The Effects of a Peer-Yoked Contingency on Observational Learning and the Collateral Emergence of Naming

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Abstract

We tested the effects of a Peer-Yoked Contingency on students' acquisition of observational learning repertoires and collateral effects on naming. Three male middle school participants, diagnosed with emotional and behavioral disabilities, were selected for this study. The three participants did not have naming repertoires, and two of the three participants did not have observational learning repertoires prior to the study. A delayed multiple probe design across participants was used to determine whether naming and observational learning would emerge as a function of a peer-yoked contingency involving training in observational learning. Naming was tested following each session of observational learning instruction. Results demonstrated that naming emerged as a function of the peer-yoked contingency and correct responses to observed learn units increased during probe sessions.

Humans learn from other human beings via observation. Learning as a function of observation occurs in many different types of situations and is a significant part of human learning. Humans can learn social behavior, cultural behavior, and academic behavior by observing another (Gautreaux, 2005). Catania (2007) defined observational learning as "learning based on observing the behaviors of another organism." More specifically, observational learning occurs when an observer observes the direct contingencies received by another and subsequently emits the target behavior observed (Davies-Lackey, 2004; Gautreaux, 2005; Pereira-Delgado, 2005; Greer & Ross, 2007; Greer, Singer, & Gautreaux, 2006; Stolfi, 2005; Yuan, 2005). In other words, one learns new operants from observing others without receiving direct contact with the reinforcement or corrections.

Greer et al. (2006) suggested that there are five different types of learning or changes in performance that can be learned via observation: (a) a behavior that is already in one's repertoire, or a performance task can be emitted as a function of observation, (b) a new operant can be learned by observation, (c) higher order operants can be learned by observation, (d) reinforcers can be conditioned by means of observing another, and (e) a complete observational learning repertoire can be acquired via observation.

Greer et al. (2006) distinguished between the maintenance of performance behaviors, or behaviors already in one's repertoire, and the learning new behaviors, not previously found in one's repertoire, as a function of observation. Much of the prior literature in the effects of observation were devoted to performance rather than learning; hence we address only those studies devoted to learning of new operants as a function of observation or observation as the dependent variable. For example, Brody, Lahey, & Combs (1978) compared modeling of adjectives to describe pictures to no modeling. In each of the control (no modeling) and experimental groups (modeling) there was no direct reinforcement delivered following the emission of target responses. The authors found, that the modeling group's correct responses increased while the no modeling group's responses were consistent with baseline responses.

The acquisition of new operants as a function of children with disabilities observing typically developing peers has been demonstrated in some studies. In such studies the typically developing peer was considered a "model" for the target participants. Egel, Richman, and Koegel (1981) demonstrated the emission of new types of discrimination after participants diagnosed with autism observed a typically developing peer. Goldstein and Mousetis (1989) found that participants with language delays emitted new social behavior that they observed typically developing peers emit. Similarly, Schoen and Ogden (1995) demonstrated the acquisition of new sight words in at risk students after observing typically developing peers learn these sight words. Rehfeldt, Latimore, and Stromer (2003) found that by teaching their participants, who were diagnosed with developmental disabilities, one set of stimuli in the same stimulus class as the target stimuli to be observed, could after observing their typically developing peers learn the second set of stimuli, emit the correct responses. By teaching the participants one set of stimuli, the experience functioned to equate the instructional histories of both the participants and their peers.

In order to learn new operants by observing, one must possess an observational learning repertoire. An observational learning repertoire is significant because there are inadequate numbers of learn units in most classrooms for students to learn from direct contact with the contingencies of instruction (Greer et al., 2006). Some have reported that observational learning repertoires may be evoked, when it is missing, in three ways, including using peer tutoring, monitoring, and the use of peer-yoked contingencies. More recently, these three procedures have been combined to provide extensive classroom instruction using observational learning. These instructional procedures are described as an observational system of instruction and the procedures are shown in Figure 1.

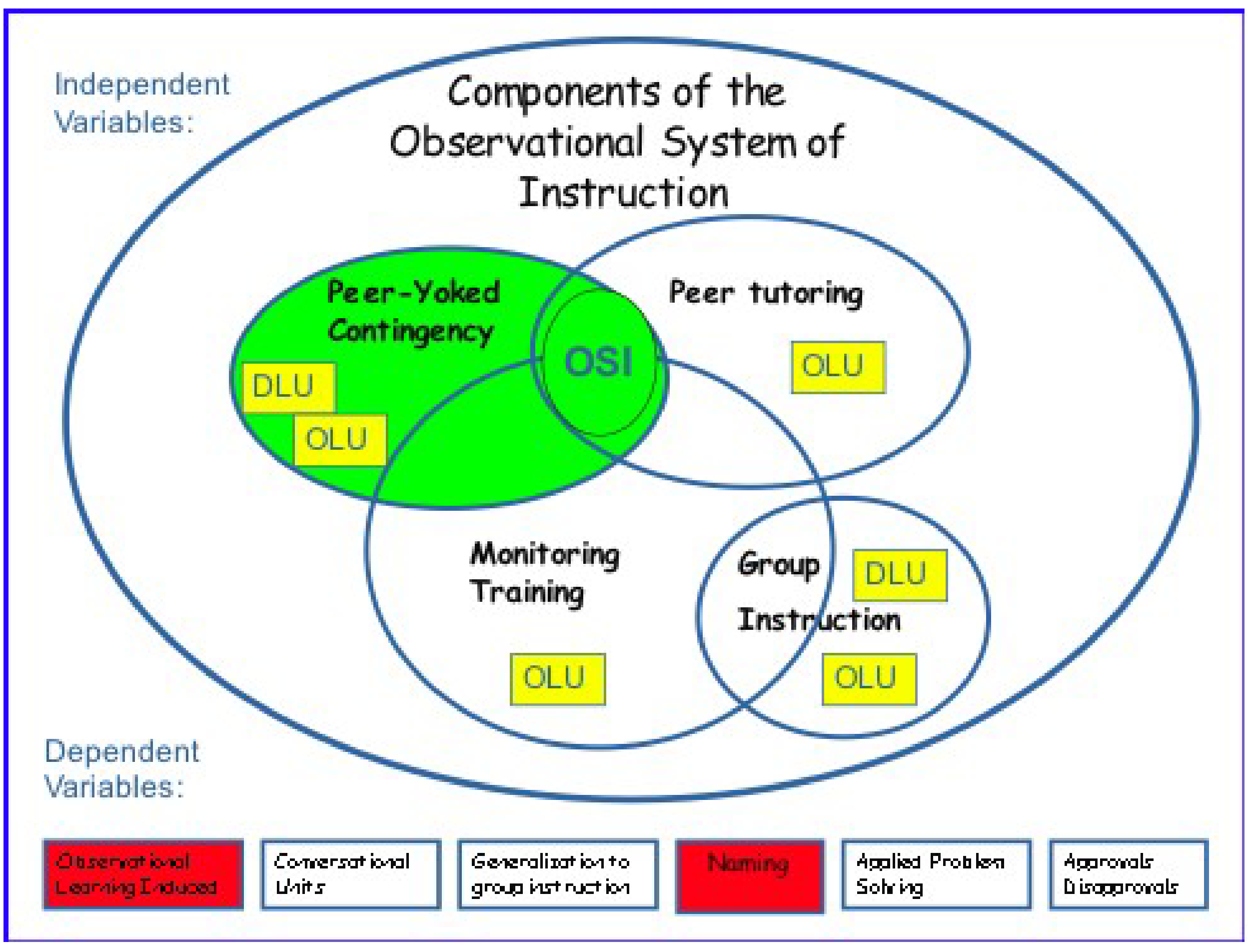


Figure 1. The Observational System of Instruction

Peer tutoring is a research based instructional tactic that has one of the strongest records of effectiveness in the literature. Mohan (1971) tested the effects of peer tutoring on responses of both the tutors and tutees. Results indicated that correct responses and approvals increased for most participants. Similarly, Harris and Sherman (1973) tested the effects of peer-tutoring on student correct responses to math problems. They found, that correct responses increased for all participants as a result of the peer tutoring. Greer and Polirstok (1982) found strong benefits for tutors as well as tutees. This study was replicated in 1986 (Polirstok & Greer). In a series of five experiments devoted to identifying the effective component of tutoring, Greer, Keohane, Meincke, Gautreaux, Pereira, Chavez-Brown, and Yuan (2004) showed it was the presence of learn units rather than whether a peer or tutor taught, and that the use of learn units was the strongest predictor for learning for either the tutee or tutor. They also found that the tutors' acquired observational learning repertoires as a function of delivering learn units. This led to subsequent research which identified components of tutoring that involved monitoring and yoked contingencies were the likely sources for the emergence observational learning repertoires (Gautreaux, 2005; Greer & Keohane, 2004).

Individuals with developmental disabilities and students who have fewer language interactions in their homes than their same age peers prior to schooling were found to have received fewer numbers of language interactions than their same age peers by the time they reached school age (Hart & Risley, 1980). In fact, these economically disenfranchised children may also fail to acquire observational learning as Gautreaux (2005) found. Conceivably, students who lack observational learning repertoires may have difficulties in traditionally designed classrooms. In such cases, monitoring has been used as a tactic to induce observational learning repertoires. Recent studies have identified some procedures that have occasioned observational learning in children with disabilities (Pereira-Delgado, 2005; Yuan, 2005) who were missing that repertoire and in middle school aged students (Gautreaux, 2005). Specifically, these experimenters found that providing various forms monitoring training resulted in the target students acquiring an observational learning repertoire.

Another successful tactic that has induced observational learning repertoires involves a peer-yoked contingency. This arrangement, which combines monitoring one's peers responses while yoking the peer's correct responses to observed learn units to reinforcement for both the observing and the observed students led to the emergence of observational learning. That is, the target student monitored a peer receiving direct learn units in order to receive points and/or move up on a game board. If the target student emitted an incorrect response, the teacher moved up the game board while the target student stayed at the same location on the game board. This procedure provided motivation for the target student to attend to his/her peer's responses and subsequently advance the students' team. This peer-yoked contingency allowed for the acquisition of new operants by observing others (Greer & Ross, 2007).

Stolfi (2005) tested the effects of the peer-yoked contingency on students with disabilities who did not have observational learning in their repertoire. Stolfi used a game board with two action figures, each with a corresponding path to the winning space that displayed pictures of preferred items. She used "The Incredible Hulk" as her action figure and her participants' action figure was chosen from a selection of "Spiderman", "Batman", and "Superman". The game board was a large picture of a building with two parallel paths, one for the experimenter and one for the participants. In order for the participants to move up on the game board as a team, the target participant needed to emit a correct response for an observed learn unit (a learn unit taught as a direct learn unit to his/her peer earlier in the session). This was the "yoked" component of the experiment. If the participant emitted an incorrect response for an observed learn unit, the experimenter moved up on the game board, while the participant team stayed in the same position on the board. The object of the game was for the participants to emit correct responses to the observed learn units and move to the top of the game board. Similar results were shown with other elementary age students who possessed a variety of disabling conditions by Davies-Lackey (2005). In both of these experiments, when students were provided intervention involving a yoked contingency, observational learning was acquired and students who could not learn by observation prior to the intervention learned new operants after the intervention.

The most related study that tested the effects of any component of the observational system of instruction on observational learning with students like those in the present study was done by Gautreaux (2005). In this experiment, the author tested the component effects of monitoring training on the acquisition of observational learning repertoires with middle school students. Gautreaux reported that intensive monitoring training led to both observational learning and other collateral behaviors. Here, we extended that research with additional students.

In our efforts to investigate the effects of a peer-yoked contingency's effects on observational learning repertoires, we considered the possibility that the capacity for naming might also emerge from observational learning interventions. Naming as defined by Horne and Lowe (1996) is "a higher order bidirectional behavioral relation" which includes both listener and speaker behavior. The individual who possesses naming can respond to novel stimuli in a myriad of ways beyond those accounted for by direct instruction. It is considered a "behavioral cusp" which marks the time when the expansion of the child's repertoire is likely to expand exponentially, and when the deliberate instruction of the child becomes pragmatically different than before (Greer & Ross, 2007; Rosales-Ruiz and Baer, 1996). Naming is a verbal capability where novel vocabulary is exponentially acquired without direct instruction experiences. It is present when an individual acquires both speaker and listener responses from observing another tact stimuli in the environment. Therefore, in addition to testing the effects of a peer-yoked contingency on observational learning repertoires, we considered whether a peer-yoked contingency package would induce naming for individuals who were previously missing a naming repertoire.

Method

Participants

Three male adolescents participated in this study. All participants were diagnosed with emotional and behavioral disabilities and were members of a middle school classroom for sixth to eighth graders with emotional and behavioral disabilities. Participants 1, 2, and 3 were selected as target students for this study because they were among the few in the school who did not have naming for academic responses prior to the study. All participants did have observational learning repertoires for social behavior; that is, they could emit performance behavior as a function of observation; however, two of the students could not learn academic repertoires from observation. Participants 1 and 3 did not emit observational learning for academic responding. Table 1 shows the participants' standardized achievement test scores (Terra Nova, 1996) and The Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV, 2003) or Stanford Binet IQ (2003) scores.

Table 1.

Target Participants' Standardized Test Scores

Participant	Chronological Age (at time of test)	Type of Intelligence Test	Full Scale Score	Type of Standardized Test	Reading *	Language *	Math *	Total Score *
1	12	WISC-IV	111	Terra Nova	4.9	4.7	7.2	6.2
2	12	Stanford-Binet	101	Terra Nova	1.9	1.4	2.8	2.0
3	13	Stanford-Binet	79	Terra Nova	4.9	2.4	3.3	3.4

Note. *=Grade Equivalent Score.

Table 2.

Sample Sequence of Instruction and Stimuli Used During Peer-Yoked Contingency

LU	Participant #	Direct/ observed	Stimulus	LU	Participant #	Direct/ observed	Stimulus
1	1	Direct	Richard Nixon	1	2	Direct	Cabaca
2	3	Direct	Woodrow Wilson	2	3	Direct	Washboard

3	1	Direct	Zachary Taylor	3	2	Direct	Marimba
4	1	Observed	Woodrow Wilson	4	2	Observed	Washboard
5	3	Direct	F.D. Roosevelt	5	3	Direct	Slapstick
6	3	Observed	Richard Nixon	6	3	Observed	Cabaca
7	3	Direct	Grover Cleveland	7	3	Direct	Conga
8	3	Direct	Lyndon B. Johnson	8	3	Direct	Timpani
9	1	Observed	F.D. Roosevelt	9	2	Observed	Slapstick
10	1	Observed	Grover Cleveland	10	2	Observed	Conga
11	1	Direct	Warren Harding	11	2	Direct	Water Drum
12	1	Direct	James Buchanan	12	2	Direct	Ratchet
13	3	Direct	Ulysses S. Grant	13	3	Direct	Castanets
14	1	Direct	Gerald Ford	14	2	Direct	Cabaca
1	4	Direct	Juniper				
2	2	Direct	Cycad				
3	4	Direct	Willow				

4	4	Observed	Cycad
5	2	Direct	Cedar
6	2	Observed	Juniper
7	2	Direct	Lily
8	2	Direct	Spruce
9	4	Observed	Cedar
10	4	Observed	Lily
11	4	Direct	Cypress
12	4	Direct	Hydrangea
13	2	Direct	Maple
14	4	Direct	Magnolia

Participant 1 was a 13-year-old male with functional listener-speaker and reader-writer/emergent self-editor levels of verbal behavior. Participant 1's current instructional programs included: math fluency, Saxon 87 math (1997), self-monitoring his own behavior (Greer, 2002), textual responding across academic subjects, and New York state Grade 7 science and social studies curriculum (New York State Education Department, 2007). During baseline conditions, Participant 1 had no evidence of naming or observational learning repertoires for academic responses.

Participant 2 was a 13-year-old male with listener-speaker and early reader–writer levels of verbal behavior. Participant 2's instructional programs included: math fluency, Saxon 54 math (Hake & Saxon, 2001), self-monitoring his own behavior, textual responding across academic subjects, and New York state Grade 7 science and social studies curriculum (New York State Education Department). Participant 2 did not have a naming repertoire for academic responses. However, observational learning repertoire was not determined prior to the study.

Participant 3 was a 13-year-old male His levels of verbal behavior were in a similar range as participant 1. Participant 3's instructional programs at the time of the study included: math fluency, Saxon 54 math (Hake & Saxon, 2001), self-monitoring his own behavior (Greer, 2002), textual responding across academic subjects, and New York state grade 7 science and social studies curriculum (New York State Education Department). During baseline conditions, Participant 3 did not show evidence of naming or observational learning repertoires for academic responses.

Setting

The study took place in a publicly middle school for students with emotional and behavioral disabilities. The classroom used a Comprehensive Application of Behavior Analysis to Schooling (CABAS) model for grades 6 – 8 in a classroom with an 9:1:2, nine students: one teacher: and two teacher assistants ratio at the time of baseline measures. The school was located in a suburb of a large metropolitan area. Data were collected during instructional sessions in the classroom where instructional programs were conducted throughout the day. The study was conducted in both group sessions and individual 1:1 tutorial sessions by the teacher and teaching assistants throughout the day and across academic subjects. During 1:1 sessions, the students sat at their individual rectangular desks while their teacher sat beside them to instruct them in various subjects. The peer-yoked contingency sessions were conducted in classroom, the school library, or in a small multipurpose center. The students earned points for correct responses and appropriate behavior. Points were exchanged twice during the course of the day for a variety of backup reinforcers.

Materials

Materials used for this study included pictures of target items as tacts. The pictures were glued onto 3 X 5 index cards, a child-sized basketball hoop which hung over a door post, a small basketball, a small magnetic white board with two columns of 7 spaces for the students and the teacher, a small audiocassette recorder, an audiocassette, a pen, and a data sheet for recording the data.

Definition of Behaviors – Independent Variables

Correct and Incorrect Responses (Pure Tact) to an Observed Learn Unit

A correct response to an observed learn unit was defined as emitting the target response to an antecedent which was run as a learn unit to a student other than the target student. For example, a correct response to tacting a president learn unit – Woodrow Wilson, occurred when presented with a picture of the president, the student emitted “Woodrow Wilson” as a vocal verbal response. Any response other than the target response was considered an incorrect response. Responses not emitted within a 5-second intraresponse period were recorded as incorrect.

Definition of Behaviors – Dependent Variable

Correct and Incorrect Responses to Novel Stimuli

Following each session of the peer-yoked contingency, all participants were tested for the presence of naming. This was done by having the students’ match 3 Greek and 3 Japanese characters while hearing the experimenter say the tact for the stimuli. Once they mastered the matching responses by learn unit instruction, they were assessed on the listener and speaker components of naming using probes with no feedback. That is the students were probed for the listener responses where they were asked to point to the tacted stimulus when the target and a non-target stimulus was displayed. Subsequently they were asked to emit the pure and intraverbal tact/textual response for the stimuli as a test of the speaker repertoire.

A correct response to novel stimuli was defined as emitting a match, point, tact, or intraverbal response that corresponded with the vocal verbal antecedent (or nonverbal antecedent for pure tacts) for naming probes. The responses were considered correct only if they matched the Greek or Japanese letter stimuli.

Data Collection

Data were collected as responses to learn units across all phases. A correct response was recorded as a plus (+) and an incorrect response was recorded as a minus (-).

Interobserver Agreement

Interobserver agreement was calculated for the peer-yoked contingency sessions by tape recording each session. An independent observer was provided with a data sheet with the target responses for each learn unit written on it. The observer listened to the tape following each session and recorded behaviors on the data sheet. Scores were then compared between the observer and experimenter to determine point-to-point agreement. Total agreements were then divided by the total number of opportunities for agreement to calculate interobserver agreement.

Interobserver agreement (IOA) was calculated using 2 independent observers for the naming probes. IOA was calculated for 16% of Participant 1's naming probes with 100% agreement, 25% of Participant 2's naming probes with 100% agreement, and 25% of Participant 3's naming probes with 100% agreement.

Interobserver agreement was calculated for 20% of Participant 1's direct learn units and 16% of Participant 1's observed learn units. Interobserver agreement for Participant 1's direct learn units yielded a mean of 100% agreement and 90% agreement for Participant 1's observed learn units. 50% of Participant 2's direct learn units were measured for agreement and 25% of Participant 2's observed learn units were measured for agreement. Interobserver agreement for Participant 2's direct learn units yielded a mean of 95% agreement and 95% agreement for Participant 2's observed learn units. Interobserver agreement was calculated for 80% of Participant 3's direct learn units and 80% of Participant 3's observed learn units. Interobserver agreement for Participant 3's direct learn units yielded a mean of 100% agreement and 100% agreement for Participant 3's observed learn units.

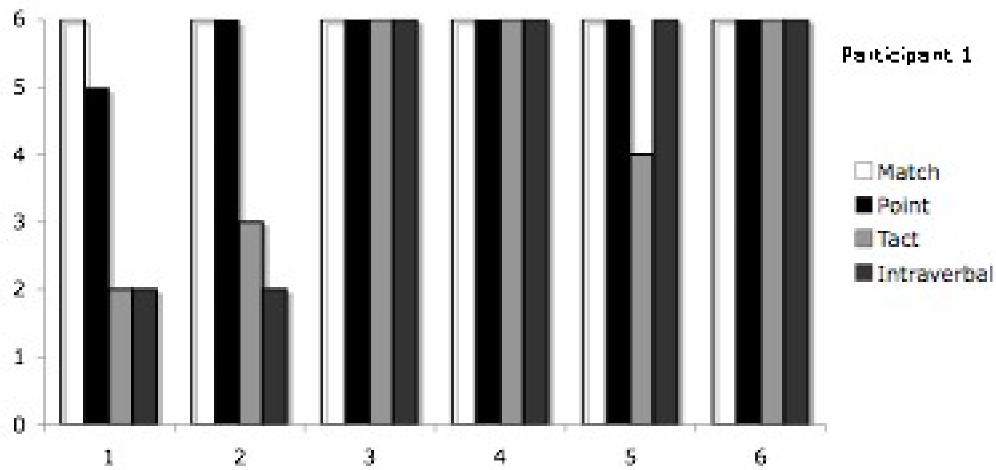
Independent Variable/Tactic: Observational System of Instruction

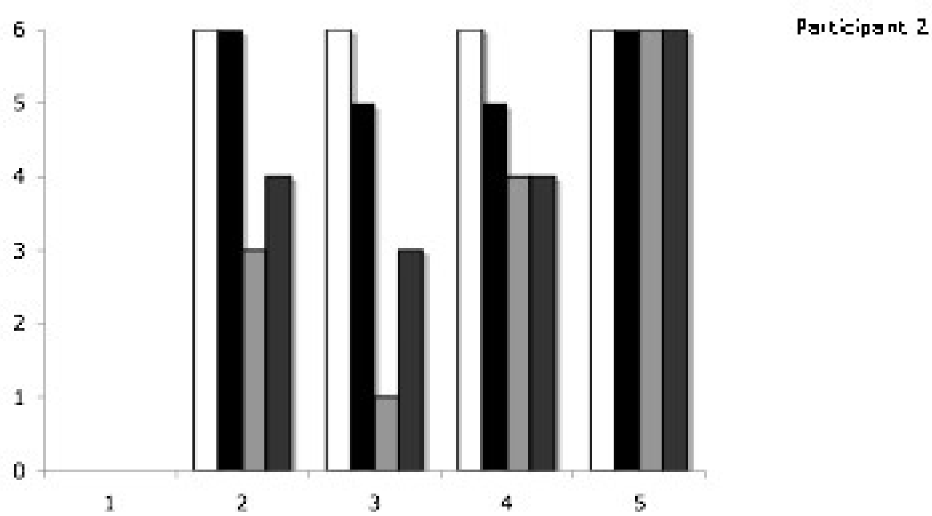
The intervention implemented during the treatment phase was a peer-yoked contingency. The peer-yoked contingency used during this study was derived from Greer and Ross's (2007) Observational System of Instruction protocol and adapted for middle school students. The peer-yoked contingency was used as an element of the larger structure of the Observational System of Instruction (OSI) and designed to test its effects on observational learning and naming repertoires. The peer-yoked contingency consisted of direct and observed learn units presented to participants. Two different sets of 5 stimuli were selected for both participants that were not in their repertoire prior to the study. Sets of stimuli included: types of trees, presidents, and musical instruments. One set of 5 stimuli was taught to Participant 1 while Participant 3 observed. Participant 3 was presented a direct learn unit prior to an observed learn unit. The sequence of instruction for all participants is shown table 1. Direct and observed learn units were presented until each participant emitted 20 direct learn units and 20 observed learn units. During the course of this instruction, a game board was designed incorporating a peer-yoked contingency where one row of seven spaces was set for the teacher and one row of seven spaces was set for the students. During the last phase of the peer-yoked contingency for Participants 2 and 3 a game board with twenty spaces was used instead of the seven spaces. The object of the game was for the students to win to take a shot on a mini basketball hoop. The game's contingency required the observing student, regardless of the direct student's responses, to emit a correct response in order for the student team to move up on the game board. If the observing student did not emit a correct response the teacher moved up on the game board. Upon the completion of seven spaces on the student side of the game board, each student on the student team was given the opportunity to take a shot on the basketball hoop. Student team members earned 15 points per completed shot on the basketball hoop.

When the individual reached criterion levels of responding on both direct and observed learn units (90% accuracy across one session), each participant was probed with a new set of stimuli for the presence of observational learning. Observational learning was considered in the target participants' repertoires if they emitted 80% correct responses during probe conditions. This procedure deviated from the original protocol as described by Greer and Ross (2007) due to the students' level of verbal behavior in this study. Despite the lack of feedback during probe sessions, the participants learned the target responses from the probe sessions. Therefore, the original stimuli were not presented as they may have been learned by a single exposure. Rather, new target stimuli were selected for a post probe to determine the presence of observational learning. To explain, new stimuli were selected for each probe to insure that the participants had actually acquired the capability without prior learning of the stimuli from previous exposures. Criteria set for the presence of naming was 90% accuracy during probe conditions.

Design

This experimental design illustrated in Figures 2 and 3 was a delayed multiple-probe design across participants to test for the acquisition of naming and observational learning repertoires as a function of the intervention. The independent variable was the peer-yoked contingency and the dependent variables were the naming repertoires and correct responses to observed learn units.





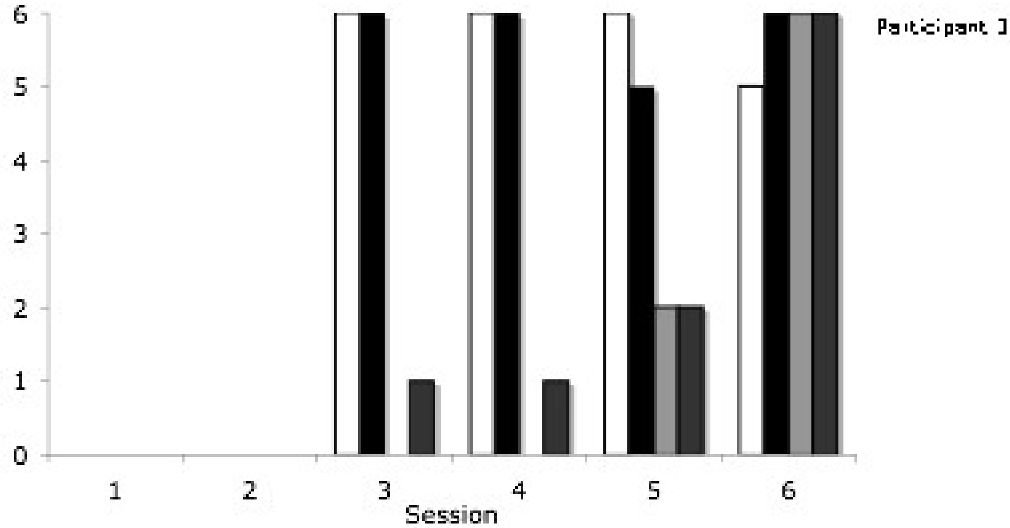
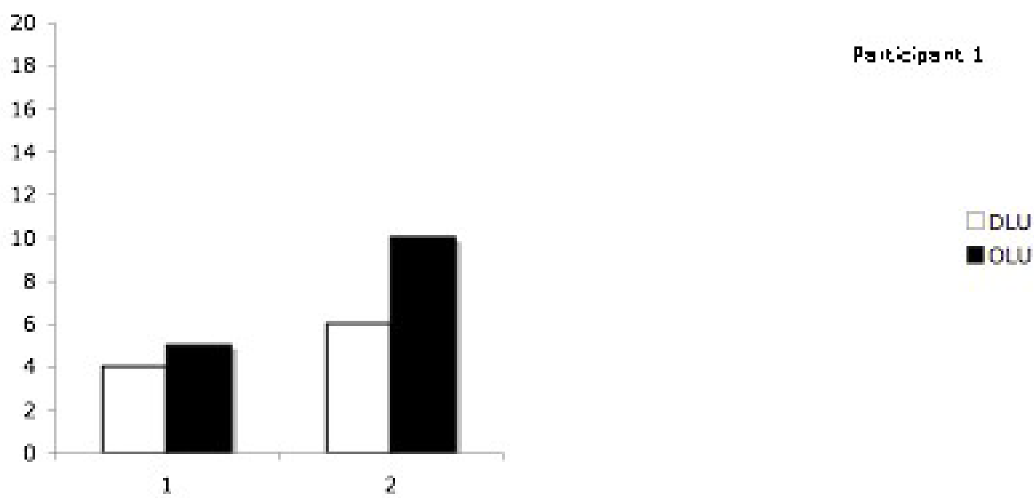


Figure 2. A delayed multiple probe design across participants testing naming for Participants 1, 2, and 3.



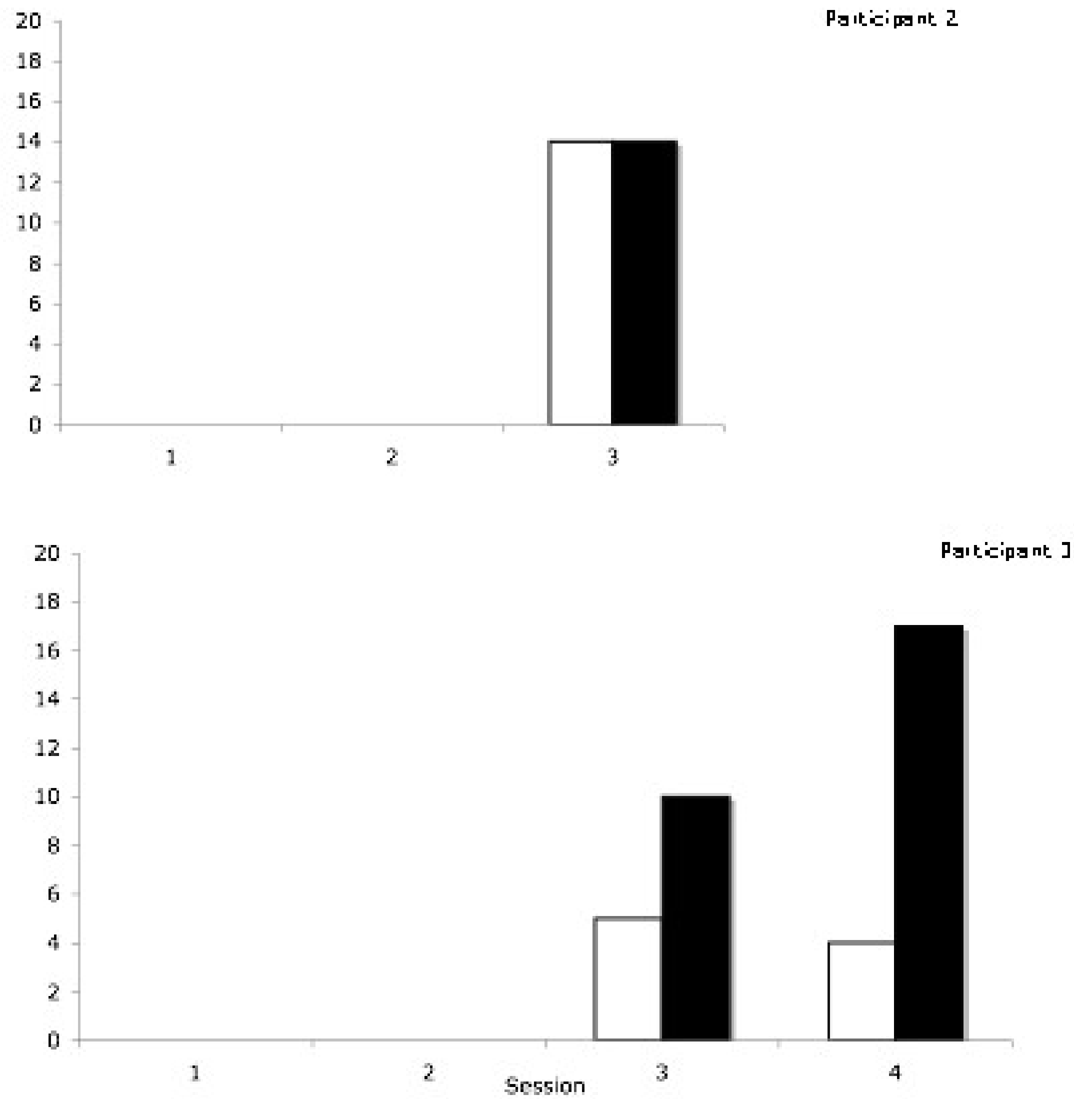
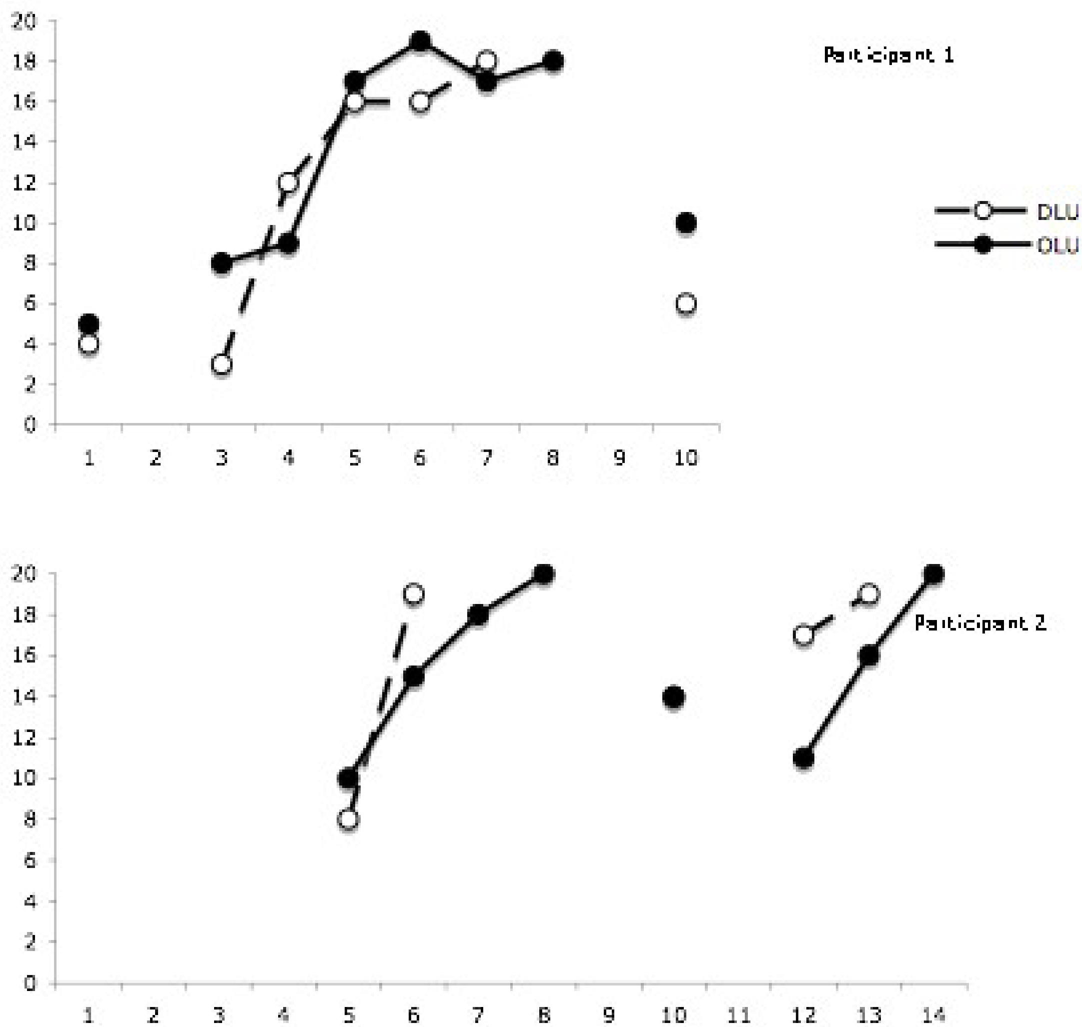


Figure 3. A delayed multiple probe design across participants testing observational learning for Participants 1, 2, and 3.


Participant 1
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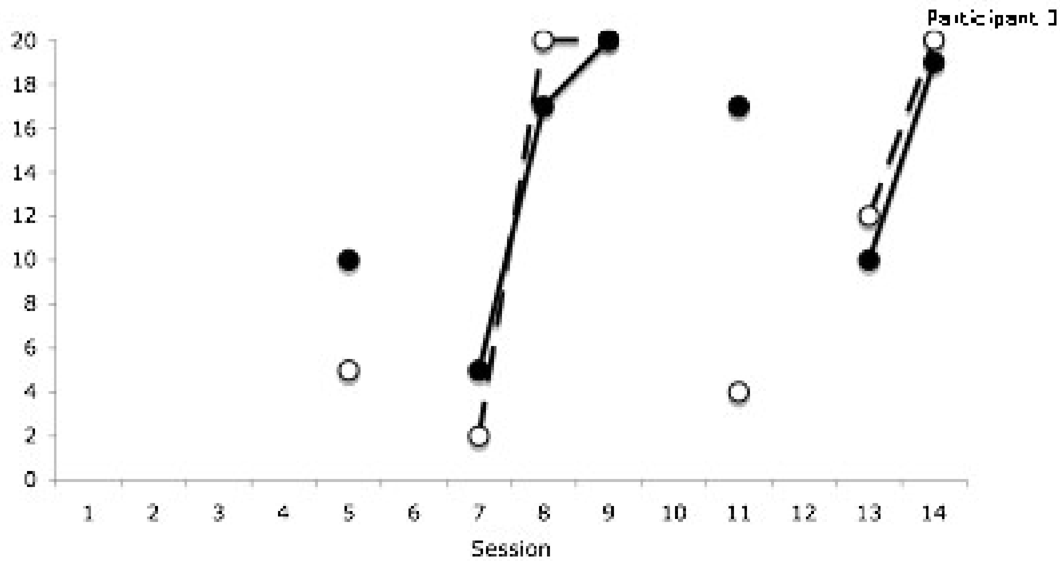

Figure 4. Correct responses during peer-yoked contingency sessions for Participants 1, 2 and 3.

Results

As compared with baseline naming probes, Participant 1's correct responses to unconsequated naming probes increased as follows: pointing increased by 1 correct response, 1 correct response, 1 correct response, 1 correct response, and 1 correct response (5 cumulative correct responses) for each respective phase; tacting increased by 1 correct response, 3 correct responses, 3 correct responses, 2 correct responses, and 3 correct responses (12 cumulative correct responses) for each respective phase; and the intraverbal responses increased by 0 correct responses, 4 correct responses, 4 correct responses, 4 correct responses, and 4 correct responses (16 cumulative correct responses). Similarly, as compared with baseline probes Participant 2's correct responses increased by the fourth phase as such: pointing increased by 0 correct responses, tacting increased by 3 correct responses, 3 correct responses (6 cumulative correct responses) and the intraverbal responses increased by 2 correct responses. Moreover, Participant 3's responses increased from baseline as follows: pointing remained the same, except for phase 3 where it decreased by 1 correct response; tacting increased by 0 correct responses, 2 correct responses, and 6 correct responses for each respective phase; and the intraverbal responses increased by 0 correct responses, 1 correct response, and 5 correct responses.

Though participant 1 did not acquire observational learning, his correct responses to observed learn units increased by 5, or 50% from baseline. Participant 2's baseline was not measured, though following the peer-yoked contingency he emitted 14 correct responses to observed learn units. Participant 3 emitted an increase in 7 responses from the baseline probe of 10 correct responses to observed learn units.

Discussion

A functional relationship between the peer-yoked contingency as a component of the observational system of instruction and naming was demonstrated for all participants. Moreover, for Participant 3 a functional relationship was shown between a peer-yoked contingency and the acquisition of observational learning. Even though Participant 1 did not yet meet our 80% criterion that we consider as evidence of the observational learning repertoire, his responses to observed learn units increased from baseline conditions. In instructional settings, this typically results in additional yoked contingency interventions until the student meets the criterion for having an observational learning repertoire.

The lack of naming repertoire in children as old as these is curious. As demonstrated by Gillic (2005), naming emerges between the ages 2 and 3. Thus, why was it missing for these students? We suspect that their lack of naming is tied to the act that these were students who were probably very much like the low SES students identified in Hart and Risley (1980). Hart and Risley found that children who have fewer language interactions are likely to have smaller vocabularies than their peers with regular language interactions. Over time, the discrepancies in vocabularies between these two populations grow. The participants of our study emitted less vocabulary than their typical peers. Moreover, it is not unlikely that not only were they lacking in tact experiences but they also missed the necessary experiences for acquiring naming, as it needs to occur in academic settings. We also suspect that there are different types of naming involving different types of stimuli. That is naming for 3-dimensional stimuli may be different than naming for 2-dimensional stimuli to name just two of many different possibilities (Greer & Ross, 2007).

There are several limitations to our study. An obvious limitation was that Participant 2 was not tested systematically for the presence of observational learning prior to the study, although it was apparent that he did not meet the observational learning criteria of 80% correct responses. However, during the first session of the peer-yoked contingency his observed responses were low, his pre-experimental data were not available. Therefore, his responses during the post-intervention do not have comparison data. While our hunch is that Participant 2 acquired observational learning from the peer-yoked contingency, this assumption cannot be supported because of the lack of pre-experimental probes for the observational repertoire. He did, however acquire naming from the OSI package.

Clearly, more research is needed. However, the observational learning effects have been documented in three prior experiments, so we believe these findings are solid. Additional research is needed to test for the generality of the naming findings. The development of protocols that expand or induce either observational learning or naming may prove critical to the advancement of a more effective science of instruction.

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