We evaluated the effects of different intertrial intervals (ITIs; time between programmed learning opportunities) on the acquisition and generalization of 2 preschoolers’ social skills. Independent and generalized skills were observed only when the daily ITI was gradually increased from short to progressively longer intervals.

Key words: generalization, intertrial interval, maintenance, preschool life skills, progressive intertrial intervals, social skills

Much research has shown that a combination of various prompting tactics and differential reinforcement procedures results in effective learning opportunities (e.g., Hernandez, Hanley, Ingvarsson, & Tiger, 2007; Lerman, Vorndran, Addison, & Kuhn, 2004). Less attention has been directed towards the relevance of timing on the effectiveness of these procedures. Intertrial interval (ITI), defined as the time between learning opportunities, is one temporal variable that has been considered. Most previous research has involved comparisons of relatively short ITIs during discrete-trial teaching (1 to 5 s; Carnine, 1976; Dunlap, Dyer, & Koegel, 1983; Koegel, Dunlap, & Dyer, 1980) and collectively showed the advantage of shorter ITIs. ITI research also has occurred with embedded teaching tactics (Bricker, Pretti-Frontczak, & McComas, 1998; Delprato, 2001; Hart & Risley, 1975), necessitating evaluations of ITIs in less structured teaching environments and involving relatively longer ITI comparisons (differing by minutes rather than seconds; Polychronis, McDonnell, Johnson, Riesen, & Jameson, 2004; Wolery, Doyle, Gast, Ault, & Simpson, 1993). This research has revealed little influence of ITIs on the acquisition and generalization of targeted skills.

Different ITI lengths may confer different advantages. For instance, shorter ITIs may allow more rapid acquisition, and longer ITIs may facilitate maintenance and generalization of skills. Therefore, rather than determining whether short or long ITIs resulted in better learning, we sought to determine whether a combination of short and long ITIs, or more specifically, a progressively increasing ITI, resulted in improved acquisition and generalization of social skills relative to the long ITIs common in classwide social skills programs like the preschool life skills program (Hanley, Heal, Tiger, & Ingvarsson, 2007).

METHOD

Participants and Setting

Two children enrolled in a full-time, inclusive preschool classroom participated. Hari was
a 4-year-old girl who had been diagnosed with Down syndrome. Lia was a 3-year-old typically developing girl with a cleft palate. Both children were selected because they had not acquired specific social skills during 17 (Lia) and 34 (Hari) weeks of classwide instruction\(^1\) prior to our study.

**Dependent Measures and Interobserver Agreement**

Lia’s target skill was responding appropriately to her name. Hari’s target skills were saying “excuse me” to obtain another’s attention and saying “thank you” after receipt of something. For a correct skill to be recorded, Lia was required to stop what she was doing, look at the teacher, and say “yes,” and Hari was required to say “thank you” while looking at the teacher within 5 s of receiving an item or “excuse me” within 10 s of the response opportunity being presented. Observers recorded children’s behavior during situations designed to evoke target skills (i.e., response opportunities). A correct skill was scored if the child performed all of the specified components without prompting and within the specified time frame after presentation of the response opportunity. During all conditions of the study, digital watches were used to track the times at which response opportunities ended and the presentation of the next response opportunity to determine obtained ITI values.

Interobserver agreement was assessed by having a second observer simultaneously but independently collect data on correct and incorrect responses per trial and the trial offset and onset times. For the latter, an agreement was defined as recording the same time within 5 s of one another during each observed trial. Agreement was assessed in at least 60% of sessions in all conditions. All agreement statistics averaged above 95% (range, 80% to 100%).

\(^1\) See Hanley et al. (2007) for a complete description of the preschool life skills program, the classroom arrangement, and the classwide manner in which the target skills were taught.

**Conditions**

**Baseline (AM and PM sessions).** Five teachers in the AM sessions arranged response opportunities during free play, meal, and outdoor or transition periods between 8:30 a.m. and 11:30 a.m.; five different teachers in the PM sessions arranged response opportunities between 4:00 p.m. and 5:15 p.m., primarily during free play. AM trials for each skill were conducted approximately every 30 min between 8:30 a.m. and 11:30 a.m., resulting in a total of seven programmed trials for Lia and 14 programmed trials for Hari. During the PM sessions, teachers presented response opportunities to the child once or twice per skill, with the two presentations occurring approximately 30 min apart. Teachers set the occasion for Lia’s responding appropriately to her name by calling her name while she was engaged in a play activity, while she was transitioning from a play activity to the bathroom, or while food and drink were passed. For Hari’s “excuse me” skill, a second teacher set up response opportunities by, for example, blocking access to materials needed for scheduled activities. Teachers set the occasion for Hari’s saying “thank you” by, for example, handing relevant toys to Hari during free play and passing food or utensils to her during meals.\(^2\)

In both AM and PM sessions, correct responses resulted in descriptive praise (e.g., for Lia, the teacher said, “I like the way you stopped what you were doing, looked at me, and said ‘yes’ when I called your name”). If the child emitted an incorrect response during a trial, the teacher walked away from the area without further comment.

**Distributed ITI (AM sessions only).** This condition was identical to baseline, except that incorrect responses resulted in the teacher describing and modeling the situation-specific behavior and arranging one practice trial, which

\(^2\) A complete description of response opportunities associated with each skill is in the appendix of Hanley et al. (2007).
provided an additional opportunity to emit the skill in the same situation. For example, the teacher told Lia, “Remember, when someone calls your name, stop what you’re doing, look at them, and say, ‘yes.’ Let’s practice.” The teacher then turned away from the child for 3 s and then stated Lia’s name. If Lia engaged in the correct skill, the teacher provided descriptive praise and ended the trial. If the child did not emit the target skill correctly during the practice trial, the teacher described the skill again and ended the trial. (This condition also was included at the end of the analysis to determine if acquired and generalized responses would be maintained under these common classroom conditions.)

**Progressive ITI (AM sessions only).** This condition was identical to the distributed condition except that ITIs were increased progressively across response opportunities each day. Following the initial response opportunity, programmed trials were initiated 3 s, 10 s, 30 s, 2 min, 4 min, and 16 min after the previous trial was terminated. Trials were terminated either after a correct response or after a description of the situation-specific behavior. The ITI was increased irrespective of the child’s performance, and incorrect responses continued to result in a practice opportunity. When programmed trials were separated by 3 s and 10 s, the teacher stayed within approximately 0.6 m of the child during the ITI but attended to other children and activities. When programmed trials were separated by more time, the teacher walked away from the child’s area and engaged with other children or activities during the ITI. This same progression of ITIs occurred daily, with the exception that the shortest ITIs were removed on the 22nd day of observations for Hari’s “thank you” skill so that the new schedule was 30 s, 2 min, 4 min, 16 min, 30 min, and 30 min (short ITIs were removed for this skill because a within-session analysis showed that Hari was routinely less successful with the shortest ITIs for this skill).

The number of programmed trials for each skill was held constant at seven in the AM and at one to two in the PM across all conditions of the analysis. Because the teaching procedures changed only during the AM periods, the PM observations served to detect whether skills taught during the AM sessions generalized to the PM sessions.

**Design**

We used a concurrent multiple baseline design across subjects and skills to determine the effects of the progressive ITI on skill acquisition and generalization. Maintenance of skills also was assessed by a return to the Distributed ITI condition on all baselines.

**RESULTS AND DISCUSSION**

During baseline, either no (Lia) or few (Hari) correct responses were observed (Figure 1). No performance improvement was observed when descriptions of the situation-specific behavior and practice trials were provided after incorrect responses (distributed ITI). Immediate increases in correct responses were observed when progressive ITIs were introduced in the AM periods for both participants. Further, these improvements were observed in the PM sessions, despite the absence of direct intervention during these times. After skills were acquired and generalized, the skills then persisted for both children in both AM and PM sessions when response opportunities were arranged every 30 min or longer (second distributed ITI phase).

Our results showed that the timing of learning opportunities was an important factor for the acquisition of the three social skills for both participants. Skills were not acquired with relatively long ITIs during the distributed condition, despite it being representative of the way in which skills were acquired for most children in Hanley et al. (2007). Rather, the initially short ITIs associated with the progressive condition likely facilitated acquisition of
Figure 1. Percentage of correct responses for Lia (top) and Hari (middle and bottom). Filled circles indicate correct responses emitted in AM observations, and open circles indicate correct responses emitted in PM observations. The asterisk denotes a modification of the progressive schedule. All PM trials were conducted using baseline procedures across all conditions. Omissions of data points indicate that the observation was not conducted due to the child’s absence from the classroom during that scheduled observation.
the target responses. As suggested by Carnine (1976) and Koegel et al. (1980), when short ITIs are used, the child is more likely to attend to the relevant stimuli (e.g., teacher prompt), less likely to attend to irrelevant stimuli, and thus less likely to engage in behavior that may interfere with learning target relations. With repeated exposure to relevant stimuli under short ITIs, the presentation of a trial also may become discriminative for other trials, signaling the availability of reinforcement for correct responding. This type of stimulus control exerted under teaching conditions with short ITIs may, however, also contribute to the reported problems with limited generalization of skills acquired under these conditions. In the current study, skill generalization across time of day and teachers may have been a function of the progressively extended ITIs in the progressive condition.

It is interesting to note that during the distributed ITI condition, correct responses often occurred on practice trials in which the situation-specific behavior was modeled following an error, but they rarely or never occurred 30 min later. Therefore, it is likely that the model prompt controlled the behavior. The introduction of progressive ITIs may have assisted transfer of control by the model prompt to the evocative situation and the associated discriminative stimuli presented on subsequent trials, in a manner similar to that described for prompt delay (Wolery & Gast, 1984). Because similar evocative situations and discriminative stimuli occurred in the afternoon, correct responses then were observed during PM observations with different teachers, despite the procedures remaining unchanged during these times.

Because the progressive ITI condition always followed the distributed ITI condition, it is possible that the effects of the progressive condition were dependent on a history with the distributed condition. Nevertheless, we advocate the use of progressive ITIs only when the classwide implementation of the preschool life skills program or other social skills curricula (involving distributed trials) fails for a particular skill with a particular child; therefore, the possible interaction between a history with distributed teaching and the progressive condition is practically irrelevant.

The primary limitation of our analyses is that we did not include a massed condition in which only short ITIs were used. Therefore, it is possible that both acquisition and generalization of target skills would have occurred without progressively increasing the ITIs. We think this is unlikely considering the difficulties often reported with generalization from massed-trial teaching (Losardo & Bricker, 1994; McGee, Krantz, & McClannahan, 1986; Wolery et al., 1993); nevertheless, a properly controlled comparison between progressive ITIs and consistently short ITIs is needed to determine if the effort required to increase systematically the time periods between teaching trials is necessary for the acquisition and generalization of social skills.

REFERENCES


