The Effects of Social Conditions on Learning New Reinforcers

Emily Ruth Katz

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ABSTRACT

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In two experiments, I arranged the environment to determine if a relation existed between the social setting, which was defined by the presence of a peer or multiple peers and measured by the participants’ verbal behavior, and the learning of new reinforcers for the participants and the confederate peers. The peers were used to establish an intervention setting that fostered interaction between individuals but did not require it. In both experiments, two pre- and post-intervention tests of the dependent variables were used to measure the learning of new reinforcers. In Experiment 1, two intervention conditions were counterbalanced across participants to identify if a neutral stimulus would attain reinforcing value by observation if it was simultaneously delivered to both participant and peer for responding to previously learned math equations (Condition 1) or if the conditioning phenomenon was only observed when the neutral item was delivered to the peer (while the participant was present but denied access to the stimulus) for responding to previously learned math equations (Condition 2). Participant behavior was measured for all variables across all phases of the experiment and peer behavior was measured during the pre- and post-intervention screening test. The results from Experiment 1 showed that the participants did not learn new reinforcers when the neutral stimulus (NS) was delivered simultaneously to both participant and peer as they completed math worksheets. However, the previously neutral stimulus did become a reinforcer when the participant did not receive the NS but observed the peer receive the NS as they completed the math worksheets. Peer behavior was also measured during the pre- and post-intervention screening test and was consistent with the participants’ results; peers acquired new reinforcers during Condition 2 but
not Condition 1, even though they were never denied access to the stimulus. In Experiment 2, I tested whether reinforcers would be conditioned through observation regardless of the role that the participant was assigned during the intervention. Pre- and post-intervention tests for the dependent variables measured the behaviors of all nine participants regardless of the participant’s intervention role (e.g. peer, recipient). In Experiment 2, participants were randomly put in groups of three that included two participants (peers) who observed the third participant (recipient) receive the NS as a reinforcement operation as all three were completing math worksheets. The setting was arranged in this manner to test the effect of the reinforcement operation when two peers observed one recipient receive the stimulus. The results are discussed as an analysis of social contingencies, reinforcement operations including deprivation, and other implications that can be drawn from the changes in the participants’ and confederates’ behavior during the post-intervention measures.
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CHAPTER I: Introduction and Review of Literature

Introduction

Behavior is the result of a “relational condition between the separate entities of organism and environment” (Johnson & Pennypacker, 1993, p.99). The relation between the individual and operant must occur under certain environmental conditions that are related to the organisms ontogenic and phylogenic histories. The behavioral effects of environmental events are “classified as evocative when we refer to immediate but momentary change in behavior and as repertoire-altering when we refer to a lasting effect that can only be observed when the situation that preceded the event is again present” (Michael, 1983, p. 19). The magnitude and strength of the behavior depends on mitigating variables such as urgency, and survival in relation to existing environmental conditions. Through operant and respondent conditioning, all organisms develop repertoires that are functional and can be consistently observed in other members of the community. Reoccurring environmental contingencies will sustain the newly conditioned behaviors through on-going, contingent, and frequent reinforcement operations.

The complexity of the skill of learning through observation is often overlooked by researchers of the psychology. That is, observational learning is complicated because it requires an organism to observe a behavioral contingency emitted by a peer, conspecific, stranger or group under a specific environmental condition, and then to learn the contingency that was observed. To research how an individual learns through observation, one must consider the action of the environment on the organism after a response has been made (Skinner, 1969).

The studies reported herein were conducted to analyze the effect of peer presence during the observational intervention on the learning of new reinforcers, and to identify if the
confederates or peers learned new reinforcers through the intervention. Due to the specialized terminology used to discuss the phenomenon of observational learning of reinforcers I will provide the reader with a glossary. Next, I will review the literature on observational learning in non-human animals; the effects of social loafing, social facilitation and deindividuation on learning through observation from a social psychology framework and the relevant research from the behavior analytic perspective on observational learning of conditioned reinforcers.
Definition of Terms

Principle of Behavior

A principle of behavior refers to “statements that summarize and characterize environment/behavior relationships for many species” (Greer, 2002, p.330). These declarative accounts used to classify research findings validate the significance of the results and provide a rationale for future research that “leads to new perspectives on the subject matter “(Greer, 2002, p.330). Operations (e.g. reinforcement operation, establishing operation) are categorized by the principle of behavior to which they relate and are defined by the tactics of behavior analysis pedagogy that “specify the procedures to implement strategies or principles of the science” (Greer, 2002, p.346).

Tactic of Behavior

The use of the principles of behavior to shape behavior. Tactics can be manipulated to produce desired effects. Tactics include but are not limited to: social reinforcement, approvals or praise, self-monitoring, contingent access to activities, token economy, social contingencies.

Operant

A three-term contingency that is composed of a stimulus, response, and reinforcement operation to measure observable behavior.

Establishing Operation

“Any change in the environment which alters the effectives of some object or event as reinforcement and simultaneously alters the momentary frequency of the behavior that has been followed by that reinforcement” (Michael, 1982, p.151). Contriving situations within the setting that momentarily effect the reinforcing or punishing contingencies (result from deprivation aversive stimulation) in the environment.
Conditioning

The term conditioning implies that reinforcement is conditional upon the presence of another stimulus condition (Michael, 1983).

Respondent Conditioning

Pavlovian or respondent conditioning is an unconditioned stimulus paired with a conditioned stimulus that elicits a response.

Operant Conditioning

Higher order conditioning, antecedent-behavior-consequences contingencies that are learned through reinforcement operations and shaped by the relevant contexts particularly establishing operations. “Operant behavior it is contingent upon a response” (Skinner, 1953, p.65).

Neutral Stimulus

A stimulus that has no value to an individual or organism.

Conditioned Reinforcer

A stimulus that has been paired with an unconditioned or conditioned reinforcer and as a result acquires reinforcing properties of its own (Williams, 1994). A stimulus change (conditioned stimulus) that establishes stimulus change for an unconditioned reinforcer and alters its value from neutral or non-preferred to reinforcing. It is differentiated from unconditioned reinforcement which refers to primary reinforcers or naturally eliciting stimuli that do not require a conditioning process to be considered reinforcing. That is, unconditioned reinforcers are effective regardless of a specified experimental history of conditioning (Keheller & Gollub, 1958).
Setting events

Bijou & Baer (1961) defined setting events as establishing operations that include deprivation and satiation and durational events such as the presence (or absence) of events, actions or objects (for example, another person’s verbal statements or instructions). These operations are considered complex environmental conditions and are differentiated from stimulus events which are less complex such as change in temperature, turning on a light, facial cues by the authors (Bijou & Baer, 1961). Wahler & Fox (1981) stated that “unlike deprivation or presence-of-object setting events, the onset and offset of some stimulus-response setting events may occur well before, yet still facilitate or inhibit, the occurrence of later behavioral relationships” (p.329).

Observational Learning of New Operants

Catania (2007) defined observational learning as "learning based on observing the responding of another organism and/or its consequences" (p. 399). Greer, Singer-Dudek and Gautreaux (2006) defined observational learning as "observation that results in the acquisition of new operants, higher-order operants, and new conditioned reinforcers" (p. 490).

Observational Learning of Conditioned Reinforcers

Observational conditioning refers to the process by which neutral stimuli become conditioned reinforcers for performance and learning as the result of an observational procedure (described in the literature review to follow).

Performance task

Performance refers to previously learned operants (Greer et al., 2006). Performance is a class of behaviors measured over extended time periods and is a subject matter of its own that
has been used as an indication of learning or motivational states (Catania, 2007). In reports of observational learning, it is important to make a distinction between changes in performance and acquiring new operants as a function of an observation (Greer et al., 2006).

*Deprivation*

A type of motivating operation that alters the environmental conditions by withholding or removing a stimulus.
Review of Literature

Observational Learning in Non-Human Animals

Non-human animals must rely almost entirely on their phylogeny but prior contact with environmental stimuli, physical changes in their surroundings (e.g. temperature), sense organs (e.g. smell, sound, vision) and the presence of conspecifics (defined as members of the same species) to detect which skills are necessary to observe, acquire and emit to ensure safety and survival. The transmission of information through animal groups by observing other members of the group is increasingly recognized as an important evolutionary factor (Thornton & Raihani, 2010). When a single organism acquires new skills through observing the other members of the group with which it identifies, the organism can learn behaviors that are essential to survive, such as, foraging skills (Galef & Giraldeau, 2001), predator avoidance (Griffin, 2004), communication (Janik & Slater, 2000) and mate choice (Dugatkin, 1996; Freeberg, 2000). Researchers have identified mechanisms, such as modeling and stimulus enhancement, are used to teach survival behaviors to the group.

Modeling

One definition of non-human learning through observation is “learning that is facilitated by observation of, or interaction with, an individual or its products” (Hoppit & Laland, 2013, p.349). Species specific survival behavior can be learned through observation of older members of the group. Several studies have shown that certain behaviors are modeled within a group to new members of the group. Even if the modeling is initially costly to the group, it is necessary to ensure the long-term survival for the entire group (Franks & Richardson, 2006; Thornton & McAuliffe, 2006; Raihani & Ridley, 2008). That is, if the new members of the group do not have the opportunity to observe how to respond when a predator arrives, they will not acquire these
repertoires and will not survive. The following studies are examples of how certain species model survival behavior so it can be learned by the group.

Franks and Richardson (2006) demonstrated this phenomenon in ant species. When naïve “follower” ants are present during a journey to a food source, the experienced ants in the colony modify their speed during the journey so the new members of the species can learn the route with their antennae. The older ants continue the run only when tapped by the follower ant’s antennae (Franks & Richardson, 2006). This is costly to the group because it results in a significant decrease in speed when running in tandem, however losing the route to the food source is costlier to the group so the ants adjust their behavior to allow naïve ants to learn the routes to the food (Franks & Richardson, 2006).

Research has been conducted to learn how Meerkats teach their pups to handle difficult prey (Thornton & McAuliffe, 2006). Older members of the Meerkat group give dead or disabled prey to the pups and demonstrate hunting skills. Over time, live, intact prey is brought to the pups for hunting. This practice can be initially dangerous if the prey escape during practice, however, because of handling practice, the pups hunting skills improve more quickly (Thornton & McAuliffe, 2006).

In pied babblers, an avian species, adults condition nestlings to respond to a specific purr call when food is present (Raihani & Ridley, 2008). Production of this call causes nestlings to begin begging and fledglings to approach adults. The process of conditioning the call requires large energy costs and does not provide any benefits to adults, however, the adults condition the call early so that if danger is present, the call can be used to lead the fledglings away from danger and recruit them to food patches (Raihani & Ridley, 2008).
Stimulus Enhancement

Stimulus enhancement facilitated the acquisition of a new behavior by an observer when increased attention to a stimulus resulted from the behavior of a demonstrator. Curio (1988) and Curio et al. (1978) demonstrated that blackbirds exposed to an arbitrary stimulus (e.g. plastic bottle) while listening to the mobbing calls of conspecifics learned to mob the stimulus. In this example, the demonstrator exposed the observer to a relationship between stimuli (e.g. predator and conspecific fear) and exposure to this relationship effected a change in the behavior of the observer (e.g. mobbing behaviors). Studies that exemplify the conditioning effect due to stimulus enhancement include changes in the pecking behavior of Japanese quails (Akins, Klein & Zentall, 2002); in the mate choice during courting rituals by female guppies based on the color of the demonstrators that they observed (Dugatkin & Godin, 1992; Godin, Herdman & Dugatkin, 2005) and in alarm responses to danger by crayfish based on odors (Hazlett, 2007). In these studies, observation of a demonstrator exposes the observer to a relationship between stimuli and in turn, exposure to this relationship effects a change in the observer (Heyes, 1996, p. 208).

Learning through aversive contingencies

The phenomenon can also occur in aversive consequences, for example, the pairing of an object with the demonstrator’s fear response can lead to observational conditioning for an observer (Mineka & Cook 1998; Whiten & Ham, 1992). Mineka and Cook (1998) showed that when naïve, laboratory raised rhesus monkeys, who did not initially react fearfully to snakes, observed a wild breed monkey respond fearfully to a snake and acquired responses as a result the demonstrator reacting fearfully.

The previously cited research discussed mechanisms used by non-human animals required for basic survival. However, non-human animal behavior that has been discussed has
focused on the learning of behaviors that result in primary reinforcement. The fact that a non-human animal who does not observe and acquire skills specific to the survival of its species will result in an inability to adapt (e.g. starve, become injured) and most likely result in the organism’s death, confounds the comparison to human learning of conditioned reinforcers. Meaning that, humans acquire secondary reinforcers (e.g. hobbies, interests, past times) through observation that are not necessary to survive.

Researchers concerned with the basic science involved in human observational learning might find such mechanisms useful in their explanation of the phenomenon and applicable to the interventions used in their methods. Another discipline that uses the mechanisms to explain observational learning is social psychology and learning of new behaviors in groups.

**The Effects of Social Loafing, Social Facilitation and De individuation**

The focus of the literature that is summarized below is on observational learning phenomena described within a social psychology framework. To illustrate this perspective three phenomena will be described: social loafing, social facilitation and de individuation.

Social psychologists suggest that observational learning occurs based on the individual’s assessment of group benefits. When applied in social psychology the social learning paradigm does not account for the role of consequences when analyzing group behavior. The focus is on structure and amount rather than an analysis of group behavior based on function (Guerin, 1994). For example, the effect of the type of group (e.g. peers or strangers), number of people in a group (e.g. ten or twenty-five) or familiarity with the people in the group (e.g. close friends or strangers) are variables that are studied by social psychologists. When the arrangement of social consequences is considered, phenomenon such as: social loafing (Karau & Williams, 1993), social facilitation (Guerin, 1999) and de individualization (Postmes & Spears, 1998) can be
explained through observational contingencies. These paradigms are derived from theories such as the activation theory or arousal responses in relation to social facilitation (Zajonc, 1965); evaluation theory is discussed as a change in behavior as a function of the perceived assessment of others (Henchy & Glass, 1968), and attention theory amount of distraction present in the environment and competing with social contingencies (Zajonc, 1965).

**Social loafing.** Social loafing was defined by Karau and Williams (1993) as the “reduction in motivation and effort when individuals work collectively compared with when they work individually or coactively” (p. 681). Meaning that, the amount of motivation to complete a task varies based on whether that individual is part of a team, for example, to complete a project or completing the project independently. The occurrence of social loafing has been considered a negative influence on group behavior. As such, the research on this topic has been largely focused on identifying the key variables that contribute to social loafing effects, such as: identifiability of participants (Williams, Harkins, & Latane, 1981), for example, whether the participants believe they are anonymous to the group; the evaluation of their performance by either the group or experimenter (Brewer, 1995); task difficulty (Jackson & Williams, 1985), and the expectations of the co-workers (Williams & Karau, 1991). That is, the way that an individual behaves in a group is effected by the previously listed examples.

**Social facilitation.** Comparatively, social facilitation was defined as the tendency of an individual to behave differently in the presence of others than when alone. People perform better on simple tasks but worse on complex tasks when alone then when in the presence of other people (Guerin, 1999). That is, social facilitation occurs based on if participant is told that performance is being evaluated (or not evaluated) and the amount of task difficulty. Zajonc (1965) theorized that three approaches contribute to these facilitative and inhibitive effects:
activation or arousal, evaluation or assessment by the audience and attention or distraction effects in the environment.

De individuation effects. De individualization is defined as behavior change when individuals become part of a group. For example, an increased amount of aggressive, deviant, anti-normative or socially unacceptable behaviors are often observed in a group compared to when an individual is alone (Guerin, 1999). Theories of social identity hold that groups provide consequences that extend beyond the immediate circumstances. The impact of the group can be observed outside the group setting, and that social consequences are shaped not only by people in the immediate environment but also by variables that effect the intensity of these behaviors is the cohesiveness of the group, such as, identifiability of individuals to those outside the group, self-awareness both private and public and accountability of those who participate in the group (Postmes & Spears, 1998). Postmes and Spears (1998) stat that individual identifiability leads to greater social identity to those within the group. Hogg and Abrams (1988) suggest that, when alone, the personal or private standards of an individuals’ behavior are shaped through the social identity of the group to which the person belongs; that is, people may never truly be acting as individual agents.

These phenomena are important to an analysis of learning through observation as they are related to the contingencies that are present when teaching occurs. Social facilitation, for example, is considered by social psychologists as shifting in the arrangement of consequences to the group which can be explained from the behavior analytic perspective as the responses, of the individuals within the specific group context, are shaped by their histories of reinforcement and punishment.

From a behavior analytic perspective, the consequences that shape an individual’s behavior
are essential to an analysis of human behavior. Rather than test the function of the consequences of behavior with a group, social psychology has focused on the structure of the group, for example, whether the individuals in the group are identifiable or not. From a pragmatic view, social facilitation can be better explained when analyzed functionally. When defined functionally, social facilitation research shows that behavior change in one organism in the presence of another organism is a function of the contingencies (e.g. dimensions of behavior that are measured include changes in rate of responding) under generalized contingencies such as distraction effects or the generalized reinforcement for attending to others, avoidance of punishing consequences or to recruit social approval and as a function of a history of reinforcing consequences which increase responding under conditions where others are present (Guerin, 1994). Social facilitation is the reinforcement provided by one organism merely through their presence. Reinforcement is provided socially even if the other organism participants merely act as an additional stimulus in the environment.

**Peer Mediated Contingencies and Observational Learning**

Early research studies showed that neutral or previously aversive items could be conditioned as reinforcers based on the peer mediated contingencies in the environment (Blechman, 1983; Dorow, 1975, 1977, 1980; Greer, 1981; Greer, Dorow, Wachaus & White, 1973; Greer, Dorow Williams, McCorkle & Asnes, 1991; McCorkle, 1988; McCorkle, Sales & Greer, 1998; Randall, 1985). These studies found that based on the peer mediation and motivating operation of deprivation, the participant’s responses changed and that increased the reinforcement value of a stimulus.

Greer, et al. (2010) states that the three-term contingency exists in different contexts. Such contexts describe setting events defined as “all of the immediate contextual conditions
surrounding the operant” (p.10). This definition is consistent with Bijou and Baer (1961) in that it considers the operant (stimulus response) relation and its interaction with the environmental conditions. Setting events can also change previously existent relations or produce new operant relations. Applied studies with human animals have shown that setting events, especially ones that contain social variables (for example, verbal instructions from a teacher), can change behavior (Bleckman, 1983; Donley & Greer, 1993; Krantz & Risley, 1977; Steinman & Boyce, 1971).

Bleckman (1983) found that reading behavior increased for students identified as problematic readers as a function of systematic reinforcement (during isolated and class time) and manipulation of environmental variables (presence or absence of on-task peer during reading task). Multiple experiments were conducted; each consisted of adjusted setting events to shape reading behavior. In one experiment, turning a student’s chair and having the student observe a peer reading increased reading behavior for the student (Bleckman, 1983). McCorkle (1989) conducted a similar experiment but isolated certain operations to draw more specific conclusions. Like Bleckman (1983) who looked at setting events to explain the controlling variables; McCorkle (1989) hypothesized that the establishing operation (EO) was a setting variable worthy of further investigation. A dependent measure in the study was number of EOs per trial; results showed that EO to trial was indicative of whether the participants achieved criterion level responding on color identification tasks (McCorkle, 1989). The results for the participant in McCorkle (1989) significantly increased following an experimental condition where two other students and a peer were also labelling colors. Though the peers and students were under different stimulus conditions than the participant and the source of control for all responses were different, the modelling of correct responding and reinforcement by the teacher
of the model’s responses (vicarious reinforcement) could have been part of the establishing operation that resulted in the participants’ increased responding (McCorkle, 1989, p.72). Conclusions can be drawn from this study that suggest that differential reinforcement might be a controlling variable for the participant repeating the model’s behavior (McCorkle, 1989, p.5).

McCorkle (1989) also tested the effect of an establishing operation on in-seat behavior by removing the participant’s chair contingent upon out-of-seat behavior and requiring the participant to request his chair to sit down. The deprivation of the chair functioned to increase the participant’s in seat behavior. The reversal design showed that sitting occurred at a low rate until the student was deprived of the opportunity to sit. Deprivation functioned to change a stimulus from neutral to reinforcing especially when deprivation occurred in the presence of a peer (Bleckman, 1983; McCorkle, 1989).

The behavioral effects of deprivation and satiation are considered as part of the establishing or abolishing operation which was defined as, “any change in environment which alters the effectiveness of some object or event as reinforcement and simultaneously alters the momentary frequency of the behavior followed by that reinforcement” (Michael, 1982, p.151). Based on the brief examples cited above, establishing stimuli have a functional effect on behavior. For example, when applied to the use of vocal verbal behavior, studies that contrive relevant conditions of deprivation to elicit mands have been effective in demonstrating the establishing effect of response deprivation (Greer & Ross, 2008; Hall & Sundberg, 1987).

Greer, Dorow, Williams, McCorkle and Asnes (1991) used a peer-mediated procedure to increase food consumption for two children who were being treated for dysphagia and food refusal. The peer-mediated procedure was compared to an isolated modeling procedure. During the experiment, the peer-mediated operation showed increased food consumption when
compared to the modeling-only phase. The intervention was used for treatment of food-related disorders to offer an alternative procedure for treatment other than the operant and respondent treatment package by Lamm and Greer (1988) which was technical and time consuming; much like the observational conditioning procedure (Greer & Singer-Dudek, 2008) as an alternative to traditional pairing procedures. The theoretical value of the study had wider implications; the authors suggest that the peer-mediated procedure was more effective because it acted as an establishing operation (Greer, et al.,1991, p.789). The authors also note that differential reinforcement, vicarious reinforcement, and the model were not controlled for and could have had an effect (Greer, et al., 1991).

Donley and Greer (1993) showed that peer social exchanges were more frequently emitted when no adults were present in the room as compared to a condition when a teacher was present. The authors attribute this effect to the setting and audience control; that is, the absence versus presence of another individual, in this case, an adult in the environment acted to increase response deprivation (or create an establishing operation) for verbal exchanges to occur when the adult was absent from the setting (Donley & Greer, 1993).

Greer, McCorkle and Sales (1998) conducted a study to establish food as a reinforcer. They compared two experimental conditions. In the first condition, the participant was deprived of oat bran cereal and instead observed as the experimenter dispensed it into a garbage can as the participant responded. The second condition consisted of deprivation of cereal for the participant, except the cereal was given to a peer rather than put in the trash. When the cereal was thrown into a garbage can it did not become a preferred item. However, when the cereal was given to a peer, it became a preferred item. The effect of the peer’s presence was examined by including a condition consisting of throwing the cereal into a trash compared to the condition of delivering it
to the peer. The discarding of the cereal into the trash can resulted in levels of performance lower than baseline levels. The level of performance increased immediately with introduction of the peer; the change in the level of responding remained high for the entire phase (Greer, et al. 1998). Sales (1998) replicated the study to compare controlling conditions and test the enduring effects of the procedure. A pre-and post- treatment design was used, first a reversal design compared the performance of both participant and peer to demonstrate that a token was not a reinforcer. Based on the participants’ decrease in correct responses when tokens were delivered versus the known reinforcer, it was determined that the token was not a reinforcer (Sales, 1998). During the experimental condition when peers were present while the target individual was deprived of the stimuli (tokens) and they were delivered to the peer, tokens became reinforcers for all participants. This did not occur when a peer was not present to receive the tokens. Tokens remained conditioned reinforcers throughout the entire post-treatment setting. McCorkle (1989) stated that the peers acted as models for the participants behavior; however, the participants observation of the other students should not be confused with imitative behavior due to the fact that the participants emitted the modeled behavior under different conditions and at a later time then it was observed and the students who modeled the behavior were able to contact reinforcement for their correct responding and the participants who identified colors correctly after observing their model did not.

These data indicate peer presence was a variable that may affect the participant’s performance behavior (Bleckman, 1983; Greer, et al., 1991; McCorkle, 1988). The observing of the reinforcement operation or vicarious reinforcement could be considered as an explanation for the change in the participants’ behavior, but was only effective with a peer. Sales (1998) also notes that the target participants never received tokens in the peer’s presence but the reinforcing
effect was maintained after the treatment procedure across different settings (Sales, 1998). Like McCorkle (1989), Sales (1998) suggests that there are clear implications of the role of the peer in the conditioning effect. The deprivation of the participant while observing the peer contact a contingency that was not offered to the participant was an effect worthy of further investigation. Later, Singer-Dudek and Oblak (2013) tested the effect of peer presence using a similar observational conditioning procedure (Greer & Singer-Dudek, 2008) and found the same results. These data are described in more detail below.

These experiments demonstrated that the presence (or absence) of certain environmental variables are indicative of whether a stimulus can be conditioned as a reinforcer through observation. These studies showed that an altered setting and conditions allow certain contingencies to exist, and a stimulus can change in value from neutral to reinforcing, which was later identified as the “observational learning effect” (Greer, Dudek & Gautreaux, 2006, p. 493). Based on the results of the seminal study by Greer and Singer-Dudek (2008) a new body of research emerged that demonstrated the applied value of conditioning new reinforcers via observation.

**Observational Learning of New Reinforcers**

Research has shown that through observation, neutral stimuli can become reinforcers using a procedure that is time efficient and non-invasive in a typical learning environment (Greer & Singer-Dudek, 2008; Singer-Dudek, Greer, & Schmelzkopf, 2008; Singer-Dudek & Oblak, 2013; Zrinzo & Greer, 2013). Furthermore, educationally significant reinforcers can also be acquired using the conditioning intervention (Greer, Singer-Dudek, Longano & Zrinzo, 2008; Lee, 2016; O’Rourke, 2006; Singer-Dudek, Oblak, & Greer, 2011). These studies have provided evidence of the applied utility of the observational conditioning as a procedure to teach new
reinforcers.

Conditioning reinforcers through observation was first tested by Greer and Singer-Dudek (2008). Many researchers referred to observational learning as copying or imitation of a modeled behavior, however, this is clearly not imitation since the participants in the following studies could not see the peer’s behavior during the intervention (only the consequence that was delivered in response to that behavior) and therefore, could not merely be copying the behavior and then emitting the same behavior as an imitation response. To test the theory of conditioned reinforcers for humans through observation, the authors “tested whether small plastic discs or pieces of string that were not reinforcers initially would emerge as reinforcers from conditions involving the observation of peers” (Greer & Singer-Dudek, 2008, p. 17). Using a reversal design, the authors measured whether plastic discs functioned to reinforce responding to performance tasks and learning tasks. The reversal design included alternating phases comparing food, a known reinforcer, and discs or stings, initially neutral items. Each of the six participants was paired with a confederate during intervention sessions; they sat side-by-side divided by a partition and responded to an antecedent; the experimenter put a piece of string or disc into the confederate’s cup throughout the session. No item was delivered to the participant. Results showed that for all participants the intervention was effective in teaching the disc or string as a new reinforcer.

O’Rourke (2006) tested whether math activities could become reinforcing for participants and, if the math worksheets became reinforcing, would the participants increase their correct academic responses in math. An ABABA reversal design with pre-and post-tests tested for changes in reinforcement effects of math for performance tasks and pre-and post-test measures for learn unit - to - criterion were used to test for changes in the rate of acquisition of math
repertoires.

Greer, Singer-Dudek, Longano, and Zrinzo (2008) tested the emergence of vocal praise as a reinforcer as a function of observation using pre-and post-intervention functional analysis of vocal praise as a reinforcer for responses. Two pre-and post-intervention response assessments were used: an ABAB functional analysis involving comparisons of praise and edible effects on performance tasks and a baseline for three learning tasks involving use of praise for correct responses and corrections for incorrect responses. Following the observational conditioning intervention, the functional analyses were repeated and showed praise had acquired reinforcing properties.

Singer-Dudek, Oblak and Greer (2011) used a delayed multiple baseline design to test the effects of the observational intervention on establishing children’s books as conditioned reinforcers. During the observational intervention, picture books were delivered to the peer confederate following each of his or her responses to a matching task, no other form of reinforcement was delivered. The participant responded to the same task but was denied access to books or any other type of reinforcement (praise). When the peer started looking at a book the partition was removed so that the participant could observe the peer looking at the book. A functional relation was demonstrated between the observational intervention and the emergence of books as conditioned reinforcers for both types of tasks. These findings extended the findings of the previously cited studies by demonstrating the utility of this procedure in conditioning educationally relevant stimuli. Singer-Dudek, et al. (2011) showed that the books that were conditioned using this procedure, were reinforcers in the post-intervention conditions and in a generalized setting (free-play area) when other known reinforcers were available. This was the first study that had a dependent measure of choice because the participants’ behaviors were
measured when other reinforcers were present in a setting that was not part of the experimental setting.

*Why is this procedure effective in establishing new reinforcers?*

More recently, research has focused on identifying the variables that exert control over the behavior of the individuals during the observational procedure and the basic science to explain the effectiveness of this procedure (Oblak, Greer & Singer-Dudek, 2015; Singer-Dudek & Oblak, 2013; Zrinzo & Greer, 2013). These studies sought to determine the source of the conditioning effect and to answer the basic science question: why was this procedure effective in establishing new reinforcers for the participants?

Zrinzo and Greer (2013) tested whether the adult who delivered the stimuli to the peer during the intervention was the source of reinforcement for the stimuli. That is, in the absence of an adult, a mechanical device delivered the stimuli to a peer while the participant observed using the same observational procedure. Results showed that the stimuli still became conditioned reinforcers in the absence of the experimenter (when delivered by the device) and the stimuli functioned as reinforcers for learning tasks two months later for the participants. To test the presence of an adult, Zrinzo and Greer (2013) compared conditions when a stimulus was delivered from a mechanical device with no experimenter present and delivered by the experimenter. They found that when the adult was not present, the stimulus still acquired reinforcing value.

The presence of the peer was another possible explanation for the conditioning effect. Singer-Dudek and Oblak (2013) examined whether a pairing was occurring between the neutral stimulus and the peer, who may have been a previously established reinforcer for the participant. To test this hypothesis, one phase of the intervention was conducted without a peer present and
delivered the stimuli to an empty cup in front of an empty chair. The effects were then compared
to an intervention phase when the peer was present and seated next to the participant. Results
showed that the stimuli only became conditioned as reinforcers following the phase when the
peer was present. Singer-Dudek and Oblak (2013) suggested that the peers were a critical source
of reinforcement that was necessary for observational conditioning to occur.

Another aspect of the procedure that was a possible explanation for the conditioning
effect was the complete denial of access to the stimuli. All the prior experiments required the
participants to observe peers receive the stimuli from an experimenter or automatic device while
being completely deprived of ever accessing, touching or seeing the objects as his/her own until
the intervention was complete. Oblak, Greer and Singer-Dudek (2015) tested if the neutral
stimulus became a conditioned reinforcer using a delivery procedure. In the delivery procedure,
the participant delivered a neutral stimulus (metal nuts) to a peer when he or she heard a timer go
off. The participant’s delivery of the metal nut to the peer was not contingent on the peer’s
responses for looking at books or not because the participant could not see the peer’s behavior.
Results showed that the conditioning effect was still present even when the participant gave the
Despite the opportunity to touch and handle the stimuli and then giving them away, the stimuli
still became reinforcers showing that complete deprivation was not necessary for conditioning to
occur (Oblak, Greer & Singer-Dudek, 2015).

**Rationale and Educational Significance**

The applied research on social learning in human and non-human animals provides a
great deal of evidence to support the many advantages of being a social learner. Data have shown
that there are practical benefits to learning through observing others as well as survival value.
The less obvious questions are concerned with the strategies and the circumstances under which
individuals learn new repertoires as a function of observation. Skinner (1969) states that, “behavior is especially likely to become more conspicuous when reinforcement is contingent on the response of another organism” (p.180). The presence of others can be indicative of changes in consequences that are specified to one person or it can be a generalized change in consequences that occur in the presence of any people (Guerin, 1994). If learning new reinforcers through observation is a social phenomenon, then the confederate’s behavior is also an important variable to study. The studies conducted by Greer, McCorkle and Sales (1998) and Singer-Dudek and Oblak (2013) showed that the presence of another individual while experiencing deprivation caused non-preferred stimuli to become preferred whereas the same deprivation experience in the absence of the peer did not have the same effect. Oblak, Greer and Singer-Dudek (2015) suggested that conditioned reinforcement under observation conditions is a function of “paired deprivations” (p.10).

Participants in the current study were placed under different social conditions to assess whether new reinforcers were learned across two social conditions: 1) simultaneously delivering a neutral stimulus to both participant and confederate (reinforcement operation for both), and 2) reinforcers conditioned through deprivation (deprivation operation for participant, reinforcement operation for confederate).

For the experiments reported herein, social behavior can be defined as “behavior of two or more people with respect to one another or in concert with respect to a common environment” (Skinner, 1953, p. 297) and arises when one organism is important to another as part of its environment. The setting was arranged during the intervention to measure the degree to which each social condition altered the strength of the controlling variables of peer presence and deprivation.
Greer and Du (2014) argued that the onset of acquiring new reinforcers via observation is itself a social and verbal behavior developmental cusp. The individuals used as participants in this experiment were extremely sensitive to the presence of the confederate and to verbal stimuli (especially when they were emitted by confederates or any peer in the classroom); thus, the data should demonstrate clear extinction effects during the observational conditioning intervention.

A dependent measure of preference was used in this study that was not used in previous studies on learning new reinforcers through observation. The data that were collected during the pre- and post-intervention screening tests in the first experiment were considered a true measure of preference as the participants independently selected their backup reinforcers from a wide array of known items without experimenter interference. In addition, the present studies measured the confederate or peer behavior.

**Research Questions**

The research questions addressed in this study were: 1) Will the participant’s select the neutral stimuli when they are given a choice of other preferred reinforcers? 2) Were the confederates (or simply their presence) during the intervention the reason why neutral stimuli became reinforcers or was the deprivation operation necessary for reinforcement to accrue? 3) Does the confederates behavior change as a function of the intervention and do neutral items become conditioned reinforcers for the confederates?
CHAPTER II: Experiment I

Method

Participants

Three males and one female were participants and four males were designated to act as confederates in the experiment. All participants and confederates were between the ages of nine and twelve and had an Individualized Education Plan (IEP). All students in the experiment were selected from a New York State Education Department (SED) approved non-public, publically funded special education school located in Manhattan. As the largest school district in the United States, New York City Department of Education (DOE) serves approximately 1.1 million students in over 1,800 schools across five boroughs (http://schools.nyc.gov/AboutUs/schools/data/stats/default.htm), approximately 200,000 of these students receive public special education services and were determined eligible to attend a SED non-public school if the Committee of Special Education (CSE) agreed that no appropriate public school services existed for the student. There are only thirty-five schools across Brooklyn, Queens, Staten Island, Bronx and Manhattan that are SED non-public schools (paid for by the city). As such, the students who attended the school lived in different boroughs of New York City and some participants traveled up to 80 miles daily to get to and from school. This is important to note because it directly impacts the demographic information of the students in the experiment. The participants were extremely diverse due to vast differences in the physical location (i.e. neighborhood) where they lived, which was indicative of certain demographics (socio-economic status, ethnicity, racial or religious grouping, etc.). Such variables directly impacted each participant and comprised the history of experiences (cultural traditions at home, language capabilities, bilingual needs, exposure or non-exposure to different environmental
stimuli, living accommodations, methods of child rearing used, and values reinforced by the community that they lived) that shaped his or her behavior on a day-to-day basis.

The school grouped students by age (within thirty-six months), academic skill level and social repertoires. The school used a behavior analytic approach to instruction, curricular design and behavior management based on the Teaching Operations for Verbal Behavior (Williams & Greer, 1989) and Teaching Language to Children with Autism and Other Developmental Disabilities (Sundberg & Partington, 1998). The participants in this experiment were selected from two classrooms that used specialized pedagogy from the Comprehensive Application of Behavior Analysis to Schooling® Accelerated Independent Learner (CABAS® AIL) model (Selinski, Greer & Lodhi, 1991). The teacher and supervisor of the classrooms acted as the experimenter and second observer in this experiment. Both had mastery and calibration of implementation of CABAS® teaching procedures, assessments, protocols, and corresponding curricular objectives; held CABAS® Board Certificate Ranks of Master Teacher and Assistant Behavior Analyst and completed masters and doctoral courses in Applied Behavior Analysis and Verbal Behavior at Columbia University, Teachers College.

The experimenter used the Verbal Behavior Development Assessment (DVB) to determine where each student was on the verbal developmental trajectory (Greer & Ross, 2008) and the behavioral capabilities that were present (and necessary) to participate in the experiment based on the research in Verbal Behavior Developmental Theory (VBDT) (Greer & Du, 2014; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009). All participants could learn new operants as a function of observation, fluently respond in writing after reading written instructions, could learn incidentally through model demonstrations, and had the Naming capability. The participants in the first experiment did not have conditioned reinforcement for
behaving as social listeners and an audience (e.g. peers) did not function to change their behavior. Table 1 provides a description of each participant’s relevant cusps and capabilities.
<table>
<thead>
<tr>
<th>Participant</th>
<th>Age</th>
<th>Gender/Ethnicity</th>
<th>Type of Diagnosis (ASD)</th>
<th>Level of Verbal Behavior&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Relevant Domains&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Relevant Social Repertoires, Cusps/Capabilities&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Math, Reading, Oral expression, Naming, Observational Learning (New Operants), Conditioned Reinforcement Social Exchanges, Audience Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>M, AA</td>
<td>Educational</td>
<td>L,S,R,W,SE</td>
<td>6:2 4:8 3:8 Y Y N N</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>F, C</td>
<td>Medical</td>
<td>L,S,R,W</td>
<td>3:5 3:2 1:3 Y Y N N</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>M, C</td>
<td>Medical</td>
<td>L,S,R,W</td>
<td>2:8 3.0 1:2 Y Y N N</td>
<td></td>
</tr>
</tbody>
</table>

Note. Abbreviations were used for gender, ethnicity, level of verbal behavior and relevant cusps/capabilities. F=female, M=male, AA=African American, C=Caucasian, H=Hispanic; L=listener, S=speaker, R=reader, W=writer, SE=self-editor; Y=yes, N=no

<sup>a</sup> All participants had a diagnosis of Autism Spectrum Disorder, relevant to include whether a medical professional (e.g. neurologist) provided the diagnosis or an educational professional (e.g. school psychologist).

<sup>b</sup> More details on levels of verbal behavior and VBDT can be found in the following publications (Greer & Du, 2014; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009).

<sup>c</sup> Standardized Test Scores were taken from the Wechsler Individual Achievement Test–Third Edition (WIAT-III) which was conducted annually for each student. Only the domains relevant to the study were included and converted to a Grade Level Equivalent (GLE).

<sup>d</sup> Cusps/Capabilities were assessed using the DVB (Greer, 2007, 2008) and the social repertoires (conditioned reinforcement for social exchanges and audience control) were assessed using procedures from Verbal Behavior Analysis (Greer & Ross, 2008). A Y indicates that the cusp/capability was in repertoire and a N indicates it was not. Prior to the onset of the study, empirically tested protocols or procedures (Greer, 2002; Greer & Ross, 2008, Greer & Speckman, 2009; Greer & Du, 2014) were used to induce missing cusps/capabilities, a bold Y indicates the capability was induced using a protocol and a regular Y indicates the capability was in repertoire. A bold N indicates a protocol was implemented but was not effective in inducing the capability, a regular N indicates the capability was not present and no formal procedure was done to induce it.
Learn units (Albers & Greer, 1991) were used to teach academic skills across settings and were delivered in a variety of ways. Some examples of instructional settings included: direct LU instruction with one student and one teacher; model demonstration LU (Corwin & Greer, 2011) in small groups of two or three students; peer tutoring; choral responding in groups of two or more; and response cards or boards (Greer, 2002). The method of delivery was dependent on the student’s academic level, self-management repertoire, and the format of the curriculum that was used to teach a given skill (i.e. Corrective Reading© and Corrective Math© were scripted curricula used that prescribed the way that the teacher should deliver his/her antecedent). The participants took part in a class-wide token economy in which they traded tokens for backup reinforcers multiple times per day. More details are provided below on the token economy, backup reinforcers, and other materials or stimuli that were used for the experiment.

Participants and confederates chosen to participate in Experiment 1 frequently selected a variety of reinforcers from the school store and on average, did not select the same item for more than two consecutive days. To be chosen to participate in the study it was necessary that the individuals demonstrated the ability to contact delayed reinforcement by saving up their points across several days or weeks if the desired reinforcer was a large prize that was expensive. It was necessary for the participants and confederates to be able to transcribe numbers at a predetermined rate, complete simple addition and subtraction problems fluently and to follow written directions. The participants and confederates also had many reinforcers within their community of reinforcers and were motivated by many different types of stimuli. The data from the pre-intervention AB phases showed that when the NS was delivered consequentially for academic responding, the stimulus did not function to reinforce the task the participant was
completing. These data are reported below and compared to each participant’s rate of responding when the generalized reinforcer was delivered.

The individuals who were confederates during the experimental intervention were selected from the same classroom as the participants. The confederates had the same levels of verbal behavior as the participants and were chosen for the study using the same rationale and criterion as described above. The confederates demonstrated rule-governed behavior across settings both in and out of the classroom, which allowed the experimenter to prepare the confederates privately or in writing for the intervention. Based on the age and history of experiences of the participants in this study, it was possible that any of the participants could use inappropriate vocal behavior such as profanity toward the confederate or experimenter in response to certain contingencies. An intervention phase that included a contrived state of deprivation for the participant was an example of such a contingency. The experimenter needed to prepare the confederates to ignore these behaviors in case a participant became non-compliant or emitted inappropriate verbal behavior toward the confederate. The confederates were students who routinely acted as tutors during peer tutoring which involved giving corrections and appropriately responding even if the tutee did not respond well to being corrected. Tutors also had to demonstrate that they could accurately collect data and consequate the behaviors of peers for academic responding with 100% interobserver agreement (IOA) with a teacher for two consecutive weeks (Greer, 2002).

Setting

All experimental sessions were conducted in the participants’ classroom. The classroom was approximately 4 by 2 meters in size (350 square feet). Figure 1 shows the classroom where the experiment was conducted. The classroom had three rectangular blue tables, two desktop
computers, one desk for the teacher, one large whiteboard in the front of the room where tokens or points were publically posted by the students at the end of each day, one smart board, four book shelves, two closets, four teacher chairs, twelve individual student desks and chairs, classroom rules posted on the wall, one student of the week public posting, large clock timer and two storage shelves that were used to store and display reinforcers (Figure 2) that could be earned in exchange for points.

![Figure 1. The classroom where the experiment was conducted.](image-url)
Figure 2. Shelves that were used as the school store and back up reinforcers that were available to the students in exchange for points or money.

Pre-experimental sessions to test if a stimulus was neutral to the participant were conducted at the student desks. Intervention sessions were completed in an alcove that was in the back-right corner of the classroom at a rectangular table with two student chairs and one teacher chair (Figure 3). A partition was placed on the table to separate the participant and confederate who were seated side-by-side (Figure 4). The partition that separated the participant and confederate was on the table top. The participant could see the confederate’s body from his or her waist to feet, the confederate’s plastic cup, the participant’s own cup and the experimenter. The partition did not stop the participant from standing up and attempting to look at what the confederate was doing during the intervention. The alcove was separated from the rest of the classroom and was not visible to other students in the classroom. During intervention sessions,
the students in the classroom who were not participating in the experiment were completing independent work, silent reading or participating in small group instruction.

*Figure 3.* The alcove in the classroom where intervention sessions were conducted.
Figure 4. Partition used in Experiment 1.

Materials

Generalized Reinforcers. The known stimuli or generalized reinforcers were tokens (clear plastic discs, points (tallies) or money (quarters). During the A phase of the pre-and post-intervention sessions, the participant’s rate of responding to math problems was consequated by the experimenter delivering a generalized reinforcer. If the generalized reinforcer was money, the experimenter would drop a coin into a clear plastic cup directly in front of the participant contingent upon written responses to the math equations. If the generalized reinforcer was points, the experimenter would draw a tally on the participant’s point sheet to consequate responding (Figure 5). The point sheet was placed on the table or desk where a cup would be placed within arm’s reach of the experimenter. The cups used throughout the experiment varied in size and are shown in Figure 6.
Figure 5. Sheet used to record points that were exchanged during school store.

Figure 6. Clear cups used to hold the generalized reinforcer or neutral stimulus (NS) so that the items were visible to the participant.

Neutral Stimuli. The neutral stimuli used in the study were: white cotton balls, red twisty ties, base ten blocks, foam earplugs and gold fasteners. Table 2 shows pictures of each stimulus.
A neutral stimulus was randomly assigned to each participant (also listed in Table 2) prior to the onset of the experiment. Once the experimenter randomly chose which stimulus was assigned to the participant/confederate pair it was used during all phases of the experiment and dropped into a clear plastic cup shown above. The neutral stimuli were also present in the environment for the pre-and post-screening sessions. The neutral stimuli were placed in clear plastic sphere containers (Figure 7) that were then put in gumball machines (Figure 8). Figure 7 also shows examples of neutral stimuli (NS) and prizes that were used in the plastic spheres.
Figure 7. Clear plastic spheres used to keep neutral stimuli and prizes in the gumball machines.
Figure 8. Gumball machines used as the mechanism to deliver NS and prizes during pre-and post-intervention screenings.
Table 2

Neutral stimuli (NS) used in the experiment.

<table>
<thead>
<tr>
<th>Neutral Stimuli</th>
<th>Experiment 1: Participants</th>
<th>Experiment 2: Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1, 2, Peers 1, 2</td>
<td>7, 8, 9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3, Peer 3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participant 4, Peer 4</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>Participants 4, 5, 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>Participants 1, 2, 3</td>
</tr>
</tbody>
</table>


In Experiment 1, the class-wide token economy was differentiated to accommodate the discrepancies of self-management skills and missing prerequisite repertoires for some students. These discrepancies were addressed through by individualizing the token economy to address each student’s needs. Examples of this included; altering schedules of reinforcement and length of delay between the generalized reinforcer and opportunity for a backup reinforcer. The stimuli used as “tokens” were also varied based on student need, for example, tokens, tallies, coins and points were all used toward early back up reinforcers. Other self-management tactics from the behavior analytic research were used in the classroom to increase learner independence such as hero contingency, public posting, and other peer-mediated tactics to ensure learner independence (Greer, 2002).

Despite the need to individualize the class-wide token economy, all participants and confederates in Experiment 1 were accustomed to the use of generalized reinforcement (e.g. vocal praise, tokens) contingent on correct academic responding, self-management and good citizenship toward peers. The participants and confederate peers were all accustomed to earning these tokens and trading in for backup reinforcers. Backup reinforcers stored in the school store are listed in Table 3.

Backup reinforcers varied in cost and were routinely changed. Novel back up items were added and removed intermittently to ensure novelty and to prevent cessation. As such, the participants were accustomed to being told a given prize, game or activity was no longer available that week or day. The experimenter checked for highly desired items and inflated prices based on demand to further motivate the students. The backup reinforcers were listed on the school store menu which was written on the white board in the front of the room and posted on the shelf that held the backup reinforcers.
### Table 3

*Backup Reinforcers that were in the school store.*

<table>
<thead>
<tr>
<th>Games</th>
<th>Toys</th>
<th>Electronics</th>
<th>Activities</th>
<th>Prizes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Lego Figurines</td>
<td>I-pad</td>
<td>Beads</td>
<td>Erasers</td>
</tr>
<tr>
<td>Scramble</td>
<td>Hot</td>
<td>Computer</td>
<td>String/Lanyard</td>
<td>Pencils</td>
</tr>
<tr>
<td>Yahtzee</td>
<td>Wheels/Ramp</td>
<td>I-phone</td>
<td>Painting</td>
<td>Stickers</td>
</tr>
<tr>
<td>Uncle Wiggly</td>
<td>Bay Blades</td>
<td>Nintendo DS</td>
<td>Glitter Pens</td>
<td>Lego Sets</td>
</tr>
<tr>
<td>Boggle Jr.</td>
<td>Heroes</td>
<td>Basketball 3D</td>
<td>Large Sticker Pad</td>
<td>Slime</td>
</tr>
<tr>
<td>Twister</td>
<td>Angry Birds</td>
<td>Wii</td>
<td>Spirograph</td>
<td>Silly Putty</td>
</tr>
<tr>
<td>Connect 4</td>
<td>Lego blocks</td>
<td>Dance Revolution</td>
<td>GeoSticks</td>
<td>Sticky Hands</td>
</tr>
<tr>
<td>Uno</td>
<td></td>
<td>Bop It</td>
<td>Magnets</td>
<td>Bouncy Balls</td>
</tr>
<tr>
<td>Air Hockey</td>
<td></td>
<td>Revolution</td>
<td>Clay</td>
<td>Bracelets</td>
</tr>
<tr>
<td>Monopoly Jr</td>
<td></td>
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Mechanism used to deliver neutral stimuli and backup reinforcers. Gumball machines were used as the mechanism to deliver the neutral and backup reinforcers (prizes). The experimenter introduced the gumball machines as mechanisms to deliver prizes, provided opportunities for the students to use them as part of the school store routine and ensured the machines were visibly present daily. To control for novelty when the experiment began, the gumball machines containing prizes were added to the school store one month before the experiment. That is, the novelty of using the machines was a potential confounding variable if the machines were introduced at the same time as the NS it would be unclear whether the participant purchased a neutral stimulus as a demonstration of preference or as a function of interest in the machine.

To reliably conduct the screening tests such that there was no experimenter interference and to establish control to ensure that novelty was not an intervening variable in the experiment, the neutral stimuli and prizes from the school store were placed in gumball machines. By using the machines, the participants could access the items completely independently. To do this the participants exchanged points (25) for a quarter that could then be put in the machine that then dispensed the stimulus. The participants could use as many or as few points as they wanted the machines (e.g. 50 points = 2 quarters). If they chose to use points for quarters, they could use their remaining points for other items dependent on the number of points had left over. When the experimenter gave the student a quarter, the student could independently place the quarter in any of the gumball machines indicative of the preference for either a neutral stimulus or known
backup reinforcer (prize). Each gumball machine dispensed a different neutral stimulus or a variety of prizes that were in clear plastic spheres.

Worksheets. The dependent and independent variables were measured using the participants’ responses to math equations that were presented on worksheets. The worksheets were taken from the curriculum that was used in the participants’ classroom to teach mathematics. The math curriculum was Direct Instruction (DI) mathematics program Connecting Math Concepts (CMC; Engelman, Carnine, Kelly, & Engelmann, 1996a) that consisted of seven levels (A-F), each with 120-125 lessons. The curriculum also contained two independent supplementary materials: 1) independent worksheets that targeted and reinforced skills taught in the lesson and 2) math fact worksheets had component skills or math facts corresponded with the curriculum and provided additional exemplars of the math facts that were being taught during math instruction.

The worksheets were copied from the math facts workbook and the independent worksheets work book. The worksheets had a lesson number written on the top to identify which lesson they were to follow. For this experiment, the experimenter selected worksheets that corresponded to previously mastered lessons. To ensure that the behaviors measured were performance behaviors, worksheets were selected from lessons that were five or more lessons earlier than the participants’ current lesson (e.g. if participant was on lesson 30, worksheets were selected from 25 or before). Ten non-identical worksheets for were copied for the pre-intervention functional analyses and ten for the post-intervention from the math facts workbook. Each participant had an individualized set of copies based on his or her level of math performance at the onset of the study.
The copies were printed on 8.5 x 11-inch white computer paper in black ink. The math fact worksheets contained multiple exemplars of addition equations or subtraction equations. The worksheets were categorized by lesson and skill. The lesson number and target skill were written at the top in large black font and the objective was noted in smaller writing on the top right corner next to the word facts. For example, the worksheet for Lesson 4 had a bold header of Lesson 4 Plus 3s and in the right corner said Facts: +3, 3+. If the worksheet contained multiple objectives it was called Lesson R (review) and the word “mix” was written after the numerals. For example, Lesson R Plus Mix: 1s, 2s, 3s had Facts: +1, +2, +3, mix typed in the top right corner. Each worksheet had either horizontally written equations, numbers written side-by-side with symbols (plus or minus) between the first and second number and an equal sign after the second number, or vertically written equations, one number written under the other number with a line drawn under the bottom number and the symbol written to the left of the number. The sheets with horizontal equations consisted of forty-four opportunities to respond; the equations were written in 4 columns with 11 equations in each. The sheets with the equations written vertically, or with the numbers stacked on top of each other, had forty-five opportunities to respond; the equations were written in five columns with 9 equations in each.

The worksheets used to measure the independent variable were copied from the independent worksheet workbook from a previous level (Level A) that had been mastered by all students in the classroom and all participants and confederate peers in the experiment. This was done to provide additional experimental control during the intervention. Twenty randomly selected lessons were copied for all participants. The worksheets were randomly shuffled and each participant was told to select a sheet from his or her folder or pile at the onset of an intervention session. All the worksheets were novel to the participants but contained previously
mastered target skills with multiple exemplars presented in several mixed formats. Examples include: column addition and subtraction with three single digits or two double digits, fill-in equations missing numbers or symbols, writing numbers given T for tens and tallies for ones or solving addition or subtraction equations presented in horizontal fashion. Participants were given pencils to complete the worksheets. See Figure 9 for examples of these worksheets.

Other Materials. The experimenter used a timer, data sheet and pen to record data during the experiment. The previously described partition (Figure 4), point sheets (Figure 5) and clear plastic cups (Figure 6) were materials that were used in the experiment.
Dependent Variables

Two behaviors were measured to establish whether there was a relation between the intervention and the learning of new reinforcingers. The first was the number of times each participant choose to exchange generalized reinforcers (e.g. frequency count or tallies) for neutral stimuli. The participant’s choices were recorded to provide data that was representative of preference. That is, if a stimulus had reinforcing value it would be preferred (and chosen) over
a stimulus that had no value. Each opportunity to exchange generalized reinforcers (e.g. tallies) for a backup reinforcer demonstrated which stimulus (from an array of many stimuli) had the highest reinforcing value to the participant at that time. The data that were collected during the pre-and post-experimental screening tests were used to determine whether the stimuli used in the experiment were initially neutral and ultimately conditioned as reinforcers. These results were based on the cumulative number of times the stimulus was selected given an array of stimuli that were determined as reinforcers prior to the experiment as a function of each participant’s instructional history.

Rate of responding to math problems was also used to assess whether the neutral stimulus had acquired reinforcing value. The participant’s numbers of correct responses and incorrect responses per minute was compared when reinforcement conditions were rotated between a generalized reinforcer (A) and a neutral stimulus (B). A performance task was used to measure rate of responding and ensure that the learning of new operants was not a confound and ensured that rate of correct and incorrect responses indicated the degree of motivation that was present during each reinforcement condition.

Screening. The numbers of times each participant and peer selected a neutral item from an array of backup reinforcers was measured during the pre-and post- experimental screening tests. The behavior was defined as selecting a neutral stimulus from an array of stimuli in the school store by putting some, all, or no quarters into a gumball machine. The screening tests were conducted during the school store period. All students were given the opportunity to exchange points for backup reinforcers. As noted above, a point system was used in the classroom and points were earned throughout the day as generalized reinforcement for academic responding and good citizenship. Each student had a point sheet that was used for one week. The
backup reinforcers that are in the school store vary in point value from ten points to one hundred and five hundred points. Backup reinforcers were stimuli that functioned to increase or maintain each participant’s performance and/or learning behaviors; access to these reinforcers was controlled by the generalized reinforcer used in the class-wide point system. Based on the amount of points earned, the student(s) could select any item that was on or below their earned point value (or multiple items that add up to their total value). The backup reinforcers were in the school store and were stored on shelves; prizes were stored in gumball machines. The neutral stimuli were added to the school store and stored in gumball machines. A neutral stimulus was defined as an item with no value to the participant or peer that did not influence the participants’ behavior, as determined by the pre-and post-experimental measures described below. The screenings were designed to provide an additional measure that demonstrated whether the stimuli were in fact non-preferred prior to and following the intervention. A stimulus was considered truly reinforcing when it was chosen from an array of other previously established competing reinforcers in a natural setting.

Each screening test was one school store opportunity or session. The participants were screened a total of twelve times prior to intervention and twelve sessions after each intervention phase. The screenings were conducted as part of the participant’s daily routine; responses were measured during the school store period, which was a twenty to thirty-minute period at the end of each school day. School store was implemented at the onset of the school year, as such, the procedures and routine involved in this reinforcement system time were not novel to the participants.

*Rate of Responses to a Performance Task.* The participants’ rate of responding to a performance task was used as the dimension of measurement to determine whether the
participants were motivated to complete the task when reinforcement conditions were rotated between generalized reinforcers (A) and neutral stimuli (B). A performance task was defined as a skill that was in the participant’s repertoire. For example, single digit addition problems were used as the performance task in this phase of the experiment. Each participant’s number of correct responses per minute (CPM) and incorrect responses per minute (ICPM) to math equations was calculated. A math equation was defined as a single subtraction or addition equation. The presentation and difficulty of the math equations varied between conditions and participants, all equations were presented on worksheets. All math objectives chosen for the study were repertoires that the participants had met criterion on prior to the onset of the study. The worksheets were considered performance tasks.

The experimenter chose to use performance rather than learning tasks to ensure that learning new math repertoires was not a confounding variable. As such, if the participant responded incorrectly or not at all, the experimenter could have concluded that it was not a function of the difficulty of the task, rather the effectiveness of the stimulus being delivered as a reinforcer. It is important to note that the task itself (completing a math worksheet) was not a conditioned reinforcer (responses were not naturally reinforcing or conditioned as reinforcing).

The worksheets were chosen and individualized based on each participant’s present level of functioning in math instruction. Pre-determined criteria were in place for all participants’ academic instruction prior to the experiment and remained consistent for the duration of the study. The mastery and rate criterion for each participant in math was also individualized based on their individual academic programing. That is, if it was determined that a student required two rather than one session of 90% correct to ensure mastery prior to the onset of the study, the instructional tactic remained in place. Rate criterion was determined by the number of digits per
minute each participant could write. This was assessed at the onset of the school year for fluency instruction. The participant’s rate criterion was not used for data collection purposes. However, it did allow the experimenter to make informed decisions about trends in the data during pre-and post-experimental phases, such as, when each condition should be terminated.

The experimenter recorded the amount of time (in seconds) required for the participant to complete the worksheet in each session. A response was considered correct if the participant accurately solved the equation, as demonstrated by the numeral written underneath or next to the math equation. A correct response was defined as writing the correct Arabic number for a given single digit addition or subtraction equation (e.g. 4 + 5 = 9). An incorrect response was defined as writing the incorrect number, a letter, a drawing or no response at all when given a single digit addition or subtraction equation (e.g. 5 – 4 = 2). After each session, the experimenter calculated the rate by counting the number of equations that the participant responded to correctly and dividing the total correct responses by the time (in seconds) for correct responses per minute. The total number of responses that were incorrect was also divided by the time (in seconds) for incorrect responses per minute. Responses were compared across two phases. During phase A, a tally or point was delivered to the participant to consequence correct responding. During phase B, a neutral stimulus was dropped into a clear plastic cup in front of the participant to consequence correct responding.

One math worksheet was used to measure each participant’s rate of responding during each session of the pre-and post-intervention phases to assess whether neutral stimuli acquired reinforcing value. It is important to note that even though the skills (math objectives) that were chosen to assess the dependent measures were in repertoire and considered performance behaviors, the worksheets that were used were completely novel to the participants. That is, the
skills presented on the worksheets were functionally equivalent to previously used worksheets but structurally different, as the math equations always appeared in a novel format. For example, the order, the position of the numbers, and the numbers used in each exemplar was varied. No worksheets were identical to worksheets completed prior to the experiment nor were the worksheets used repeatedly during the experiment. Each worksheet was only used for one session per participant.

Independent Variable

The environment was arranged to compare participants’ rate of responding across two experimental conditions. Participant 1 completed a performance task under the observed pairing condition while Participant 2 completed a performance under the observational intervention condition. The intervention was considered completed based on a steady state of low levels of correct responses and high levels of incorrect responses. When this occurred for either participant, the phase was terminated for both participants regardless of the experimental condition.

The intervention in this study was the manipulation of the experimental setting during the sessions. Two experimental conditions were used to explore the extent to which the presence of a peer during intervention effected the participant’s performance. In both conditions the participants and a confederate peer were given directions to complete a math worksheet. During the observed pairing condition, the experimenter simultaneously delivered a neutral stimulus to the participant and peer non-contingent on correct responses. During the observational intervention condition, the experimenter delivered the neutral stimulus to only the peer while the participant was present and could observe the delivery of the item. The response definitions and
measurement parameters were the same across both conditions as were the instructions given to the participant and confederate about the task that they were completing.

The behavior measured for across both experimental conditions for all intervention sessions was rate of responding to a variety of math skills, presented on a worksheet, that were considered performance behaviors. All worksheets were targeted skills that were taught during math lessons that were mastered by the participant and peer prior to the experiment. Identical to the pre-and post-intervention functional analyses, the tasks were presented on worksheets that targeted skills that were taught in the student’s math curriculum. Each participant was given a different worksheet individualized based on the lessons that had been previously mastered during math instruction. All participants had previously achieved mastery criterion on the math lessons that corresponded to the worksheets used (90% correct responding or better across 1 lesson). Though the skills were in repertoire, the math problems on the worksheets were novel exemplars that differed in form but exemplified the same functional repertoires. Completion of one worksheet was considered one session or intervention trial. All sessions were timed to calculate rate per minute. After each session, the experimenter calculated the rate correct by counting the number of problems that were answered correctly and dividing the total by the time (in seconds) for correct responses per minute and the total number of incorrect responses divided by the time (in seconds) for incorrect responses per minute. For this study, incorrect responses were not consequated as feedback could not be provided during the intervention sessions. Since the worksheets were performance-based and not learning, an immediate correction was not necessary. It was assumed that writing an incorrect response or no response at all was a function of lack of motivation not difficulty of skill.
Several types of math skills were presented on the worksheets. Each type of problem had multiple exemplars, none were identical. Examples of the skills targeted on the worksheets included: single digit addition/subtraction, double digit addition/subtraction, place value, number lines and fill-ins.

A correct response to single and double digit addition or subtraction equations was defined as the participant solving and transcribing the accurate sum or remainder of the given addition and/or subtraction equation legibly and with appropriate placement (after the equal sign or underneath the problem) as an Arabic numeral such that a naïve scorer was able to mark the responses blindly (no history with the students and their handwriting repertoires) and without assistance from the experimenter. An incorrect response was defined as the participant transcribing an Arabic numeral that was not the accurate sum or remainder, writing a letter, symbol, scribbling, misplacement of the number so it did not correspond to a problem or leaving the space blank and not writing an answer at all. For equations with two digits, responses with one correct digit and one error (e.g. number written in ones column is correct but number in tens is incorrect) were marked as incorrect; that is, the complete Arabic numeral was considered one response, each digit was not counted as a separate response.

For place value, a correct response was defined as transcribing an Arabic numeral that was labeled and printed in a grid on the worksheet to column format with accurate placement in each column to signify identification of the digit place value (hundreds, tens and ones columns). An incorrect response was defined as incorrect placement of one or more digits in the column, only transcribing one digit or transcribing an additional digit, placement of the Arabic number outside of the designated column, transcribing a number without one to one correspondence with the original number, writing a letter, symbol, scribbling, or not writing anything at all.
For equations with a missing component, a correct response was identifying the missing component of the equation (symbol or number) and writing it in the appropriate place such that the equation was written correctly. An incorrect response was defined as not identifying the missing symbol or number and leaving it blank, writing an incorrect symbol or number in the equation or any other writing that did not directly correspond with the given equations.

Intervention was considered complete when a steady state of responding was observed. The experimenter also matched the number of intervention sessions for participants under the simultaneous delivery condition with the participants in the deprivation condition. That is, the participant’s rate of responding under the observational intervention condition was used to determine criterion for participants who were under the observed pairing condition. For example, if Participant 2’s data were descending and reached a low but steady state of responding after 5 sessions then the intervention for Participant 2 and Participant 1 was considered complete even though Participant 1 was under the observed pairing condition. If the number of sessions was not adequately monitored and controlled in the observational intervention condition, the participant could potentially emit physically aggressive behavior toward the peer, due to the deprivation that was included in this condition. Some examples from the experiment included: grabbing for the plastic cup, pushing over the partition, making loud vocal sounds, banging on the table and using profanity. In addition to the obvious ethical considerations that required the experimenter to control for and to ensure that the number of sessions did not exceed what was necessary to collect reliable data, the data collected during the screening tests included the peer. As such, if there were repeated instances when the participant’s verbal behavior was consistent with the previously listed aggressive behavior within a session, the session was terminated and the participant’s data were not included.
Data Collection

The experimenter observed the students during the school store period and recorded the backup reinforcer or neutral item that was selected by each student on a data sheet. The experimenter recorded these data for all students in the classroom; even those who were not target participants in the experiment, as they were part of the social environment and naturally occurring social conditions of the classroom. Twelve screenings were conducted across a five or six-day period to ensure that the data were consistent and that the neutral stimuli were not selected purely because they were novel, as this would be a confounding variable. Data were recorded for twelve sessions prior to the onset of the functional analysis for the reinforcing properties of a neutral stimulus and after the functional analysis was completed.

A frequency count was used to measure the numbers of times each target participant and peer selected a neutral item from the school store. Data were recorded by making a tally mark next to the participant’s number that indicated which stimulus had been chosen. The data sheet had a list of the neutral items and each day the experimenter noted on the data sheet the other backup reinforcers that were posted on the school store menu. During the school store period, the experimenter observed and recorded a tally or tallies as described above. All selections or choices were recorded even if multiple selections were made within a session or the participant or peer selected and then decided to change the original selection (and had enough points to do so). At the end of the pre-and post-screening periods, all the data from the sessions was totaled and reported as number of selections out of total opportunities.

Data were collected during the pre-and post-functional analyses as the number of correct and incorrect responses per minute to a math worksheet that contained simple addition and subtraction math equations. At the end of each session, the experimenter wrote the number of
correct responses and incorrect responses for each participant as correct over incorrect (e.g. 22/1) on a separate sheet of paper next to the participant’s number. This was done to ensure that the experimenter did not transcribe any marks on the permanent product (worksheet). The sessions were timed and numbers of correct and incorrect responses per minute were calculated by dividing the number of correct responses by the total time (in seconds) and the number of incorrect responses was divided by the total time (in seconds).

Intervention data for the independent variable were collected on the participants’ correct and incorrect responses per minute. As described above, the experimenter calculated rate by dividing the number of correct responses by the time for correct responses per minute and incorrect responses by the time for incorrect responses per minute. These data were recorded on a separate data sheet and the permanent products from the session were saved in a folder so that a second, independent scorer could conduct inter scorer agreement at the end of the school day.

**Design**

The experiment used a pre-and post- experimental screening test was used to measure preference and to establish stimuli as initially neutral for each participant and confederate. An AB design was used as a pre- and post-intervention functional analysis of the reinforcing properties of neutral stimulus (B) compared to a generalized reinforcer (A). The dependent measures were delayed across participants 1,2 and 3,4. The intervention conditions were counterbalanced across participant 1,3 and 2,4.
Procedure

Experimental Sequence

*Pre-Experimental Screening Tests.* First, the experimenter screened all participants and recorded the number of times, given 12 opportunities, that neutral items were selected from an array of backup reinforcers. Several opportunities were provided to ensure that the participants did not select the neutral items based on novelty. During the screening the neutral stimuli were placed in the school store in gumball machines. The experimenter arranged the school store such that the participants could independently access the contents of the gumball machines by feeding their money into the machine and turning the metal lever causing the machine to dispense the item. Each day the participants added the points that they had earned for the day and they publically posted the total number of points on the classroom white board then selected a backup reinforcer from the school store. Based on the points earned, the students could choose any item listed on the menu for the day and use it for the period (e.g. playing on the computer or free time in the leisure area) or to buy a prize and take it home if they had enough points (equal to or greater than) for the item. Based on the participants’ history of experiences and level of self-management skills they could complete the routine independently. The experimenter did not emit any vocal verbal directions or comments that indicated to the participants that new items had been placed in the store. The experimenter was not involved in the delivery of the item. That is, no additional instructions or supervision was needed. For this experiment, this ensured that there was no interference by the experimenter and that the data reflected the participants’ preferences. As such, the measure of preference was considered evidence that the neutral stimulus did not function as a reinforcer prior to the onset of the experiment. If the participant were to select the neutral stimulus during the pre-experimental screening for multiple, consecutive sessions the
data would reflect that the stimulus was not neutral and could not be used during intervention. However, if the stimulus was selected less than three times during the pre-experimental screening, data would support the use of the neutral stimulus during intervention as it had no significant value to the participant.

Pre – Experimental Intervention Analyses: Rate of Responses to Math Problems

Baseline data were collected on the rate of correct and incorrect responses to a performance worksheet. Data were collected across two phases, during phase (A) a generalized reinforcer was delivered for the participants’ written responding to the math worksheet and during phase (B) a neutral stimulus was delivered as the consequence for written responding to the math worksheet. If the data from these sessions showed a significantly higher rate of responding when a generalized reinforcer (A) was delivered versus a neutral stimulus (B) and the pre-experimental screening test demonstrated that the participant did not prefer the neutral stimulus over other known backup reinforcers, it was determined that the stimulus had no reinforcing value to the participant and the stimulus could be used during the intervention conditions.

The order of the phases was randomly assigned to the participants. Participant 1 and Participant 4 began with the A phase followed by the B phase. Participant 2 and Participant 3 started with the B phase followed by the A phase.

At the onset of each session, the experimenter provided the participant with a worksheet and pencil and started a timer. The first session began with the experimenter requesting that the participant come sit at an empty desk. All the students in the classroom were completing independent seatwork at the time of the functional analyses. The experimenter allocated an empty desk to be used for the performance task. All the students were seated at a desk or
working independently and the experimenter was seated in the center of the desks which were arranged in a horseshoe shape. The experimenter asked the participant to bring his or her money jar or point sheet to the empty desk. The participant sat down at the desk directly facing the experimenter such that compliance resulted in the experimenter delivering a point or coin during phase A and a neutral stimulus during phase B therefore for following directions and to evoke a vocal tact by the participant. It was expected that the participant would say, “money for school store!” or “points for school store!” when this occurred. In the first session of Phase B, the neutral stimulus was delivered for following directions. If the participant did not respond when the neutral item was presented or responded with a tact that was incorrect or asked, “what is this?” the item was considered neutral and the session began. If the participant could tact the item correctly it was not considered neutral and the experimenter selected a different neutral item (Table 2). This setting was contrived to ensure that the participant was unable to identify the neutral stimulus in tact form, thus to demonstrate that there was no history of experiences between the participant and the stimulus. That is, the participant had never encountered the stimulus prior to the experiment.

A worksheet with written math problems was placed in front of the student on his or her desk. Math problems were provided in written form and all answers were required to be written as well. The experimenter provided the vocal antecedent, “please begin.” While the participant completed the worksheet, the experimenter used a generalized reinforcer (Phase A) to consequeate the participant’s responding and a neutral stimulus was provided as the consequence for responding in Phase B. During both phases the stimuli were delivered intermittently and were not dependent on whether the participant responded correctly or incorrectly. Sessions were repeated until the participants were responding at a steady state across at least 3 sessions. No
vocal or non-vocal form of reinforcement or correction was provided other than the delivery of
the generalized reinforcer (A) or neutral stimulus (B). When the participant had completed the
worksheet he or she gave thumbs up and the experimenter stopped the timer and told the
participant to return to his or her seat work. The experimenter collected the worksheet, calculated
the rate and recorded it on a separate sheet of paper. The worksheet was then stored such that a
second scorer could calculate rate and compare their scores for inter scorer agreement.

The experimental conditions started once both functional analyses and screening tests
were completed and the data demonstrated that the stimulus was neutral and had no reinforcing
value to the participant. Multiple potentially neutral stimuli were selected (Table 2) prior to the
experiment so that if one stimulus was known to a participant the experimenter could select a
different stimulus to be used. The stimulus used during the pre-experimental conditions was used
during the intervention conditions.

*Experimental Intervention Conditions.* Two experimental conditions (were used to assess
the effect of the social environment on learning new reinforcers. Both conditions included one
target participant and one non-target peer. In both conditions, the participant and the peer were
seated at a table side-by-side and separated by a partition. The participant was blocked by the
partition from observing the peers’ facial expressions, gestures and written responses. The
participant could, however, see the clear plastic cup that was placed at the edge of the partition
directly in front of the peer. The participant also had a clear plastic cup in front of him or her.
The cups were used as containers for the experimenter to deliver the neutral stimulus to the
participant, peer, or both during the session. Two participants began with the observed pairing
condition and two with the observational conditioning intervention.
Simultaneous delivery of NS. The participant and peer sat side-by-side at the table as described above. The clear cup, a worksheet and a pencil were given to both the participant and peer by the experimenter. The experimenter sat at the center of the partition across the table facing the participant and peer. Both the participant’s cup and the peer’s cups were within arm’s reach of the experimenter. At the onset of the session, the experimenter gave the vocal verbal direction, “please begin,” and started a timer. The experimenter delivered the neutral stimulus to both the participant and the peer intermittently throughout the session if they were attempting to respond to the math exercises that were presented on the worksheet. If both participant and peer stopped responding completely, no stimulus was delivered. As noted above, the participant could not see the peer writing responses, facial expression, gestures or any other movements above the table and vice versa but was able to see the other student’s clear plastic cup (and its contents). When the participant had completed the worksheet, he or she signaled to the experimenter, the experimenter stopped the timer, recorded the time on a separate data sheet and collected the worksheet from the participant and the peer regardless of whether the peer was finished. If the peer finished before the participant, the experimenter waited for the participant to complete the worksheet to stop the timer and had the peer read a book or do an additional worksheet. No other forms of praise or corrections were provided during the session. The experimenter ignored all vocal verbal behavior emitted by the participant or peer about the stimuli in the cup.

Reinforcers conditioned through deprivation. This condition was a replication of the procedure used in previous studies (Greer & Singer-Dudek, 2008; Singer-Dudek & Oblak, 2013; Singer-Dudek, Oblak & Greer, 2011; Singer-Dudek, Greer, & Schmelzkopf, 2008; Zrinzo & Greer, 2013). The experimental conditions were arranged identically to the observed pairing. However, the participant’s responses were not consequated with the delivery of a neutral
stimulus into a cup but the peers were. The experimenter never delivered the neutral stimulus to the participant but did drop neutral stimuli into the peer’s cup during each session.

As in the first condition, the participant and confederate sat side-by-side at a table but were separated by a partition that was placed on the table top and prevented the students from observing each other’s responses, gestures, or facial expressions but they could see the translucent cups that were at the edge of the table on either side of the partition. In addition to a cup, the participant and peer had a worksheet and a pencil. The experimenter sat across from the students at the center of the table where the partition was placed. Both participant’s and peer’s cups were within arm’s reach of the experimenter. At the onset of the session, the experimenter gave the vocal verbal direction, “Please begin,” and started a timer. As in the first condition, a neutral stimulus was delivered to consequence responding by the experimenter dropping the item into a cup. Unlike the first condition, the experimenter did not deliver the stimulus to both participant and peer, rather, delivered the neutral stimulus to the peer only during each session. The participant did not receive the neutral stimulus at any point during the intervention sessions but could observe the peer’s receipt of the neutral stimulus. When each session was over, the participant and peer were given access to their cups; the participant’s cup was always empty.

The criterion was determined by steady state responding at low levels by the participant. As in the previously cited studies, the vocal verbal behavior emitted by the participant was also a measure used to establish criterion during intervention sessions but only anecdotal data were collected on this measure. The participant’s vocal mands (e.g. “where’s mine?” “I want one,” “give me that,” etc.) and non-vocal mands (e.g. grabbing the confederate’s jar, knocking his jar off the table, attempting to grab the experimenter’s hand as she delivered the stimulus) and disapprovals toward the peer (e.g. “You’re wrong,” “You suck,” “Stop stealing my gold”) were
considered in determining criterion for the completion of the intervention. Throughout all intervention sessions, the experimenter ignored all behavior (vocal and non-vocal) emitted by the target participant and continued to deliver the neutral stimulus to the peer. The experimenter also ignored any behavior emitted by the peer (e.g. in response to the participant, tacts of receiving the stimulus) including any attempts to touch or play with the neutral stimuli that were in the cup or being dropped into the cup. Upon completion of the intervention, post-intervention measures were conducted for preference for neutral stimuli during screening tests and rate of responding during the post-intervention functional analyses.

Post-Intervention Procedures for Dependent Variables: Screening Test and Rate of Responses to Math Problems. The post-experimental screening test was also completed for selection of the neutral stimulus given the array of backup reinforcers. The screening was identical to the pre-experimental screening and the behaviors of both participant and peer were measured. Twelve screening sessions were conducted as the post-screening test for all participants, however, it should be noted that Participant 1 and Participant 3 had two additional screening sessions, each consisting of twelve opportunities, following the observed pairing condition and before the onset of the observational intervention condition. The screening tests were structured as part of the classroom’s daily routine. That is, the experimenter measured the selection of neutral items during the period that was designated for trading in generalized reinforcers for back up reinforcers each day, thus, additional opportunities were not contrived or added. As such, the additional screening test (out of 12 opportunities) was done to ensure that the data were consistent and at a low level before beginning the observational intervention condition. The post-intervention functional analysis was identical to the pre-intervention functional analysis procedure described above. During the (A) phase, a generalized reinforcer was delivered
to the participant to consequate responding and during the (B) phase, the neutral stimulus was delivered to measure if it had acquired reinforcing value as indicated by a change in the participant’s rate of responding. The materials used were identical to the materials used during the pre-intervention functional analysis. Participant 1 and Participant 3 had two additional phases, the data following the observed pairing condition showed no significant increase in rate of responding so participant 1 and participant 3 repeated the procedure, in an identical fashion to the description above. To replicate the evidence from participant 2 and participant 4, rather than repeat the observed pairing which was not effective, the experimental condition used was the observational conditioning procedure. That is, the procedure described above was completed for all four participants and then repeated for participant 1 and participant 3 only and the observed pairing condition was replaced with the observational intervention condition when the sequence was repeated.

Interobserver Agreement (IOA) and Interscorer Agreement (ISA)

IOA Dependent Variable 1: Screening tests

Interobserver agreement (IOA) for the data that were collected during the pre-and post-intervention screening tests were calculated using trial-by-trial IOA (Cooper, Heron & Heward, 2007). Two independent observers recorded behaviors emitted during the screening tests. After each session was complete, the two experimenters counted the number of agreements and disagreements across the session. The number of agreements was divided by the total number of agreements plus disagreements and multiplied by 100 to calculate a percent agreement. During the screening test, the experimenter and a second data collector observed as the students exchanged their points for a backup reinforcer(s) and independently recorded a tally mark in the row of the data sheet that corresponded to the stimulus chosen, under the column heading that
corresponded to the participant’s or peer’s assigned number. When the screening test (school store period) was finished, the experimenter and observer compared their data to calculate IOA. For example, if Experimenter 1 recorded 3 tally marks for Participant 1 and Experimenter 2 recorded 4 tally marks for Participant 1, there would be 3 agreements and 1 disagreement for a total agreement of 75%. It should be noted that data was initially collected for all stimuli present during the screening (e.g. a tally was recorded for any stimulus chosen not just the neutral stimuli) but were ultimately reported and presented in graphic form as 0/1 or 1/1 for each screening test session. That is, if Participant 1 selected a neutral stimulus during the session it was recorded as 1/1 and if Participant 2 selected computer time it was recorded as 0/1. Due to this limitation in experiment 1, the IOA for screening tests was either 0 or 100%. That is, if the experimenter and observer agreed that a neutral stimulus was chosen there was 100% agreement and if they did not agree there was no agreement or 0. Adjustments were made for this measure to be more precise in experiment 2. It should be noted that participants 1, 3 and peers 1, 3 had two sets of pre-and post-screening tests as both experimental conditions were conducted with these participants due to the data that were recorded after the first condition (see results). For participants 1, 3 and peers 1, 3 the total opportunities for IOA was out of 24 screening tests pre-experimental sessions and 24 screening tests post-experimental sessions. For participants 2, 4 and peers 2, 4 the total opportunities for IOA was out of 12 screening tests pre-experimental sessions and 12 screening tests post-experimental sessions. Across all participants and peers in experiment 1, IOA was collected for 75% of screening tests conducted with a mean of 100% agreement. Table 4 displays the mean percent agreement for each participant and each peer. Range of scores was not included in the table for the reasons described above.
Table 4.

Percentage of sessions that interobserver agreement was calculated for pre-and post-screening tests. Mean percentage of agreement for all participants and confederate peers for pre-and post-screening tests.

<table>
<thead>
<tr>
<th>Participant</th>
<th>PRE- SCREENING TEST</th>
<th>POST- SCREENING TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of sessions</td>
<td>Mean</td>
</tr>
<tr>
<td>1</td>
<td>83.30%</td>
<td>95%</td>
</tr>
<tr>
<td>2</td>
<td>100%</td>
<td>75%</td>
</tr>
<tr>
<td>3</td>
<td>79.16%</td>
<td>78.94%</td>
</tr>
<tr>
<td>4</td>
<td>83%</td>
<td>70%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Peer</th>
<th>% of sessions</th>
<th>Mean</th>
<th>% of sessions</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>83.30%</td>
<td>85%</td>
<td>83.30%</td>
<td>95%</td>
</tr>
<tr>
<td>2</td>
<td>100%</td>
<td>75%</td>
<td>83.30%</td>
<td>80%</td>
</tr>
<tr>
<td>3</td>
<td>75%</td>
<td>88.89%</td>
<td>91.67%</td>
<td>77%</td>
</tr>
<tr>
<td>4</td>
<td>91.67%</td>
<td>54%</td>
<td>83%</td>
<td>80%</td>
</tr>
</tbody>
</table>

ISA Dependent Variable 2: AB phases

Inter scorer agreement (ISA) was used as the measure of fidelity for pre-and post-intervention sessions and the intervention sessions. Rate of written responses was the dimension of measurement used during baseline sessions, intervention conditions and post-experimental sessions. As such, the permanent products (e.g. written answers to math equations) were used to
calculate percent of agreement for each worksheet completed by each participant. The worksheet used during each session was collected once the session was complete and scored by the primary experimenter. On a separate data sheet, the experimenter recorded the duration in seconds, total number of responses, number of correct responses and number of incorrect responses. No marks were made on the worksheet to indicate which responses were correct or incorrect. The worksheets were saved after the session was complete and given to a second scorer who independently scored the worksheet and recorded total number of responses, number of correct responses, and number of incorrect responses on a data sheet. ISA was then calculated by counting the number of agreements for each worksheet and dividing by the number of possible agreements (or total number of responses).

Table 5 displays mean percent agreement for written responses across experimental phases for each participant. As with dependent variable 1, an additional A phase and B phase were conducted for participant 1 and 3. ISA was calculated for all sessions for all participants, however, participants 1 and 3 had 30 sessions and participants 2 and 4 had 20 sessions. In addition to the individual inter scorer data that are presented in table 5, all sessions of the AB phases were videotaped such that a second observer could review the videotaped sessions after the sessions were finished. To ensure procedural fidelity, inter observer agreement was conducted on the primary experimenter by two independent observers on the experimenter’s behavior and procedure for 20% of the pre-and post- intervention sessions with a mean agreement of 64% (range 35%-95%).
Table 5

Mean and range of inter scorer agreement for all written responses within Experiment 1 participants. ISA was conducted for all sessions of Dependent Variable 2.

<table>
<thead>
<tr>
<th>Participant</th>
<th>PRE-EXPERIMENTAL CONDITIONS</th>
<th>POST-EXPERIMENTAL CONDITION 1</th>
<th>POST-EXPERIMENTAL CONDITION 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Range</td>
<td>Mean</td>
</tr>
<tr>
<td>1</td>
<td>91.40%</td>
<td>77%-100%</td>
<td>93.72%</td>
</tr>
<tr>
<td>2</td>
<td>88.73%</td>
<td>72.73%-97.78%</td>
<td>83.92%</td>
</tr>
<tr>
<td>3</td>
<td>90.16%</td>
<td>72.7%-100%</td>
<td>89.19%</td>
</tr>
<tr>
<td>4</td>
<td>89.62%</td>
<td>77.27%-97.78%</td>
<td>80.45%</td>
</tr>
</tbody>
</table>

IOA Independent Variable: Social Condition

Table 6 displays the mean and range of IOA for sessions that measured the independent variable. IOA was calculated in the same manner as described above (Dependent Variable 1). A second observer was present during the intervention and recorded data separately from the experimenter. The data were recorded by experimenter and observers as the participant was completing the worksheet. The responses were recorded as pluses (+) for correct responses and minuses (-) for incorrect responses and rate was calculated at the end of the session. No data were collected on the peer’s responses. Informal and anecdotal data were recorded on the participant’s verbal behavior during the session by the experimenter and observer but were not used to calculate IOA because the behaviors were not operationally defined and a method for measurement was not prescribed prior to the onset of the first experiment. This was considered a
limitation in experiment 1 and adjustments were made in experiment 2 such that these data could be used for analysis. IOA was recorded for 31% of the first set of experimental conditions across the four participants with a mean agreement of 94.2%. Participants 1 and 3 received an additional set of intervention sessions under the observational intervention condition. IOA was calculated for 61% of the observational intervention conditions with a mean agreement of 90.65%. The mean and range of IOA for each participant across the first experimental condition (regardless of which condition was in place) can be found in Table 6.

Table 6

Mean and Range of IOA recorded during intervention sessions for all four participants.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Experimental Condition 1</th>
<th>Experimental Condition 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of sessions</td>
<td>Mean</td>
</tr>
<tr>
<td>1</td>
<td>37.50%</td>
<td>95.11%</td>
</tr>
<tr>
<td>2</td>
<td>33.33%</td>
<td>92.36%</td>
</tr>
<tr>
<td>3</td>
<td>33.33%</td>
<td>95.30%</td>
</tr>
<tr>
<td>4</td>
<td>23.07%</td>
<td>94.04%</td>
</tr>
</tbody>
</table>

Results

Preference for neutral stimuli following the experimental intervention was measured across two dependent variables, number of purchases and rate of responding. Figure 10 shows the numbers of times out of total numbers of opportunities that the participants purchased NS when presented with an array of known, backup reinforcers during school store. Data were also collected on the confederates who were present throughout the experimental conditions but only
on the numbers of purchases during screening tests. These data are displayed in Figure 11 and in Table 7.

Results from the screening test that was conducted prior to the onset of experimental conditions, and the participants’ rate of responses to a performance math task when a NS was delivered as the consequence for responding, showed that the NS did not function as a reinforcer for participants or confederates. All participants and confederates chose the NS less than 50% of total opportunities during the initial screening when none of the participants or confederates had experience and exposure to observing or participating in an intervention to condition new reinforcers. Confederate 4 purchased NS four times; however, anecdotally, the confederate had a history of choosing the newest item in the school store each time one was added. Since there were four stimuli added to the array of gumball machines these data are consistent with the observation of his behavior. Participant 1 and 2 were counterbalanced across experimental conditions; participant 1 (P1) was under the condition that was described as the experimenter simultaneously delivering NS to both participant and confederate for responding. At the same time, the experimenter began a replication of the reinforcers conditioned through deprivation. Data showed a significant increase for both participant 2 (P2) and confederate 2 (C2) in the numbers of times P2 and C2 purchased the NS. These data suggest that the stimulus was established as a reinforcer through deprivation.

To test whether the same neutral stimulus that did not acquire reinforcing value during the simultaneous delivery phase would become a reinforcer if the procedure used with P2 and C2 was implemented, despite exposure during the simultaneous delivery of a neutral stimulus, an additional post-intervention screening was done for P1 and C1 at the same time as the pre-intervention screening for P3, P4, C3, C4. Procedures were also counterbalanced across
conditions and P3 and C3 began the experimental condition where the neutral stimulus was simultaneously delivered to both confederate and participant for responding. P4 and C4 began the experimental condition that included depriving P4 of the stimulus while he observed C4 receive the stimulus for responding. Results were consistent with the second set of participants. P3 and C3 did not show significant increases in the numbers of times a NS was selected from the school store. Data suggested that the NS was conditioned as a reinforcer for P4 and C4 (Table 7, Figure 10, Figure 11). As written in Table 7, all participants and confederates had 12 opportunities per phase to select the neutral stimuli and all participants and confederates had a pre-experimental screening test and a final post experimental screening test. P1, P3, C1, C3 had two additional screenings following the simultaneous delivery of the NS. The first 12 opportunities were considered the post-experimental test and the second set of opportunities ensured there was no effect and determined a steady state before starting the other experimental condition during which reinforcers were conditioned through deprivation. P2, P4, C2, C4 did not have additional screenings as the NS became reinforcers through deprivation and no additional experimental conditions were needed to determine whether the procedure had a significant effect.
Figure 10. Results for the pre- and post-intervention screening tests for participants.
Figure 14.

Numbers of times out of total numbers of opportunities to purchase neutral stimuli (NS) from an array of backup reinforcers.

C1: Pre-Intervention Screening, Simultaneous Delivery of NS, Simultaneous Delivery of NS2, Reinforcers Conditioned Through Deprivation.

C2: Pre-Intervention Screening, Reinforcers Conditioned Through Deprivation.

C3: Pre-Intervention Screening, Simultaneous Delivery of NS, Simultaneous Delivery of NS, Reinforcers Conditioned Through Deprivation.

C4: Pre-Intervention Screening, Reinforcers Conditioned Through Observation.

Figure 11.

Results of the pre- and post-intervention screening tests for confederates.
Table 7
Results for all participants and confederates from screening tests across all phases of the experiment, each screening consisted of 12 opportunities to purchase neutral stimuli from the array of backup reinforcers in the school store.

<table>
<thead>
<tr>
<th>Participant /Confederate</th>
<th>Pre-Experimental Screening Test</th>
<th>Simultaneous Delivery of NS</th>
<th>Reinforcers conditioned through deprivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>C1</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>P2</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>C2</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>P3</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C3</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>P4</td>
<td>1</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>C4</td>
<td>4</td>
<td>0</td>
<td>11</td>
</tr>
</tbody>
</table>

As shown in Figure 10, simultaneous delivery of a stimulus did not result in a significant change in the numbers of times participants purchased a neutral item. Prior to the experimental condition, Participant 1 selected 1 neutral stimulus during the screening test and following the observed pairing selected 2 neutral stimuli. Participant 3 selected 0 neutral stimuli prior to the experimental condition and 3 following the observed pairing. Due to the slight increase in the number of selections and to establish a stable trend prior to implementing an additional experimental condition, a second set of screening tests were conducted for these participants.
Participant 1 did not select the neutral stimulus during the screening which was a decrease from the first and second screening and Participant 3 purchased 1 neutral stimulus across 12 opportunities on both screening sets. Following the conditions where the reinforcers were conditioned through deprivation, the number of times participants and confederates choose neutral stimuli increased (Figure 10 and 11).

In addition to the screening test to measure preference, a pre-experimental functional analysis was conducted using an AB design to assess whether the neutral stimuli functioned as reinforcers for written responses to previously mastered math equations. Rate of responding was measured when a neutral stimulus was delivered as the consequence for responding (phase B) and compared to rate of responses when a generalized or known reinforcer (phase A) was delivered. These data are presented in Table 8 as rate of correct responses and incorrect responses per session per participant. The mean rate of responses for each participant across phases are also reported in Table 8.

Figure 12 shows the rate of correct and incorrect responses for all participants during each phase of the experiment. Prior to the first experimental condition, the experimenter randomly assigned each participant to the A phase or the B phase by blindly selecting letters that were held by a second observer for fidelity of agreement. After the first phase was decided all subsequent phases were alternated between the delivery of either a neutral stimulus (B) or a known reinforcer (A). P1 and P4 started with A followed by B. P2 and P3 started with B followed by A. Regardless of which experimental condition the participant was assigned to, an A and a B phase were completed prior to the onset of the given condition. P1 and P3 had an additional AB phase because their rate of responses did not change significantly after the simultaneous delivery of a neutral stimulus whereas P2 and P4 only had one AB phase prior to
the experimental condition and one AB phase after the experimental condition. P1 started with A at the same time as P2 started with B, after a state of steady responding was reached P1 received B as the consequence and P2 received A; both showed significantly higher rates of correct responses and lower rates of incorrect responses when A was delivered. When the first set of experimental conditions were terminated an additional A or B phase began for P1 and P2 while P3 and P4 began their first pre-intervention AB phase. P3 started with B therefore followed by A and P4 started with A followed by B. Once P1 and P2 completed the second AB phase of the experiment, it was determined that the neutral stimulus had become a reinforcer for P2 but not P1. The data also showed that the neutral stimulus (B) did not function to reinforce responding for P3 and P4 so all three participants started the intervention phase of the experiment. P1 and P4 were under the condition where reinforcers were conditioned through deprivation and P3 started with the simultaneous delivery of a neutral stimulus with C3. Once complete, results showed that P1 acquired reinforcement for the same NS that did not reinforce responding during the first two AB phases. P4 also learned a new reinforcer through the intervention condition of reinforcement conditioning through deprivation as shown by both screening tests and his rate of responses during the second AB phase both neutral stimulus and known reinforcer resulted in steady states of correct responses and low levels of incorrect responses for P1 and P4. P3 did not acquire a new reinforcer after the simultaneous delivery and began the second experimental condition followed by a final AB phase which showed consistent numbers of correct responses when given A or B.
Table 8

Mean and range of correct rate of responding for all AB phases of the pre- and post-experimental conditions.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Pre- Intervention</th>
<th>Post-Intervention</th>
<th>Post-Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(A) = Generalized Reinforcer</td>
<td>(B) = Neutral Stimulus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>P1</td>
<td>Mean</td>
<td>25.28</td>
<td>19.86</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>23-27.4</td>
<td>18-23.4</td>
</tr>
<tr>
<td>P4</td>
<td>Mean</td>
<td>12</td>
<td>8.87</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>11.8-12.5</td>
<td>8-10.3</td>
</tr>
<tr>
<td>P2</td>
<td>Mean</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>12.9-14.8</td>
<td>15.2-17.2</td>
</tr>
<tr>
<td>P3</td>
<td>Mean</td>
<td>8.9</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>7.2-9.4</td>
<td>11-12.7</td>
</tr>
</tbody>
</table>
(A) = Generalized Reinforcer  (B) = Neutral Stimulus

Figure 12. Numbers of correct and incorrect responses per minute during pre-and post-intervention AB phases.
Two experimental conditions were used to identify if there was a source for the conditioning effect related the social environment. The simultaneous delivery of NS was compared to reinforcers conditioned through deprivation as described above. Participants were randomly assigned to an experimental condition. Participants 1 and 3 began the experimental phase with the observed pairing condition and participants 2 and 4 with the observational conditioning procedure. The session by session intervention data for each participant are reported in Table 9. Figure 13 displays the data for all four participants during the intervention.
Figure 13. Numbers of correct and incorrect responses per minute during intervention phases for all participants.
Table 9. The numbers of correct and incorrect responses during intervention phases of the experiment for all participants.

<table>
<thead>
<tr>
<th></th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CPM</td>
<td>ICPM</td>
<td>CPM</td>
<td>ICPM</td>
</tr>
<tr>
<td>Simultaneous Delivery of Neutral Stimuli</td>
<td>5.42</td>
<td>1.8</td>
<td>5.1</td>
<td>1.76</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>2.3</td>
<td>5.33</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>5.71</td>
<td>1.54</td>
<td>5.04</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>5.51</td>
<td>1.22</td>
<td>5.47</td>
<td>1.76</td>
</tr>
<tr>
<td></td>
<td>4.43</td>
<td>2.33</td>
<td>4.54</td>
<td>2.33</td>
</tr>
<tr>
<td></td>
<td>3.7</td>
<td>2.43</td>
<td>4.3</td>
<td>1.98</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>2</td>
<td>3.1</td>
<td>2.77</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>2.01</td>
<td>2.97</td>
</tr>
<tr>
<td></td>
<td>3.3</td>
<td>1.9</td>
<td>1.91</td>
<td>2.77</td>
</tr>
</tbody>
</table>

Participant 1’s mean rate of correct responses given a neutral stimulus as the consequence was 19.86 (range 18-23.4) prior to the observed pairing condition and 17.36 (range 16.8-18.3) after the observed pairing. Participant 3’s data also showed a decreased rate of responding following the observed pairing, with a mean of 8.68 (range 7.17-9.6) correct responses was recorded and following the observed pairing a mean of 7.06 (range 6.8-7.3) correct responses was recorded. The data from the screenings as well as the post- functional analyses established that the neutral stimuli did not gain reinforcing properties as a function of the observed pairing condition.
Participant 2 and Participant 4 received the observational conditioning procedure as their first experimental condition. Data showed an increase in the numbers of times neutral stimuli were selected during the screening tests following the procedure when compared with the screening tests that were conducted prior to the procedure. Participant 2 did not select any neutral stimuli prior to the conditioning procedure and selected 8 neutral stimuli after the procedure. Participant 4 selected 1 stimulus prior to the intervention and 9 following the intervention. The data from the post functional analysis for these participants was also significant. Participant 2 responded correctly with a mean rate of 13.96 (range 12.9 – 14.8) prior to the observational condition. After the experimental condition, the rate increased to 17.18 (range 16.6-17.5). Participant 4 responded with a mean rate of 8.87 (range 8-10.4) correct responses prior to the observational conditioning and a mean of 11.94 (range 11-12.5) correct responses after the intervention. More detailed data on all four participants is displayed in Table 9.

The data summarized above indicated that the neutral stimuli were effective in consequating responding as well as preferred by the participants over other known reinforcers as a function of the observational conditioning procedure. Due to this analysis, it was determined that the participants who received the observed pairing as their experimental condition would be given an additional intervention to determine if the neutral stimuli would become reinforcers under the intervention condition that was effective at establishing reinforcers for Participants 2 and 4.

For both participants, the conditioning with deprivation changed their preference for neutral stimuli as well as their rate of responding when the neutral stimulus was provided as the reinforcer. Prior to the deprivation condition participant 1 selected a mean of 1 neutral stimulus (range 0 to 2) across 3 sets of twelve session screening tests. After the observational conditioning
8 stimuli were selected by Participant 1. Participant 3 selected a mean of 1.67 neutral stimuli (range 0 to 3) across 3 sets of twelve session screening tests. After the observational conditioning 9 stimuli were selected by Participant 3.

The data from the post functional analysis also showed that the observational conditioning procedure was effective in establishing the neutral stimuli as reinforcers for participant 1 and participant 3 after the observed pairing condition showed that there was not a significant effect. Participant 1 emitted a mean rate of correct responding of 17.36 (range 16.8-18.3) following the observed pairing and 26.48 (range 22.2-30) after the observational conditioning procedure. Participant 3’s rate of correct responding increased from a mean of 7.06 (range 6.8-7.3) to a mean of 11.3 (range 10.9-12) after the observational conditioning procedure.

**Discussion**

The results of Experiment 1 demonstrated that there was a no change in preference for the neutral stimulus (Figure 10, 11) and no change in rate of responding (Figure 12) following the simultaneous delivery of NS. There was a change in preference and rate of responding when reinforcers were conditioned through deprivation (Figure 10, 11, 12). These findings are consistent with the prior research on learning new reinforcers through observation (Greer & Singer-Dudek, 2008; Oblak, Greer & Singer-Dudek, 2015; Singer-Dudek, Greer, & Schmelzkopf, 2008; Singer-Dudek & Oblak, 2013; Singer-Dudek, Oblak, & Greer, 2011; Zrinzo & Greer, 2013). The procedure also demonstrated a significant effect on the confederate’s preference for the neutral stimuli (Figure 11).

Prior to the onset of the intervention, pre-intervention data showed that the stimuli used in the intervention had no value to the participants or confederate peers. After the first intervention condition when the neutral stimuli were simultaneously delivered to Participant 1,
Confederate 1, Participant 3 and Confederate 3, the stimuli still had no value as shown by the post-intervention screening (Figure 10, 11) and the post-intervention AB phases (Figure 12). Participants 2, Confederate 2, Participant 4 and Confederate 4 did select the neutral stimuli after the first intervention condition when the reinforcers were conditioned through deprivation (Figure 10, 11, 12). Based on these data, Participant 1, Confederate 1, Participant 3 and Confederate 3 began a second intervention. Data showed that they learned new reinforcers through deprivation (Figure 10, 11, 12).

Past researchers suggested a “theory of reinforcer conditioning via observed stimulus-stimulus pairings” (Oblak, Greer, Singer-Dudek, 2015, p.711). The neutral stimulus was paired with a conditioned reinforcer, as in a traditional stimulus-stimulus pairing procedure (Greer, Becker, Saxe, & Mirabella, 1985; Greer, Dorow, & Hanser, 1973; Greer, Dorow, Wachhaus, & White, 1973; Nuzzolo-Gomez, Leonard, Rivera, & Greer, 2002; Longano & Greer, 2006; Pereira-Delgado, Greer, Speckman, & Goswami 2009; Sundberg, Michael, Partington, & Sundberg, 1996; Tsai & Greer, 2006; Yoon & Bennett, 2000). The researchers supposed that peers were previously conditioned or naturally occurring reinforcers that were paired with the neutral stimulus.

Research has shown that the presence of the peer is an important component of the procedure and necessary for the observational intervention to be an effective. Greer, McCorkle, and Sales (1998) showed that when bran cereal, a non-preferred stimulus for the participant, was dispensed into the garbage while the participant was denied access to the bran cereal, it did not become a reinforcer. However, when the participant was denied access to the cereal and it was given to a peer (instead of thrown in the garbage) and the participant observed the peer receive the cereal, it did become a reinforcer (Greer, McCorkle & Sales, 1998). Singer-Dudek and Oblak
(2013) tested the effects of the presence and absence of peers during the observational intervention. They found that when the participant observed the stimulus being delivered to an empty chair the stimulus did not become a reinforcer. When the participant observed the stimulus being delivered to a peer in the chair, the stimulus became a reinforcer.

The peers must be partially responsible for the acquisition of new reinforcers as they act as a source of reinforcement or motivation (Singer-Dudek & Oblak, 2013), however, “it is unlikely that pairings alone resulted in the establishment of conditioned reinforcers as a function of observation” (Oblak, Greer & Singer-Dudek, 2015, p. 712). The data from Experiment 1 provided new evidence to support this notion. If the peer was a conditioned or natural reinforcer, the participant should have learned a new reinforcer during the simultaneous delivery condition. Meaning that, if pairings alone caused the participants to learn new reinforcers then the simultaneous delivery condition would have shown an effect.

Results from Experiment 1 provide data that exemplify the importance of deprivation as a motivating operation and the peer’s presence during the intervention. When the NS were simultaneously delivered to participant and peer, no variables existed that necessitated an observing response or any observation of the confederate’s behaviors. Given these results, the effectiveness of the procedure must be partially related to the establishing operation that was absent in the simultaneous delivery of NS. By delivering the neutral stimulus to the peer and not the participant, the experimenter altered the environment and motivation for the participant and, in turn, the reinforcing value of the neutral stimulus changed. The data shows that the deprivation experience functioned to reduce rate of responding during the intervention, then, when the stimulus that was withheld during intervention was reinstated as a consequence for responding during the post-intervention B phase, the responding that appeared suppressed during
intervention showed an increased to the same level as the A phase (Figure 12). The change in reinforcement value of the stimulus was also apparent during the screening tests (Figure 10).

The results of Experiment 1 show that the participants will not learn new reinforcers if there is no deprivation operation. The performance of the participants changed with the contingencies. The behavior change was a function of the environmental conditions which included the behaviors of the peer being reinforced while the same behavior emitted by the participant was ignored.

The confederate peers in Experiment 1 learned new reinforcers after reinforcers were conditioned through deprivation but not after the simultaneous delivery phase (Figure 11). These results are important because they provide evidence of the importance of the deprivation operation. The stimulus was not withheld from the confederate peer at any time during the experiment regardless of the phase. However, the peers did not demonstrate observational learning of new reinforcers after the simultaneous delivery of NS. This shows that the presence of a deprivation operation had an effect for the peers even though it was not the peer’s reinforcement operation. Further investigation is needed to understand why the confederate, who received the stimulus under both conditions, did not acquire a new reinforcer after the simultaneous delivery and did learn a new reinforcer after deprivation.

One explanation is that the participant’s verbal behavior during intervention may have acted as an establishing operation for the confederate peer to attend to the participant’s deprivation operation. For example, on the sixth session of the second intervention condition (Figure 13), Participant 1 threw his empty cup at the experimenter and said, “You’re going to give him another golden arrow and I get nothing for doing all of this math that I know is correct, I’m done.” The participant then started ripped the top of his paper off and threw it at the
experimenter, when the experimenter did not respond to this, and continued to deliver the stimulus to the peer, the participant picked up the remaining piece of paper and continued responding at a low level. This may have occasioned Confederate 1 to look up, observe the empty cup and ripped paper. There was also an increase in his rate of responding after observing this. These data showed an effect on the behavior of the confederate and suggested that the confederate can also learn new reinforcers through observation. It is possible that simply acting as the listener during the experiment was enough to condition the stimulus for the confederate. The confederate effects warranted further investigation and provide a rationale for Experiment 2.

There were also several limitations from the first experiment that informed Experiment 2. The simultaneous delivery did not condition the NS as reinforcers. This condition was not used in Experiment 2. In Experiment 1 the screening test was used as a measure of preference. A frequency count was used to measure whether the neutral stimulus was selected during the screening test. The participant could have also selected other backup reinforcers from the school store during the session, if the neutral stimulus was selected once it was recorded as preferred or 1/1 for the session. To provide a more valid measure of preference, in the second experiment, the experimenter recorded the numbers of points used for neutral stimuli out of the total number of points earned per session.

In Experiment 2, all individuals present during the intervention, regardless of their role (confederate or peer), were considered participants. The participants were recipients (participants who the experimenter delivered the NS to, equivalent to the confederate in Experiment 1) or peers (participants that the experimenter withheld the NS from, equivalent to the participants in Experiment 1).
In Experiment 2, I measured the VB emitted during the intervention for all participants. These data were collected to see if the onset of verbal behavior occurred at the same time as the extinction effect (decrease in rate of responding) and if the verbal behavior emitted by the recipients effected the peers’ behavior and vice versa.
Chapter III

EXPERIMENT II

Method

Participants

Nine elementary aged (10 to 12 years of age) students served as participants in Experiment 2. All participants in Experiment 2 had Individualized Educational Plans (IEPS). The participants in Experiment 2 were chosen from the same school as the participants in Experiment 1. As in Experiment 1, the participants were chosen from a classroom that implemented classroom management tactics and academic instruction according to procedures derived from the CABAS ® and AIL ® (Comprehensive Application of Behavior Analysis to Schooling and Accelerated Independent Learner) models of Teaching as Behavior Analysis (www.cabasschools.org). The participants were accustomed to working individually or in groups with one or more peers using learn units (Albers & Greer, 1991), completing a Personalized System of Instruction (PSI) (Keller, 1968), responding chorally, and using response boards.

The experimenter assessed the participants’ development of Verbal Behavior across listening, speaking, writing, editing, algorithmic and social repertoires using the Verbal Behavior Development Assessment (VBDA) (Greer, 2008; Greer & Ross, 2008; Speckman & Greer, 2009). All participants demonstrated the ability to learn new operants as a function of observation (Greer & Ross, 2008). Other relevant cusps and capabilities as well as standardized test scores are displayed in Table 10.
### Table 10

Demographic, Academic and Verbal Development Information for Experiment 2 Participants

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Autism Diagnosis</th>
<th>Level of Verbal Behavior</th>
<th>Grade Equivalent for Reading &amp; Math</th>
<th>Grade Equivalent for Oral Expression</th>
<th>Listener Half of Naming</th>
<th>Full Naming</th>
<th>Observational Learning for New Operants</th>
<th>Conditioned Reinforcement for behaving as a Social Listener</th>
<th>Audience Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R</td>
<td>M, AA</td>
<td>Educational L,S,R,W,SE</td>
<td>M-4.0, R-4.5</td>
<td>6.5</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>P</td>
<td>F, AA</td>
<td>Educational L,S,R,W,SE</td>
<td>M-6.8, R-5.7</td>
<td>7.1</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>P</td>
<td>M, W</td>
<td>Medical L,S,R,W</td>
<td>M-3.0, R-3.7</td>
<td>4.8</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>R</td>
<td>M, AA</td>
<td>Educational L,S,R,W</td>
<td>M-1.7, R-2.7</td>
<td>4.5</td>
<td>Y*</td>
<td>Y*</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>P</td>
<td>M, Hispanic</td>
<td>Educational L,S,R,W,SE</td>
<td>M-4.2, R-3.5</td>
<td>5.7</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>P</td>
<td>F, Hispanic</td>
<td>Educational L,S,R,W,SE</td>
<td>M-4.5, R-4.0</td>
<td>5.1</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>R</td>
<td>M, AA/</td>
<td>Medical L, S, R, (W)</td>
<td>M-4.8, R-2.8</td>
<td>1.3</td>
<td>Y*</td>
<td>Y*</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>8</td>
<td>P</td>
<td>M, Hispanic</td>
<td>Educational L,S,R,W,SE</td>
<td>M-3.2, R-3.8</td>
<td>6.8</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>9</td>
<td>P</td>
<td>M, Hispanic</td>
<td>Educational L, S, R,SE</td>
<td>M-3.7, R-2.1</td>
<td>4.7</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

* Each participant was assigned a number, a grouping and a role during intervention. Group 1 was participants 1,2,3. P1 served as the recipient (R), 2 and 3 as the peers (P). Group 2 was participants 4,5,6. P4 served as the recipient (R), P5 and P6 as the peers (P). Group 3 was participants 7,8,9, 7 served as the recipient (R), 8 and 9 as the peers (P).

* All students who were participants in the experiment had a diagnosis of Autism and an Individualized Education Plan (IEP). All students who attended the school were required to at least have a diagnosis of Autism as per the NYC Board of Education requirement to be admitted to a CBST privately run, publicly funded school. In addition, to attend the school, it had been determined by the district that the child could not be served within his or her home district or District 75 (D75). The diagnosis of Autism was included in the table above to indicate whether it was a Medical or Educational diagnosis. A Medical diagnosis was made by a physician (usually using the Diagnostic and Statistical Manual) and/or neurological testing. An Educational Determination was made by a multidisciplinary evaluation team of school professionals using authorized measurement tools.

* The participants level of verbal behavior (VB) was determined by verbal cusps and capabilities (Greer & Ross, 2009) that were identified as present or absent by the experimenter using the procedures described in the Verbal Behavior Development Assessment procedures (Greer, 2009). Based on these cusps/capabilities the level was determined as the students level of VB was determined as L=Listener, S=Speaker, R=Reader, W=Writer or SE=Self-Editor.

* Standardized Test scores were taken from the most recently administered Wechsler Individual Achievement Test–Third Edition (WIAT-III) which was conducted annually for each student as a requirement by the public school district. The scores were reported as the Grade Level Equivalent, only Reading, Math and Oral Expression were relevant to the experiment and included above.

* Listener half of naming, Full Naming and Observational Learning were all cusps/capabilities that were present or induced prior to the Experiment. For a more detailed description on these capabilities refer to Greer & Ross (2008); Greer (2002); Greer & Speckman (2009); Greer & Du (2014). A Y* denotes that the capability was induced using empirically tested procedures that can be found in Greer & Ross (2009).

* Conditioned Reinforcement for behaving as a Social Listener and Audience Control are reinforcers that make the development of complex social language possible (Greer & Du, 2014) and are relevant to the implications of the study. A procedure was unsuccessfully attempted to establish these repertoires prior to the experiment which is noted by N. See Greer & Du (2014) for more details on these.
The participants in Experiment 2 demonstrated social listener reinforcement and audience control. The participants emitted spontaneous vocal verbal operants across both instructional and non-instructional settings. The participants reliably acted as both speakers and listeners in conversational exchanges. Anecdotal evidence and frequency data on the participants' vocal verbal operants across settings conducted in the months prior to the onset of the study demonstrated that all the participants could contact the natural reinforcement of peers' responses when acting as a speaker and responding as a listener in social exchanges.

As in Experiment 1, several social contingencies were in place in the classroom environment. These tactics included: a class wide hero contingency, peer tutoring, generalized reinforcement in the form of a point system, and individual behavior tactics that were in place as individualized instruction, such as self-management programs that taught students to collect and graph their own data and identify trends to set personal goals. In addition to the peer contingencies in place, the participants were grouped by level for all academic instruction. During group instruction, the participants were required to respond chorally, use response boards and collect data on their own learning behavior.

All participants received generalized reinforcement in the form of tallies or points throughout the day for both academic responding and good citizenship behavior. That is, the teacher and teacher’s aides provided frequent and continuous praise in the form of vocal approval when they awarded points to the participants for correct academic responses (“Correct, give yourself a tally for correctly spelling the word waiting”) and good citizenship behavior (“Thank you for nicely asking your friend to push his chair in give yourself a tally”). The participants frequently played card and board games and read books in pairs and participated in other language activities that provided additional opportunities to engage in functional,
reciprocal language experiences such as completing mad libs, joke telling, and games such as headbands, guess who, and charades.

Seven of the participants had been in the school for at least one school year prior to the onset of the study and were accustomed to a classroom that employed an approach to education that employed the principles of Teaching as Applied Behavior Analysis (CABAS ®). Two of the students had been in the school for four months at the onset of the study.

Each participant served as either a recipient (R) or a peer (P) for the intervention. The roles are described in more detail below. Table 10 shows each participant’s role next to their participant number as (R) or (P). This designation was only important for the intervention sessions.

To ensure that the participant roles were assigned randomly and without bias, the experimenter assigned a role to each number (e.g. 1 and R or 2 and P) prior to assigning a number to each participant. Participant numbers 1, 4 and 7 were assigned to the recipient (R) role and 2,3,5,6,8 and 9 were selected as the peer (P) roles. The experimenter then assigned participant numbers by having the participants select their own number without experimenter interference. This was done by labeling nine index cards, each card had a number written on the blank (not lined) side of the 3 x 5 index card. A total of nine cards were labeled and placed with the lined side facing up and the side with the number facing down so that the number was not visible. The experimenter asked each participant to come to the table and choose an index card. Each participant chose a card and returned to his or her desk. A large manila envelope was hung with a magnet on the white board (Appendix B). The experimenter gave the direction, “after you choose a card, please write your name on the lined side of the index card and put it in the envelope that is on the board.” The cards were stored in the manila envelope; after the school day
was over, the experimenter removed the cards from the envelope and wrote the participant’s name next to his or her number in a database for data collection purposes.

**Setting**

The setting was identical to the setting described in Experiment 1.

**Materials**

All the materials used in Experiment 2 were identical to the materials used in Experiment 1 except for the partition that was placed between the recipient and peers. The partition used is shown in Figure 14.

*Figure 14. Partition used in Experiment 2.*

Three participants were present for the intervention, the partition was created for three participants to be present during the intervention. Each participant needed to see the cups of the other two participants that were present during the intervention. The partition was designed so that two participants (peers) could be seated on one side of the partition and the third participant (recipient) could be seated on the inside of the partition. The cardboard partition was created from a poster presentation board and had three 2 x 4 inch windows cut out of the bottom. Each
participant placed his or her cup in the window closest to where he or she was seated for the intervention.

In Experiment 2, data were collected during the screening test for preference for the neutral stimulus in a different way than in Experiment 1. To ensure that the experimenter could calculate the exact percentage of points exchanged to earn the neutral stimulus out of total points earned, the quarters that were used in Experiment 2 were labeled with each participant’s number. Figure 18 shows the quarters that were used in Experiment 2. The numbers were written in black sharpie. The numbers corresponded with the numbers that were assigned to the participants by the experimenter for data collection purposes described above. If a participant traded in 25 points for a quarter, the experimenter gave the participant a quarter(s) with his or her number.

![Figure 18](image.png)

*Figure 18. Coins used in Experiment 2 to conduct IOA.*

**Design**

The design used in Experiment 2 was identical to Experiment 1.
Procedure

Experimental Sequence

The experimental procedures were the same as Experiment 1. The only difference was that there was one intervention condition with three participants in each group. The experimenter divided the participants into three groups, each of which contained two peers (P) and one recipient (R), these roles were also randomly chosen prior to the onset of the intervention. Six intervention sessions were conducted for each group of three participants. This was set prior to the onset of the experiment due to potentially aggressive behavior that was demonstrated by the participants in Experiment 1. The participant information presented in table 10 includes the role that each participant had during the intervention (peer or recipient).

Pre- and Post- Intervention Tests of the Dependent Variables

Dependent variable 1: Numbers of points used out of total points earned to select neutral stimulus

The dependent variable was defined in the same way as Experiment 1. Instead of counting each session as either 0/1 or 1/1 for selecting neutral stimuli, the number of points used toward the NS out of the total earned was recorded.

Definitions of Correct Responses to Pre- and Post-Intervention Tests: Dependent Variables

The dependent variables were the number of points used toward gaining access to the neutral stimulus out of total points earned throughout the day during the pre-and post-intervention screening tests and rate of correct and incorrect responses to math problems when reinforcement conditions were rotated between a generalized reinforcer (A) and a neutral stimulus (B). All responses were defined in the same way as Experiment 1. Data were collected on all nine participants for all variables in the second experiment.
Dependent Variable 1 and Data Collection: Number of Points Used Out of Total Points Earned during Pre- and Post-Intervention Screening Tests. In Experiment 2, each opportunity to trade in points was considered one screening test. Each day, for five days, prior to and following the intervention, data were collected during the class wide school store period which was considered the screening test. The behavior measured during the screening test was the number of points used to gain access to the neutral stimulus. A selection response was defined as placing a quarter in the gumball machine that contained the neutral stimulus and turning the knob so the stimulus was dispensed.

These data were used to calculate the mean number of points used for neutral stimulus. Data were collected and recorded for the selection response defined above using the quarters that were used in the gumball machines, public posting of student points, and the participants’ data sheets. The experimenter used the public posting and point sheet to record each participants’ total points for the day. At the end of each school day when the students were no longer present, the experimenter recorded the total points earned for each participant on a computer-generated spreadsheet. Each quarter used in the gumball machine that dispensed the stimuli was coded by participant number. The experimenter took each gumball machine, opened it using a key and removed the quarters that had been used in it. The experimenter used the participant numbers that were written on the quarters to indicate the amount spent by a given participant. For example, if two quarters labeled as “1” were in the machine, a total of 50 was recorded by the experimenter for participant 1. Once the experimenter had added the total amount of money (or points converted to money for use of the machines) used for the neutral stimulus, it was recorded on her spreadsheet next to the total points earned. The raw data were recorded for each screening
test and later added to calculate the mean across the five-day period. Mean was calculated by adding the amount used and dividing by five.

*Dependent Variable 2 and Data Collection: Numbers of correct and incorrect responses per minute to a math performance task across two reinforcement conditions*

These data were collected and defined in the same way as Experiment 1.

*Independent Variables and Data Collection*

The independent variables in the second experiment were the participants’ rate of correct and incorrect responses to math problems and the number of occurrences of verbal behavior for each participant during each session. A single session consisted of three one-minute performance tasks. The participant’s mean correct responses and mean incorrect responses were calculated and used as the data for that session.

Verbal behavior was cumulative across the session; sessions varied from four to six and one-half minutes but never exceeded that time; this depended on the participants and how quickly they completed the steps between the performance task timings (these steps are described in more detail below).

In Experiment 2, the nine participants were divided into three groups, each group had three participants; one participant was designated as the recipient (R) and two of the participants were considered peers (P). A recipient (R) was defined as the participant who received the neutral stimulus in his or her cup during the observational intervention. A peer (P) was defined as a participant who was denied the neutral stimulus and could observe the recipient's cup while the experimenter delivered the neutral stimulus during intervention.

Participants were randomly grouped in sets of three for the intervention sessions; thus, it was necessary for all participants to complete pre-intervention conditions simultaneously such
that there was no delay in the onset of the intervention. The intervention started at the same time for all participants. The performance task was the same as Experiment 1 (math problems) but the intervention session was conducted as a one-minute timing (rather than open ended).

The rationale for one minute timings was that three participants were randomly and blindly assigned as a group, so the participants had different math levels, fluency of facts and rate of written responses. Though the worksheets were chosen based on previously mastered skills, a more advanced math student might have more fluent responding to math fact worksheets due to practice and experience. The participants had different average rates of responding and different criteria for fact fluency. If the timings were open ended the recipient could potentially complete his worksheet prior to the peers and the peers would have fewer opportunities to observe the stimulus being delivered to the peer. For these reasons, the experimenter chose to do one-minute timings so that there were no confounding variables.

During intervention sessions, all three participants were seated at a 3 by 5-foot table. A partition was placed between the recipient and the peers. When the participants sat down at the table for the first time, the experimenter gave the verbal direction: “Put the cup in the window or cut out of the partition that is closest to your seat.” The experimenter then said, “This is where you will put your cup each time we play this game.” After the first session, this direction was not repeated and cups were handed out each time and placed in the correct window. The recipient was seated on the interior fold of the cardboard partition and the peers were seated on the exterior of the partition.

The experimenter then passed out a stapled packet of three worksheets to each participant and told the participants that they should work until they heard a timer beep (the participants did one-minute timings routinely and were familiar with this routine). These directions were
reviewed at the onset of each session. Each worksheet packet was labeled with the participant’s number and the experimenter asked the participants not to write their names. The experimenter set a timer for one minute and gave the vocal direction: “Please begin.” While the participants completed the worksheet, a neutral stimulus was dropped in the recipient’s clear plastic cup by the experimenter each time an answer was written. No neutral stimuli were put in the peers’ cups. If a participant asked a question or made a comment directed toward the experimenter during the intervention, the experimenter pointed at the worksheet. No vocal responses were given. At the end of one minute the timer beeped, participants put their pencils down, and turned the worksheets over. The experimenter then requested that each participant empty his or her cup into an empty bowl located at the end of the table. Then directed the participants to put the cup back down in the designated window. If a participant replied to this direction by stating, “there’s nothing in my cup” (this occurred on multiple occasions because the peers’ cups were empty), the experimenter ignored him or her and repeated the direction. Participants either emitted vocal behavior in response to this or gestured emptying a cup. In some cases, participants attempted to take from the recipient during this step. Once all participants had done this and sat back in their seats, they were told to turn the page of their packets and a timer was started for the next one-minute timing. In some cases, based on the student’s individual needs, the experimenter ripped the completed page off the packet and re-stapled it at the end of the session. This process was repeated in an identical manner three times per session.

Each session consisted of three one minute timings for a total of three minutes of written responding per session or 180 seconds. Six sessions were completed for each group. This criterion was determined by the fact that the students had high numbers of verbal operants across all instructional and non-instructional settings and high levels of academic and self-management
behavior. Six sessions were chosen to ensure that there was enough data for a trend and to prevent for possible effects of taunting, teasing, mocking, aggression and physical violence from the participants. The participants were assigned roles randomly so the experimenter was blind to which student would be the recipient or the peer.

The dependent measure of numbers of correct and incorrect responses was defined as it was in Experiment 1. No calculations were needed for rate per minute as each worksheet completed was within a one-minute timing. Since each participant completed three timings, a mean was calculated for correct responses and a mean for incorrect responses as the data for the session.

Verbal behavior was defined as any non-vocal gesture (e.g. pointing, tapping, touching) or vocal behavior (e.g. making remarks or comments, requesting items, approving or disapproving other participants) emitted across one session. This included vocal or gestural behavior that was emitted when the participants were emptying their cups (examples described above of this process). If the participant emitted a vocal verbal operant or physical movement, gesture, or sound that was not consistent with the response definition for the math task (writing an Arabic numeral on the paper), it was considered an instance of verbal behavior and was recorded by the experimenter.

Data were collected on the participants’ written responses using the permanent products. No record of time was necessary since each performance task was one minute. The occurrences of verbal behavior were transcribed. An instance of verbal behavior was recorded by writing down the verbal behavior exactly as it was emitted during the intervention with point to point correspondence. The experimenter transcribed the behavior as it occurred, for example, if the recipient said, “I win,” the experimenter wrote down the participant number and “I win.”
Post–Intervention Tests for the Dependent variables

The post-intervention tests for dependent variables was identical to the pre-intervention tests and the measures used in Experiment 1. When the intervention was complete, post-intervention sessions were conducted in the same order as above. Five sessions of the A phase and five sessions of the B phase were completed. The screening was done for all participants for five days.

Interobserver Agreement (IOA) and Interscorer Agreement (ISA)

IOA Dependent Variable 1: Screening tests. Interobserver agreement was 100% for all screening tests prior to and following the intervention in Experiment 2. Experiment 1 required the experimenter and an independent observer to be present during each screening to collect data using a frequency count. Thus, not all sessions could be calibrated. To ensure reliability for Experiment 2, the experimenter labeled the coins used by the participants prior to the onset of the study as described above. To ensure all interobserver agreement could be calculated without multiple observers present, the experimenter told the students that they were going to review a writing game that they had played at the beginning of the year during trade in time. The “game” was a part of the writer immersion (Greer & Ross, 2008) protocol and which had the students use written mands to request items in exchange for points. This ensured that the experimenter had a permanent product that showed what each participant purchased at the end of the school day in addition to the coins that were dispensed in the gumball machines that were labeled with a participant number.

At the end of the school day, the experimenter copied each participant point sheet and blacked out the student’s name with a sharpie and wrote their number instead. She then gave three independent blind speech therapists, uninvolved with the experiment, the point sheet. They
were also given a data sheet to record the amount of points per participant and what they were used toward. She then compared each scorer’s responses and calculated the mean. The experimenter also dumped out each machines coin and counted the number of money each participant used to purchase neutral stimuli or prizes based on the coin numbers. She then put the coins back in the machine. An additional scorer came and repeated the process. The experimenter compared their results to calculate mean. This was done each day for 5 days prior to intervention and following intervention.

**IOA Dependent Variable 2: performance task.** Interobserver agreement was conducted for 40% of the pre- and post-intervention sessions. A total of ninety sessions across all participants were conducted prior to the intervention and ninety sessions following intervention. A second observer was present for 36 of the 90, or forty percent of the sessions. The observer collected interobserver agreement during each session by timing, reviewing the responses written on the worksheet, and calculating rate correct and incorrect. The observer then wrote the data on a computer-generated spreadsheet. At the end of the day the experimenter used her data from the session to calculate numbers of correct and incorrect responses per minute and compared it to the second observer’s data to determine the interobserver agreement; there was a mean agreement of 77% (range 50%-90%). Due to the number of participants and sessions required for each phase of the experiment, the number of sessions was 50% during this phase of the experiment.

**IOA Intervention.** Interobserver agreement was conducted for 60% of the intervention sessions with a mean agreement of 73% (range 50%-86%). Eighteen intervention sessions were conducted (each consisted of three on minute timings), interobserver and scorer agreement was collected for ten out of the eighteen. A second observer was present for part of an eleventh
session but had to leave before the session was complete. This was session 2 for Participants 7, 8 and 9.

Prior to the experiment, the experimenter arranged to have a second observer present for at least two sessions for each group of 3 participants. Table 11 shows the inter observer agreement for each grouping of participants. Each intervention session an experimenter and observer collected data on all three participants (correct/incorrect responses using the worksheets and verbal behavior emitted); therefore, each grouping of participants had the same percentage of sessions and mean agreement for all participants in the group. See Table 11 for details. For mean correct and incorrect responses, the experimenter and observer separately counted the number of correct responses and number of incorrect responses for each one-minute timing and then separately calculated the mean correct and mean incorrect. These numbers were compared for agreement.

The agreement was much lower for verbal behavior then responses to worksheets. These data were transcribed by hand and some verbal behavior was recorded by one experimenter and not the other and vice versa. Only the verbal behavior that was observed or heard by both observers (100% agreement) was used for the study. During the seven sessions with one observer, the transcript was compared to a video of the session and the data that the experimenter had transcribed was compared to audio and visuals from the video. The verbal behavior that matched the video (agreed with what was on the video) was used for the results of this study.
Table 11. Mean and range of IOA recorded during intervention sessions for all participant groups.

<table>
<thead>
<tr>
<th>Participant Group</th>
<th>% of sessions</th>
<th>session number</th>
<th>session by session %</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1,2,3</td>
<td>20.00%</td>
<td>1</td>
<td>65.00%</td>
<td>71.00%</td>
<td>65-75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>75.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>73.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P4, 5, 6</td>
<td>20.00%</td>
<td>1</td>
<td>67.00%</td>
<td>78.00%</td>
<td>67-86%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>74.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>86.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>85.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P7, 8, 9</td>
<td>20.00%</td>
<td>1</td>
<td>50.00%</td>
<td>72%</td>
<td>50-83%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>77.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>78.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>83.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>60%</td>
<td></td>
<td></td>
<td>73%</td>
<td>50-86%</td>
</tr>
</tbody>
</table>

Results

The results for all participants on the screening tests are presented in Table 12 and Figures 16, 17, 18.

Table 12 displays each participant’s individual mean points earned mean points used and the range across five days of screening tests. Figures 16 and 17 display mean points used with bars to represent the high and low range of points across five screenings pre-intervention and five screenings post-intervention. Participants 1,4 and 7 were the recipients and 2,3,5,6,8,9 were the peers.
Table 12

All participants mean and range of points across five pre- and five post-screening tests that were used to exchange for neutral stimuli.

<table>
<thead>
<tr>
<th></th>
<th>Pre-Experimental Screening</th>
<th>Post-Experimental Screening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>Recipient P1</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Recipient P2</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>Recipient P3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Recipient P4</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Recipient P5</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Recipient P6</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Recipient P7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Recipient P8</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Recipient P9</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>
Figure 16. Mean points used for neutral stimuli across five screenings pre-intervention and five screenings post-intervention for the recipients (participants who were not deprived of the stimulus). High and low range bars show the range of points.
Figure 17. Mean points used for neutral stimuli across five screenings pre-intervention and five screenings post-intervention for peers (participants who were deprived the NS during intervention). High and low range bars show the range of points used.

In addition to the screening test, a pre-intervention functional analysis was conducted using an AB design to assess whether the neutral stimuli functioned as reinforcers for written
responding to performance math equations. Rate of responding was measured when a neutral stimulus was delivered as the consequence for responding (phase B) and compared to rate of responding when a generalized or known reinforcer (phase A) was delivered as a consequence for responding. These data are presented in Table 13 as rate of correct responses (CPM) and incorrect responses (ICPM) per session per participant. The mean rate of responses for each phase across participants are also reported in Table 13. Figure 17 and 18 display these data across all participants for all pre-and post-intervention analyses.
Table 13

Rate of correct and incorrect responses across pre- and post-experimental conditions for all participants.

<table>
<thead>
<tr>
<th>Participant</th>
<th>PRE EXPERIMENTAL CONDITIONS</th>
<th>POST EXPERIMENTAL CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CPM</td>
<td>Mean</td>
</tr>
<tr>
<td>P1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>44</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>28</td>
<td>0.2</td>
</tr>
<tr>
<td>P2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>P3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>P4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>11.2</td>
<td>1.7</td>
</tr>
<tr>
<td>B</td>
<td>12.5</td>
<td>0</td>
</tr>
<tr>
<td>P5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>21</td>
<td>0</td>
</tr>
<tr>
<td>P6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>41.5</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>P7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>P8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>26.4</td>
<td>1.3</td>
</tr>
<tr>
<td>B</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>P9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>32</td>
<td>0</td>
</tr>
</tbody>
</table>

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Figure 18. Participants’ correct and incorrect responses per minute during the A and B phases prior to and following the intervention.
Figures 19, 20, 21 display the data from the intervention. These data were numbers of correct and incorrect responses per session and cumulative verbal behavior emitted per session. Graphs are grouped by recipients and corresponding peers.

![Graphs showing data](image)

*Figure 19. Correct responses per minute, incorrect responses per minute and cumulative verbal behavior emitted during intervention sessions for Participant 1 (recipient), Participant 2 (peer) and Participant 3 (peer).*
Figure 20. Correct responses per minute, incorrect responses per minute and cumulative verbal behavior emitted during intervention sessions for Participant 4 (recipient), Participant 5 (peer) and Participant 6 (peer).
Figure 21. Correct responses per minute, incorrect responses per minute and cumulative verbal behavior emitted during intervention sessions for Participant 7 (recipient), Participant 8 (peer) and Participant 9 (peer).
Discussion

The results of Experiment 2 further contribute to the growing research on the observational learning of new reinforcers. The second experiment included all students that were present in the environment during the experiment as participants regardless of their role in the intervention (recipient or peer). All behaviors for all participants were measured across all phases of the experiment. The results showed an increase in the number of purchases during screening tests for all participants except Participant 3. Participant 3 did not purchase NS prior to or following the intervention, as such, the mean points used to purchase the NS were 0 for all screening tests. However, the data showed a significant difference in Participant 3’s correct responses per minute prior to and following the experimental conditions when the neutral stimulus (B) was delivered as the consequence for math responses. Participant 3 frequently selected electronic backup reinforcers (e.g. computer time) and rarely chose to earn a prize. This could be why the screening data did not show an increase and the participant’s rate did change following the intervention. The NS may have acquired enough reinforcing value to reinforce the participant’s responding but the NS may not have been potent enough for the participant when it was presented in an array of known backup reinforcers. Participant 3 was a reader/writer and had an advanced academic repertoire but engaged in the lowest numbers of verbal operants with peers during non-instructional times. He was the newest member of the class and at the onset of the study had only been at the school for one month.

One limitation in the first experiment was that the experimenter did not set a consistent criterion or level of responding that indicated that the phase (A or B) should be terminated and the next phase should begin. In Experiment 2, the experimenter established the criterion prior to
the onset of the study. This may have also been a limitation, however, as it was decided that for all participants on the pre- and post-intervention phases that six sessions per phase was enough to establish whether the stimulus was neutral or had value comparable to a generalized reinforcer.

For participants in the present study, the onset of vocal verbal behavior may have been the onset of the items becoming conditioned reinforcers. When a peer or recipient emitted a vocal verbal operant in response to the experimenter delivery of the neutral stimulus, the rate of responding decreased or remained consistent but low levels of responding. These data are shown in Figures 19, 20 and 21.

The Experiment 2 data is consistent with the Experiment 1 data that shows that all participants learned new reinforcers regardless of whether they were recipients (confederates) or peers (participants). The recipients (participants 1, 4 and 7) all showed a change in rate of responding and increased mean purchases from pre-to post-intervention. The peers (participants 2, 3, 5, 6, 8, 9) all showed a change in rate of responding and increased mean purchases from pre-to post-intervention. All peers (participants) and all recipients (confederates) learned new reinforcers through observation. The question is now posed, why are reinforcers conditioned for recipients (confederates)? Possible answers to this question and implications for future research are presented in Chapter IV.
CHAPTER IV

GENERAL DISCUSSION

Experiment 1 and Experiment 2 were conducted to determine the variables that contributed to the observational learning of new reinforcers for participants and confederates or peers. Experiment 1 compared the effects of two social conditions on the learning of new reinforcers. The first condition, the simultaneous delivery of NS to both participant and confederate peer, was not effective in conditioning new reinforcers but when the reinforcers were conditioned through deprivation the participants and confederates learned new reinforcers. Based on the results of Experiment 1; Experiment 2 only included one condition but increased the number of participants in each intervention group from two students (one participant and one confederate) to three students’ (one recipient and two peers). The basic finding in both Experiment 1 and Experiment 2 was the effect of the intervention on the confederates. The confederate peers were present during the intervention but were never deprived of the stimulus, and in both experiments, all participants and confederate peers learned new reinforcers through observation. This poses the question, why are reinforcers conditioned for the confederate peers through the observational intervention?

In the current experiment, confederate effects were defined as the effect of the observational intervention on the behaviors of the confederate or recipient. Though confederates and recipients observed the deprivation operation, they did not directly experience it. This finding suggests that, for the confederate peers in Experiment 1, and for the recipients in Experiment 2, observing the contingencies of the participants (Experiment 1) and the peers (Experiment 2) was enough to learn new reinforcers. The intervention was effective even when the deprivation operation was observed and not experienced.
Gold (2013) measured confederate behavior after an intervention that used a yoked-contingency game board to induce the observational learning for the participant. Though the intervention was not the same, the results from the study were like the confederate effects in the present study. Gold (2013) suggested that the peer gained capabilities as a function of acting as a model. “The peer participant creates a social contingency which has shown to be extremely effective in the induction of capabilities” (p.90). The present experiment shows more evidence, though not conclusive, that peers who act as models, tutors, monitors, or confederates, are the part of the contingency that caused the participants to learn new reinforcers.

The experiment adds provides more information about the significance of the role of each participant within the intervention configuration. As mentioned in the discussion of the first experiment, when the participant emitted vocal verbal behavior in response to not receiving the stimulus, it may have functioned to gain the confederate’s attention and the onset of the conditioning for the confederate peer as the verbal behavior acted as an establishing operation to observe the participant’s deprivation contingencies.

In the second Experiment, regardless of whether the stimulus was withheld or given to the participant, all participants learned new reinforcers through observation. The recipients (participants 1, 4 and 7) all showed a change in behavior from pre-to post-intervention. This data can be compared to the confederate data from Experiment 1. These participants were never denied access to the stimulus but they still learned new reinforcers through observation. Unlike the confederates in Experiment 1, the recipients in Experiment 2 emitted high levels of verbal behavior during intervention. This was most likely a function of having two participants under deprivation and one who received the stimulus. Meaning that, the contingencies in Experiment 2
were competitive because there were two participants that did not receive the stimuli that could be a “team” playing against the one participant (recipient) who did receive the stimulus.

Recipient 1 and Recipient 7 emitted vocal verbal responses to taunt the peers who were not receiving the stimuli. They both said things that were competitive and negative.

This shows evidence of being “singled out.” In Experiment 1, and in all previous studies that used the observational intervention, the participant was singled out, he or she was deprived the stimulus and emitted vocal verbal behavior in response to that deprivation. This was consistent with the peers in Experiment 2 except that the peers were a team. Where the participants in Experiment 1 may have felt singled out, the recipients in Experiment 2 most likely felt singled out because they were not part of the deprivation “team.” In both examples, the participants may have been wondering, “Am I special or not?” If this is true, the value of the stimulus increased to the recipient because he or she was the only one receiving it so it makes him special. Another possibility is that he or she observed his peers not receiving the stimulus and may have felt singled out.

The results of Experiment 1 showed that the deprivation operation was necessary for conditioning to occur, however, the confederates who showed an increase in purchases were not deprived of the stimulus and it still became a reinforcer. Yet, in the first social condition when the stimulus was delivered simultaneously to both participant and confederate it did not become a reinforcer. The confederate never experienced deprivation, not even during the condition where the deprivation operation was present. How do the confederates or peers acquire new reinforcers by observation without being participants in the intervention? Perhaps observing the experience of a classmate who was deprived the stimulus was enough to create an establishing operation for
the participant to attend to that deprivation and respond to the contingency. Societies have leaders that they look to for guidance of what is or isn’t acceptable.

In a study conducted by Byers (2016), new reinforcers had been established via repeated probes where participants were denied access to the stimuli and then served as confederates. Anecdotally, Byers states that, “these participants were observed to emit responses that demonstrated compassion to the target participants who were placed under brief deprivation in the probes for peer attention and observational learning” (p.106). In the experiment, the participants who had acquired observational learning of new reinforcers then were the confederates for other target participants. During these phases of the experiment the participants who became confederates emitted “mands on the behalf of their peers” (Byers, 2016, p. 104). The mands were evidence that the participants had acquired an observational repertoire and, possibly, responding that could be defined as empathy.

Similarly, in the current experiment, participants, confederates (recipients and peers), emitted mands throughout the intervention conditions. Unlike the mands that the participants emitted in the study conducted by Byers (2016), the mands that were emitted by the participants in my experiment were intended to evoke the opposite effect. That is, rather than advocate for their classmates who were being denied the NS, the recipients in Experiment 2 emitted verbal behaviors that can be described as aggressive, teasing and taunting. These are more like vicarious or competitive behaviors then empathic ones.

This could also be an effect of the age of the participants. The participants in the present experiment were upper elementary aged and had encounter competitive contingencies such as winning or losing a game unlike the younger participants in Byers (2016). As such, the mands that were emitted were in the form of vocal disapprovals or negative sequelics that were intended
to mock the peers and recipients. In Experiment 1, the deprived participant emitted verbal behavior and the confederate peer did not. In Experiment 2, all participants, regardless of role, emitted verbal behavior. In some cases, the recipient antagonized the peers, Participant 1 and Participant 2 engaged in several vocal exchanges that were could have resulted in a physical altercation had the session not been completed. For example, in one session, Participant 4 (recipient) was observed purposefully knocking his cup over so that the neutral stimuli that had been delivered spilled out on the other side of the partition where the peers were sitting.

Future Research

Future research should continue to include all data on all individuals who are present during the study and focus on the confederate effects that were seen in this study and anecdotally in other studies. Measures of verbal behavior could include approvals and disapprovals to help identify the operant or type of verbal behavior that was emitted influenced the behavior of the confederate. That is, did the confederates in this study learn new reinforcers because the verbal behavior was competitive (e.g. “look at what I have”) or did the verbal behavior (regardless of approval or disapproval, mand or tact) act as a motivation operation for the confederate to attend to the neutral stimulus?

These results can be compared to interventions that were used to establish observational learning repertoires that involved peer mediated tactics such as peer monitoring or tutoring. Delgado and Greer (2005) found that peer monitoring was an effective intervention to establish the observational learning capability even when the participants never came in direct contact with the contingencies. Gautreuax (2005) used peer monitoring training and peer tutoring conditions to included observational learning capability. In the experiment, the participants went through phases of tutoring and monitoring and showed the most significant results when they
observed instruction and observed other consequences without being involved in the interaction.

Other areas for future studies could include increasing the group size and rearranging participants so that there are multiple recipients and only one confederate.
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spanning over 100 years of research. *Psychological Record, 40*(2), 289.


Appendix 1

Verbal behavior from all intervention sessions of Experiment 2

Group 1: Participant 1 (R), Participant 2 (Peer), Participant 3 (Peer)

Session 1

P1: “Look at me, I guess I’m already winning.”

P1: “Yep, I am amazing. The winner!”

P1: “What losers!”

P1: “I am actually AMAZING!”

P2: “STOP”

Session 2

P1: “Winner again?”

P1: “Yes I am the greatest ever.”

P1: “Watch me kick your butt to china town.”

P2: “Shut up!”

P3: “Hey, can we stop this now, I don’t have any.”

Session 3
P1: “Tallest, fastest and best in the class.”

P1: Pushes his cup over, so the other two see they are losing and laughs

P2: “I’m taller than you”

P3: “Oh come on”

Session 4

P1: “I rule”

P1: “I’m amazing”

P1: you’re small (at peer)

P2: You’re so annoying

P2: Who cares, if I’m taller

P2: You’re so annoying

P2: Get off

P3: Where are mine

P3: There is nothing in this cup

P3: Oh man I’m disappointed

Session 5

P1: kick, poked, scratched x2

P1: lalalallalaa look at me

P2: No you suck

P2: moved P1’s cup
P2: knocked over P1’s cup
P2: shut up
P2: Don’t start with me
P3: I don’t have any
P3: oh no, not this again
P3: This is the worst

Session 6
P1: Who’s the smartest in the class?
P1: spills out cup to count in the middle of the session
P1: I cant even count I have so many
P2: shut up
P2: I am smarter and taller than you
P3: knocked down cup apologized and picked up his cup
P3: whoops
P3: alright already

Group 2: Participant 4 (R), Participant 5 (Peer), Participant 6 (Peer)

Session 1
P6: Umm this is weird, I think you forgot about us

Session 2
P5: But uh, where is it
P6: I don’t know I think she forgot us again

Session 3
P5: Oh I guess they are invisible

Session 4
P4: Oh thanks, wow!
P4: Look at me, wow gosh
P4: I got some
P5: Invisible, ok yes, these are invisible things in my cup
P5: Ok Ill get mine later
P5: I think you’re supposed to put some in mine too
P6: (name of P4) isn’t even following the directions
P6: I really think you forgot something (teacher name)
P6: Don’t you think you’re forgetting about some of us

Session 5
P4: I have so many I got them oh my
P4: Im really getting a lot of that
P5: But I don’t have any
P5: invisible
P5: Youll give it to us later
P5: Please put some in mine
P6: (name of experimenter) I think you forgot something
P6: experimenters name
P6: look up, look up, look up

Session 6
P4: (Name of teacher conducting IOA) can you believe it? Look what I have
P4: I got some
P5: I guess we’re invisible again or our stuff is invisible
P5: You lied to us
P5: are we done yet?
P6: Look up
P6: Just look at us
P6: I cant believe (name of P4) is winning he’s never the student of the week
P6: Throws cup

Group 3: Participant 7 (R), Participant 8 (Peer), Participant 9 (Peer)

Session 1
P7: Hey stop it
P8: why aren’t you speaking
P8: whats that in his cup
P9: This isn’t fair

Session 2

P7: P8 is being so mean to me
P7: Ugh stop it guys its not my fault
P8: This is actually infuriating
P8: I am like so mad right now
P8: If I have to do this one more time I swear
P9: This is worse than losing hero
P9: Come on now
P9: What the (profanity)

Session 3

P7: Ouch stop (in response to being kicked under the table)
P7: P8 and P9 are kicking me
P7: This is not my fault
P8: I cant believe this is happening on a Wednesday the worst day of the week
P8: I will lock you in a closet
P8: P7 fault always P7
P8: how is this happening again
P9: Grab and kick cup
P9: Knock over partition onto P7
Session 4

P7: This is not my fault guys
P7: No but yes but no but yes
P7: Do I get points from this
P7: Just leave me alone before I explode
P8: You’re doing this on purpose aren’t you
P8: This is the most terrible idea you’ve ever had
P8: lets fight
P8: I wont do it no I wont
P9: Kicking under the chair
P9: banging on the table
P9: rips paper
P9: I am fed up (emitted several disapprovals profanity)

Session 5

P7: Stands up and looks at what peers are doing
P7: I guess Ill just sit here and enjoy
P7: I think they want some
P7: What happens if I give them some
P8: I give up
P8: Oh man not this torture again I tell you torture
P8: How can this be happening again to me
P8: I actually will lock you in the closet P7
P8: Why and how is this my life

P9: Well this is bull (curse).

P9: kicking the table, floor and other student

P9: Well I guess I don’t even care about this

P9: messed up (curse)

Session 6

P7: I am just going to mind my own business

P7: P8 stop being so mean to me

P7: I am great but so are you guys, I don’t know why you don’t have any

P7: heavy intentional breathing and loud grunting

P8: This is outrageous

P8: I want a restraining order

P8: No not me again

P8: did another student from the class name win his game

P8: I wont give into this

P9: Here we go again

P9: profanity

P9: Snaps pencil into small pieces

P9: Starts putting pieces of pencil into his cup as experimenter delivers stimulus to P7