Research Article

Assessing the Differential Effects of Known and Mystery Rewards in a Preschool-Based Group Contingency

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Abstract

Group contingencies have been used successfully to modify a variety of behaviors for children with diverse characteristics across multiple settings. However, these interventions have not been applied to increase social interactions (SI) between typically developing children and those with multiple or severe disabilities (MSD). Furthermore, little research has been conducted to examine whether differential outcomes are associated with the type of reward used (known or mystery). The purpose of this study was to examine the differential effects of known versus mystery rewards on the SI of preschool children with and without MSD within an independent group contingency. The findings indicated that although there were no differences in levels of SI between reward types, both were superior to the baseline condition and were viewed as socially valid by classroom teachers and naive raters. In addition, this study was conducted with high methodological quality exceeding that of previous group contingency research conducted in preschool settings and of other studies examining the differential effects of known and mystery rewards. The results provide meaningful information regarding practices that support children with MSD and add to the group contingency literature.

Keywords

preschool, group contingencies, contingency management, multiple or severe disabilities

Introduction

The Individuals With Disabilities Education Act (IDEA, 2004; 34 CFR §300; Musgrove, 2012; Ryder, 2017) stipulates that educational services for children with disabilities be delivered in the least restrictive environment that meets their educational needs. In 2015, the U.S. Departments of Health and Human Services (DHHS) and Education (DOE) released a policy statement on inclusion of children with disabilities in early childhood (EC), which highlighted the research, laws, and practices that support high-quality EC inclusion. Data from the most recent, 37th report to Congress on IDEA indicated that almost 55% of children with disabilities spend at least 10 hr per week in regular EC programs (U.S. Department of Education, 2016). Children with disabilities can be successful in high-quality inclusive settings when effective practices are implemented

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and teachers receive adequate professional development (Barton & Smith, 2015; Odom, Buysse, & Soukakou, 2011; Strain & Bovey, 2011).

Inclusive programs have resulted in positive outcomes for individuals with a variety of disabilities. However, positive effects might be reduced for young children with multiple or severe disabilities (MSD) who often spend the majority of their day interacting with adults rather than peers (Hanline & Correa-Torres, 2012). Research has demonstrated that children with disabilities must interact regularly with their peers to realize the benefits of an inclusive setting (Odom et al., 2011; Strain & Bovey, 2011). These benefits include long-lasting improvements across developmental domains (Cole & Meyer, 1991; Holahan & Costenbader, 2000; Rafferty, Piscitelli, & Boettcher, 2003). For example, the development of social-emotional competence, including peer social interactions (SI) and early friendships, is a predictor of later social, academic, and vocational success (Jones, Greenberg, & Crowley, 2015; Weissberg, Durlak, Domitrovich, & Gullotta, 2015). The establishment of these skills through regular interactions is essential for young children both with and without disabilities (Barton, 2013) and is a primary concern for parents (Meyer & Ostrosky, 2014; Petrina, Carter, & Stephenson, 2015). Although typically developing children might be amenable to playing with their peers with MSD, without explicit instruction they may not do so (Buysse, Goldman, & Skinner, 2003; Hanline & Correa-Torres, 2012; Nijs & Maes, 2014). Thus, effective social skills intervention specifically designed to teach preschool children without disabilities to interact with their peers with MSD should be a critical component of EC curricula.

One potential intervention is a group contingency, which involves manipulating environmental consequences. Group contingencies are those applied to whole groups, as opposed to a single child (Skinner, Skinner, & Sterling-Turner, 2002). They require that all children in a group work toward common behavioral criteria and rewards. Group contingencies are categorized as independent (i.e., each child who achieves the criteria receives the reward), interdependent (i.e., all children must achieve the criteria for all to receive the reward), or dependent (i.e., if specific children achieve the criteria all children receive the reward) (Litow & Pomroy, 1975). Group contingencies have been used successfully to improve a variety of behaviors (e.g., challenging behavior, prosocial behavior, on-task behavior, academic skills) for participants with diverse characteristics across multiple settings (Little, Akin-Little, & O'Neill, 2015; Maggin, Johnson, Chafouleas, Ruberto, & Berggren, 2012; Pokorski, Barton, & Ledford, 2016). Specifically, they have been effective in EC settings, most often when targeting challenging behavior of typically developing children (Pokorski et al., 2016). Group contingencies have demonstrated strong social and ecological validity by resulting in positive outcomes across children with reduced adult effort when compared with individualized behavior-change programs (Litow & Pomroy, 1975; Little et al., 2015; Maggin et al., 2012).

Rewards within group contingencies can be matched to any function of behavior or any preference, and might be tangible, social, edible, or a favored activity, such as extra playground time (Cooper, Heron, & Heward, 2007). Research shows that using varied rewards across sessions may be more effective than using consistent ones (Wine & Wilder, 2009). Rewards can be known to the children or can be unknown "mystery" rewards. The result of providing known, preferred rewards to produce desired behaviors (i.e., positive reinforcement) has been thoroughly documented: Individuals typically respond positively to the promise of motivating items (Cooper et al., 2007). Consequently, the majority of group contingency studies have used known rewards (or have not reported their reward type; Little et al., 2015; Maggin et al., 2012; Pokorski et al., 2016). Known rewards can be selected in a variety of ways, including observation of children's favored items, child-choice, or a preference assessment (Skinner et al., 2002). However, individually selected rewards are typically less feasible within class-wide group contingencies, given that teachers might not have the resources to (a) assess the individual preferences of a classroom of children, (b) procure a variety of individualized rewards, and (c) regularly provide individualized rewards.

Thus, nonspecialized rewards are typically used for the entire group (Litow & Pomroy, 1975). However, when nonspecialized rewards are used, knowing the reward could have detrimental effects for children who are not interested in earning it. For these children, *not* knowing the reward—that is, using a mystery reward—might be more effective than using a known reward. When rewards remain a mystery each has the potential to be preferred and children might be motivated to earn it (Skinner et al., 2002).

The group contingency literature demonstrates that both known and mystery rewards can result in positive behavior change. Specifically, studies conducted in EC settings have shown positive effects with both types: known (Hunt, 2013; Swiezy, Matson, & Box, 1992) and mystery (Reitman, Murphy, Hupp, & O'Callaghan, 2004). Although both reward types have been effective, little is known about their differential effects, which might have practical importance. For example, if mystery rewards result in comparable or enhanced effects compared with known rewards, this would provide important information that could improve the feasibility of the intervention in EC settings. Only two studies have directly compared the effects within the context of a group contingency (Hoag, 2006; Robichaux & Gresham, 2014). Hoag (2006) examined the differential effects of known and mystery rewards on the disruptive behavior of preschool students across four classrooms using an A-B-A-C design and found no clear differences between reward types. Robichaux and Gresham (2014) compared outcomes of student-selected versus mystery rewards on the inappropriate classroom behaviors of elementary students, with minimal differentiation observed between treatments. However, their study had several methodological concerns (e.g., inadequate reliability).

No studies to date have examined the use of group contingencies on the SI of children with MSD and their peers. In addition, further research is needed on the differential effects of known versus mystery rewards within a group contingency. Thus, to facilitate a comprehensive understanding of the group contingency literature, additional inquiries are required. The following research questions were examined in the current study:

Research Question 1: Does the use of an independent group contingency increase the level of peer-directed SI between typically developing children and children with MSD within a preschool classroom?
Research Question 2: Does the use of known rewards versus mystery rewards result in differential rates of skill acquisition or in differential effects within this context?
Research Question 3: Are the goals, procedures, and outcomes of this intervention viewed as socially valid by practitioners?

Method

Participants

Nine preschool children, four of whom were diagnosed with MSD and five who were typically developing (i.e., target children), participated. After obtaining study approval from the institutional review board, potential participants were screened using the social skills section of the Social Skills Improvement System Rating Scales (SSiS): Teacher Form (Gresham & Elliot, 2008). Children meeting inclusion criteria were placed into one of two intervention groups based on their classroom placement, Group 1 and Group 2. A White female Special Education graduate student working toward her behavior analyst certification implemented all procedures.

Children with MSD. Inclusion criteria for children with MSD required that they (a) were diagnosed with a low-incidence disability (e.g., cerebral palsy, autism, Down syndrome), (b) scored below the norm for their chronological age on the social skills section of the SSiS, and (c) engaged in few

to no SI with peers during free play settings, based on teacher report. Group 1 consisted of two children with MSD: Maisie and Trent. Maisie was 42 months old, White, and was diagnosed with a congenital syndrome resulting in global developmental delays. She communicated through facial expressions and crying, was nonambulatory, and required physical assistance for all tasks. Maisie did not initiate or reciprocate SI with peers. Trent was 53 months old, White, and had autism. He occasionally communicated independently using one-word utterances on a voice-output AAC. Trent primarily played alone, and occasionally responded aggressively when peers attempted to interact with him. Group 2 included three children with MSD: Esteban, Massimo, and Maisie. Esteban was 52 months old, of Asian descent, and was diagnosed with a chromosomal disorder resulting in global developmental delays. He communicated independently using one- to two-word utterances via a voice-output AAC. Esteban received constant support from an adult for positioning purposes and to block his frequent self-injurious behavior (SIB); a behavior plan unrelated to the current study was in place to address his SIB. He did not seek out peers in play and sometimes engaged in self-injury if peers attempted to engage him or the adult supporting him. Massimo was 46 months old, Latino, and had Down syndrome. He communicated using some signs and one-word utterances. He often initiated SI with peers using challenging behaviors (e.g., hitting). Massimo began the study concurrent with his Group 2 peers but moved to a new school after Session 10. Maisie re-joined the study in Group 2 following Massimo's departure.

Target children. Inclusion criteria for target children were (a) demonstrating average or above-average social skills for their chronological age (per the SSiS), and (b) attending the same classroom as participating children with MSD (required due to classroom schedules). Group 1 consisted of three target children (Alex, Chloe, and Sarah) who were White girls 38 to 43 months old. Group 2 consisted of two target children: Lars, a Latino boy 36 months old, and William, a White boy 37 months old.

Social validity raters. Social validity was assessed via participating classroom staff and via naive raters (i.e., individuals not familiar with the study). Three classroom staff from Group 2 (who observed the study when supporting children with MSD) and 11 naive raters participated. Staff members included a classroom teacher with an MEd in Special Education and 5 years experience and two paraprofessionals—one with a high school degree and one pursuing her MEd in Special Education—with 2 years experience each; all staff members were White females. Ten females and one male ranging in age from 23 to 32 years participated as naive raters; all were White, with one rater also reporting Asian descent. Naive raters held either a bachelor's degree ($n = 4$) or a master's degree ($n = 7$). Seven were graduate students in Special Education and three were educational consultants.

Setting and Materials

Participants attended an inclusive, university-based preschool. Sessions occurred in the free play area of participants' classrooms. Each free play area was approximately 30 ft × 30 ft and consisted of a selection of play materials arranged in themed centers (e.g., dramatic play, art, blocks) that were separated by 2-ft-high shelves. Sessions included the participating children from that group, one implementer, and one videographer; sessions for Group 2 also included one to two classroom staff who provided positional support to the children with MSD. No other children or staff members were in the classroom during sessions.

Materials included a visual timer, a MotivAider®, and four 9 in × 12 in, laminated pictures of "good friend" behaviors (i.e., sharing, helping, talking to, playing with). Additional color-coded treatment-specific items (i.e., activity stories and a bandana worn by the implementer) were used as discriminative stimuli. Activity stories were researcher-created books that detailed the importance of being a good friend and provided specific ways to be a good friend, referencing

Table 1. Dependent Variables: Operational Definitions, Examples, and Nonexamples.

Behavior	Operational definition	Examples	Nonexamples
Social interactions	Any appropriate verbal or nonverbal initiation or response directed at a peer. Verbal interactions may be words or nonword vocalizations. Nonverbal interactions must include physical touch, gesture, or material exchange.	• Asking to play • Sharing • Helping • Talking with • Playing with shared toys and interest • Providing physical affection	• Playing near, but with different toys • Observation of others • Unkind statement • Challenging behavior • Interactions with adults
Challenging behavior	Any verbal or nonverbal behavior characterized as unsafe to self or others, defiant, or otherwise inappropriate per classroom rules, including (but not limited to) socially inappropriate initiations or responses.	• Hitting • Pushing • Knocking toys off shelves • Taking toys from others • Throwing toys • Self-injurious behavior • Crying for >30 s	• Ignoring request from peer • Refusing to share • Stereotypy • Inappropriate use of materials or toys

Note. Behaviors will be considered new instances if they (a) are produced by a different participant; (b) are directed toward a different child; (c) are separated by a space of three or more seconds from the conclusion of the previous behavior marked within that category; or (d) meet the definition of a different dependent variable.

children with MSD. Books were identical except for color and, for known and mystery stories, a review of the contingency in effect. Known and mystery sessions also included a large color-coded token board with pictures of the children, the reward, and five spaces to place tokens per child. Additional materials included a Canon VIXIA mini digital camera, laptop computer, external hard drive, and ProcoderDV software (Tapp, 2003).

Dependent Variables

The primary dependent variable was SI between target children and children with MSD. Experimental decisions were made based on SI for all target children per group. The secondary dependent variable was challenging behavior. Both SI and challenging behaviors were recorded using timed event recording. Operational definitions—which were based on social behaviors identified through literature review and social skill taxonomies (Joseph, Strain, Olszewski, & Goldstein, 2016; Kaczmarek, 2002)—and coding rules for dependent variables are provided in Table 1.

Interobserver agreement. Interobserver agreement (IOA) was assessed for at least 30% of randomly selected sessions across participants, conditions, treatments, and behaviors. Prior to the start of the study, the first author trained a graduate student in Special Education as the second observer using the following methods: discussion of definitions and coding rules, joint coding sessions (using practice videos simulating the conditions in the study), and independent coding practice with feedback until the criterion of three videos with 90% or greater agreement across behaviors and participants was met. Data between observers were compared using the point-by-point method of agreement (total number of agreements divided by number of agreements plus disagreements, multiplied by 100; Ledford, Lane, & Gast, 2018). IOA met contemporary

Table 2. Interobserver Agreement for Social Interactions (SI) and Procedural Fidelity (in Percentages).

		Prebaseline	Baseline	Known	Mystery	Follow-up
Group 1						
Interobserver agreement	Alex	100	100	89 (81-100)	93 (86-00)	0
	Chloe	100	100	93 (89-100)	100	—
	Sarah	100	100	97 (92-100)	95 (90-100)	100
	Maisie	100	100	100	100	100
	Trent	100	100	100	100	100
Procedural fidelity	Total	100	100	99 (95-100)	99 (97-100)	100
Group 2						
Interobserver agreement	Lars	100	100	100	93 (87-100)	—
	William	100	66.7 (0-100)	94 (82-100)	87 (75-100)	—
	Esteban	67 (0-100)	100	78 (0-100)	100	—
	Massimo	100	83 (66-100)	58 (50-66)	100	—
	Maisie	—	100	100	100	—
Procedural fidelity	Total	100	97 (90-100)	100	100	—

Note. Data collection for Massimo ended following Session 10; data collection for Maisie began Session 12.

standards across behaviors and groups (Kratochwill et al., 2013). IOA for SI is listed in Table 2; IOA for challenging behavior averaged 95% (range = 0%-100%) for Group 1, and 88% (range = 0%-100%) for Group 2.

Experimental Design and Analysis

An alternating treatments design (ATD) was used to assess the differential effects of known and mystery rewards. ATD controls for common threats to internal validity through the rapid alternation of treatments across a relatively short time frame. The current study included four conditions: prebaseline, baseline, treatment comparison, and follow-up. Two treatments were alternated with baseline during the treatment comparison. The study was conducted initially with Group 1; upon completion of data collection for this group, data collection for Group 2 commenced. Data were coded, graphed, visually analyzed daily by comparing data within and across conditions and treatments to determine whether either treatment resulted in differential levels of SI. Five data characteristics (i.e., level, trend, variability, immediacy, and consistency) were examined to analyze data patterns and identify functional relations (Barton, Lloyd, Spriggs, & Gast, 2018).

Procedures

Reinforcer and token assessment. A multiple stimulus without replacement (MSWO) procedure (DeLeon & Iwata, 1996) was conducted twice for each target child. Items for the assessment were selected based on results of preference surveys completed by the child's parent and classroom teacher. Children's preferences were rated based on the percentage of time they chose each item, with items rated as highly preferable tested as reinforcers using a brief multiple schedule reinforcer assessment (Cooper et al., 2007). Verified reinforcers were ranked in order from most to least reinforcing (for each child) and added to a master list for each classroom; three to five highly reinforcing stimuli were identified for each participant. For Group 1, Alex's top three reinforcers were puzzles, gummies, and cookies; Chloe's were baby dolls, princess figurines, and stickers; Sarah's were balloons, watching a movie clip, and princess dolls. For Group 2, Lars's

top four reinforcers were Star Wars figurines, LEGOS®, the bubble machine, and marshmallows; William's were playing dress-up, M&M'S®, watching a movie clip, and gummies. Finally, a brief token assessment was conducted with target children to ensure they would follow simple directions to obtain tokens after being told three tokens would earn them a reinforcer; all demonstrated the ability to do so.

Prebaseline. Sessions were conducted one to two times daily, with at least 4 hours between sessions, 3 to 5 days per week. Across conditions, sessions included two target children and two children with MSD; sessions were typically not conducted if either target child was absent. Sessions began when all children were situated in the play area, and the implementer stated, "Let's play!" and started the timer (set for 5 min). No specific directions were provided to children, who were allowed to play anywhere in the free play area with the materials of their choosing, either alone or with peers. The implementer provided praise for remaining in the free play area 2 to 3 times per child per session; praise was included as a control variable. Redirections were provided when considered necessary for the safety of the child or other children.

Child training. A brief group training was conducted with target children following the prebaseline condition. This single, 15-min session consisted of demonstrations of (a) the specific behavior to be reinforced during treatment sessions (i.e., SI) and (b) the reinforcement procedures. During the training, children were first read the white story (i.e., baseline-specific story) while the implementer wore the white bandana. The "good friend" visuals were presented and modeled by the implementer and a research assistant. Next, the green (i.e., known reward treatment) and blue (i.e., mystery reward treatment) stories—which explained the contingency between SI and rewards during these sessions—were read. Finally, the implementer and the assistant modeled a treatment session, consisting of (a) the use of SI, (b) the immediate token and verbal reinforcement provided following the SI, and (c) the final reward at the end of the session, contingent on earning the required number of tokens. A practice session, during which children practiced the targeted behaviors and received reinforcement for engaging in them, concluded the training.

Baseline. Baseline sessions were identical to prebaseline sessions, with the following additions: (a) children were read the white activity story immediately before the session; (b) the implementer wore the white bandana for the duration of the session; and (c) the "good friend" visuals were present in the play area. Baseline approximated EC classrooms and were included as "business-as-usual" comparison.

Treatment comparison. During the treatment comparison phase, two treatment conditions—known and mystery rewards—and baseline sessions were alternated. The two treatments were counterbalanced with baseline occurring approximately every fourth session.

Known rewards. Known rewards sessions included the same components as baseline; however, the implementer wore the green bandana, started the session by reading the green story, and oriented children to the green token board, which displayed a picture of the reward they could earn. Rewards were randomly selected with the following rules: (a) they could not be selected more than twice in a row, and (b) at least one of each child's identified reinforcers must be selected within three consecutive sessions. Each target child had five opportunities per session to earn a token for SI, but was only required to earn three tokens to receive the reward. The implementer wore a MotivAider® set for 1-min intervals to space the token delivery evenly throughout the session. In each interval, the first observed SI between each target child and a child with MSD was immediately reinforced with behavior-specific praise and a token. Although all SI were coded, no behaviors were reinforced or acknowledged outside of token delivery. If

a target child did not receive a token during an interval, at the start of the next interval he or she was reminded of the contingency and the specific reward available that session. Children with MSD were noncontingently provided tokens concurrent with target children until they reached a maximum of five tokens. At the end of each treatment session, the implementer reviewed the contingency and provided a reward to all qualifying children. Children who did not qualify for the reward were told they could try again soon.

Mystery rewards. The mystery reward treatment was identical to the known reward condition with the following exceptions: the materials were blue, the token board displayed a picture of a question mark as the reward, and children did not have prior knowledge of the reward (which was selected from the same pool and following the same criteria as known rewards).

Follow-up. Follow-up, which was identical to baseline, occurred for Group 1 only. This condition was included to assess if the behavior change demonstrated by two target children during baseline sessions would continue following the removal of treatments.

Modifications. For Group 2, modifications were made to shape target children's SI toward more appropriate behavior. Although their SI were topographically acceptable (i.e., sharing with a peer) and coded as such, they did not consistently engage in SI in an ideal manner (e.g., by sharing a single toy rather than dumping a pile of toys near a peer). Thus, a mini M&M® was provided to target children, concurrent with each token, for engaging in more appropriate SI (e.g., handing a toy to or talking to a peer) starting Session 19; edible reinforcement was thinned starting Session 22. Consequently, no edible end-of-session rewards were used for Sessions 19 to 25.

Procedural Fidelity

Procedural fidelity was measured via video for at least 30% of randomly selected sessions, across participants and conditions; implementation fidelity was assessed for each child training session. Elements that were either correct or incorrect were scored using a checklist; elements that occurred multiple times within a session were scored using timed event recording. For procedural fidelity, procedural adherence and differentiation were assessed. Cross-condition behaviors (e.g., session length, delivery of praise for remaining in the free play area) and condition-specific behaviors (e.g., reading the correct story, delivery of token and praise contingent on SI, providing the postsession reward) were assessed across all sessions and conditions. The implementation fidelity measure evaluated the extent to which the implementer provided all required elements in each child training. Fidelity was calculated using the following equation: correct / (correct + incorrect) × 100. Procedural fidelity was high across conditions for both groups (see Table 2). IOA for procedural fidelity was assessed for one third of sessions (randomly selected) in which procedural fidelity data were collected using the point-by-point method (Ledford et al., 2018); the first author served as the second observer. IOA for procedural fidelity averaged 93% (range = 80%-100%) for Group 1, and 94% (range = 83%-100%) for Group 2. Implementation fidelity was 100% across trainings.

Social Validity

Social validity was measured in two ways: (a) the change in preferred social partners of target children, and (b) study procedures and outcome ratings by classroom teachers and naive raters. Target children's preferred social partners were identified prior to and following the study using a paired-comparison sociometric measure, adapted from Cohen and Van Tassel (1978). This measure was included to assess if the intervention resulted in a change in social status for any child

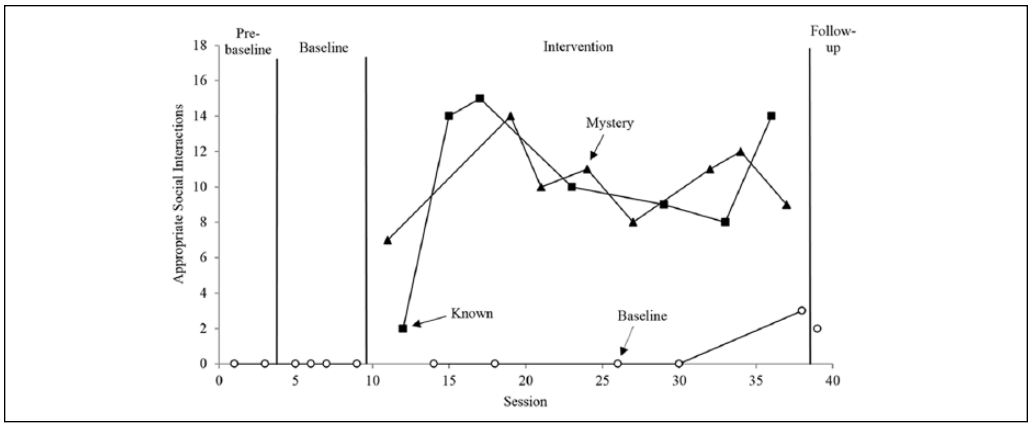

Figure 1. Frequency of social interactions for Alex.

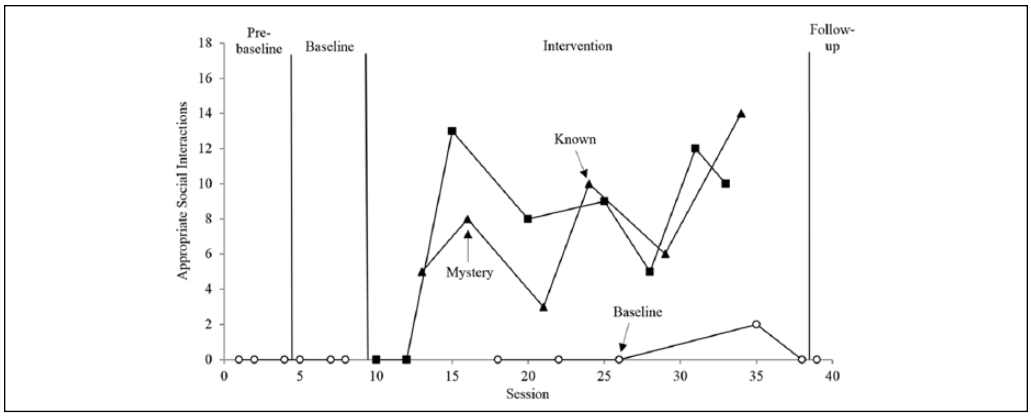

Figure 2. Frequency of social interactions for Chloe.

involved in the study. During the assessments, target children were presented a pair of pictures representing all possible combinations of children in their group and asked to point to the picture depicting the child he or she would most want to play with. Each pair was presented twice. Children's preferences were rated based on the percentage of time they chose each child as a desired play partner. The social validity of study procedures and outcomes were assessed at the study's conclusion. Raters ($N = 14$) viewed a pair of randomly selected videos presented in random order depicting a baseline session and a treatment session (either known or mystery). Each video was followed by a survey in which raters indicated the relative acceptability and effectiveness of implementer behaviors and the perceived affect and motivation of participants using a 5-point Likert-type scale.

Results

Visual analysis was used to determine the presence of functional relations and the differentiation of treatment effects. SI data are presented and analyzed individually for each group and child and can be viewed in Figures 1 to 7. No meaningful differentiation occurred between the known and mystery reward treatments. Both treatments were equally effective in increasing

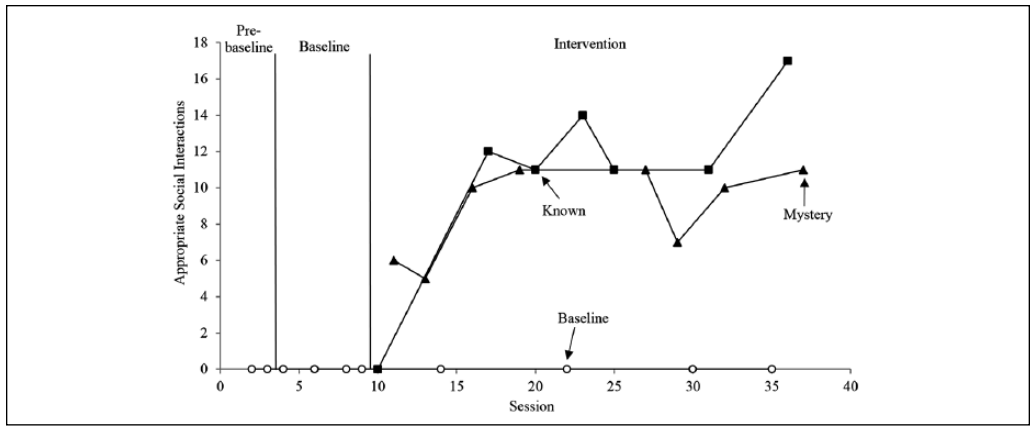

Figure 3. Frequency of social interactions for Sarah.

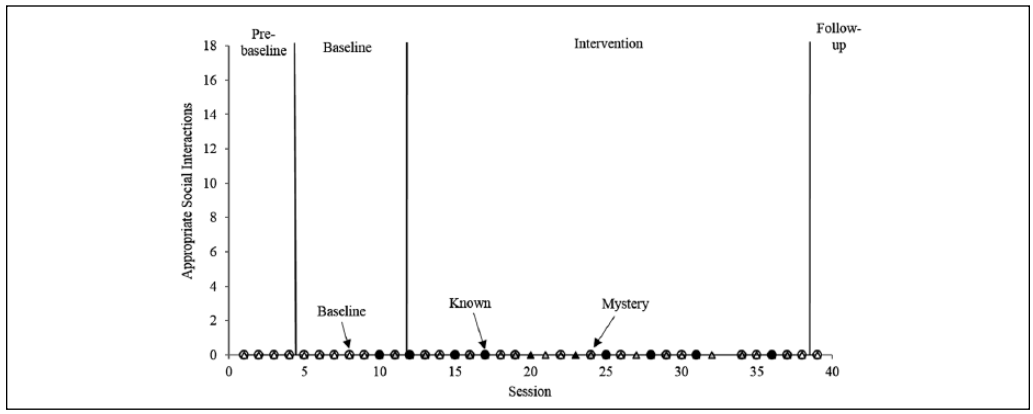

Figure 4. Frequency of social interactions for children with MSD in Group 1: Trent (circles) & Maisie (triangles).

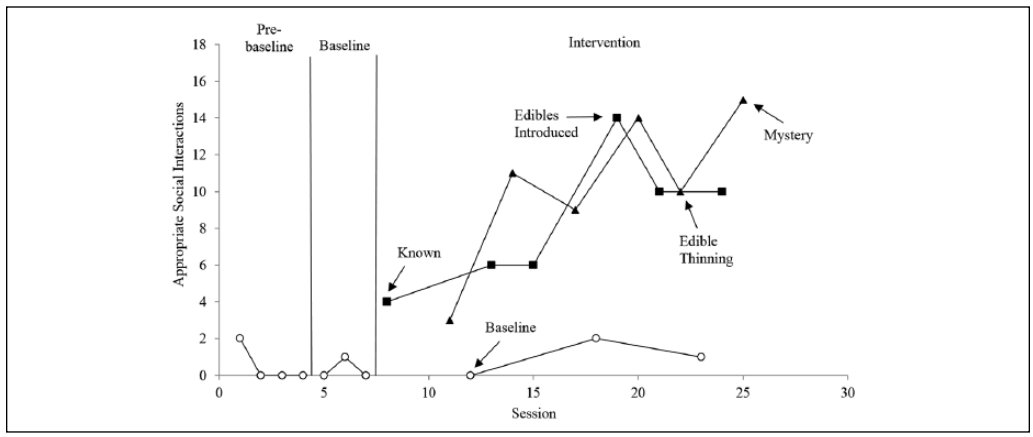

Figure 5. Frequency of social interactions for Lars.

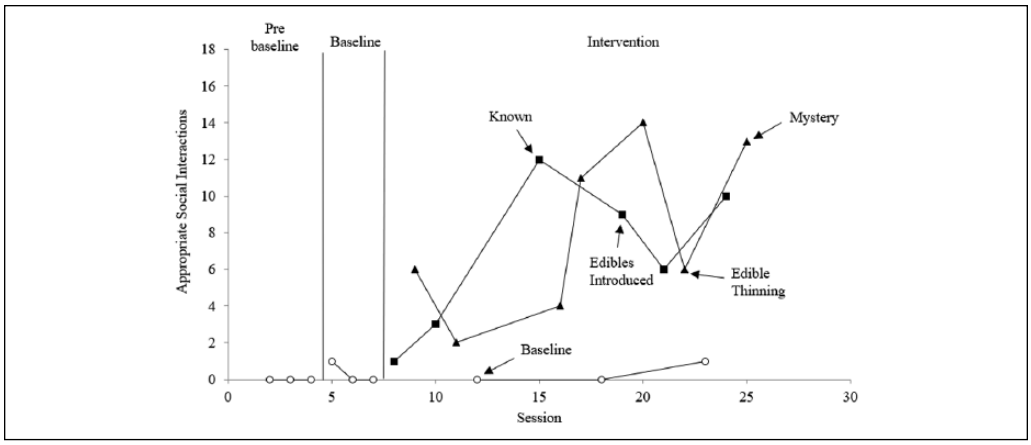

Figure 6. Frequency of social interactions for William.

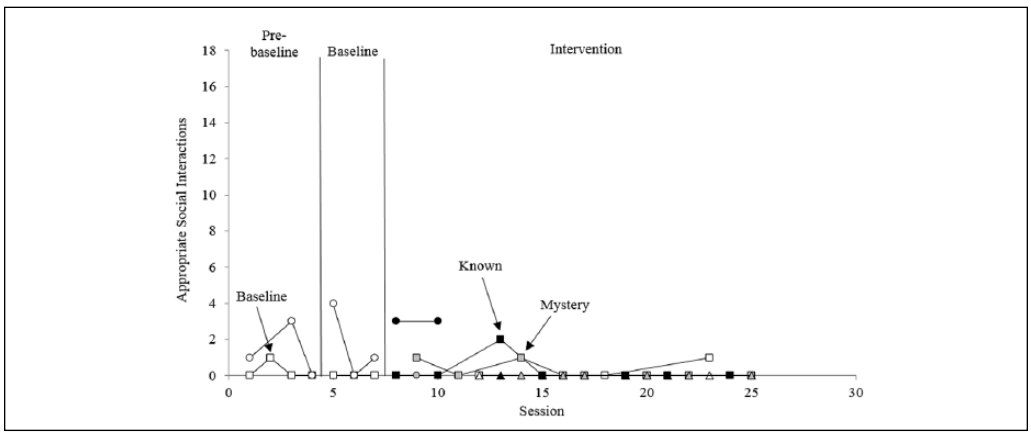

Figure 7. Frequency of social interactions for children with MSD in Group 2: Esteban (squares), Massimo (circles), & Maisie (triangles).

the SI for target children, as indicated by significant overlap between treatments across children. However, both treatments demonstrated clear differentiation from the baseline condition, with minimal overlap across conditions, demonstrating increased levels of SI compared with no intervention. Consequently, a clear functional relation was identified between the combined reward treatments and target children's SI. Experimental control was demonstrated through the immediate increase in SI with the onset of intervention, with minimal overlap between treatment sessions and baseline sessions. No functional relation was identified between reward treatments and SI for children with MSD. Because all children exhibited low levels of challenging behavior—with little conditional variation—across the study, these data are analyzed at the group level in Table 3.

Group 1

Alex. No instances of SI occurred during prebaseline or the initial baseline condition (Figure 1). When intervention commenced with the known reward treatment, Alex demonstrated an

Table 3. Average Challenging Behavior.

	Prebaseline	Baseline	Known	Mystery	Follow-up
Group 1					
Alex	0	0.1 (0-1)	0.1 (0-1)	0	0
Chloe	0	0	0	0	—
Sarah	0	0	0	0	0
Maisie	0	0	0	0	0
Trent	0	0	0	0.8 (0-4)	0
Group 2					
Lars	1.8 (0-6)	2.6 (0-8)	.2 (0-1)	0	—
William	1.3 (0-3)	1.5 (0-6)	.2 (0-1)	0	—
Esteban	0.5 (0-1)	0	.9 (0-5)	0	—
Massimo	3.3 (3-4)	4.1 (2-7)	2.5 (0-5)	2	—
Maisie	0	0	0	0	—

Note. Data collection for Massimo ended following Session 10; data collection for Maisie began Session 12.

immediate, yet minimal, increase in her use of SI. After one session, SI increased sharply and stabilized between 8 and 15 instances per treatment session. Alex engaged in few SI in baseline sessions during the treatment comparison. Significant overlap was displayed between the known and mystery treatments, with no differentiation. There were no overlapping data points between treatment and baseline conditions.

Chloe. Chloe demonstrated no instances of SI during prebaseline or the initial baseline condition (Figure 2). This pattern continued for the first two sessions following the introduction of the intervention (known reward). In the third treatment comparison session (mystery reward), Chloe's use of SI increased to 5, demonstrating a gradual increase, with some variability, for the remainder of intervention. Chloe demonstrated no SI during the majority of baseline sessions during the treatment comparison, with the exception of 2 in the fourth session. Overlap was high between treatments but minimal between treatment and baseline sessions, resulting in clear differentiation between treatment and baseline.

Sarah. Sarah used no SI during prebaseline and baseline conditions (Figure 3). SI data stabilized after the fourth intervention session, with approximately 10 to 14 interactions per known and mystery sessions and no interactions during the baseline condition. Overlap was high between treatments; however, Sarah's performance in the known rewards treatment resulted in slightly higher levels during the final three comparisons. Similar to Chloe, overlap between treatment sessions and the baseline condition was minimal, with one overlapping datum point.

Children with MSD. Maisie and Trent demonstrated no SI during the study (Figure 4).

Group 2

Lars. Lars demonstrated SI during one prebaseline session and one baseline session (Sessions 1 and 6), with levels returning to zero before the treatment comparison (Figure 4). When intervention commenced with the known reward treatment, Lars' use of SI immediately increased in level, followed by an increasing trend and some variability for the remainder of treatment sessions. Minimal SI occurred in baseline sessions during the treatment comparison. Substantial

overlap occurred between the known and mystery treatments, with no differentiation between treatments; however, no overlap occurred between treatment and baseline.

William. William used no SI during prebaseline but engaged in one interaction during the first baseline session (Figure 5). When treatments were introduced, William's use of SI was variable but demonstrated an overall increasing trend for both treatments, with 6 to 14 interactions per session for the final eight treatment sessions. No SI were demonstrated for the first two baseline sessions of the treatment comparison, with one SI in the third. Significant overlap occurred between the known and mystery treatments, with no differentiation between the two. There was no overlap between treatment conditions and baseline sessions.

Children with MSD. Both Esteban and Massimo used minimal SI per session, with no differentiation between treatments or conditions for either child (Figure 7). As in Group 1, Maisie did not demonstrate SI during sessions.

Challenging Behavior

Levels of challenging behavior were variable across groups (Table 3). In Group 1, challenging behaviors were rarely emitted. Challenging behavior was more frequent in Group 2 and was exhibited by all children except Maisie. For Lars, William, and Massimo, levels of challenging behavior increased when baseline was introduced but were considerably lower during the treatment comparison. Esteban demonstrated challenging behavior, typically prolonged crying, during two prebaseline and two known reward sessions. No clear treatment differentiation or functional relations were identified.

Social Validity

Results from the paired-comparison sociometric measure demonstrate all children in Group 1 had an increased preference for students without disabilities in their group (i.e., Alex, Chloe, and Sarah) when compared with those with disabilities (i.e., Maisie and Trent). Group 2's data were confounded by the fact that one child with MSD who began the study, Massimo, was not included at the postassessment due to his attrition, while another who joined the study, Maisie, was added. Lars's order of peer preference did not change during the intervention, with William being his most preferred play partner, Esteban his second-most preferred, and Massimo or Maisie being least preferred for both assessments. William's prestudy assessment identified Lars as most preferred, followed by Esteban and Massimo, and his poststudy preference identified Maisie as most preferred, followed by Lars and Esteban.

The social validity of procedures and outcomes was high, as indicated by ratings from staff members affiliated with the study and naive raters. As there was no discernible difference between groups for any question, aggregate data are provided. On a scale of 1 to 5, raters indicated that the intervention was developmentally appropriate (M = 4.7, range = 3-5); would take little time to train and implement (M = 4.6, range = 4-5); would not be difficult to implement while managing other classroom duties (M = 3.9, range = 2-5); and could be used across children, behaviors, and settings (M = 4.7, range = 4-5). In addition, when compared with baseline, 86% of raters saw improved affect in children, 93% believed the children were more motivated by the implementer's behavior, and 86% saw a decrease in the potential for negative effects associated with the procedure. Finally, 64% of raters said they would use the intervention to address challenging behavior, and 93% would use it to increase social or on-task behaviors.

Discussion

This study demonstrates that the use of an independent group contingency to increase the level of peer-directed SI between typically developing children and children with MSD within a preschool classroom was a successful and socially-valid intervention. The application of the group contingency resulted in an immediate or near-immediate increase in all target children's SI, with levels substantially greater than those seen in baseline. Furthermore, the magnitude of change demonstrated in this study was equal or greater than that of previous group contingency studies in EC settings. These results indicated that a group contingency, which has typically been used to reduce challenging behavior and improve academic performance (Little et al., 2015; Pokorski et al., 2016) can be effective for increasing social initiations of young children. In addition, study outcomes support the use of procedural adaptations (i.e., temporary pairing of tokens with edible rewards to increase reinforcement salience) within a group contingency to support children with suboptimal responding.

It is notable that the methodological rigor of the current study exceeds that of any other group contingency study conducted in an EC setting. In general, previous studies demonstrated insufficient experimental control (Pokorski et al., 2016): Authors provided minimal description of baseline conditions and control variables, did not include procedural fidelity data, and used partial interval recording, which is likely to over or underestimate behaviors without the use of statistical corrections (Ledford, Ayres, Lane, & Lam, 2015; Wood, Hojnoski, Laracy, & Olson, 2016). The current study improved upon these studies by comprehensively describing and measuring the implementer's behavior during baseline, collecting procedural fidelity data using direct observation (reporting consistently high levels of fidelity, as verified by IOA), and using timed event recording to record outcomes, which increases confidence in the results.

Treatment Differentiation

Although a functional relation was demonstrated between the intervention and SI for target children, the two reward types did not result in differential rates of skill acquisition or produce greater levels of SI for any child. One explanation for these results might be carryover effects from the rapid alternation of conditions. However, this is unlikely because discriminative stimuli were provided for each condition and there were no carryover effects observed during the baseline condition. We are confident that the children understood the differences between the two treatments, as previous research indicates children of this age consistently respond to multiple contingencies with clear discriminative stimuli, especially when pretraining of stimuli is provided (Cantor, 1955). Furthermore, comparable equivocal results were demonstrated by Robichaux and Gresham (2014) using a similar intervention with elementary aged children.

The lack of differentiation between the treatments could be explained by behavioral contrast. It is possible that the difference between baseline (i.e., no praise or reward for SI) and intervention (i.e., descriptive-praise, token reinforcement, and reward in response to SI) was great enough that *any* reward type would have produced similar results. That is, when positive reinforcement was provided for a behavior for which no reinforcement had previously been provided, an increase in the target behavior would be expected regardless of type of reinforcement. Because baseline approximated a typical EC classroom, similar results might be expected if either treatment were introduced to these settings. It also is possible that each potential reward from the set provided an equal amount of motivation for children to engage in target behavior, regardless of whether it was identified or a mystery. If this were the case, children would not respond differently to known or mystery treatments because all would result in a high-quality reward. This is a likely possibility given the similar interests of target children by group, the overlap in preferred reinforcer type, and the fact that the same set of items was used for rewards across treatments to control for potential differences in child preference across multiple sets.

Children with MSD. Although both treatments produced positive change for target children, no associated changes occurred for children with MSD. SI data for these children showed no meaningful change across conditions, and the results of the social validity peer preference assessment revealed a decreased or unchanged social status. There are several possible reasons for this. First, the children with MSD who were included for the majority of the study (i.e., Maisie, Trent, and Esteban) demonstrated significant delays that impeded communication and, for Maisie, a reduced ability to reciprocate to SI in any clear way. These children were not experienced with interacting with peers, and in the case of Trent and Esteban, they resisted these interactions. Even if all children were able to engage in reciprocal interactions, extensive prompting and practice were likely required to support this skill's development. It is possible that given more time or individualized instruction, increases in SI for these children would have occurred. Second, although these data were not captured empirically, target children's SI represented minimal variation in topography, potentially resulting in reduced peer-to-peer interactions. Target children interacted with children with MSD primarily by bringing them toys, with occasional instances of talking to them or engaging in parallel play. Because bringing a peer a toy and immediately walking away provides minimal opportunity for interaction, it is not surprising children who are inexperienced engaging with peers would not show improvements in SI. Although the implementer attempted to expand target children's skill repertoire by reminding the children of all the possible ways they could be a good friend, any SI that occurred at the appropriate time were reinforced. Consequently, target children did not develop an expanded behavioral repertoire during the course of the study. Third, it is possible that the lack of demonstrated change in SI for children with MSD was due to dissatisfaction with the rewards being provided. Because these participants were not the targets of the intervention, we did not assess their reward preferences. Thus, it is possible they understood the contingency and were willing to engage with peers but were not motivated to do so. Fourth, it is possible that increases in SI did occur for children with MSD, but that the coding system did not capture them. If the definitions had been modified for this group to include secondary measures of social engagement (e.g., eye-gaze or affect), increases in SI might have been demonstrated. Finally, it is hypothesized that target children who did not rate children with MSD as more favored throughout the course of the study might have developed an increased preference for the other target children in their group via increased interactions with them. In the current study, children were selected to participate regardless of current friendships. A small group activity including positive, reciprocal exchanges with previously neutral peers might have resulted in an increase in their overall status.

Although the level of SI did not increase for children with MSD, this intervention arguably produced meaningful outcomes for this group. In general, children with disabilities will demonstrate increased engagement and skill development, including play and social skills, when included in groups with peers without disabilities (Odom et al., 2011). However, for children with MSD who have more significant delays that might impede their ability to move or communicate independently, placement in an inclusive play group is not likely to be effective unless peers come to *them* to initiate and maintain SI. That is, to benefit from access to inclusive SI, children must also be provided meaningful opportunities to participate in them (i.e., proximity to and social bids from peers; Barton & Smith, 2015). Providing rewards to typically developing children—who might rarely interact with children with MSD otherwise, as was the case in this study—for increasing the frequency or duration of SI with peers with MSD is an important initial step to increase motivation to engage in this behavior. While the ideal frequency of peer-directed SI needed to result in increases in behavior for children with disabilities is likely idiosyncratic and dependent on individual child characteristics and quality of interactions, future research on this topic is warranted.

Limitations

There were several limitations. First was the attrition of Massimo and the subsequent addition of Maisie in Group 2. Although this was not within the researcher's control, it had the potential to impact outcomes for target children and precluded the determination of a functional relation for Massimo and Maisie (when in Group 2). Second was the variable and sometimes low session agreement for SI. This occurred with low-frequency behaviors, as was the case for the follow-up session for Alex in which a single disagreement resulted in a session agreement of 0%. A third limitation was the possibility that the coding system did not capture changes in the behavior of children with MSD. Because these children demonstrated minimal vocal communication and, for Esteban and Maisie, limited mobility, it is possible that changes in behavior might have manifested as increased engagement with peers or materials rather than as SI. Finally, having a researcher rather than a teacher implement sessions and conducting sessions in a classroom without additional children and staff does not represent typical EC settings. This method of intervention was chosen because the purpose of this study was to test two treatments with similar components empirically, which required a high level of fidelity. It was hypothesized greater experimental control would be obtained if all procedures were implemented by the researcher and if fewer potential confounding variables, which might be more likely with additional classroom staff and children present, could occur. Future research should continue to examine the use of group contingencies in EC settings within naturally-ocurring contexts.

Implications and Future Research

This study has significant implications for researchers and practitioners. It demonstrates that when high-quality rewards are provided for SI within a group contingency, typically developing children will increase their use of this behavior. This is important because it provides empirical data supporting the use of group contingencies for SI and evidence that rewards of equivalent quality can be equally effective. Survey data indicate attitudes and beliefs are a primary challenge to inclusion (Barton & Smith, 2015). For example, a majority of classroom teachers were in favor of inclusion of children with disabilities, yet cited this practice as a burden that tended to disrupt classrooms (Hadadian & Hargrove, 2001), and teachers felt more prepared to serve children with mild disabilities than children with MSD (Eiserman, Shisler, & Healey, 1995). Reinforcing peer-directed SI through the use of a group contingency might be a relatively low effort strategy, which increases the likelihood of applied use. Furthermore, having the flexibility to choose the reward type they prefer might make group contingencies even more feasible for teachers to implement, and also has the potential to improve child outcomes (Ennis, Cho Blair, & George, 2016). Consequently, when planning future studies or classroom use of group contingencies, researchers and practitioners can use their preferred reward type—assuming rewards are based on child preference and regularly alternated with other rewards of equal quality—and can anticipate positive social outcomes.

These types of equivocal findings are important, if often overlooked, in single-case research (Ledford et al., 2016). In recent years, there has been increased focus on publication bias (also known as the "file drawer effect"), which results in the disproportionate publication of studies demonstrating positive outcomes or large effects (Shadish, Zelinsky, Vevea, & Kratochwill, 2016; Tincani & Travers, 2018). This can significantly impact the identification of evidence-based practices, threatens the validity of specific interventions, and has a negative impact on the replication of studies with complex or unpredictable variables (Cook & Therrien, 2017; Tincani & Travers, 2018; Travers, Cook, Therrien, & Coyne, 2016). One strategy for preventing publication bias is to publish studies based on their methodological rigor rather than on treatment differentiation or the magnitude of behavior change (Cook &

Therrien, 2017). Although the findings in the current study did not clearly differentiate between reward types, the results are important for ensuring balanced information is available to guide future research and practice regarding the application of group contingencies with young children (Cook & Therrien, 2017). For example, in the future researchers might investigate the effect of providing individualized supports within the context of a group contingency, and whether the differential reinforcement of topographically diverse behaviors will result in an expanded behavioral repertoire. In addition, while small group settings provide ideal conditions for young children's skill development (Ledford, Gast, Luscre, & Ayres, 2008), future research might consider expanding the use of an independent group contingency to modify social skills within a larger group setting.

Conclusion

The purpose of this study was to examine the differential effects of known versus mystery rewards within a group contingency. The findings indicated that although there were no differences in levels of SI between reward types, both were superior to the baseline condition. Although the overall impact of the intervention did not produce meaningful behavior change for children with disabilities, positive outcomes were demonstrated as an increased frequency of SI (an essential precursor to reciprocal SI) between children with and without disabilities. Given that current policy and practice supports the placement of children with MSD in inclusive settings (U.S. DHHS & DOE, 2015), this study provides meaningful information regarding practices that support these children in their natural EC environment.

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