
<td>Touch nose 1 vs. 2 times</td>
</tr>
<tr>
<td>16.</td>
<td>Touch knee with one hand</td>
</tr>
<tr>
<td>17.</td>
<td>Point with index finger on desk</td>
</tr>
<tr>
<td>18.</td>
<td>Shake head yes</td>
</tr>
<tr>
<td>19.</td>
<td>Shake head no</td>
</tr>
<tr>
<td>20.</td>
<td>Open mouth from 10 feet away</td>
</tr>
</tbody>
</table>

**Figure 1.** Comparative scores on the Partington Imitation Skills Assessment at specific ages for typically developing children and children with autism prior to intervention.

**Instruments:** The study used the PISA as well as a short version of the PISA called the Brief Imitation Skills Assessment (20 imitation skills derived from the larger PISA - see Table 3).

**Setting and materials:** A familiar adult conducted all teaching sessions and assessments in the children’s public school special education classroom. The materials used on the PISA and Brief Imitation Skills Assessment were a drum, two drumsticks, two wooden cubes, a book, a small plastic container, a mirror, a toy dump truck, and a toy car garage.

**Procedures:** A familiar adult (teacher) administered the PISA individually to all participants. Due to the lengthy nature of the assessment, it was administered in several smaller sessions determined by the needs of each child, for a combined total of over 60 minutes for each participant. Participants were not corrected if they responded incorrectly but received moderate verbal praise and encouragement (e.g., “You are doing such a great job”) throughout the test.

A familiar adult also individually administered the Brief Imitation Skills Assessment, which was completed by each participant in about five minutes. As with the PISA, the adult made no attempt to fix incorrect responses and used no reinforcement other than moderate verbal praise for continuing testing.

Thirdly, an imitation training intervention was conducted over a two-month period. We selected six initial responses to be included in each student’s intervention program based on an analysis of the individual student’s baseline imitation skills. The students’ classroom teacher determined the imitative domains in which students had numerous errors and created an imitation curriculum for each student focusing on these deficit areas. A classroom staff member conducted the teaching sessions in a 2-to-1 student-to-teacher ratio. Since not all students in the classroom were experiment participants, the researcher ensured that participants would not be paired together during imitation teaching sessions. Participants were seated or stood (depending on the task) across from the instructor at a distance of approximately one-and-a-half feet. All of the staff had received training in DTT teaching methodology.

The intervention presented 18 trials per day (three trials for each of the six specific imitation responses selected). When the child was attending to the instructor, the instructor provided an instruction to imitate and modeled an action. Instructors provided participants with gestural or physical prompts necessary to perform the action. The prompt level (i.e., full physical to partial physical to gestural) was faded across trials, and instructors delivered greater reinforcement for more accurate and independent imitative responses. Instructors immediately followed up correct imitative responses (i.e., responses that matched the model) with verbal praise and a participant-specific reinforcing item or activity. For a skill to be considered acquired, the student was required to correctly and independently imitate the instructor-performed action on the first trial of three consecutive days of learning trials. Whenever a child met the mastery criterion for a response, it was replaced by another imitative response in the teaching sequence.

Incorrect responses were corrected using a systematic correction procedure. The correction procedure consisted of repeating the instruction to imitate, again modeling the action, and using the level of
prompting (physical or gestural) necessary to have the child perform the action. Prompted imitative responses were followed by praise. The instructor continued the correction procedure until the child was able to perform the target imitative response without a prompt. After achieving an unprompted response, the instructor asked the child to perform a different known response (a distracter trial), and then repeated the previous imitative response that had not been correctly imitated on the first presentation to obtain a required independent (unprompted) response. The corrected imitative response was then followed by praise and a child-specific reinforcing item or activity.

**Measures and analysis:** The study used three measures. The first measure was the number of correct imitative responses to the 108 items in the PISA. The second was the number of correct imitative responses on the Brief Imitation Skills Assessment. Finally, trial-by-trial data regarding the number of correct, incorrect, prompted, and failed responses were measured for each skill taught during each of the instructional sessions. For all three measures, we considered a response correct only if it topographically matched the action performed by the model within five seconds of the presentation.

The PISA assessment was administered prior to and immediately following the imitation training intervention as well as 10 months post-intervention to determine whether the results of the intervention were maintained. Additionally, we employed a multiple baseline across subjects design that allows participants to be their own control group by staggering the start time of each participant’s treatment phase (Creswell, 2008; Gliner, Morgan, & Harmon, 2000). Biweekly data on the 20-item Brief Imitation Skills Assessment were collected on all subjects throughout the study. After the first subject, Luke, demonstrated a stable baseline on this measure, the treatment phase began for Luke only. During his treatment phase, we continued to collect biweekly data using the 20-item assessment tool for all three participants. After Luke demonstrated an upward trend of increased imitation skills on this measure, the treatment phase for subject two, Lisa, began. The same procedure was followed for subject three, Steve.

**RESULTS**

Participants demonstrated improved imitation skills as measured by all three types of data: the 108-item pre- and post-intervention PISA, the 20-item biweekly Brief Imitation Skills Assessment, and the daily trial-by-trial DTT data. On the PISA, participants demonstrated an increase in their percent of correct items on the pre- and post-intervention administration (Figure 2). Luke’s scores increased from 67% to 83% (scores of 72 to 90), Lisa’s scores increased from 33% to 68% (36 to 73), and Steve’s scores increased from 37% to 59% (40 to 64).

![Figure 2.](image)

**Table 4.** Pre-, post-, and 10-month follow-up scores of children with autism on the Partington Imitation Skills Assessment

<table>
<thead>
<tr>
<th>Participant</th>
<th>Number of responses</th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>10-month follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luke</td>
<td>Correct</td>
<td>72</td>
<td>90</td>
<td>98</td>
</tr>
<tr>
<td></td>
<td>Approximation</td>
<td>12</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Incorrect</td>
<td>23</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Non-response</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lisa</td>
<td>Correct</td>
<td>36</td>
<td>73</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>Approximation</td>
<td>11</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Incorrect</td>
<td>41</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Non-response</td>
<td>20</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Steve</td>
<td>Correct</td>
<td>40</td>
<td>64</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Approximation</td>
<td>9</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Incorrect</td>
<td>53</td>
<td>14</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Non-response</td>
<td>6</td>
<td>13</td>
<td>4</td>
</tr>
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</table>

From the first to the second administration of the PISA, all three participants also changed in their overall pattern of responding, with an increase in both correct responses and approximations [see Table 4]. In addition, participants’ PISA scores increased or were maintained at 10-month follow-up. Two of the subjects (Luke and Lisa) demonstrated further increases in their correct scores at 10 months, while the third (Steve) scored close to his immediate post-intervention score. Lisa demonstrated the largest increase, going from 73 correct responses immediately after the end of training to 93 correct responses at 10-month follow-up.

The mean scores on the 20-item Brief Imitation Skills Assessment increased for all participants from the baseline to intervention phases [Figure 3]. At baseline, Luke had an average score of 11.3 correct responses out of 20, rising to a mean score of 16.6 during his treatment phase. Lisa’s average correct scores increased from 6.6 (baseline) to 14.5 (intervention), and Steve’s scores increased from an average of 5.9 to 10.8 correct responses for the baseline and intervention phases.
The intervention phase was in effect for eight and a half weeks for Luke (43 treatment days), five and a half weeks for Lisa (27 treatment days), and two and a half weeks for Steve (13 treatment days). Over his 43 days of treatment, Luke learned 24 new imitation skills (an average of 3.5 days per skill). Over her 27 days, Lisa acquired 14 new imitation behaviors (an average acquisition rate of 5 days per skill). Over only 13 treatment days, Steve acquired 3 new skills (an average of 7 days per skill) (see Table 5).

**DISCUSSION**

All three subjects demonstrated improved imitation skills through their participation in the child-specific imitation curriculum conducted via discrete trial training in their classroom. Moreover, participants’ pre- and post-test PISA results indicate that their overall improvement score was much greater than the quantity of specific skills they were taught through their in-class imitation curriculum. For example, Steve acquired only three new imitation skills as measured by his classroom curriculum training. However, following the intervention, he improved on 24 responses on the PISA. We observed similar patterns in the other two subjects, demonstrating that participants were generalizing the skills they learned during their individualized intervention curriculum to other similar imitative behaviors. This result supports earlier findings of generalized imitation (Baer & Deguchi, 1985).

**GENERAL DISCUSSION**

The important role of imitation in the development of a child’s language skills (Partington et al., 1994; Ryan, 2007), social interaction skills (Garfinkle & Schwartz, 2002; Nadel & Peze, 1993), and play skills (Ingersoll & Schreibman, 2006) has been widely acknowledged. However, there is a significant lack of data about what types of imitative skills need to be taught and how to develop these skills in children who have specific deficits in this repertoire. It is particularly noteworthy that only one prior study has developed simple imitative skills in a school classroom setting (Ryan, 2007). With the significant increase in rates of ASD diagnosis and the corresponding increase in the number of ASD children who attend special education classrooms in public schools, it is crucial that methods to develop imitative skills in these environments be investigated and validated.

In our first small-scale study, typically developing children demonstrated the ability to perform a wide variety of imitative skills without any previous structured teaching. Their performance on the broadly scoped PISA demonstrated their ability to fluently imitate a large number of actions within a 20-to-30-minute time period when provided only with social reinforcement. Furthermore, when unable to imitate an action or series of actions on the first attempt, the children often were able to successfully imitate the actions when provided with an additional demonstration.

In our second study, the initial evaluation of children with ASD using the PISA furnished results consistent with previous research pointing to deficits in imitative skills in ASD children (Perra et al.,

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**Table 5.**

<table>
<thead>
<tr>
<th># of skills acquired</th>
<th>Treatment days</th>
<th>Average days to acquisition</th>
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</thead>
<tbody>
<tr>
<td><strong>Luke</strong></td>
<td>24</td>
<td>43</td>
</tr>
<tr>
<td><strong>Lisa</strong></td>
<td>14</td>
<td>27</td>
</tr>
<tr>
<td><strong>Steve</strong></td>
<td>3</td>
<td>13</td>
</tr>
</tbody>
</table>
interactions. Our preliminary research indicates that comparing the skills of children with ASD to children without developmental delays can help identify a wide range of actions to target for intervention programs and that relatively small amounts of instruction can quickly produce substantial improvements in imitative skills. However, there are still many issues that warrant further investigation. First, it would be desirable to study a larger sample of typically developing children, especially those younger than 3 years of age. Because the children who were already 3 years of age were able to imitate the majority of the actions, assessing younger children might help to identify the developmental sequence in which the various types of imitative responses are acquired. This additional information could prove valuable in helping parents and educators identify the actions to target for intervention with children with ASD. Second, increasing the sample size for studies involving children with ASD would confirm the efficacy of current teaching strategies with individuals displaying a wider range of general skill deficiencies and would also ensure that established procedures can be replicated in other classrooms, treatment centers, and home environments. Third, although our relatively brief intervention (18 trials per day for several weeks) produced a substantial increase in imitative skills, it would be desirable to investigate whether increasing the number of teaching trials per day and extending the length of the intervention would produce even greater effects.

Further research is also needed to determine the most efficient methods for developing a generalized imitative repertoire that includes a broad range of imitative skills. Our research utilized a DTT format to teach imitative skills to children with ASD in a special education classroom. However, some research findings suggest that these skills can also be developed in less structured teaching interactions that occur in the child’s natural environment (Ingersoll & Schreibman, 2006; Sundberg & Partington, 1999). A direct comparison of the effectiveness of each of these approaches and combinations of the two approaches would help practitioners identify the most effective strategies for parents and educators to use with children with varying levels of deficiencies in their imitative repertoire.

CONCLUSION

The development of a repertoire that includes a broad range of imitation skills is likely to assist children of all ages in being better prepared to learn from interactions with family members, peers, and others who have not been trained to systematically teach such skills. Furthermore, children who have developed an imitative repertoire may be better prepared to benefit from an inclusive educational setting because they are more likely to learn new skills merely by watching and then using their imitative skills to perform the actions demonstrated by others. Therefore, parents and educators should place a major emphasis on ensuring that instruction is provided such that all children have a well-developed set of imitation skills. These necessary skills can help them achieve the greatest amount of overall independent functioning, including self-help skills, social interaction skills, and other skills that facilitate participation in family and community events.

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REFERENCES


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