

## **THE EFFECTS OF PEER MONITORING TRAINING ON THE EMERGENCE OF THE CAPABILITY TO LEARN FROM OBSERVING INSTRUCTION RECEIVED BY PEERS**

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*We tested the effects of teaching peer monitoring on the emergence of an observational learning (OL) capability in 2 experiments using delayed multiple probe designs with children diagnosed with developmental disabilities. In probes for the OL capability before and after each stage of the peer monitoring intervention, participants received unsequenced probes on material that was novel to them after they observed peers who were taught mastery of the material. In Experiment 1, 2 participants were probed for the presence of OL of textual responses and tact responses to pictures taught to peers prior to and after each stage of the peer monitoring intervention. In the training, target participants observed peers receiving different instruction involving reinforcement for accuracy and corrections for errors. After participants met criterion on the monitoring intervention, they demonstrated OL with the peer they trained with and a novel peer. In Experiment 2, the same results accrued for vocal spelling responses. The data suggest that for children like these, acquiring the capability to learn by observing instruction received by others in classrooms results from monitoring others receive instruction.*

There is no doubt that much of what typically developing children learn occurs via observation, especially in classroom settings, where children must learn from the instruction received by others. In fact, observational learning (OL) appears to be one of the leading indicators of success in educational settings (Greer, 2002; Greer, Singer-Dudek, & Gautreaux, 2006). Research shows that students with disabilities (e.g., autism, developmental disabilities), as well as students who have language deficits as a result of the lack of opportunities to acquire vocabulary in impoverished environments (Hart & Risley, 1995), are less likely to learn from observing others receive instruction (Gautreaux, 2005; Reilly-Lawson & Trapenberg, 2007). Although there has been a great deal of research on OL as an independent variable, recently investigators have begun to identify factors that lead to the emergence of OL where OL is a dependent variable. In these studies, OL is used as a dependent variable for

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interventions that lead to OL in students who were missing the capability (Greer et al., 2006).

Catania (1998) defined OL as “learning based on observing the responding of another organism (and/or its consequences)” (p. 227). It is distinguished from modeling (Zentall, 1996) and imitation (Baer, Peterson, & Sherman, 1963; Baer & Sherman, 1964; Epstein, 1984). When students engage in one type of OL, they learn from indirect contact with consequences experienced by others. This is demonstrated in the following example: A child, who cannot add, observes another child receive instructional presentations and consequences, and learns to add without direct instruction. The capability to learn from observation is necessary in most classrooms, in that teachers frequently directly instruct only one student and the remaining students in the classroom must observe that one student’s response and the teacher’s consequences for that student surrounding that response. In the aforementioned example, the teacher’s consequence may be a correction (“The answer is five”) or an affirmative response that functions as positive reinforcement for the student (“Good job, the answer is five”). Although the remaining students in the classroom did not have direct contact with the teacher, they observed the contingencies involved between the student and teacher interaction and had to learn from that experience.

One possible explanation for the lack of research on interventions to induce OL for students who do not have that capability is that the distinction between “learning” and “performance” has been blurred (Catania, 1998). Catania’s above definition of OL includes two possible effects of observation. One effect involves the child doing what he can already do by observing consequences (performance); the other effect is that the child is able to do something she could not do before (learning). Several studies have shown that by manipulating schedules of reinforcement, rates of the display of certain behaviors changed as a function of observation and may be examples of changing one’s performance based on observation rather than learning. For example, Deguchi, Fujita, and Sato (1988) found that preschool students imitated lever responses at high rates after observing a model only when direct reinforcement procedures were in place. Because the emission of lever presses was occasioned by reinforcement, it is likely that the responses had been previously acquired and that learning or the acquisition of new operants was not occurring. Similar findings were demonstrated in Bol and Steinhaur’s (1990) study, where only some kindergarten students engaged in puzzle completion after observing a model and others actually decreased their performance. These findings suggest that some children had previously learned the responses and did not emit the desired behavior because of the lack of reinforcement, whereas others had not learned the response. Ollendick, Dailey, and Shapiro (1983) ) found that after their target participants observed peers engaging in puzzle-completion tasks while receiving direct reinforcement from a teacher, there was an initial increase for the target participants followed by a decrease below baseline levels, even when they received reinforcement on an intermittent schedule. The responses of putting together puzzles were previously learned, and the lack of responding was a result of a lack of direct reinforcement. Such findings may be examples of research that shows changes in performance, or previously learned behavior, as a function of the application of modeling and the manipulation of reinforcement schedules. In some cases responding

decreased, and in other cases the participants ceased responding. This suggests that it was not a learning task per se, at least for some participants. However, because the researchers did not explicitly test whether the behaviors (e.g., puzzle completion) were in the target participants' repertoires prior to the observational experience, it is impossible to determine whether the observation affected performance or learning. If learning is defined as the acquisition of doing something one could not do before a particular intervention, pre- and postintervention measures are necessary.

However, some studies did test the effects of observing others being taught (if it can be done) on the acquisition of new operants by participants who were shown to be lacking the operants prior to the observation of the model. Griffen, Wolery, and Schuster (1992) found that students with mental retardation who could not perform a chained food preparation task did so after observing it completed by a peer who was directly taught using a zero-second time delay procedure. This finding was replicated by Werts, Caldwell, and Wolery (1996), who found that students with disabilities who could not perform a task showed higher accuracy after observing a typically developing peer emit the chains accurately. Children with autism demonstrated color discriminations after observing typically developing students perform color discrimination tasks (Egel, Richman, & Koegel, 1981). Rehfeldt, Latimore, and Stromer (2003) found that after children and adults with developmental disabilities observed a person without disabilities model prerequisite conditional discriminations, several of the participants demonstrated full stimulus class formation for reading skills. However, when stimulus classes did not occur, new skills emerged that had previously not been taught as a function of observation coupled with stimulus class technology. These researchers determined that the target participants did not have the behavior in their repertoires prior to implementing observation as an independent variable. Thus, their findings demonstrated that learning occurred as opposed to performance (previously acquired behaviors). In these cases, the use of observation as an independent variable was effective, and learning was made possible by the participants' capability to learn from watching others receive instruction or emit correct responses.

Several studies have shown that children's behavior did not change as a function of observing a model receive instruction (Hewett, 1965; Ingram & Johnson, 1987; Masters & Driscoll, 1971; Schoen & Ogden, 1995). These findings suggest that OL is actually a learning capability itself and perhaps a behavioral developmental cusp (Rosales-Ruiz & Baer, 1997). However, the means by which individuals come to acquire an observational learning capability has received little attention. While Skinner (1957) proposed that OL is learned, others (e.g., Bandura, 1986) have treated the changing of behavior by observation as a given.

Research in peer tutoring has suggested possible interventions that may induce OL. Much of the well-documented learning that occurs from functioning as a tutor has been traced to the ability to learn from indirect contact with contingencies. In a series of experiments designed to test the components of tutoring that lead to learning on the part of the tutor (Greer et al., 2004), Greer et al. experimentally tested for the presence or absence of operants for the tutors prior to the tutors engaging in peer tutoring. In these studies, the tutors used learn-unit presentations (Albers & Greer, 1991; Bahadourian, Tam, Greer, & Rosseau, 2006; Emurian, 2004; Emurian,

Hu, Wang, & Durham, 2000; Greer, 1994a, 1994b, 2002; Greer & McDonough, 1999; Ingham & Greer, 1992) to tutor peers. Learn units are instructional presentations that include components of instruction that are deemed necessary, if not sufficient, conditions for learning (Greer, 1994a). The teacher or experimenter presents an unambiguous antecedent while the student is attending, and the student is provided with an opportunity to respond, followed by the appropriate consequence. The consequence for a correct response to a learn-unit presentation results in immediate reinforcement in the form of a prosthetic or a generalized reinforcer. The consequence for incorrect student responses involves a correction procedure in which the student must repeat the accurate word or tact provided as a correction for the student's incorrect or missing response and the corrected response is not reinforced.

The presence or absence of learn units predicted student outcomes for both the tutor and tutee, as well as other individuals who observed the tutor and tutee process (Greer et al., 2004). Of particular interest are the strong gains noted by the tutor who acquired novel operants as a function of serving as a tutor. In one case, these studies showed that when tutors presented learn units (reinforcement of correct responses and corrections for incorrect responses) versus non-learn units (composed of no consequences in one experiment and reinforcement for correct responses without corrections for incorrect responses in another experiment), the tutors produced higher levels of correct responses following tutoring sessions where the tutors used learn units. Opportunities to observe corrections were found to be necessary. The authors concluded from these findings that observing consequences, both corrections and reinforcement, but particularly corrections, was the key component for the tutor to learn. Thus, in order for students to engage in OL, they must observe their peers receive consequences from the teacher, and the process of teaching the tutors to present corrections and reinforcement may lead to observational learning itself. Students who do not have OL may not have learned to attend to the correction or reinforcement consequences received by others. This led to the intervention used in the experiments reported herein.

The purpose of the research that we report was to examine whether students identified as lacking an OL repertoire would acquire it as a result of being taught to monitor correct and incorrect responses emitted by their peers under conditions that forced them to observe consequences. The intervention consisted of teaching children who lacked OL to master monitoring the accuracy of peers receiving instruction using a three-stage process and then testing for the emergence of OL.

## Experiment 1

### *Method*

#### *Participants*

Four participants took part in this study. Two of the participants were the peer confederates and two were the target participants. The target participants were both 5-year-old males diagnosed with autism and were selected as

participants in the study because they did not demonstrate OL, as confirmed by pre-experimental probe sessions. The students' actual repertoires were assessed and maintained in inventory form using *The CABAS® International Curriculum and Inventory of Repertoires for Children From Pre-School through Kindergarten* (PIRK; Greer & McCorkle, 2003). The target participants could both follow one-step directions in a group but had difficulty attending to instruction in a group setting. Participant 1 often engaged in aberrant behavior that included leaving his seat, not following classroom rules, and occasionally engaging in assaultive behavior in the classroom. Participant 2 often displayed behavior inconsistent with attending, which included humming, tipping his chair, looking elsewhere, and not following classroom rules during group instruction.

The peer confederates served as the "models" for all probe and instructional sessions. Peer Confederate A was a 5-year-old girl diagnosed with autism who served as the peer for Participant 1. Peer Confederate B was a 5-year-old male diagnosed with Asperger syndrome, and he served as the peer for Participant 2. The peer confederates demonstrated OL for textual and tact responses. Both the participants and peer confederates engaged in speaker/listener exchanges and were reading on a prekindergarten level.

### *Setting*

The study was conducted in a public elementary school that included students from kindergarten through Grade 5 and was located in a suburban area outside of a large metropolitan city. The participants attended a K-1 special education classroom within the school that employed the Comprehensive Application of Behavior Analysis to Schooling (CABAS) model (Greer, 1994a) of instruction. The ratio of the classroom was a 6:1:2 (students:teacher:teaching assistants). The students' ages ranged from 4 to 6 years.

All parts of the study were conducted in one of three settings: the classroom, the teacher's office (situated within the classroom), or a small office located adjacent to the classroom. During all sessions, the teacher sat across from the students while a peer sat directly next to the target participant. While the participants were participating in the study, the other students in the classroom were engaged in typical instruction with other instructors. Instruction took place at two tables that measured 137 cm × 127 cm and 403.87 cm × 403.87 cm.

### *Materials*

The materials included numerous sets of Dolch words (Dolch, 1948), which were presented on 7.62-cm × 12.70-cm index cards in multiple fonts and colors. Dolch words are the 220 most frequently used words in the English dictionary. The Dolch words used from this study were selected from the Dolch sight word list found at <http://gemini.es.brevard.k12.fl.us/sheppard/reading/dolch.html>. Pictures of unusual fruits were used as the tacts for this experiment. The pictures were selected from <http://www.google.com/images> and cut and pasted onto 7.62-cm × 12.70-cm index cards. Tables 1, 2, and 3 display the materials that were used for the experimental probe sessions, including Posttraining 1 and 2 probe sessions. The words and pictures for all probes were material that was not in either student's repertoire. Multiple sets

of Dolch words only (not tacts) were used (these differed from words used in the experimental probe sessions) for the monitoring intervention. The words used for the monitoring intervention were not in the confederate's repertoire but may have been in the target participant's repertoire, depending on the stage of the intervention (see Procedure below).

**Table 1**  
*Sets of Words Used for Participants 1 and 2 When They Were Paired With Confederates A and B, Respectively, During Experimental Probes in Experiment 1*

Participant	Pre-Probe	Post-Stage 1	Post-Stage 2	Post-Stage 3
1	Going	Give	Make	Called
	Know	Many	Hers	Every
	Live	Shall	For	Find
	Asked	Had	Came	Why
	Look	Before	All	Once
	Called	Give	Make	Going
	Every	Many	Hers	Know
2	Find	Shall	For	Live
	Why	Had	Came	Asked
	Once	Before	All	Look

**Table 2**  
*Sets of Tacts Used for Participants 1 and 2 When They Were Paired With Confederates A and B, Respectively, During Experimental Probes in Experiment 1*

Participant	Pre-Probe	Post-Stage 1	Post-Stage 2	Post-Stage 3
1	Cantaloupe	Currants	Loquat	Fig
	Honey dew	Plum	Cherimoya	Avocado
	Plantain	Mango	Date	Grapefruit
	Guava	Pomegranate	Paw paw	Kiwi
	Passion fruit	Papaya	Tamarind	Apricot
	Fig	Currants	Loquat	Cantaloupe
	Avocado	Plum	Cherimoya	Honey dew
2	Grapefruit	Mango	Date	Plantain
	Kiwi	Pomegranate	Paw paw	Guava
	Apricot	Papaya	Tamarind	Passion fruit

Pretest measures were used to assess whether the words or tacts selected were in the participants' repertoires. The teacher used unsequenced trials, whereby if the student responded incorrectly for three consecutive opportunities, the target word or tact was scored as not being in the student's repertoire. Similarly, if the student responded with three consecutive correct responses, the target word or tact was scored as being in the participant's repertoire. For the dependent variable, all material was pretested prior to the experiment and immediately prior to the phase in the study in which

the material was introduced. That is, the words and tacts used in the postexperimental probes were pretested again when the student was at this phase in the study. This was to ensure that the material selected was not in the student's repertoire and the student did not acquire it from learning outside of the experiment. For the independent variable, the words used were pretested only prior to the phase in which the words were introduced.

**Table 3**  
*Sets of Dolch Words Used During Experimental Probes for Participants 1 and 2 When They Were Paired With Confederates B and A, Respectively*

Participant	Pre-Probe	Post-Stage 1	Post-Stage 2	Post-Stage 3
1	Hold	Light	Much	Laugh
	Because	Does	Made	Upon
	Both	Hurt	Clean	Grow
	Get	Around	About	Eat
	Long	Ride	write	fall
	Laugh	Light	Much	Hold
2	Upon	Does	Made	Because
	Grow	Hurt	Clean	Both
	Eat	Around	About	Get
	Fall	ride	write	Long

Small red and green sorting blocks and Lego cubes were used for monitoring intervention. The sorting blocks were in the shape of either a cube (2.54 cm × 2.54 cm × 2.54 cm or a sphere (2.54 cm). The small Legos were in the shape of a cube (3.81 cm × 3.81 cm × 3.81 cm). Two small, clear, rectangular plastic containers (17.78 cm × 12.7 cm × 10.16 cm) or cups were used to place the blocks in. The use of a red object by a target student was a way to record incorrect responses and a green one to record correct responses.

### *Design*

A delayed multiple-probe design across participants (Greer, Stolfi, Chavez-Brown, & Rivera-Valdez, 2005; Greer, Stolfi, & Pistoljevic, 2007; Horner & Baer, 1978) was used to test the effects of the peer monitoring intervention on acquisition of OL. The sets of stimuli for the pre- and postexperimental probes were counterbalanced for Participants 1 and 2. The sequence of the design was as follows: (a) probe sessions for OL for the target participant across textual responses with the peer confederate they monitored and a peer confederate they did not monitor and tact responses only with the peer confederate they monitored, (b) the monitoring intervention (included Stages 1, 2, and 3), and (c) postobservation probe sessions for OL for all measures for the target participant (this occurred after each stage of the monitoring intervention). All experimental probes were staggered to control for maturation and instructional history. Pre-experimental probes were conducted on the first participant only and not on the second participant until the intervention began with the first participant. The intervention was not implemented with the second participant until progress was observed for the first participant. The pre-experimental probes and intervention

were staggered similarly for the third participant. Postexperimental probes were conducted only when each participant met criterion on the monitoring intervention (see Table 4).

Table 4  
*Sequence of Experiment 1*

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- 1) Pre-experimental Probes for OL for Target Participants
    - a. Reading words with Paired Peer Confederate
    - b. Reading words with alternate Peer Confederate
    - c. Tacting Fruits with Paired Peer Confederate
  - 2) Monitoring Intervention Stage 1 with paired Peer Confederate
  - 3) Conduct Post-experimental Probes
    - a. Reading Words with Paired Peer Confederate
    - b. Reading Words with alternate Peer Confederate
    - c. Tacting Fruits with Paired Peer Confederate
  - 4) Monitoring Intervention Stage 2 with paired Peer Confederate
  - 5) Conduct Post-experimental Probes
    - a. Reading Words with Paired Peer Confederate
    - b. Reading Words with alternate Peer Confederate
    - c. Tacting Fruits with Paired Peer Confederate
  - 6) Monitoring Intervention Stage 3 with paired Peer Confederate
  - 7) Conduct Post-experimental Probes
    - a. Reading Words with Pair Peer Confederate
    - b. Reading Words with alternate Peer Confederate
    - c. Tacting Fruits with Paired Peer Confederate
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*Experimental Probes.* The dependent variables in this study were responses to OL probes for the target participants for textually responding to words or tacts after observing 20 learn-unit (Albers & Greer, 1991) presentations delivered to the peer confederate by the teacher. The behaviors were defined as follows for both participants:

1. *Textual responses (see print and say word)*—A correct response included emitting the correct vocal word within 2 s upon presentation of the word printed on a card, while an incorrect response included not responding within 2 s, or emitting an incompatible word that did not correspond to the word. Responses to these probe trials were not reinforced or corrected for the target participant.
2. *Tacts (see picture and say word)*—A correct response included emitting the correct vocal word within 2 s upon presentation of the picture, while an incorrect response included not responding within 2 s or emitting an incompatible word that did not correspond to the picture. Responses to these probe trials were not reinforced or corrected for the target participant.

*Procedure for Pre- and Postexperimental Probes.* During all experimental probe sessions, the target participant sat directly next to the assigned peer confederate while the teacher sat in front of both participants. The presence

of OL was tested for the following: (a) textual responses to Dolch words with the peer they were paired with during peer monitoring, (b) tact responses with the peer they were paired with during the peer monitoring, and (c) textual responses to Dolch words (novel set) with an *alternate* peer to test if OL would generalize to a nonpeer confederate. All experimental probes were conducted concurrently for each participant. The OL probes were arranged so that the target participant observed a set of 20 learn units (Albers & Greer, 1991) delivered to a peer for textual or tact responses (five stimuli in a set presented four times each). Similar to typical group-instruction sessions, the teacher would present the antecedent “look here” as needed to gain the students’ attention. However, no more than one direction was given per learn unit to gain the students’ attention. Immediately following an observational session, probe sessions (20 opportunities per session), in which responses were not consequated, were conducted for the target participants.

*Peer Confederate.* The peer received reinforcement or a correction procedure as per the learn-unit protocol, while the target participant observed textual responding or tact responses. A session comprised 20 learn-unit presentations (five words or tacts presented four times each) delivered by the instructor. Criterion for mastery of a given set was 90% or better for two consecutive sessions.

*Target Participant Probe Sessions.* Following each 20-learn-unit session for either textually responding to words or tacting pictures, a probe session was immediately conducted for the target participant to determine whether he or she acquired any of the target responses. Probes consisted of 20-trial sessions; however, these trials were unsequated. The stimulus was presented to the student and he or she had 3 s to respond. Following the response or lack of response, another trial was presented, until all 20-trial probe sessions were conducted for a session. Probe sessions with the target students were conducted following each session of instructing the peer confederate. These sessions continued until the peer confederate mastered the words or tacts for the pre- and postexperimental probes only. For the probes conducted following Stages 1 and 2 of the monitoring intervention, only 3 sessions were conducted.

### *Peer Monitoring: Independent Variable*

The independent variable in this study consisted of the monitoring experiences involving the target student monitoring the correctness or incorrectness of the responses of the *peer textually responding to words only (different words from the experimental probe sessions)* during learn-unit presentations by the teacher. There were three component stages of this intervention for the target participants (see Table 5). These stages varied with regard to whether the stimuli were in the target participant’s repertoire (previously mastered) and at what point during the learn-unit presentation for the peer the target participant was required to monitor the peer’s response. In all stages of the peer monitoring, the target participant was required to meet criterion on monitoring both correct and incorrect responses emitted by the peer before moving on to the next sequential stage (90% for one or two sessions for monitoring correct and incorrect responses). The criterion was individualized for each student based on his or her learning history. The target participant used red and green blocks to indicate his or her monitoring

response (green for accurate responses and red for inaccurate responses emitted by the peer). Multiple sets of stimuli that were not used during the experimental probe sessions were used throughout the intervention to ensure adequate opportunities for monitoring the peer's responses. Because prior literature (Greer et al. 2004) has demonstrated that the observation of incorrect responses and the correction of those incorrect responses are predictors of OL, observing incorrect responses as well as correct responses was thought to be a critical component of the independent variable.

Table 5  
*Sequence of Peer Monitoring Intervention*

Stage	Program	Objective	Sequence of Events
Stage 1	In Participant's Repertoire/ Not in Confederate's	Participant (P) waits for teacher consequence to Confederate (C) then selects cubes	1) Present antecedent to both students 2) C responds 3) Teacher delivers consequence to C 4) P is given an opportunity to select a cube 5) Teacher delivers consequence to P
Stage 2	Same as Stage 1	Participant is given the opportunity to beat teacher's consequence	1) Present antecedent to both students 2) C responds 3) P is given the opportunity to select cube (2 seconds) 4) Teacher delivers consequence to C 5) Teacher delivers consequence to P
Stage 3	Not in P & C's repertoires	Same as Stage 2	Same as Stage 2

*Stage 1.* The stimuli selected for this stage were novel for the peer but were previously mastered by the target participant. The target participant observed his peer confederate receive learn units on a set of words that were novel for the peer but mastered by the participant. However, following *each* learn unit, the participant was given an opportunity to monitor the student's responses. In this stage, the teacher's consequence for the peer confederate probably served as the discriminative stimulus for the target participant to select a block. The target participant received reinforcement for correct monitoring responses and corrections for incorrect responses from the teacher consistent with learn-unit protocol. This stage continued until the participant met criterion on monitoring both correct and incorrect responses. When this stage was mastered, the participant began the next stage of implementing the independent variable.

*Stage 2.* Stage 2 of the monitoring intervention was similar to Stage 1 in that the words were in the target participant's repertoire but not in the peer's repertoire. However, during this stage, the target participant was given an opportunity to select a block immediately following the peer's response, but before the teacher consequated the peer's response. Thus, the peer's response to learn-unit presentations by the experimenter, rather than the experimenter's consequence, had to serve as the discriminative stimuli for the target participant to select a block for responses made by the peer in order to be reinforced for a correct monitoring response or corrected for an incorrect response. For example, if the target word was *car* and the peer

responded "car," a correct response, the target participant was required to select a green block in order for the target student to be counted as correct and receive reinforcement. If the peer responded with an alternate word ("cat"), a correct response was recorded and the target participant was reinforced if he selected a red cube. An incorrect response was recorded for the target participant, and he was not reinforced if he selected a green cube when the response was incorrect ("cat") or if he selected a red cube when the response was correct ("car"). After the target participant emitted his monitoring response, the experimenter consequated the target participant first and then consequated the peer for the accuracy or inaccuracy, as per the learn-unit protocol. This stage continued until the participant met criterion on monitoring both correct and incorrect responses without observing the experimenter's consequences for the peer. Once the target student mastered this stage, he began Stage 3.

*Stage 3.* Stage 3 of the monitoring intervention was similar to Stage 2 except that the stimuli being taught were novel for both the peer and the target participant. This stage closely reflected the conditions of the experimental probes except that the students were consequated according to learn-unit protocol.

### *Data Collection*

*Peer Confederate.* Data were recorded on responses to learn units throughout *all* phases of the experiment for the peer confederate. The peers were reinforced for correct responses and received corrections for incorrect responses, which they had to repeat but were not reinforced for. A correct response resulted in the experimenter's recording a plus (+) and a minus (-) for incorrect responses on a data sheet according to the behavioral definitions for the peer. Each session consisted of 20 learn units (five sets of stimuli presented four times each).

*Target Participants-Experimental Probes.* During the pre/postexperimental probes, data were collected using unsequated probe trials for the target participant. After the participant observed an entire teaching session of 20 learn units delivered to the peer, the data were collected on the participant's responses, testing OL from indirect contact with the peer's learn units. Probe sessions consisted of 20 probe trials, involving the same responses that had been taught to the confederates (five stimuli presented four times each). Probe trial sessions were conducted following each session in which the peer received learn units, until the peer confederate met criterion on the set for the pre- and postexperimental probe sessions only. Only 3 probe sessions were conducted following the post-monitoring training Stage 1 and 2 probe sessions. Probe sessions were not continued until the peer confederate met criterion during the postmonitoring training Stages 1 and 2.

*Target Participants-Monitoring.* During the monitoring intervention, data were collected using learn units for monitoring responses to learn-unit presentations to the peer confederate. The data were blocked and graphed separately out of 20 responses for monitoring correct and 20 responses for monitoring incorrect responses emitted by the peer confederate. For a correct response, the teacher reinforced the student using verbal praise, and/or tokens could be traded in for reinforcers (e.g., books). An incorrect

response resulted in a correction procedure whereby the teacher represented the antecedent and prompted the correct response. Because the number of opportunities to monitor correct or incorrect responses varied depending on the confederate's responses each session, the experimenter continued to record responses until 20 responses for each target behavior (monitoring correct or incorrect responses) were achieved. That is, in a given stage of the intervention, if the peer confederate achieved criterion on a set of words (90% for two consecutive sessions) and the target participant had not mastered or completed a session of monitoring incorrect or correct responses, a novel set was introduced to the peer. The target participant did not progress to the next stage of the intervention until he met criterion on monitoring correct and incorrect responses. For example, it was often the case that the peer met criterion on a set of words quickly, resulting in numerous opportunities for the target participant to monitor correct responses and fewer opportunities to monitor incorrect responses. The infrequent opportunities to monitor incorrect responses resulted in the target participant's achieving criterion for monitoring correct responses prior to achieving criterion on monitoring incorrect responses. To provide additional opportunities to monitor incorrect responses, additional sets of words were introduced. The target participant continued to monitor both responses (even though he had mastered monitoring correct responses) until he achieved criterion on monitoring incorrect responses emitted by the peer. It was not until criterion on monitoring both responses was achieved that the target participant moved to the next stage of the intervention.

A correct response for the target participant during the monitoring intervention included his selecting a green block when the peer's response was correct or a red block when the response was incorrect within 2 s of the peer's response. An incorrect response during the monitoring intervention consisted of the target participant's selecting a green block when the peer's response was correct or selecting a red block when the peer's response was incorrect or the peer did not respond within 2 s of the peer's response. The criterion was individualized for each student on the basis of the student's instructional history (90% for one session or two consecutive sessions) for monitoring both correct and incorrect responses.

*Interobserver Agreement.* Interobserver agreement for the dependent variables and instructional responses, as well as procedural reliability, were calculated by the teacher's correct presentation of learn units as recorded on the Teacher Performance Rate Accuracy (Ingham & Greer, 1992) form. Interobserver agreement was assessed by having two observers simultaneously, and independently, collect data on the students' responses and the second observer record procedural reliability. Procedural reliability was recorded by the second observer on whether all components of the learn unit were present or not present for learn units or if probe trial antecedents were unambiguous and no consequences were given by the experimenter. The agreement was calculated for each session by dividing the total numbers of agreements for the presentation of learn units by the number of agreements plus disagreements and multiplying by 100%. For Participant 1, interobserver agreement was collected for 33% of sessions with a mean of 100%. For Participant 2, interobserver agreement was collected for 29% of sessions with a mean of 97% (range from 95% to 100%). Interobserver agreement was calculated for a total of approximately 32% of all sessions with

a mean of approximately 98% agreement. Procedural mean agreement on the components of the experimenter's presentations was 98% accurate (range 95%-100%).

## Results

### Pre-Experimental Probes

Figure 1 shows the correct responses emitted by Participants 1 and 2 after observing textual responses for words emitted by Confederates A and B, respectively. Figure 2 shows correct responses emitted by Participants 1 and 2 after observing tact responses emitted by Confederates A and B, respectively. Figure 3 shows correct responses by Participants 1 and 2 after observing textual responses to words by Peer Confederates B and A, respectively.

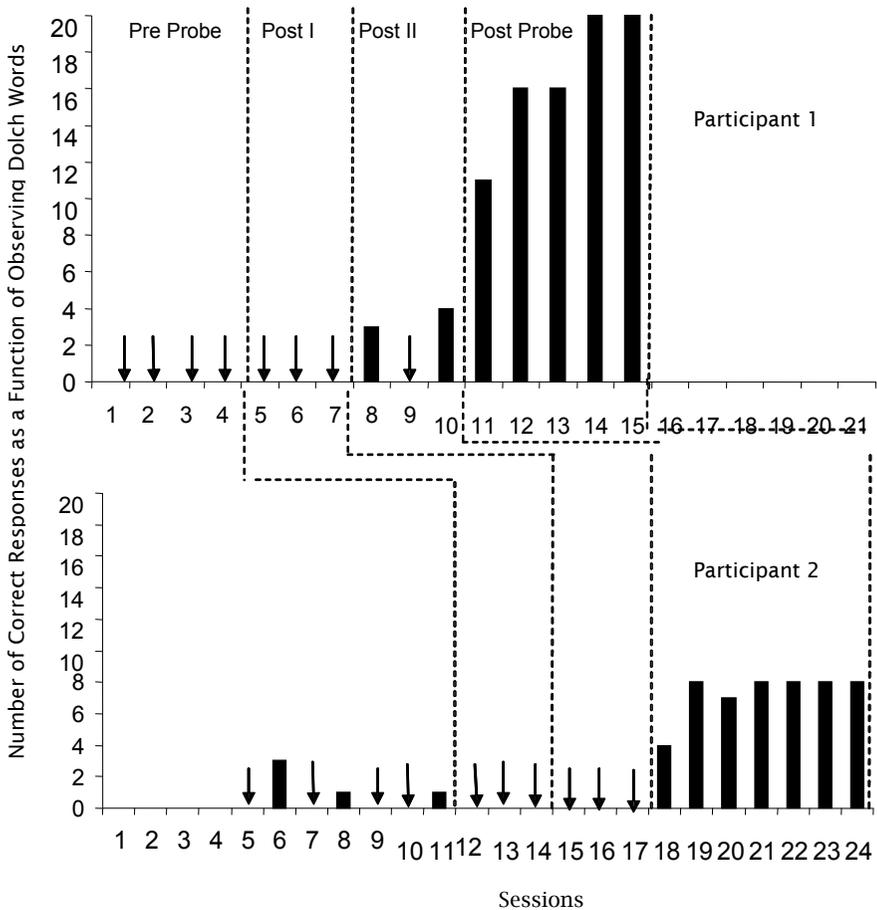


Figure 1. The number of correct responses to probe trials for textual responses for Participants 1 and 2 when paired with Peer Confederates A and B, respectively, in Experiment 1.

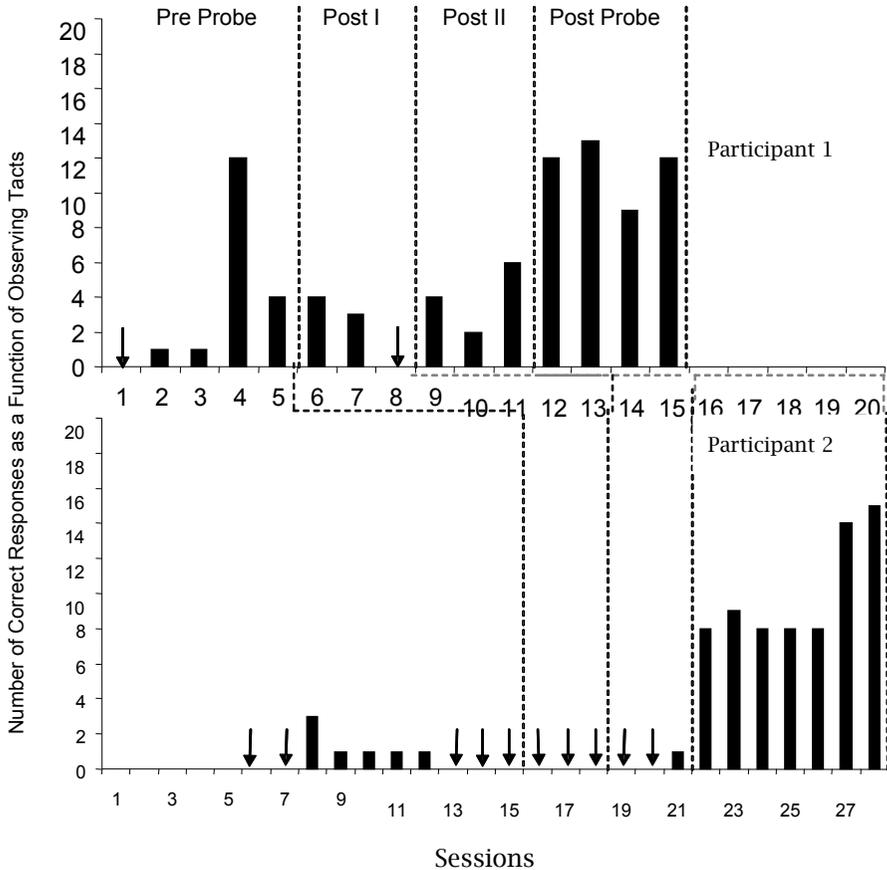


Figure 2. The number of correct responses to probe trials for tact responses for Participants 1 and 2 when paired with Peer Confederates A and B, respectively, in Experiment 1.

For textual responses (see Figure 1), pre-experimental probe sessions showed that after observing learn units being delivered to the peer confederates, Participant 1 emitted no correct responses across sessions and Participant 2 emitted a mean of .71 correct responses (range 0-3). For tacts (see Figure 2), the probe sessions showed that after observing learn units being delivered to the peer, Participant 1 emitted a mean of 3.8 correct responses (range 0-12) and Participant 2 emitted a mean of .47 correct responses (range 0-3). In Figure 3, Participant 1 responded with a mean of 2.3 correct responses for textual responses (range 1-4) when paired with Confederate B. When Participant 2 observed responses emitted by Confederate A, the participant emitted no correct responses in the pre-experimental probe phase.

### Post-Monitoring 1 and 2 Probes

After meeting criterion on monitoring the confederate's responses in each monitoring stage, probe sessions were conducted for each participant.

Figure 1 shows that Participant 1 emitted no correct responses across sessions during the Postmonitoring 1 phase for words. Following the mastery of the second monitoring stage, the participant emitted a mean of two correct responses (range 0-4). Participant 2 emitted no correct responses in either postmonitoring phase. In Figure 2, Participant 1 emitted a mean of 2 responses (range 0-4) in the Postmonitoring 1 phase. The mean in the Postmonitoring 2 phase was 4 (range 2-6). Participant 2 emitted no correct responses during the Postmonitoring 1 phase and a mean of .33 correct responses in the Postmonitoring 2 phase (range 0-1). When the participants were paired with alternate confederates for observing printed words, the data showed a low level of correct responses; Participant 1 emitted zero correct responses during the Postmonitoring 1 phase and a mean of 2 correct responses (range 0-4). Participant 2 responded with a mean of 4 correct responses at (range 2-8). Subsequently, Participant 2 emitted zero correct responses in the Postmonitoring 2 phase (see Figure 3).

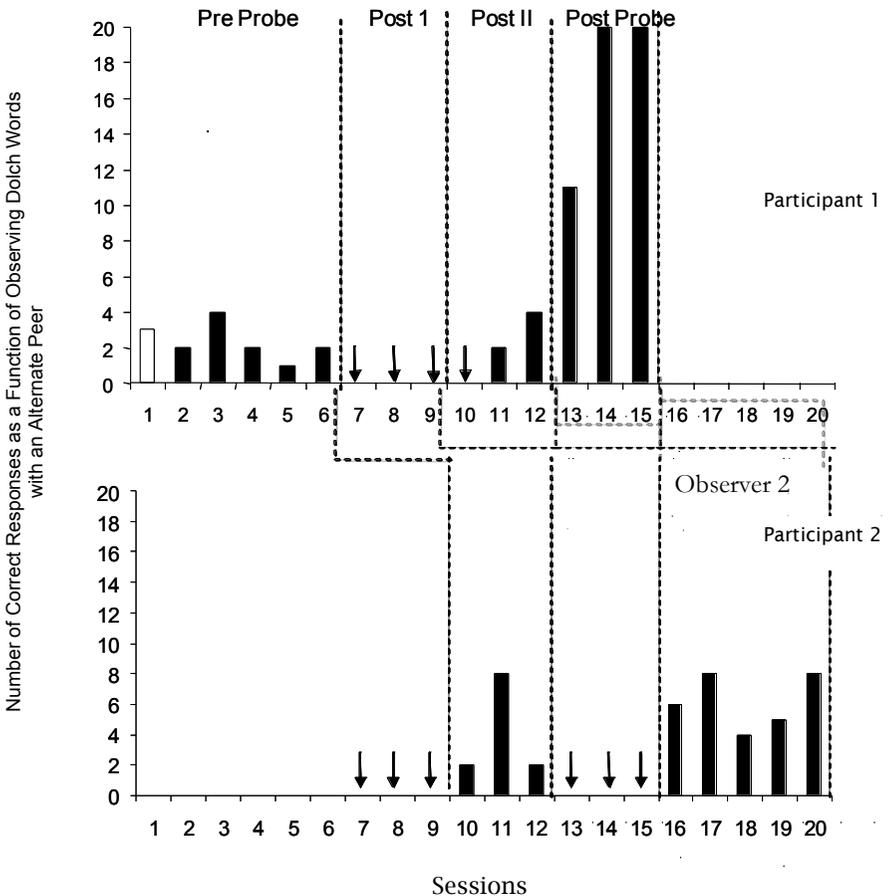


Figure 3. The number of correct responses to probe trials for textual responses for Participants 1 and 2 when paired with Peer Confederates B and A, respectively, in Experiment 1.

### *Postexperimental Probes*

Following the completion of the third monitoring stage of the intervention, a postexperimental probe was conducted across all participants (see Figure 1). For Participant 1, in the fourth phase the results showed that the participant learned through observation at 100% accuracy, which was an increase of 100% (from 0 to 20 correct responses) over correct responding in the pre-experimental probes on words. The participant responded in the postexperimental phase with an overall ascending trend (range 11-20). Participant 2 also showed an increase in correct responding in the postexperimental probe sessions. The mean correct responses for Participant 2 were 7.3 during the postexperimental probe sessions for words (range 4-8; see Figure 1). For tacts (see Figure 2), Participant 1's mean of correct responses was 11.5 during the postexperimental probes (range 9-13). For Participant 2, there was an increase in correct responding in the postexperimental probe (range 8-15; see Figure 2). In Figure 3 an increase in the postexperimental probe sessions for Participants 1 and 2 was observed. There was an ascending trend in the number of correct responses emitted by Participant 1 in the fourth phase (range 11-20). Participant 2's mean of correct responses was 6.2 (range 4-8). These results showed that the peer monitoring intervention was successful in increasing both participants' OL. Both students showed a higher level of responding to probe sessions following the completion of the peer monitoring intervention.

### *Monitoring Intervention*

In Figure 4, results of the peer monitoring teaching sessions in which the participants were required to monitor the peer confederate's correct responses are displayed. In Stage 1, there was an overall ascending trend (range 8-20), and the participant met criterion in six sessions. In the second phase, there was an ascending trend (range 9-20), and criterion was achieved in seven sessions. The participant met criterion in three phases during monitoring Stage 3 (range 9-20). Participant 2 met criterion on monitoring correct responses in three sessions (range 15-18) during the first monitoring stage. In the subsequent phase, criterion was achieved in three sessions (range 13-20). In the third monitoring stage, Participant 2 met criterion on monitoring correct responses in four sessions (range 8-18).

Figure 5 shows the results of the peer monitoring teaching sessions in which participants monitored peers' incorrect responses. Participant 1 met criterion on monitoring incorrect responses in three sessions during Stage 1 of the monitoring intervention (range 6-17). In the subsequent phase, the participant met criterion in four sessions (range 4-20). In the last phase of the monitoring intervention for Participant 1, the participant met criterion in two sessions (range 10-18). Participant 2 responded with 18 and 20 correct responses in the first phase of the monitoring intervention. In the second phase, Participant 2 met criterion in three sessions (range 14-20). In the third stage of the monitoring intervention, Participant 2 met criterion in five sessions (range from 15 to 18).

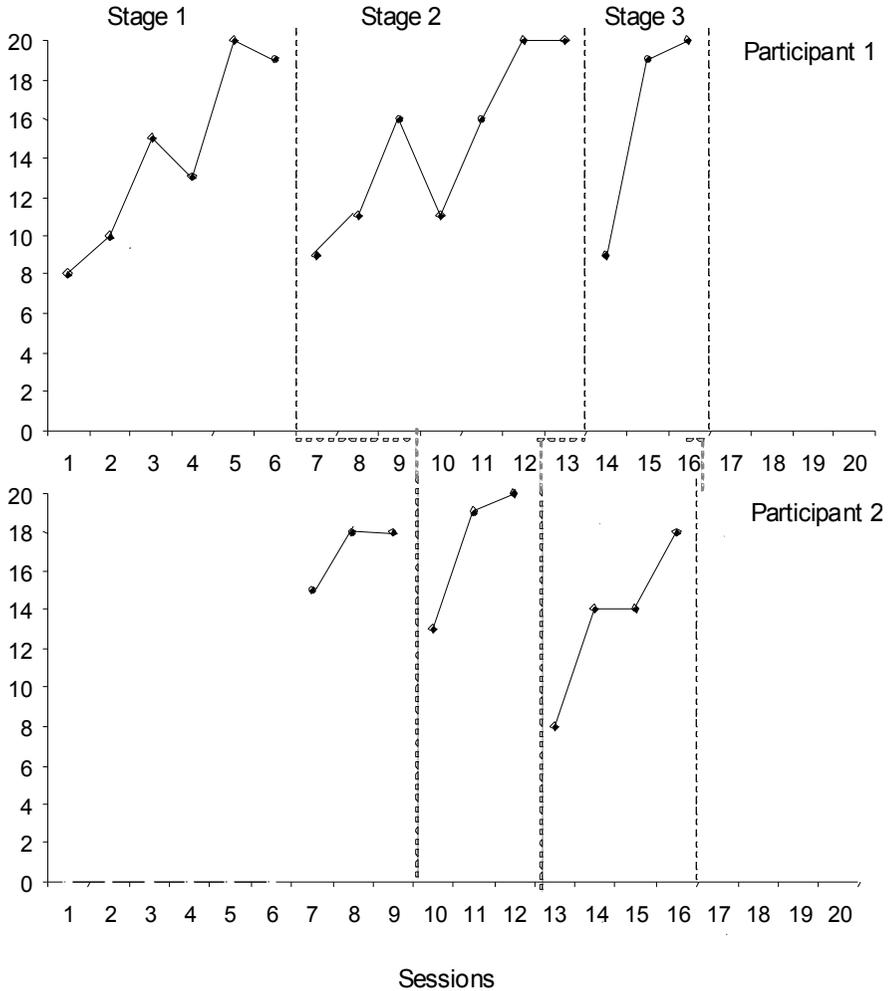


Figure 4. The number of correct responses to learn unit presentations for monitoring correct responses for Participants 1 and 2 in Experiment 1.

### Discussion

The results in the first study demonstrated that both participants had a higher level of correct responding from observing peers receive learn units following the three-stage monitoring intervention. Participant 1 achieved mastery in the postexperimental probe session for textual responses when he was paired with the peer whose responses he learned to monitor. Higher levels of responding were found for observing tact responses after the participants monitored textual responses emitted by their peers (at the end of all three stages). This suggests that although the participants learned to monitor one

specific response (textual responses), this generalized to other responses (facts). Thus, the participants acquired OL across both the taught response class and the untaught class. Both participants emitted higher levels of correct responding in the postexperimental probe sessions than in their pre-experimental probe sessions when paired with an alternate peer confederate.

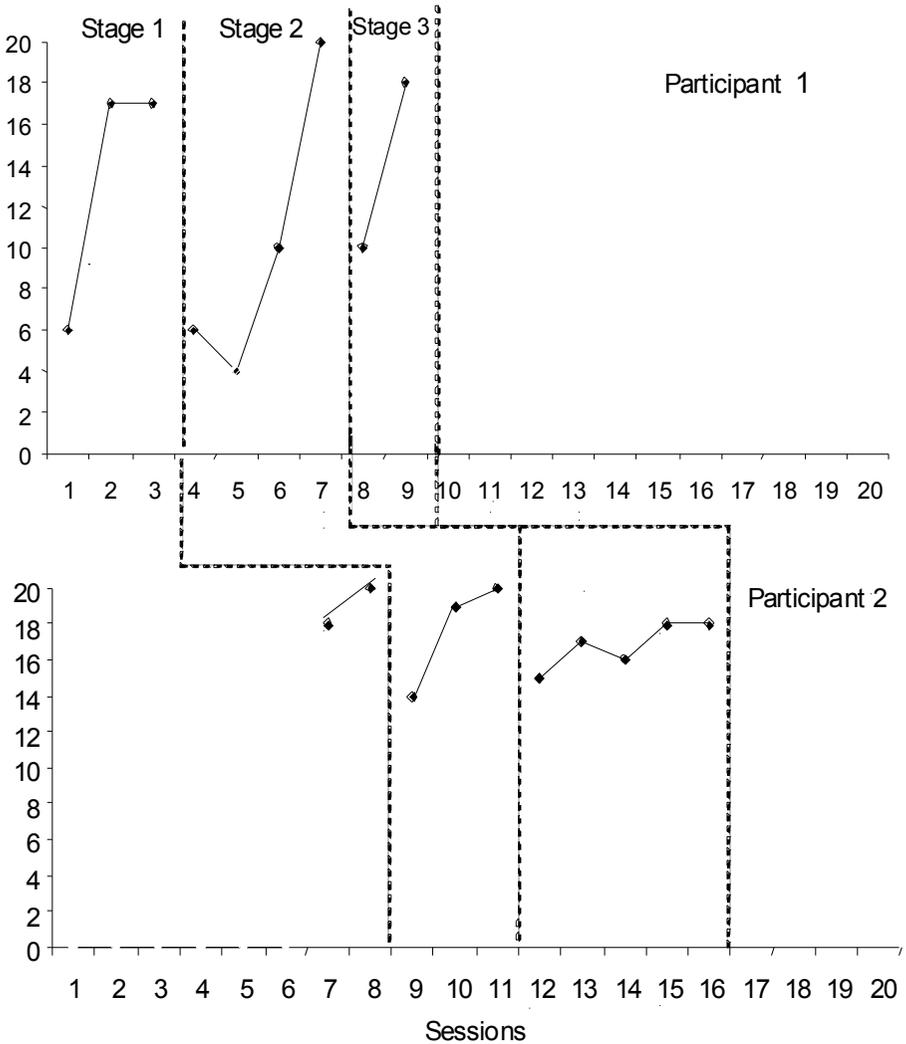


Figure 5. The number of correct responses to learn-unit presentations for monitoring incorrect responses for Participants 1 and 2 in Experiment 1.

The probe sessions following each stage of the monitoring intervention were designed to determine at which stage of the peer monitoring students would acquire OL. Our findings suggest that it was not until all stages were completed that OL began to emerge. Probe sessions following Stages 1 and 2 may have served as a limitation in the study, particularly for Participant 2. In his case, the extensive nonconsequated probe sessions created motivational

problems because there were no consequences given to the student during the probe sessions. In addition, it was not until all three stages of the monitoring intervention were completed that the target participant began to show higher levels of responding. Therefore, earlier probes resulted in a pattern of frequent incorrect responses for the target participant. This may have contributed to his lower levels of responding in the postprobe sessions. In Experiment 2, we eliminated probe sessions following each stage and therefore conducted probes only after the participants had mastered all three stages. In addition, we had three participants in Experiment 2.

## Experiment 2

### *Participants*

The target participants in this study were three 6-year-old males diagnosed with Other Health Impairment. Participants 2 and 3 were participants in the first study. The participants were selected for this study because they did not have OL for spelling words vocally; however, they all demonstrated OL for textual and tact responses. At the onset of the study, all of the participants were reading approximately 6 months below grade level. All of the participants engaged in speaker/listener exchanges with teachers and peers. In addition, they all followed three-step directions fluently in a group; but when presented with group instruction, they were easily distracted.

One participant served as the peer confederate for all of the target participants during the monitoring intervention. Also, the peer confederate served as the peer during the pre- and postexperimental probes for Participant 2 only. The peer confederate was a 6-year-old female diagnosed with autism. During the pre- and postexperimental probes only, Participant 3 served as the peer confederate for Participant 1 and Participant 1 served as the peer confederate for Participant 3. Because the design was staggered, there were no confounds. Participant 3 did not begin the experiment until he finished serving as a peer confederate for Participant 1. This was important, because it showed that in baseline conditions they did not acquire OL due to serving as a confederate in pre- and postexperimental conditions. That is, Participant 1 finished all phases of the experiment before serving as a peer confederate.

### *Setting*

The setting for the experiment was the same as the conditions described in Experiment 1.

*Pre- and Postexperimental Probes.* The pre- and postexperimental probes were conducted as in Experiment 1. However, probe sessions were not conducted between each stage of the monitoring intervention. Probe sessions were conducted only prior to the target student's receiving instruction and after the target participant met criterion on all three stages of the monitoring intervention (Stages 1, 2, and 3). Eliminating the experimental probe sessions after each stage was warranted, given the findings from Experiment 1, and eliminating these probes decreased the possibility that the probes functioned as a teaching component of the intervention (i.e., frequent probe sessions may have functioned to teach by exclusion).

*Dependent Variable.* The dependent variable for this study was the participants' responses to pre- and postexperimental probes for spelling words (see Table 6). A correct response during the experimental probe for spelling words consisted of the participant vocally responding with the correct vocal spelling within 3 s of the teacher's antecedent, which was the spelling word in dictated form (e.g., "Spell *car*"). An incorrect response consisted of the participant incorrectly spelling the word by omitting and/or using inaccurate letters within 3 s of hearing the instruction "Spell \_\_\_\_."

Table 6  
*Sets of Dolch Words Used During the Pre- and Postexperimental Probe Sessions for Participants 1, 2, and 3 in Experiment 2*

Participant	Pre-Experimental Probe	Post-Experimental Probe
1	Old	Own
	Put	Has
	Off	Say
	Its	Any
	Own	Old
2	Has	Put
	Say	Off
	Any	Its
	Try	Use
3	How	Why
	May	Buy
	Cut	Our

The spelling words were selected from a Dolch word list retrieved from the following Web site: <http://gemini.es.brevard.k12.fl.us/sheppard/reading/dolch.html>. Each set of spelling words comprised 4 words that were presented in blocks of 20 (each word presented five times). The sets were counterbalanced across Participants 1 and 2. The spelling words utilized for this study in sets are listed in Table 6. Other spelling programs were suspended during the duration of this experiment. Consistent with Experiment 1, during the experimental probe sessions the words selected were words that were not in the target participants' or peer confederates' repertoires. Pretest measures as described in Experiment 1 were used to assess whether the words were in the target participants' repertoires. The words selected for the monitoring intervention differed from the words used during the probe sessions and were not in the peer confederates' repertoires, but they may have been in the target participants' repertoires, depending on the stage of the intervention (see below).

### *Independent Variable-Peer Monitoring*

During the peer-monitoring intervention, the participants were required to meet criterion on each stage, as explained in Experiment 1 of the intervention, but in this case they monitored vocal spelling responses emitted by their peers.

*Interobserver Agreement.* Interobserver agreement and procedural reliability were calculated in the same way as in Experiment 1. For Participant 1,

interobserver agreement was collected for 36% of sessions with a mean of 100%. For Participant 2, interobserver agreement was collected for 36% of sessions with a mean of 100%. For Participant 3, interobserver agreement was collected for 33% of the sessions with a mean of 100%. Teacher performance rate accuracy for procedural reliability showed 100% accuracy across sessions for all participants. In addition, a tape recorder was used to record the students' spelling response. An independent observer later recorded responses after viewing the tapes and compared the results with the experimenter. Agreement was calculated for 100% of the pre-experimental probe sessions, resulting in a mean of 99% agreement. During the postexperimental probe sessions, agreement was calculated for 89% of the sessions with 99% agreement.

### Design

The experimental design was the same as in the first experiment, with one exception. The first phase compared responses to pre-experimental probes, whereas the subsequent phase compared the participants' responses to the postexperimental probes, following the completion of all three stages of the monitoring intervention.

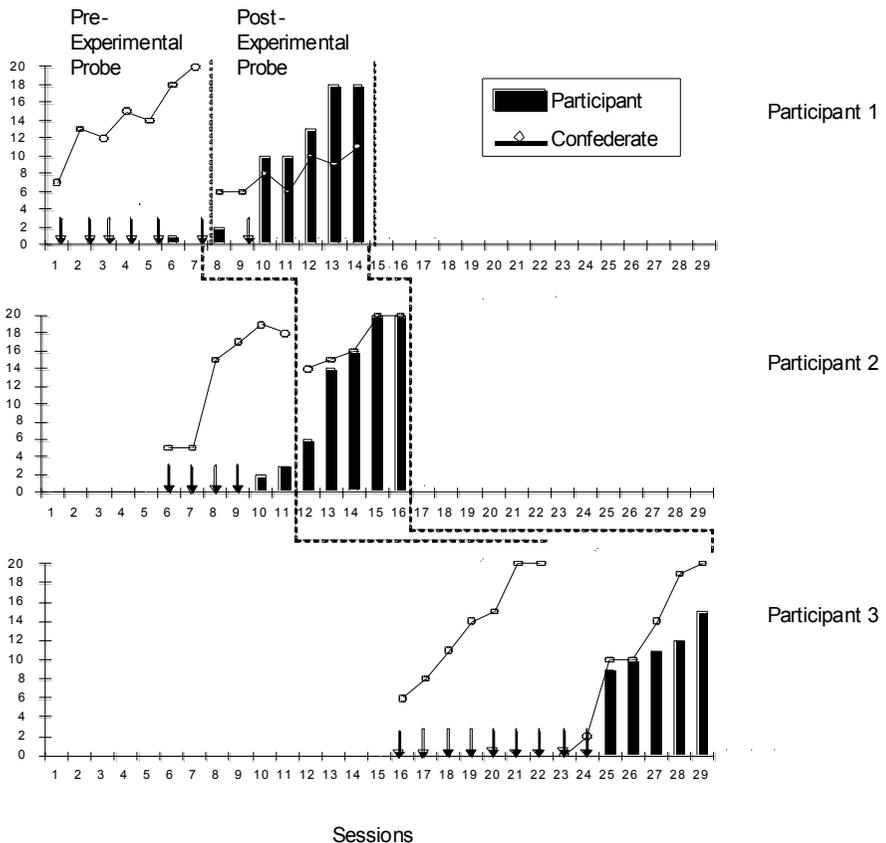


Figure 6. The number of correct responses to probe trials for spelling responses for Participants 1 and 2 in Experiment 2.

### Results

During the experimental probe sessions, all of the target participants made low levels of correct responses after observing the peer confederate respond to learn unit presentations (see Figure 6). Participant 1 had a mean of .14 correct responses (range from 0 to 1). Participant 2 had a mean of .83 correct responses (range from 0 to 2), and Participant 3 made no correct responses.

Following the monitoring intervention, all of the participants showed high levels of correct responses during the postexperimental probe sessions (see Figure 6). For Participant 1 there was an ascending trend (range 0-18), as was the case with Participant 2 (range 6-20) and Participant 3 (range 0-15). The results showed that Participants 1 and 2 achieved the established learning criterion where they responded at 90% accuracy. Figure 6 also shows correct responses made by the confederates (open circles). The data also show, as indicated by the open circle, that the peer confederates learned through learn-unit presentations.

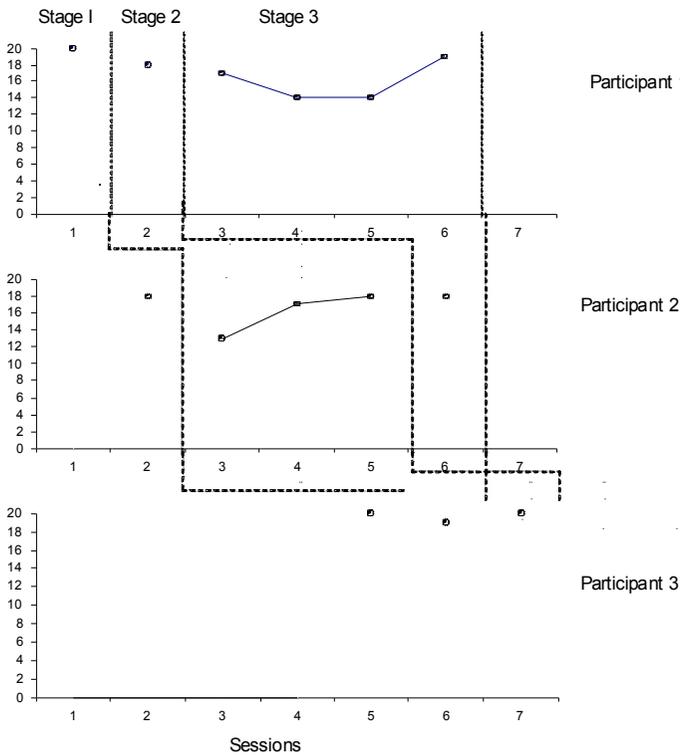


Figure 7. The number of correct responses to learn unit presentations for monitoring incorrect responses for Participants 1, 2, and 3 in Experiment 2.

Figures 7 and 8 show that all of the participants met criterion quickly on each stage of the monitoring intervention for monitoring correct and incorrect responses made by the confederates. The criterion for monitoring the confederate's responses was 90% for one session. Figure 7 shows the number of correct responses to learn-unit presentations for monitoring

incorrect responses. Participant 1 met criterion in one session for Stages 1 and 2 and in four sessions for Stage 3. Participant 2 met criterion in one session for Stage 1, three sessions for Stage 2, and one session for Stage 3. Participant 3 met criterion in one session for each stage of the monitoring intervention.

Figure 8 shows the number of correct responses as a function of observing correct responses. Participant 1 achieved criterion in one session in Stage 1 and in two sessions in Stages 2 and 3, responding at criterion levels. Participant 2 achieved criterion in one session for Stage 1, three sessions in Stage 2, and two sessions in Stage 3. Participant 3 achieved criterion in one session for Stage 1, two sessions for Stage 2, and three sessions for Stage 3.

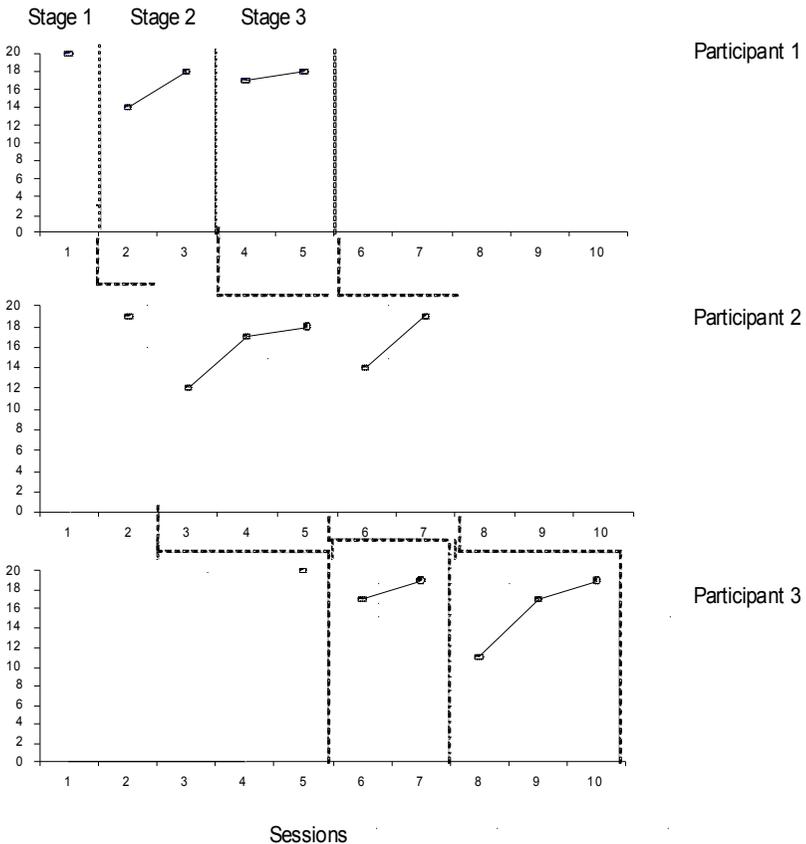


Figure 8. The number of correct responses to learn-unit presentations for monitoring correct responses for Participants 1, 2, and 3 in Experiment 2.

### Discussion

The findings in this experiment replicated the results of the first experiment, but the gains were stronger for the participants in Experiment 2 compared with the gains made by the participants in Experiment 1. All of

the participants acquired OL for spelling responses after they completed all three stages of the monitoring procedure. We found that in the pre-experimental probe sessions, the participants made few, if any, correct responses after observing a peer receive learn units on spelling responses. After the monitoring intervention, in the postexperimental probes, all of the participants showed a higher level of responding corresponding with the ascending trend shown by the peer. Participant 2 mastered the responses at the same time as the peer, and Participant 3 mastered the responses before the peer did.

One potential limitation was the participant selection: The target students also served as participants in the first study and had acquired OL for facts and textual response, but not for spelling. The accelerated mastery for the monitoring intervention stages in Experiment 2 may be due to their prior participation in this research and familiarity with the procedure. However, the lack of OL for these participants for spelling responses warrants further investigation, suggesting that there are different types of OL. Recent research has isolated a few types, such as observational conditioning (Greer, Singer-Dudek, Delgado, & Oblak, 2007; Greer & Singer-Dudek, 2008), where generalized conditioned reinforcers could be acquired via observation. In these studies, previously unconditioned reinforcers (e.g., string, books) were conditioned using an observational conditioning procedure whereby the target participants observed these items being delivered to a peer.

### General Discussion

OL emerged for all of the participants following the three-stage peer monitoring intervention. In the first experiment, although the target participants monitored their peers' textual responses to words only during the monitoring intervention, they acquired OL for tact responses also. Furthermore, their responses generalized across peer confederates. Experiment 2 replicated these findings across a different type of response, where all three of the participants engaged in OL for vocal spelling responses following the monitoring intervention. Interestingly, two of the three participants acquired mastery at the same time as, or at a faster rate than, their peer when observing learn units delivered in the postexperimental probe sessions. This latter phenomenon occurred also in Gautreaux's (2005) study of the effects of monitoring on the acquisition of OL, in that at the conclusion, his participants learned faster through OL than through direct contact with learn units.

The implications of this research are twofold. The first involves identifying that OL appears to be a behavioral developmental cusp (Rosales-Ruiz & Baer, 1997), or a "developmental stage that is acquired incidentally or induced" (Greer & Ross, 2007, p. 8). According to Rosales-Ruiz and Baer (1997), a developmental cusp occurs when a child can contact contingencies that he or she could not before. Hence, prior to the intervention, the participants could not contact the components of instruction (response and corrections or reinforcement) that were given to the peers, whereas afterwards they could. This means that they can now come into contact with the contingencies they could not before, and it shows not only a cusp but a capability, in that the children can now learn in ways they could not before (Greer & Ross, 2008;

Greer & Speckman, 2009; Rosales-Ruiz & Baer, 1997). This research treated OL as a “dependent variable.” The purpose of the experimental probe sessions was to test for the presence or absence of OL. The procedure related to the experimental probe sessions is a useful means for educators to test whether or not a student can learn by observing the contingencies of instruction received by others.

A second implication of this research is that peer monitoring was identified as a successful tactic that resulted in the emergence of OL. Peer-mediated tactics like peer monitoring are widely used to promote academic and social responding in behavior analytic and educational literature (Dougherty, Fowler, & Paine, 1985; Fowler, 1986; Fowler, Dougherty, Kirby, & Kohler, 1986; McCurdy & Shapiro, 1992). The intervention demonstrated the teaching of an operant whereby the participants learned responses from indirect contact with contingencies. Following the sequential stages using peer monitoring, all of the participants acquired OL. The stages during the intervention forced attention to the response and prior corrections and reinforcements with the same material. This forced the target participant to attend to the response relative to the consequences and thus as the instruction progressed, the participant learned from prior learn units given to the peer. Thus, the students learned while monitoring the reinforcement contingencies and the discriminative stimuli occasioning correct and incorrect responding.

Recently, similar research has tested the effects of peer-yoked contingencies on the acquisition of OL (Davies-Lackey, 2004; Stolfi, 2004). Moreover, Gautreaux (2005) tested the effects of monitoring training on the acquisition of an OL repertoire under peer tutoring conditions, generalization, and collateral effects with middle school students. Taken together with this current research, these studies present promising findings, in that peer-mediated tactics were successful in inducing OL for students who previously lacked this learning capability.

OL may be a critical developmental capability—one that allows children to advance via indirect contact with learn units received by others (Greer, 1994). Greer, Singer-Dudek, and Gautreaux (2006) defined OL as a critical learning capability. The acquisition of OL exponentially expands students’ ability to learn. Without OL, students can learn new operants only via direct instruction, a process that is time-consuming and expensive. Additionally, the induction of OL provides a means of access to more advanced capabilities. In a recent experiment, the induction of OL resulted in naming (Rothstein & Gautreaux, 2007). In teaching in applied behavior analysis, one of our major objectives is to advance students’ levels of verbal behavior development (Skinner, 1957) by inducing higher order verbal operants (Greer & Ross, 2008). By identifying pedagogical interventions that result in new developmental capabilities, such as the procedures described in these two experiments, we may have found some ways to provide students with the means to learn in ways they could not before.

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