The Effects of Playful Physical Contact as an Establishing Operation on Correct Academic Responding of Three Preschool Students

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Abstract

The purpose of this study was to test the effects of playful physical contact as an establishing operation (EO) on correct academic responses for four-year-old preschool students with developmental disabilities who functioned at the pre-speaker and pre-listener levels of verbal behavior. Two males and one female served as participants who attended a publicly funded, private preschool outside a large metropolitan area. A multi-element design (alternating treatments design followed by an AB design) was used to test the effects of the establishing operation. The data were collected in seven acquisition programs and one performance program for each participant. The establishing operation consisted of experimenters' tickling, spinning, and hugging the participants as pre-instructional play for 10 seconds for every 10 learn units. The results of these data showed that an establishing operation was effective at increasing correct academic responding across all participants. In addition, Participants A and B emitted more mands for the playful physical contact during the pre-play sessions (mands were not measured for Participant C).

Keywords: establishing operations, pre-session reinforcement, conditioned reinforcement, reinforcer sampling.

Motivating individuals with developmental disabilities can be challenging to educators (Egel, 1981, Greer, 2002). In an effort to motivate them, the effects of variation of reinforcer stimuli on correct responding and on-task behavior of individuals with disabilities have been tested (Egel, 1981) and those of variation of antecedent stimuli during discrimination tasks have been evaluated (Dunlap & Koegel, 1980). The influence of antecedent and consequent variables on problematic behaviors were also tested (Carr, Yarbrough, & Langdon, (1997); Mace & Lalli, 1991); and Repp, Felce, & Barton, 1988) in relation to the motivational variables. The results of these studies demonstrated that arrangement of antecedent stimuli or consequent stimuli affected behaviors of individuals with developmental disabilities. However, there were other variables in addition to the core components of the three-term contingencies that affected behaviors of individuals with disabilities (Berg, Peck, Wacker, Harding, McComas, Richman, & Brown, 2000).

Several studies identified instructional history as one of variables that affect children's acquisition of verbal operants (Greer, Nirgudkar, & Park, 2003; Greer, Stolfi, Chavez-Brown, & Rivera-Valdez, 2005; Lee Park, 2005). For example, in Greer et al.'s study (2005), young children with developmental disabilities who did not exhibit *Naming* prior to the study acquired Naming as a higher order operant after they had instructional history of Naming through multiple exemplar instruction. Another variable that affects acquisition of new operants is establishing operations (EOs). William and Greer (1993) created EOs by placing children under deprivation for specific items in order to create a motivational context, which is necessary in the acquisition of a verbal operant: the mand. Other studies also demonstrated EOs as necessary components of children's learning of new verbal operants (Hall & Sundberg, 1987; Ross, Nuzzolo, Stolfi, Natarelli, & Greer, 2006; Reilly-Lawson & Greer, 2006).

As we mentioned above, the three-term contingencies were affected by establishing operations (EOs) as the contexts of the contingencies that preceded the antecedent stimuli (Greer, 2002). EOs as

motivational events alter the value of reinforcers that follow responses and thus affect the probability of the responses (Greer, 2002; Greer & Ross, 2008; Michael, 1982). For example, after parents arrange deprivation of playing a computer game by not allowing a child to play the game for a period of time, the child is more likely to finish his/her homework in order to gain the assess to the computer game. In this case, deprivation of playing the computer game is establishing operation and this increases the reinforcement effects of the games and the probability of finishing his/her homework.

In O'Reilly's (1999) study, four analogue analysis conditions (i.e., attention, demand, leisure, and play) were randomly conducted in order to test the effects of pre-session attention on the occurrence of attention-maintained yelling and head hitting. Levels of attention (no attention versus high attention) were manipulated prior to the analogue analysis condition to test the influence of pre-session attention on the problem behavior during the attention analogue condition. The results showed that higher levels of yelling and head hitting occurred when the participant was deprived of attention prior to the attention analogue condition. McComas, Thompson, and Johnson (2003) tested the effects of pre-session attention on the subsequent occurrences of problem behavior with elementary school students with disabilities. In their study, variation of continuous attention conditions was followed by ignoring conditions on attention-maintained or escape-maintained problem behaviors. The results showed that the pre-session exposure to attention decreased attention-maintained problem behaviors, whereas it did not affect escape-maintained problem behaviors. In summary these studies demonstrated that behavior maintained by attention occurs more often in cases where the individual has limited access to attention during pre-session conditions.

McAdam, Klatt, Koffarnus, Dicesare, Solberg, Welch, and Murphy (2005) evaluated the effects of deprivation and satiation as potential establishing operations on the preference assessment for activities and items (leisure items or toys) with three individuals with developmental disabilities and three typically developing children. During the control condition, the participants received equal access to each of the four items prior to the preference assessment. During the deprivation condition, the participant received equal access to three of the four items. In the satiation condition, the participants had free access to one of the four items prior to the preference assessment. The results showed that deprivation resulted in increased selection of the items. Similarly, Klatt, Sherman, and Sheldon (2000) tested the effects of variation of deprivation of preferred and non-preferred activities in length (15-min, 2-hr, and 1 to 4 days) on subsequent engagement of the activities with three adults with developmental disabilities. The results showed that 1 to 4 days of deprivation induced the highest level of engagement in the high-preferred activity for each participant.

Ayllon and Azrin (1968) tested the effects of a reinforcer sampling procedure (i.e., watching movies, going for walks, and attending music periods) on participation in those activities as reinforcers. In the study, patients in a mental hospital were required to engage in the reinforcing activities for a limited period of time as sampling before they were asked whether they wanted to exchange tokens for participating in the activities. Those participants who elected to exchange tokens for the activities then engaged in the activities. More patients participated in the three activities when the reinforcer sampling procedures were implemented. The sampling procedure induced participation in the activities by participants who had not utilized the reinforcers before and increased the frequency of participation of the participants who were already utilizing the reinforcers.

The research described above tested the effects of exposures to events or conditions prior to antecedent stimuli presentations on problem behaviors, responses during assessment, or participating in reinforcing activities. Ramaswamy (2005) tested the effects of pre-instructional play activities on the learning of children with autism spectrum disorders during instruction. This study appears to be one of the few studies on the effects of pre-instructional presentations (i.e., antecedents) in children's acquisition of new operants and maintenance of learned operants. In two experiments, Ramaswamy tested the effects of

playful physical contacts as establishing operations for response acquisition (learning new tasks) and performance (already mastered) tasks. The first experiment was conducted to test the effects of a sampling procedure. In the sampling conditions, the experimenters provided the participants with playful physical contacts such as hugs, runs, and jumps prior to instruction. The conditions were randomly rotated with non-sampling conditions wherein no playful interactions were provided. This multi-element design was followed by an AB design wherein the sampling condition was followed by a no-sampling condition (Hains & Baer, 1989). The results of the experiments indicated that the participants emitted more correct responses under the reinforcer sampling condition than those in the no-sampling condition. The second experiment replicated the first experiment with an additional dependent variable measured: tacts emitted during instruction. The results of the experiments demonstrated that the pre-instructional playful physical contacts as EOs increased accuracy in learning new operants and functioned as establishing operations for generalized social reinforcers and thus induced verbal operants: tacts.

In the present study, the participants required extra efforts from the instructors in order to motivate them during instruction, which consisted of utilizing preferred items such as praise, edibles, or toys as reinforcers. Thus, we sought to test whether pre-instructional play in the form of playful physical contacts as EOs affected the value of the reinforcers used, thus increasing the emission correct responses during instruction. This study systematically replicated Ramaswamy's (2005) study. The numbers of correct responses during two different conditions (pre-session play condition vs. no pre-session play condition) were compared and the same number of learn units were presented during each condition. Ramaswamy (2005) also measured the frequency of tacts during Experiment II. In the present replication of Ramaswamy's study, instead of number of tacts emitted by the participants, we measured the number of mands emitted by the participants during each condition.

Method

Participants and Setting

Three preschoolers with developmental disabilities served as the participants for this study. They attended a publicly funded private preschool that implemented the Comprehensive Application of Behavior Analysis to Schooling (CABAS®) model of education (Greer, 2002). All of the participants were placed in one of the self-contained classrooms in the school. The ratio in the classroom was 6 students: 1 teacher: 2 teaching assistants. All long-term and short-term objectives for the students in the school were determined based on the CABAS® International Curriculum and Inventory of Repertoires for Children from Preschool through Kindergarten (Greer & McCorkle, 2003). The participant and experimenter sat at a rectangular table (25x20 inches) which was arranged in the area where other students received individualized instruction from other teachers throughout the day.

The participants selected for this study emitted low levels of correct responses in instructional settings, despite using contingent praise, toys, or edibles following correct responses. Participant A and Participant B emitted palilalia and Participant C emitted vocal stereotypy (e.g., /ee/) during instruction as well as in free play settings (e.g., toy area). Detailed information for each of the 3 participants is presented in Table 1.

Table 1

Description of Participants

Participant	Age	Standard Scores	Verbal Capabilities
A	4: 9	Vineland Adaptive Behavior	Listener, Speaker, Early Reader
		Scale (VABS):Classroom Ed.	Textual Responding to Letter & Numbers
		SS=87	Dolch Words (50 Words)
		Preschool Language Scale (PLS-4)	Generalized Imitation
		Auditory Comprehension, SS 50	Full Naming, Transferring
		Speaker Communication, SS 50	Establishing Operations (EOs) between Mands & Tacts with Autoclitics
B	4: 7	VABS: Interview Ed.	Listener, Speaker, Early Reader
		SS=77, 6 %	Generalized Imitation
		PLS-4	Full Naming, Transferring Eos between
		Auditory Comprehension, SS 67	Mands & Tacts with Autoclitics
		Speaker Communication, SS 74	Textual Responding to Letter & Numbers
			Dolch Words (50 Words)
C	3:7	VABS: Interview Ed.	Pre-Listener, Pre-Speaker
		SS 57, Age Equivalent 1:6	Mand with Gesture
		PLS-4	Conditioned with Voices of
		Auditory comprehension SS 50	Adults as Reinforcers
		Speaker Communication, SS 55	

Design

A multi-element design was used The alternating treatment component of the multi-element design is simply a fast-paced reversal design (Hains & Baer, 1989) and it is used to test the effect of the independent variable on the dependent variable, in rapidly rotated sessions. An AB design follows the alternating treatment component in order to test for the replicability of any effects and spill-over effects that might be found during the alternating treatment condition. Phase A consisted of no pre-instructional play sessions while phase B consisted of pre-instructional play sessions.

Dependent Variables

The dependent variables in this study were correct responses to teacher learn unit presentations (Albers & Greer, 1991; Greer, 2002; Greer & McDonough, 1999; Emurian, Wang, & Durham, 2000; Selinske, Greer, & Lodhi, 1991) during seven acquisition programs and one performance program for each

participant. The programs and target behaviors are defined and described in Table 2 for Participant A, Table 3 for Participant B, and Table 4 for Participant C. Another dependent variable was the number of mands emitted by Participants A and B during each condition. A mand is "a verbal operant in which the response is reinforced by a characteristic consequence and is therefore under the functional control of relevant conditions of deprivation or aversive stimulation" (Skinner, 1957, p. 35-36). In the present study, Participant A and Participant B emitted mands in full sentences (e.g., I want toys, please) and they received playful physical contact (e.g., tickling) when they emitted mands in a full sentence (e.g., tickle me, please) during the pre-session play condition. However, mands that were emitted by the participants were not reinforced during the no-pre-session play conditions. Participant C did not have vocal verbal behavior capabilities and the experimenters did not measure mands during the study.

Table 2.

Instructional Programs for Participant A

Instructional Program	Definition of Behavior
Tact food	- Presented a picture of food (e.g., orange) the participant was required to emit correct tact (e.g., "Orange").
Tact common items	- Presented a picture of various items that are found in a classroom (e.g., paper), the participant was required to emit correct tact (e.g., "Paper").
Stating Personal information	- Given a vocal antecedents (e.g., "What is your name?"), the participant was required to emit correct intraverbal (e.g., "Kane").
Multiple exemplar Instruction for Transportation	- Given a vocal antecedent (e.g., "Point to___," "Match ___ with ___," "What is this?") or non-vocal antecedent (e.g., hold up a picture) for each topography, the student was required to point correct picture, match pictures, or emit tact or intraverbal following the antecedent.
Following Two-step Directions	- Given a vocal antecedent (e.g., "Stand up, and clap hands "), the student was required to follow the directions given by teacher.
Point to clothing	- Given a vocal antecedents (e.g., "Point to shirt"), the student was required to place finger on an appropriate target picture.
Textual responding to Letters	- Presented a letter card (e.g., A) and pointed to the letter card, the student was required to emit correct textual responses (e.g., "A").
Two-step GMI (Performance Task)	- Given a vocal antecedent (e.g., "Do this" with a two-step model action), the student was required to follow the model actions.

Table 3.

Instructional Programs for Participant B.

Instructional Program	Definition of Behavior
Count Objects	- Presented several items on the table (e.g., 3 mini dinosaurs) and a vocal antecedent (e.g., "Count"), the participant was required to count them vocally (e.g., "One, two, three").
Tact common items	- Presented a picture of various school items and a teacher points to various items in the picture, the participant was required to emit correct tact (e.g., "Paper").
Stating Personal information	- Given a vocal antecedents (e.g., "What is your name?"), the participant was required to emit correct intraverbal (e.g., "Kane").
Ed Mark Reading	- Given a vocal antecedents as scripted by the particular reading lesson, the participant was required to emit vocal responses of the word to be read or point appropriate word.
Following Three-step Directions	- Given a vocal antecedent (e.g., "Stand up, clap hands, and jump") the student was required to follow the directions given by teacher.
Point to Numbers	- Presented written or typed stimuli along with the vocal antecedent (e.g., "Point to 3"), the student was required to place figure on corresponding card.
Textual responding to Letters	- Presented a letter card (e.g., A) and pointed to the letter card, the student was required to emit correct textual responses (e.g., "A").
Two-step GMI (Performance Task)	- Given a vocal antecedent (e.g., "Do this" with a two-step model action), the student was required to follow the model actions.

Table 4.
Instructional Programs for Participant C

Instructional Program	Definition of Behavior
One-Step GMI	- Given a vocal antecedent (e.g., "Do this" with a 1-step model action), the student was required to follow the model action.Tact Common Items Given a vocal antecedent (e.g., "Do this" with a 1-step model action), the student was required to follow the model action.
Clean Up	- Given a vocal antecedent (e.g., "Clean up"), the student was required to put the predetermined number of toys to the toy shelf.
Sit Still	- Given the vocal antecedents (e.g., "Sit still"), the student was required to place her hands on the knees without movement for the predetermined time period
Matching Pictures	- Presented one sample pictures and two comparison pictures along with a vocal antecedent (e.g., "Match fan with fan"), the student was required to match the sample to one of the comparison which is identical to the sample.
Matching Objects	- Presented one sample object and two comparison objects along with a vocal antecedent (e.g., "Match pen with pen"), the student was required to match the sample to one of the comparisons which was identical to the sample.
Matching Objects to Pictures	- Given a vocal antecedent (e.g., "Match pen with pen") and a sample object and two comparison pictures, the student was required to match the sample object to one of the comparisons which was corresponding picture to the sample.
Matching Shapes	- Presented one sample shape and two comparison shapes along with a vocal antecedent (e.g., "Match circle with circle"), the student was required to match the sample to one of the comparison which was a same category of shape as the sample.
Compliance (Performance Task)	- Given vocal antecedent (e.g., "Pick up the pen") with gesture cues (e.g., pointing the pen), the student was required to follow given direction within two seconds.

Independent Variable—Playful Physical Contact

The independent variable in this study was the delivery of playful physical contacts. Pre-session play sessions and no pre-session play sessions were rotated randomly during the multi-element design. In the

pre-session play sessions, the experimenters delivered playful physical contacts (e.g., ticklin g, hugging, and spinning) as pre-session play for 10 seconds for every 10 learn units. That is, the experimenter and the participant were engaged in playful physical contacts for approximately 10 seconds prior to the delivery of every 10 learn units. In both of the pre-session play and no pre-session play conditions, the participants' correct responses were reinforced by edibles and/or vocal praise, and a correction procedure was provided for the participants' incorrect response or no response.

The experimental sessions were run twice per day (i.e., a morning session and an afternoon session) and the two experimenters were rotated across conditions for each participant. The sessions of each condition (i.e., pre-session play session or no pre-session play session) were randomly assigned to morning or afternoon sessions in the counterbalanced format. For Participant A, four pre-session play sessions and four no-play sessions were run in the morning; three pre-session play sessions and three no pre-session play sessions were run in the afternoon. For Participants B and C, three sessions for each condition were run in the morning and three sessions for each condition were run in the afternoon.

Each experimental session contained seven acquis ition tasks and one performance task (i.e., the emission of previously mastered operants). Acquisition tasks consisted of programs to induce new operants; performance tasks consisted of the programs to test participants' responses to mastered operants. Twenty learn units were delivered in each program. This resulted in 160 per session and 320 learn units per day for each participant. Each session lasted approximately one hour. In acquisition programs, once the participants met the criterion (emitting over 90% correct responses out of 20 learn units for 2 consecutive session) on a short-term objective in each program, a new, more advanced short-term objective for the curriculum was implemented. The correct responses to the performance task program did not include criteria measures since the task was previously mastered.

Data Collection

Throughout the experiment, instruction was delivered in learn units as instructional trials which met a criterion of effective instruction. During learn unit presentation, all three core components of operants were presented clearly. Several studies have demonstrated that instructional trials that meet these criteria have been shown to be efficient and effective in teaching and learning (Albers & Greer, 1991; Greenwood, Hart, Walker, & Risely, 1994, Greer & McDonough, 1999). During these trials, the experimenter presented an unambiguous antecedent while the participant was attending, the student participant was provided with an opportunity to respond, followed by the appropriate consequence. Accurate learn unit consequences to a correct response consisted of the immediate presentation of a generalized reinforcer (e.g., an edible). Accurate learn unit consequences to incorrect responses involved a correction procedure in which the instructor re-presented the antecedent and modeled the correct response and then the student was given an additional opportunity to emit the correct response. The corrected response was not reinforced. For example, when the vocal antecedent, "Sit still," was presented by the experimenter, the participant was required to sit in the chair without any movement for the predetermined time period. If the student sat still for the target time period, he/she received a reinforcer; if not, the participant received a correction procedure in which the experimenter physically guided him/her to sit still for the target time period with a repetition of the vocal antecedent, "Sit still."

The data were collected on data collection forms by the instructor during all experimental sessions. A plus (+) sign was recorded when the participant responded correctly within 3 seconds, and a minus (-) sign was recorded when the participant emitted an incorrect response or no response. The participants' correct responses to each instructional program were measured and graphed daily during all phases of this study. At the end of each experimental session, the participant's correct responses were added up. This number was then divided by the total number of learn units presented (i.e., 160 per session) to determine the percentage

of correct responses during the session. The numbers of mands emitted by the participants were also recorded using an event recording (check marks) during each condition.

Interobserver agreement

Throughout the procedure an independent observer measured the accuracy and rate of learn unit presentations by the experimenter using a TPRA (Teacher Performance Rate and Accuracy Scale) form (Ingham & Greer, 1992; Ross, Singer-Dudek, & Greer, 2006). The numbers of participants' correct and incorrect responses were recorded as well. The data were compared to the data collected by the experimenter after each session. Interobserver agreement was calculated by dividing the number of agreements by the total number of agreements plus disagreements and multiplying by 100 (Cooper, Heron, & Heward, 1987). For Participant A, interobserver agreement was obtained for 37% of the sessions with 100% interobserver agreement. For Participant B, interobserver agreement was obtained for 32% of the sessions with 100% interobserver agreement. For Participant C, interobserver agreement was obtained for 27% of the sessions with 100% interobserver agreement.

Results

The results of the study are represented in Figure 1and 2. Figure 1 shows the percentage of correct responses emitted by participants. In the alternating treatment phase, Participant A emitted a mean of 60.98% correct responses with a range from 48% to 66% during the no pre-session play sessions, and a mean of 72.23% correct responses with a range from 64% to 94% during the pre-session play sessions. In the repeated no pre-session play phase Participant A emitted a mean of 59.68% correct responses with a range from 47% to 66%. In the repeated pre-session play phase, he emitted a mean of 87.18% correct responses with a range from 79% to 94%. In the alternating treatment phase, Participant B emitted a mean of 67.81% correct responses with a range from 57% to 73% during the no pre-session play sessions, and a mean of 86.77% correct responses with a range from 76% to 94% during pre-session play sessions. In the repeated no pre-session play phase Participant B emitted a mean of 70.53% correct responses with a range from 61% to 77%. In the repeated pre-session play phase he emitted a mean of 90.89% correct responses with a range from 83% to 96%. In the alternating treatment phase, Participant C emitted a mean of 64.47% correct responses with a range from 58% to 69% during the no pre-session play sessions, and a mean of 78.33% correct responses with a range from 81% to 75% during the pre-session play sessions. In the repeated no pre-session play phase Participant C emitted a mean of 66.69% correct responses with a range from 65% to 68%. In the repeated pre-session play phase she emitted a mean of 81.16% correct responses with a range from 76% to 86%.

Figure 1, Next Page

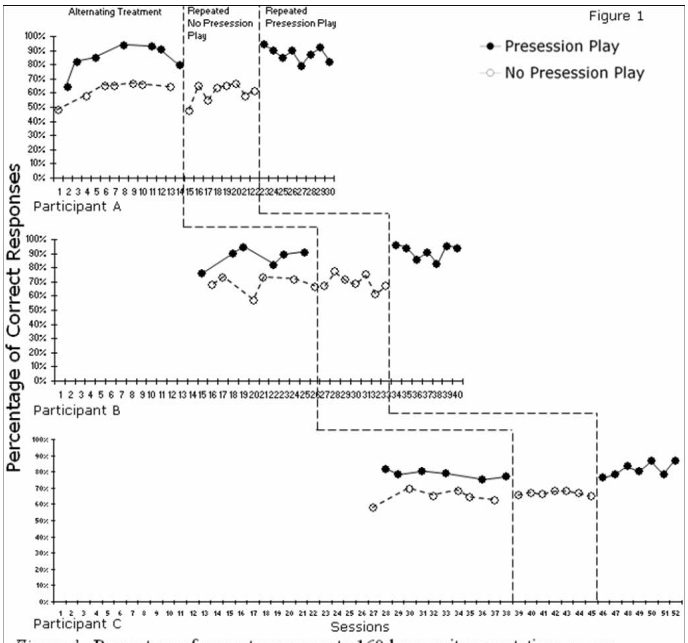

Figure 1. Percentage of correct responses to 160 learn unit presentations across sessions under pre-session play condition and no pre-session play condition for Participant A, B, and C. Open circle represents number of correct responses during no pre-session play condition and close circles during pre-session play condition.

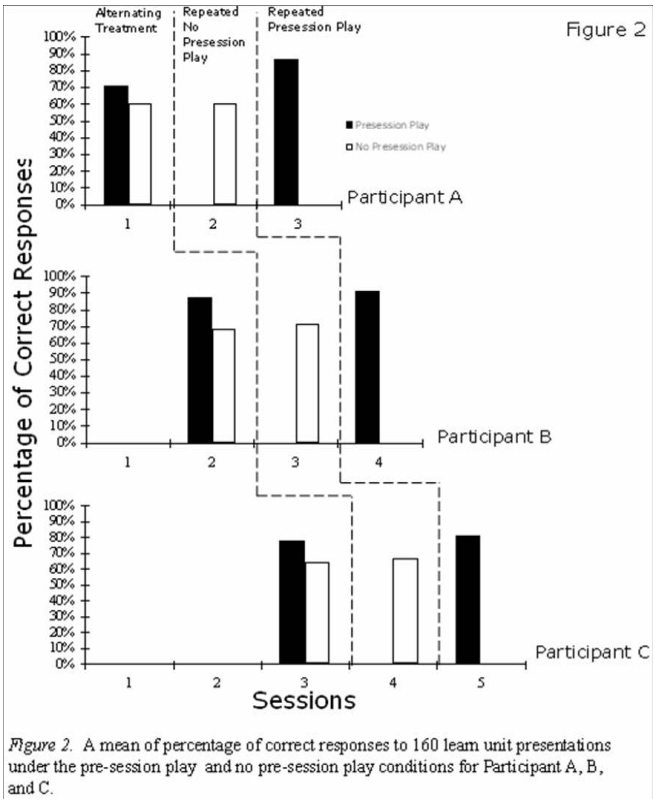

Figure 2. A mean of percentage of correct responses to 160 learn unit presentations under the pre-session play and no pre-session play conditions for Participant A, B, and C.

Figure 3 shows the number of mands emitted by Participant A and B. In the alternating treatment phase, Participant A emitted 0.29 mands (range 0 to 1) for the playful physical contacts during the no pre-play sessions, and a mean of 7.29 mands (range 4 to 15) during the pre-session play sessions. In the repeated no pre-session play phase Participant A emitted a mean of 1.38 mands (range 0 to 4) for the playful physical contacts. In the repeated pre-session play phase, his mands for the playful physical contacts increased up to a mean of 4.75 mands (range 2 to 9) for the playful physical contacts. In the alternating treatment phase, Participant B emitted a mean of 5.67 mands (range 0 to 10) for the playful physical contacts during the pre-session play sessions, and a mean of no mands during no pre-session play sessions. In the repeated no pre-session play phase Participant B emitted no mands for the playful physical contacts. In the repeated pre-session play phase, however, his mands increased up to a mean of 2.71 mands (range 0 to7) for the playful physical contacts.

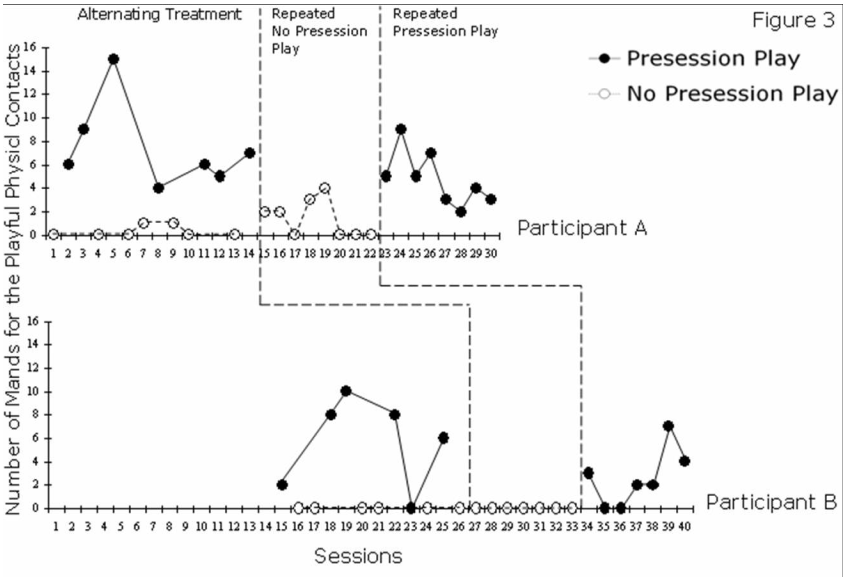

Figure 3. Number of mands for the playful physical contacts under the pre-session play and no pre-session play conditions for Participant A, and B.

The results showed that all participants emitted a higher number of correct responses under pre-session play conditions, compared to no pre-session play conditions. In addition, Participant A and Participant B emitted a higher number of mands during pre-session play conditions.

Discussion

The data demonstrated a functional relationship between the delivery of the playful physical contacts as an establishing operation and the correct responses emitted by the participants. We suggest that the effect was due to the likelihood that the pre-session play acted as an EO for the reinforcers (i.e., praise, tickling, edible, toys, etc.) which were delivered as consequences to the participants' responses because of the increase in correct responses under pre-play conditions over the no-play conditions. The data showed that the pre-play procedure was effective in teaching various responses classes; motor imitation, compliance with a visual cue, match-to-sample, tact, intraverbal, pointing, clean-up, and following the experimenter's directions (hear and do or auditory stimulus control for the spoken instructions of the experimenters). The level of correct responses across the participants showed clear differences under two conditions during alternating treatment phases and repeated treatment phases (AB design). The use of both

types of designs (alternating treatment design followed by AB design) would appear to confirm the reliability of the effect for the participants.

Motivation is a key to all instructional effectiveness and students' responses as targeted operants cannot be considered independently of the motivational setting as well as the antecedent and consequence (Greer, 2002; Michael, 1982, 1983, 2000). Exposure to events or conditions as establishing operations (EOs) prior to the antecedent stimuli "alter the effectiveness of some objects or event as reinforcement" (Michael, 1982, p. 150). That is, such conditions establish the reinforcing value of various stimuli. McGill (1999) integrated Michael's (1982) concept of EOs with analysis of variables which maintain problem behaviors by reviewing relevant studies. He suggested that decreasing problem behavior can be effective when relevant EOs and the classes of responses evoked by these EOs are addressed simultaneously. Greer (1986) incorporated EOs as necessary components in a scripted curriculum for the mand training procedure. The effects of this on the acquisition of verbal operants of individuals with developmental disabilities have been demonstrated extensively (Greer, Nirgudkar, & Park, 2003; Greer & Ross, 2008; Nirgudkar, 2005; Nuzzolo-Gomez & Greer, 2004; Schwartz, 1994; Williams & Greer, 1993; Hall & Sundberg, 1987; Ross, Nuzzolo, Stolfi, Natarelli, & Greer, 2006; Reilly-Lawson & Greer, 2006). The role of context and the EOs as part of the context has been demonstrated in the RFT studies (Hayes, Barnes-Holmes, & Roche, 2001) and the findings we report appear consistent with the effect of context demonstrated in contemporary behavior analysis.

As we mentioned above, motivation is viewed as the current and prior environmental events that effect three-term contingencies on a momentary basis (Greer, 2002). Ramaswamy (2005) interpreted her results also as evidence that the pre-session play conditions were EOs where the play was already a conditioned reinforcer and the pre-session play enhanced teacher attention and social praise for correct responses as reinforcers. Having access to pre-instructional play for a limited time functioned as pre-session sampling for the participants. Pre-instructional play as pre-session sampling established an increased momentary value of experimenters' praise or other form of social reinforcement (e.g., smiling, patting, making eye contact, etc.) during instruction. The results of the present study support Ramaswamy's argument that identifying variables that arrange the effects of EOs can lead to more effective instruction. These results parallel those of Ayllon and Azrin's (1968) study which tested the effects of a reinforcer-sampling procedure on participation in the activities as reinforcers.

In Ramaswamy's (2005) study, pre-instructional play as social interaction (e.g., smiling, patting, etc.) was considered to be pre-instruction sampling for social reinforcers (e.g., smiling, praise, approvals, etc.). She tested whether the pre-instructional play affected the emission of tacts, for which establishing operations as motivational variables were social reinforcers. In the present study, all three participants emitted more mands for playful physical contact and more eye contact during pre-session play conditions. The present study also produced some results not reflected in the data. As this study progressed, Participants A and B emitted noticeably less stereotypy in one-to-one and group instruction conditions compared with previous sessions.

The limitation of the study is that the other behaviors for which the controlling variable is social (e.g., tacts, eye-contact, mands out of instruction, stereotypy, etc.) were not measured systematically. Future studies should investigate the relationship between the playful physical contact and stereotypy during instruction. Another limitation in this study was the potential spillover effect due to the rapid and random rotation of two procedures (i.e., no pre-session play conditions and pre-session play conditions). During the no pre-session play conditions, some data points overlapped with those of pre-session play conditions with Participant B and Participant C. One explanation for the overlapping data points across both conditions was that the experimenters were conditioned as reinforcers through playful physical contact during the pre-session play conditions and the effect of this was carried over during the no pre-session play conditions.

However, the difference between the correct responses in the pre-session play condition and no pre-session play conditions increased as the study progressed within repeated no pre-session play phase and pre-session play phase (AB phases) following the alternating treatment phase.

In Ramaswamy's (2005) study, the pre-session play provided a pre-session sampling of social reinforcers and thus set EOs for social reinforcers that were delivered during instruction. The results of the present study demonstrated that playful physical contacts as pre-session play set EOs for social reinforcers which were delivered during instruction, supporting Ramaswamy's finding. Another implication of the pre-instructional play of the present study was that by delivering pre-instructional play as EOs, it affected the value of the reinforcers that were delivered by the experimenters who were paired with conditioned stimuli (i.e., tickling, hugging, etc.) during the pre-instructional play. It was evident that the social interaction was enhanced as a reinforcer for Participant A and Participant B who had vocal verbal mands when we looked at the increase in mands for the playful physical interactions under the pre-play conditions.

References

Albers, A. E. & Greer, R. D. (1991). Is the three-term contingency trial a predictor of effective instruction? *Journal of Behavioral Education, 1,* 337-354

Ayllon, T. & Azrin, N. H. (1968). Reinforcer sampling: A technique for increasing the behavior of mental patients. *Journal of Applied Behavior Analysis, 1,* 13-20.

Berg, W. K., Peck, S., Wacker, D. P., Harding, J., McComas, J., Richman, D., & Brown, K. (2000). The effects of pre-session exposure to attention on the result of assessments of attention as a reinforcer. *Journal of Autism and Developmental Disorders, 33*, 463-477.

Carr, E. G., Yarbrough, S. C., & Langdon, N. A. Effects of idiosyncratic stimulus variables on functional analysis outcomes. *Journal of Applied Behavior Analysis, 30,* 673-686.

Cooper J. O., Heron T. E., & Heward, W. L. (1987). *Applied Behavior Analysis*. Upper Saddle River, New Jersey: Prentice Hall, Inc.

Dunlap, G. & Koegel, R. L. (1980). Motivating autistic children through stimulus variation. *Journal of Applied Behavior Analysis, 13*, 611-617.

Emurian, H. H., Hu, X., Wang, J., & Durham, A. G. (2000). Leaning Java: A Programmed Instruction approach using applets. *Computers Human Behavior, 16*, 395-442.

Greenwood, C. R., Hart, B., Walker, D.I., & Risely, T. (1994). The opportunity to respond and academic performance revisited: A behavioral theory of developmental retardation. In R. Gardener 3rd, et al. (Eds.) *Behavior analysis in education: Focus on measurably superior instruction.* Pacific Groves, CA: Brooks Cole.

Greer, R. D. (1986). A manual of teaching operations for verbal behavior. Unpublished manuscript, Yonkers, NY: CABAS® and The Fred S. Keller School.

Greer, R. D. (2002). *Designing teaching strategies: An applied behavior analysis systems approach.* New York: Academic.

Greer, R. D. & McDonough, S. H. (1999). Is the Learn unit a fundamental measure of pedagogy? *The behavior analyst, 20*, 5-16.

Greer, R. D., Nirgudkar, A., & Park, H. (2003, June). *The effect of multiple exemplar instruction on the transformation of mand and tact functions.* Paper presented at the annual international conference of the Association for Behavior Analysis, San Francisco.

Greer, R. D. & Ross. D. E. (2008). *Verbal behavior analysis: Inducing and expanding new verbal capabilities in children with language delays.* New York: Pearson.

Hall, G. & Sundberg, M. L. (1987). Teaching mands by manipulating conditioned establishing operations. *The Analysis of Verbal Behavior, 5*, 41-53.

Hayes, S., Barnes-Homes, D., & Roche, B. (2000). *Relational Frame Theory: A Post Skinnerian of human language and cognition*. New York: Kluwer/Academic Plenum.

Lee Park, H. S. (2005). Multiple exemplar instruction and transformation of stimulus function from auditory-visual matching to visual-visual matching. (Doctoral dissertation, Columbia University, 2005). Abstract from UMI Proquest Digital Dissertations (on-line). Dissertations Abstracts Item: AAT 3174834.

Hains, A. H. & Baer, D. M. (1989). Interaction effects in multielement designs: Inevitable, desirable, and ignorable. *Journal of Applied Behavior Analysis, 22*, 57-69.

Klatt, K. P., Sherman, J. A., & Sheldon, J. B. (2000). Effects of deprivation on engagement in preferred activities by persons with developmental disabilities. *Journal of Applied Behavior Analysis, 33*, 495-506.

Mace, F. C. & Lalli, J. S. (1991). Linking descriptive and experimental analyses in the treatment of bizarre speech. *Journal of Applied Behavior Analysis, 24*, 553-562.

McAdam, D. B., Klatt, K. P., Koffarnus, M., Dicesare, A., Sloberg, K., Welch, C., & Murphy, S. (2005). The effect of establishing operations on preferences for tangible items. *Journal of Applied Behavior Analysis, 38*, 107-110.

McComas, J. J., Thompson, A., & Johnson, L. (2003). The effects of pre-sessions attention on problem behavior maintained by different reinforcers. *Journal Applied Behavior Analysis, 36*, 297-309.

McGill, P. (1999). Establishing operation: Implications for the assessment, treatment, and prevention of problem behavior. *Journal of Applied Behavior Analysis, 33*, 393-418.

Michael, J. (1982). Distinguishing between discriminative and motivational functions of stimuli. *Journal of Applied Behavior Analysis, 37*, 149-155.

Michael, J. (1983). Evocative and repertoire altering effects of an environmental event. *The Analysis of Verbal Behavior, 4*, 19-21

Michael, J. (2000). Implications and refinements of the establishing operation concept. *Journal of Applied Behavior Analysis, 33*, 401-411.

Nirgudkar, A. S. (2005). The relative effects of the acquisition of naming and the multiple exemplar establishing operation experience on the acquisition of the transformation of establishing operation across mands and tacts. (Doctoral dissertation, Columbia University, 2005). Abstract from UMI Proquest Digital Dissertation(on-line). Dissertations Abstract Item: AAT 3159751.

Nuzzolo-Gomez R., & Greer, R. D. (2004). Emergence of untaught mands or tacts with novel adjective-object pairs as a function of instructional history. *The Analysis of Verbal Behavior, 19*, 55-89.

O'Reilly, M. F. (1999). Effects of pre-session attention on the frequency of attention-maintained behavior. *Journal Applied Behavior Analysis, 32*, 371-374.

Ramaswamy, S. (2005). An establishing operation for response acquisition and its differential effect on performance tasks. *Teachers College Columbia University Digital Dissertations.*

Reilly-Lawson, T. & Greer, R. D. (2006). Teaching the function of writing to middle school students with academic delays. *Journal of Early and Intensive Behavioral Intervention*,*3*(1), 151-169.

Repp, A. C., Felce, D., & Barton, L. E. (1988). Basing the treatment of stereotypic and self-injurious behaviors on hypotheses of their causes. *Journal of Applied Behavior Analysis, 21*, 281-289.

Ross, D. E., Nuzzolo, R., Stolfi, L, Natarelli, S., & Greer R. D. (2006). Effects of speaker immersion on the spontaneous speaker behavior of preschool children with communication delays. *Journal of Early and Intensive Behavioral Intervention*, *3*(1), *135-150*

Ross, D. E., Singer-Dudek, J., & Greer, R. D. (2005). The Teacher Performance Rate and Accuracy scale (TPRA): Training as evaluation. *Education and Training in Developmental Disabilities, 40*(4), 411-423.

Selinske, J., Greer, R.D., & Lodhi, S. (1991). A functional analysis of the Comprehensive Application of Behavior Analysis of Schooling. *Journal of Applied Behavior Analysis, 13*, 645-654.

Schwartz, B. S. (1994). A comparison of establishing operations for teaching mands to children with language delays. (doctoral dissertation, Columbia University, 1994). Abstract from UMI Proquest Digital Dissertations (on-line). Dissertations Abstract Item: AAT 9424540.

Skinner, B. F. (1957). *Verbal behavior.* Massachusetts: Copley Publishing Group.

Williams, G. & Greer, R. D. (1993). A comparison of verbal-behavior and linguistic communication curricula for training developmentally delayed adolescents to acquire and maintain vocal speech. *Behaviorology*, *1*, 31-46.

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