The Effect of a Social Condition on the Establishment of Direct and Indirect Conditioned Reinforcement for Writing by Second Graders

Jennifer Lee

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ABSTRACT

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I used an alternating treatments design and a delayed multiple probe across participants design to conduct a functional analysis of the effects of a social condition on the direct reinforcement value of writing and indirect conditioned reinforcement for writing. I defined the direct reinforcement value of writing as writing taking place under conditions where the natural contingencies of writing resulted in the participant emitting the behavior. That is, writing automatically or implicitly reinforced the participant's behavior and the reinforcement was intrinsic to the stimulus. I defined indirect conditioned reinforcement for writing as changes in performance (the emission of behaviors already in repertoire) or learning (acquisition of new repertoires) when opportunities to write were the consequence for responding. I conducted a functional analysis of indirect conditioned reinforcement for emitting performance behaviors through analyzing changes in rate of writing the letters A-Z. Two treatment conditions were implemented in which green tickets (access to a preferred activity) or red tickets (opportunities to write) were delivered upon responding to the performance task. I tested indirect conditioned reinforcement for learning new operants through analyzing correct responding when participants were given opportunities to learn new chemical element names. For this dependent variable, participants were given immediate access to an opportunity to write upon correct responses to learning presentations. Lastly, I measured the direct reinforcement value of writing in 5-minute observations of responding to writing tasks, where I collected data on whole, 5 s intervals of writing. After establishing that participants' behaviors were not directly or indirectly reinforced

by writing, I exposed participants to a social condition where he or she was deprived of opportunities to write. I chose participants because their rate of writing was slow and writing was not a preferred activity. I conducted 2 experiments, with the second as a replication and expansion of the first. Experiment 1 results showed writing was not an indirect reinforcer for emitting performance behaviors and learning new operants, and writing was not a direct reinforcer. Following the social condition, direct reinforcement for writing increased for all participants and opportunities to write were indirect reinforcers for performance behaviors and acquisition of new operants for 2 participants, with marginal increases for 1 participant. Experiment 2 was a replication of Experiment 1, with 4 added dependent variables including number of letters written, number of words written, a statistical analysis of naïve readers' scores of permanent products, and numbers of correct structural and technical components. Results showed increases in direct reinforcement for all participants, and increases in indirect reinforcement for emitting performance behaviors for 2 out of 4 participants. Indirect reinforcement for learning new behaviors increased for 3 participants. Results are discussed in terms of the onset of the demonstration of the ability to acquire new reinforcers via social conditions as a prerequisite for some verbal developmental cusps, different kinds of reinforcement, and writing in the context of today's educational practices.

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DEDICATION

This dissertation is dedicated to my students and their families, past and present. You are the inspiration for the work I do every day. Your learning is the greatest reinforcer.

Chapter I

INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

Ontogenic and phylogenic histories contribute to the ability to acquire new conditioned reinforcers via observation. Recent empirical studies in Verbal Behavior Development Theory (VBDT) (Greer & Du, 2014; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009), an extension of Skinner's *Verbal Behavior* (1957), have identified a possible new mechanism by which novel conditioned reinforcers are acquired (Greer & Singer-Dudek, 2008). This observational phenomenon results in previously neutral stimuli becoming conditioned as reinforcers as a function of observing other individuals receive those stimuli, and more specifically, as a function of being denied those previously neutral stimuli while others receive them. Behavior analytic treatments of conditioned reinforcement and observational learning provide the basis for discussion of the acquisition of new reinforcers via observation, and the direct and indirect properties of reinforcement. Verbal developmental cusps, capabilities, and their associated conditioned reinforcers and motivating operations also provide the context for the acquisition of this capability and the contact with new contingencies that result from having this capability in repertoire.

The overall purpose of Experiments 1 and 2 was to determine if conditioned reinforcement for writing is a verbal behavior developmental cusp which can be induced through a social condition. I first established that writing activities did not function as indirect reinforcers for target participants, during learning and performance tasks. I then developed a social condition where target participants observed peer confederates receiving writing tasks and completing

them with access to the natural reinforcement contingency of writing. Peer confederates communicated via writing while the target participant was denied access to the writing exchange.

The review of literature will address three key areas of theory related to the acquisition of new reinforcers via social learning. They include discussions of 1) conditioned reinforcement, 2) observational and social learning, and 3) the ontogenic and phylogenic changes in preferred stimuli across comparative psychology, social psychology, Social Pragmatic Theory, and Verbal Behavior Development Theory. These domains are discussed in an attempt to further theoretically define the observational acquisition of new reinforcers and its social value and evolutionary origins, link epigenetics and behavior principles, and describe the new ways in which it allows individuals to learn.

Review of the Literature

Conditioned Reinforcement – a Principle of Behavior

Skinner (1953) and Keller and Schoenfeld (1950) cited conditioned reinforcement, a principle of behavior, as critical to understanding complex human behavior. Taken together with earlier research from Thorndike (1911) and Pavlov (1906), basic researchers studied schedules of reinforcement and conditioned reinforcement to understand how stimuli became reinforcers, and how those in turn affected learning. Though many studies were conducted which focused on conditioned reinforcement, the topic fell out of favor in the research community for a number of years. Williams (1994) discussed how the basic science focused on conditioned reinforcement in the 1960s and addressed some possible reasons for why it fell out of favor in the basic research in the decades that followed. One possibility was that the basic research community dismissed new research on conditioned reinforcement because it was regarded as largely understood. In addition, behavioral research declined in popularity in general after the 1960s, with a popular

emphasis on cognitive psychology for explaining animal and human behavior. Third, there was disagreement among behaviorists about the legitimacy and utility of conditioned reinforcement as a possible explanation for certain behavioral phenomena (Kelleher & Gollub, 1962). In general, few basic scientists studied human behavior prior to Stimulus Equivalence (Sidman, 1971) and Relational Frame Theory (Barnes-Holmes, Barnes-Holmes & Cullinan, 2000), leaving much unknown about conditioned reinforcement in humans. However, Verbal Behavior Development Theory (Greer & Ross, 2008) includes several empirical and theoretical findings which suggest that conditioned reinforcers may be the source for higher-order operants (Greer & Du, 2014).

Kelleher and Gollub (1962) reviewed chained schedules of reinforcement in their extensive paper on the basic origins of understanding conditioned reinforcement within behavior analysis. Through the compilation of a number of studies that systematically tested chained schedules, Kelleher and Gollub (1962) were able to conduct a diligent review of conditioned reinforcement in order to define it for the behavior analytic research community. They defined conditioned reinforcement as the pairing of a stimulus with a reinforcer, conditioned or unconditioned, such that the stimulus becomes a conditioned reinforcer itself. They addressed three major questions: 1) what conditions are necessary for stimuli to become conditioned reinforcers, 2) what variables contribute to the strength of the conditioned reinforcer and 3) what applications will conditioned reinforcement have for research in the future? Kelleher and Gollub (1962) made three important distinctions in their answers to these questions. They found that any stimulus, neutral or even aversive, can become a conditioned reinforcer(s). Their strength as a conditioned reinforcer depends directly on the immediacy of the pairing of the stimulus and the known reinforcer and the frequency of pairings between the stimulus and the known reinforcer.

Kelleher and Gollub's (1962) findings indicated that it was understood how conditioned reinforcers were acquired, but that its utility in explaining other behavioral phenomena was still an important area of research to be conducted. Further, they described in detail how to test for conditioned reinforcers. However, they did not identify categories of learned reinforcers. Also, the research was largely restricted to non-human animals and a few primates. Verbal Behavior Development Theory (VBDT), suggests that conditioned reinforcers are the foundational basis for many behavioral cusps and cusps that are capabilities in humans (Greer & Du, 2014), and further that learned reinforcers are critical to understanding what an individual can do. For example, acquiring writing as a reinforcer may then allow an individual to learn to write more effectively, engage in writing activities, and access new contingencies through writing that he or she could not before.

Observational Learning – a Behavioral Capability

Catania (1998) defined learning as "a relatively permanent change in behavior" that occurs following direct contact with contingencies of reinforcement and punishment. He further defined observational learning as learning by observing the consequences received by another individual, beyond simple imitation. Bandura's (1977) early work defined vicarious learning in a manner consistent with Catania's definition of observational learning, emphasizing the role of modeling, punishment, reward and no consequence on imitative behavior. Some studies found that punishment had an effect, whereas rewards and no consequence had no difference. Though the terms reinforcement and punishment are used loosely, they point to the importance of the consequence in observational learning. Bandura and Jeffrey (1973) defined the mechanisms of observational learning through cognitive mediation, where an input-output "Ghosts in the Machine" model consisting of attentional, retention motor reproduction, and motivation

constructs which they proposed could accurately address the delayed emission of observed behaviors. This shift in the social learning theoretical model caused Bandura and colleagues to reject the behavior analytic position, stating that it could not fully address the delayed emission of observed behaviors with contingencies of reinforcement and punishment alone.

Deguchi (1984) discussed the critical role radical behaviorism plays in explaining modeled behavior that occurs later in time. Deguchi defined three distinctive features of observational learning as outlined in social learning theory from the radical behaviorist's perspective. They include one-trial learning, delayed performance, and observed consequences. In one-trial learning, a new behavior is imitated after a single exposure to a model without external reinforcement or direct prompting. Radical behaviorists look at the individual's history of reinforcement for imitation, while social learning theorists believe that new behavior is acquired as a result of cognitive processes of observation. Delayed performance is when that same behavior is emitted later and without the model (the behavior could be just observed previously and not imitated). Social learning theorists explain this through cognitive mediation, while radical behaviorists suggest that these processes can be mediated through behavior beneath the skin. Lastly, in observed consequences, a model's behavior is consequated. Behaviorists propose that observing a model and its consequence (vicarious reinforcement) functions as an SD for imitating the behavior, while in social learning theory vicarious reinforcement plays a role. Bandura did not define the role of direct reinforcement in the definition of vicarious reinforcement.

The Verbal Behavior Development Theory (Greer & Du, 2014; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009) attempts to address the criticisms and the supposed limitations of behavior analytic principles in explaining observational learning. Within

this theory, observational learning is a higher-order operant or behavior developmental cusp (Rosales-Ruiz & Baer, 1997) that is a new learning capability. A verbal behavior developmental capability is a learned developmental stage which allows individuals not only to come into contact with new contingencies and learn faster, but to learn in new ways (Greer & Ross, 2008). Further, observational learning occurs along a developmental trajectory of numerous other cusps and capabilities. As individuals come into contact with contingencies of reinforcement, new cusps and capabilities emerge, which function to increase verbal and social functioning.

Donahoe and Palmer (2004) discussed the importance of initial experiences with an individual's environment, and how these experiences lead to the acquisition of conditioned reinforcers. VBDT argues that these initial key experiences are the foundational cusps upon which more complex behaviors can develop. Donahoe and Palmer (2004) referenced infants as young as ten days old blinking in response to a tone followed by a light puff of air. As these tone and air puff trials continued, the infants began blinking following the tone. They argue that an individual is born with a set of respondent behaviors and unconditioned reinforcers, which respond to eliciting stimuli. Contact with the environment allows other stimuli to become conditioned reinforcers.

These newly acquired conditioned reinforcers allow individuals to emit increasingly more complex and social behavior. Similarly, Greer and Du (2014) proposed that when a new verbal behavior developmental capability is in repertoire it is because a new conditioned reinforcer has been established. This is a critical feature of the verbal developmental model in being able to address criticisms of the behavior analytic account of complex human behaviors such as observational learning. Establishing a new conditioned reinforcer allows the reinforcing consequences of behaviors to pull along antecedent control and associated motivating operations

necessary to develop complex social behaviors. Within this model of verbal development, reading and writing are verbal and thus, social behaviors. In order for more complex social behaviors to occur, such as writing to affect a reader, a new conditioned reinforcer must be established.

Three Kinds of Observational Learning

In a continuation of the VBDT perspective on observational learning and a synthesis of the current theoretical standings across disciplines, Greer, Singer-Dudek and Gautreaux (2006) proposed a definition of observational learning consisting of three different types. They stated that observational learning can result in 1) acquisition of new operants, 2) behavior change for performance behaviors, and 3) the acquisition of new conditioned reinforcers.

Acquisition of new operants and induction of a new capability. The acquisition of new operants refers to others observing the contingencies of reinforcement and punishment such that the observer could emit the operant behavior observed. This definition of observational learning is more consistent with early studies in observational learning across behavior analysis and social learning theory. However, Greer et al. (2006) distinguish between this and observational learning as a verbal behavior developmental capability. Several studies in the VBDT literature determined that individuals could demonstrate correct responding after observing the learn units of others when a specific instructional history was provided. Pereira-Delgado and Greer (2009) taught young children with disabilities to discriminate between the correct and incorrect responses of their peers. Before this intervention, they could not acquire new operants through observation, but could emit correct responses afterwards. These findings were replicated across several studies which provided the instructional history necessary for children to acquire new operants through observation (Davies-Lackey, 2005; Gautreaux, 2004;

Stolfi, 2004). These were the first studies to focus on testing if observational learning was present and define a series of procedures such that students can learn through observation when they previously could not. Following these procedures, participants could learn in new ways.

Behavior change for performance behaviors. Still another distinction regarding observational learning is the distinction between acquiring new operants and changing behaviors already in repertoire, or performance. Changes in performance behaviors refer to behaviors in repertoire emitted as a result of observing a model's consequence. This differs from imitation, as Catania's (1998) definition of observational learning states, because in imitation the correspondence between the model and the observer's behavior is the reinforcer. With imitation, the observer is directly accessing the contingencies of reinforcement. If an individual changes his or her behavior to emit a behavior already in repertoire, as a result of observing another individual receive a favorable (or punishing) outcome, the observer is not directly contacting those contingencies but is still adapting his or her behavior to the contingencies present.

Acquisition of new conditioned reinforcers. The third type of observational learning as proposed by Greer et al. (2006), and the one most relevant to the present review of literature, is the acquisition of new conditioned reinforcers through observation. Greer and Singer-Dudek (2008) proposed a new kind of observational learning based on their research findings where participants acquired new reinforcers after being denied access to them. Participants were able to observe a peer confederate accept the neutral stimulus as a reinforcer. Following this procedure, target participants acquired conditioned reinforcement for plastic discs, and the discs functioned to reinforce both learning and performance behaviors. The results of these studies will be discussed in detail herein; however, limited research is available outside of VBDT describing similar phenomena.

The Emergence of Conditioned Reinforcement from Observation in Comparative Psychology

We can look to comparative psychology and social psychology to enhance the understanding of acquiring new reinforcers via observation. Fantino (2008) and Williams (1994) cite studies by Wykoff (1952, 1969) which found that organisms, including pigeons, rats, and humans, observe stimuli even though observation had no direct bearing on the schedule of reinforcement. This indicates that behavior can be maintained through conditioned reinforcers. Fantino discussed the conditioned reinforcement hypothesis of observing, where an individual will observe a stimulus that has been previously paired with positive reinforcement. Therefore, a stimulus that has been associated with a high probability of reinforcement will come to function as a conditioned reinforcer, and by contrast, a stimulus that has been associated with a delay in reinforcement or smaller quantity of reinforcement will be less likely to function as a conditioned reinforcer. These factors taken together will either maintain or decrease observing responses (Fantino, 2008; Williams, 1994; Wykoff, 1952, 1969).

Given these treatments of conditioned reinforcement and observation, it follows that individuals may be capable of acquiring new reinforcers through observation, as empirically determined by several aforementioned studies in VBDT (Greer & Singer-Dudek, 2008; Greer, Singer-Dudek, Longano, & Zrinzo, 2008; Singer-Dudek, Greer, & Schmeltzkopf, 2008; Oblak, 2010; Oblak, Greer, & Singer-Dudek, 2015; O'Rourke, 2006; Singer-Dudek, Choi, & Lyons, 2013; Singer-Dudek, Oblak, & Greer, 2011; Zrinzo & Greer, 2013). These studies proposed that these changes in behavior are due to the acquisition of conditioned reinforcement for a stimulus which did not previously function to reinforce performance or learning behaviors. Some criticisms of these studies propose that the observational procedures did not truly function to

condition new reinforcers, but that they only created establishing operations. According to Michael's (1993) definition of an establishing operation, the momentary value of the reinforcer must change in order for an establishing operation to be in place. Studies measuring the reinforcing value of previously neutral stimuli during follow-up probes demonstrate changes were not due to an establishing operation because they were not momentary; rather they were maintained over time (Zrinzo & Greer, 2013). Apart from this body of research, no comparable studies in human subjects have been found where stimuli were conditioned as reinforcers through observation. Thus, it is necessary to both replicate and expand upon these results.

However, studies in non-human subjects have identified instances of observational learning for conditioned reinforcers or punishers for mating and survival in female guppies (Dugatkin & Godin, 1992), rhesus monkeys (Cook, Mineka, Wolkstein, & Laitsch, 1998; Mineka & Cook, 1988), and birds (Galef & White, 2000). Mineka and Cook (1988) and Cook et al. (1998) conditioned fear of snakes in unrelated rhesus monkeys. Monkeys raised in laboratories with no previous exposure to snakes observed other monkeys escape or avoid snakes, and did the same following observing their conspecific. They demonstrated that snakes can become conditioned punishers through observation. Zentall (1996) discussed these results and the theoretical mechanisms by which this conditioning took place. Zentall suggested that monkeys could recognize fearful behavior in their conspecifics, resulting in that stimulus being paired with an unconditioned stimulus, such that the snake now becomes a conditioned stimulus.

Similar results were found in blackbirds who observed a conspecific escaping a friarbird, which is not a natural predator (Curio, Ernest, & Vieth, 1978). Epstein (1984) also demonstrated pigeons engaging in novel behavior as a function of observing a peer receive food as

reinforcement for engaging in these activities. These findings suggest that observing and copying behaviors of others allows individuals to escape danger or access food as a means for survival.

Godin, Herdman, and Dugatkin (2005) refer to a growing body of research where the capability for mate choice copying is present in polygenous species, particularly fish and birds, where gestation of their young begins with internal fertilization and the majority of rearing is conducted by the mother. Female guppies, who are genetically predisposed to select their mates based on their brightly colored scales, were shown to select dull-colored males after observing another female engage with a dull-colored male. In fact, Dugatkin and Godin (1992) had designed a mirror system in which it appeared that other female guppies chose to mate with dull colored males. A series of studies replicated and expanded upon these results (Dugatkin, 1992, 1996a, 1996b; Dugatkin & Godin 1992, 1993, 1998; Dugatkin et al. 2002, 2003). Godin et al. (2005) conducted a follow-up study to determine if these changes in mate selection would be maintained over time. Results showed that females' preferences for dull colored males generalized to other males and changed their phenotypic mate preferences, resulting in epigenetic influences.

Similar findings were reported in a study by Galef and White (2000), where female Japanese quail observed another female court and mate with a non-preferred male. Following this observation, females spent more time with the previously non-preferred male. However, female quails who did not observe the non-preferred male with a model female did not change their behavior. Godin et al. (2005) argue that these social mating preferences are significant because, if they remain in an individual's ontogeny, male preference traits can be passed on through natural selection. These cultural inheritances can affect the phylogeny of male traits across generations.

These studies are relevant to the body of research in VBDT on human acquisition of new reinforcers because they show that other species can acquire new reinforcers through observation, and that those new preferences are maintained over time and are not only momentary changes, as in an establishing operation. These findings may also be significant because they suggest that the ability to acquire reinforcers socially may have evolutionary advantages in natural selection (Darwin, 1860).

Mate Copying and Mate Poaching in Humans

The closest approximation to the mate selection studies in human species are social psychology studies on mate choice copying, mate poaching, and perceived attractiveness in humans. Waynforth (2007) examined mate choice copying in human females and presented females with pictures of males who appeared with a date or alone. Male attractiveness was also considered within the experimental design. Results showed that women copied other women's mate choices only when the men were attractive. Waynforth discusses these results in the context of their evolutionary advantages and the possible cultural transmission of the male's traits across generations and time. He suggests that females may engage in mate copying as a means to quickly assess male features, such as paternal ability. This is significant because genetic quality expressed in attractiveness yields little information about a male's ability as a caregiver for children. Similarly, Eva and Wood (2006) found that women rated men who were described as married to be more attractive than men who were single, when presented with a picture and description of the man. Graziano et al. (1993) found that women's attractiveness ratings of men were affected by their peers' low attractiveness ratings.

Schmitt (2004) and Schmitt and Buss (2001) describe mate poaching as the cross-cultural preference for pursuing an attached male or female. Parker and Buckley (2009) set out to

investigate whether one gender engaged in more mate poaching than another. They found that women indicated that they were more interested in men who were not available but only when they were single. They found no differences among men and women who were in committed relationships. Further, attractiveness did not correlate to probability of mate poaching. This is consistent with Waynforth's (2007) assertion that attractiveness does not convey enough information about paternal ability and that mate copying or mate poaching may be an efficient means to garner information about a potential mate. Mate copying and mate poaching may be a reproductive application of the ability to acquire new conditioned reinforcers through observation. However, there may be some components of denial that contribute to this phenomenon.

Social Pragmatic Theory

Social Pragmatic Theory is a critical component of the discussion of the differences between the social and evolutionary utility of the ability to acquire new conditioned reinforcers through observation. Michael Tomasello (2008) proposed a model of human language acquisition which incorporated evolution, behavior, linguistics, and psychology into an ontogenic perspective of language. Tomasello's *Origins of Human Communication* (2008) proposed that human behaviors have some similarities to apes, in gestures and vocalizations. However, these similarities, such as pointing, eventually diverge when infants begin to speak using language. In Tomasello's view, humans have underlying biological and evolutionarily inherited mechanisms by which to acquire language, which are fundamentally different from apes. However, the majority of language is acquired through interactions with individuals in the environment. Tomasello argued that apes do not have cooperative communication and only separate, individual goals achieved through communication. According to Tomasello, cognitive

structures in humans allow cooperative communication to happen, which Tomasello called shared intentionality. Pointing in human infants is a key indicator of their capacity for shared intentionality prior to language acquisition because the function of pointing can vary from asking for something, calling attention to, and cooperating. Tomasello argued that this collaborative capacity in humans is the result of successive approximations from actions and vocalizations made by ancient humans and human predecessors, in an effort to convey the necessity for mutually beneficial collaborative and cultural actions. Over time, adaptations were acquired phylogenically and language became more complex, incorporating grammar into three major functions of communication which Tomasello proposed. They are: 1) requesting, 2) informing, and 3) sharing and narrative. Thus, Tomasello's theorization of language accommodated a phylogenic endowment, but also emphasizes the ontogenic selection of language-based behavior through functions which are beneficial to the speaker and listener. Skinner (1986) shared a common theory with Tomasello in that some advantageous physiological features evolved to allow social learning, and that social learning developed as a result of contact with contingencies of the basic principles of behavior. However Skinner and other radical behaviorists diverge from Tomasello in denying the need for explanations that attribute the phenomenon to changes in cognition.

Human Clothing and Body Decoration

In addition to mate selection, perhaps another outcome of acquiring conditioned reinforcers though observation is present in human fashion and body adornment. Cartensen (2013) states that clothing is uniquely human. Perhaps an obvious assertion, it speaks to Tomasello's Social Pragmatic Theory (2008) in that some social behaviors are uniquely human. Cartensen describes why humans first adapted to wear clothing, following the species' loss of

body hair. In an interview with Cartensen, Ian Gilligan, a bioanthropologist at the Australian National University and a prehistoric clothing expert, stated that humans may have begun to wear clothing to keep warm during the ice age. Ornamentation with body paint and prehistoric jewelry was also prevalent, even before the need to dress to keep warm. By contrast, Neanderthals did not adapt to cooler temperatures with clothing, and this may have been a factor in their extinction. Thus, adornment with clothing is an evolutionarily advantageous human capability, but it is also a social one. Cartensen states that adornment can be a display of wealth or social status. This, as Tomasello argues, is the shared intentionality that only humans are able to attribute to the actions of their peers.

Cartensen (2013) goes on to state that this differs from animals who engage in adornment as a part of mating rituals, such as adornment crabs and peacocks, but it may not be entirely unrelated. Courtship and mating are social behaviors, and clothing may convey certain assets or features which may be advantageous in a mate. In the same way that mate copying allows individuals to quickly assess for paternal ability, clothing and body decoration enhances human physical capabilities (i.e. wearing shoes increases walking ability) and shared intentions about social status, wealth, and reinforcer preferences, pointing to a possible social cusp or ability.

Though the present review of literature did not find empirical studies suggesting that clothing and body decoration preferences are conditioned as new reinforcers through observation, their utility in social interactions and courtship rituals suggests this is an area for future research. The VBDT treatment of the acquisition of new reinforcers via observation attempts to provide the underpinning principles missing in the literature, suggesting that this ability may have social utility beyond survival and procreation. However, what may distinguish

humans from animals is the ability to acquire new reinforcers through observation which are unrelated to mating rituals or survival through escaping danger or access to food.

Acquisition of New Reinforcers through Observation

Studies in the acquisition of new reinforcers via observation began with empirical studies on children's food choice following observation. In several studies (Birch, 1980; Duncker, 1938; Greer et al.1991; Greer & Sales, 1997) children's food preferences changed following observations of a peer or peers consuming the food. Birch found that when children's non-preferred foods were given to peers, they began to consume the nonpreferred foods after three days of exposure. Results were more significant in younger children than in older children. Duncker found similar results in preschoolers, whose choices corresponded to the target individual's preference for the peer. For example, participants consumed the food that experimenters told them was their favorite superhero's favorite food, but nonpreferred adults' preferences did not have any influence on consumption. Similarly, Greer et al. (1991) and Greer and Sales (1997) conditioned consumption of nonpreferred foods by delivering those foods to a peer while denying the observing participants the foods. Taken together, these studies suggest that observation of one's peers consuming a nonpreferred food item is analogous to observing a peer receive a neutral stimulus as a reinforcer for a behavior.

The results found in Greer and Singer-Dudek's (2008) study were replicated with similar results, including more neutral stimuli (Singer-Dudek, Greer, & Schmeltzkopf, 2008; Oblak et al. 2015), academic subjects (O'Rourke, 2006), and teacher approvals (Greer, Singer-Dudek, Longano & Zrinzo, 2008). Singer-Dudek, Greer, and Schmeltzkopf (2008) found consistent results with a partial replication in pieces of string as the previously neutral stimulus. Oblak (2010) conditioned metal nuts through similar observational procedures. Singer-Dudek, Oblak,

and Greer (2011) used an observational procedure to condition books as a reinforcer in non-instructional and instructional settings. They found that following an observational intervention, or social condition, books functioned to reinforce both learning and performance behaviors. Further, books were conditioned reinforcers in free-play settings, demonstrating that observational interventions were an effective and efficient method for conditioning books, an academically significant reinforcer. Greer, Singer-Dudek, Longano, and Zrinzo (2008) conditioned teacher approvals and praise through a similar application of the observational procedure. Zrinzo and Greer (2013) eliminated the role of the adult in these experiments and further determined that the experimenter or teacher presence did not create a stimulus-stimulus pairing condition. These results determined that the emergence of the new reinforcer could be attributed to the observational intervention. O'Rourke (2006) conditioned math activities as a reinforcer for performance and learning using an observational intervention for second graders. Most recently, Oblak, Greer, and Singer-Dudek (2015) demonstrated that when target participants delivered a neutral reinforcer to a peer while being denied access to the neutral stimulus, the neutral stimulus became a conditioned reinforcer for both the target and peer confederates. Altogether, these studies suggest that the ability to acquire conditioned reinforcers through observation can result in new, complex social behaviors.

Writing as a Complex Social Behavior

Successful writers write for social function, which affects the behavior of their reader through technical or aesthetic writing (Greer, 2002). Further, in order to be a successful contributor to society, individuals must function at the writer status of verbal behavior.

The writer status includes several behavior developmental cusps, including print transcription (see-write), dictation (hear-write), joint stimulus control across saying and writing

(Greer, Yuan & Gautreaux, 2005), technical writing that precisely affects the reader's behavior (Helou-Care, Lai, & Sterkin, 2007), aesthetic writing that affects emotions (Jodlowski, 2000), writer self-editing (Marsico, 1998), and technical writing for complex operations. These cusps develop through a precise history of contact with reinforcement contingencies in the environment, including several key pre-reader, reader, and pre-writer verbal behavior development cusps and capabilities. These cusps and capabilities include conditioned reinforcement for observing 2D print (Keohane, Greer & Pereira- Delgado, 2009), Naming (Fiorile & Greer, 2006; Gilic & Greer, 2011; Greer & Ross, 2008; Greer, Stolfi, Chavez-Brown, & Rivera-Valdez, 2005; Horne & Lowe, 1996), and conditioned reinforcement for print and book stimuli (Buttigieg, 2015; Dinsmoor, 1983; Greer & Ross, 2008; Tsai & Greer, 2006). Protocols to induce these cusps differ from curricular objectives because they are designed to systematically replicate the precise reinforcement contingencies necessary to allow individuals to learn in new ways.

All of these cusps allow writers to affect their audience (reader) in ways that evoke emotion or can attain a desired end result. For example, effective aesthetic writers can make their reader laugh, cry, or experience fear. Effective technical writers can have their work replicated by the reader, which is essential to dissemination of research across many disciplines, especially in the natural sciences.

Writing as a Curricular Foundation

Graham, Harris, and Santangelo (2015) conducted a meta-analysis of writing instruction in schools. They discussed the importance of writing to educational success. They stated that proficient writing is critical to everyday life, as well as many high-paying jobs, and cited several alarming statistics regarding performance of writers in the United States. The National

Assessment of Educational Progress (NAEP) reported that just 30% of students in grade 8 and grade 12 scored "proficient" in writing (National Center for Education Statistics, 2012) in the United States. Further, only 1% of students with disabilities and 5% of English language learners performed at the proficient level in writing. The Common Core State Standards (CCSS, 2010) implemented wide-spread changes in national curricular objectives in order to address this national deficit. Further, the CCSS not only includes English Language Arts writing objectives, such as grammar, mechanics, and spelling, but also emphasizes the importance of writing for problem solving in math and the natural sciences.

Troia and Olinghouse (2013) conducted a review of the state of the Common Core State Standards with regards to writing, and the need for evidence-based practices (EBPs) in teaching writing. This review found that the CCSS places little emphasis on research-based tools for teaching writing, such as teacher feedback, motivation, and goal setting. Further, they stated that few teachers used EBPs in their classrooms and that low writing standards in both length and complexity are pervasive. As such, it may be necessary for teachers to not only increase demands and expectations for writing quality as the CCSS attempt to do, but also find ways for students to simply produce more writing such that teachers may effectively provide feedback. The VBDT sequence of writer status cusps addresses many of these shortcomings in writing curricula, while providing the basis for further verbal development.

Direct reinforcement for writing may be one objective measure of writing ability in students. If students lack conditioned reinforcement for writing, they lack this curricular foundation, and they are unable to contact many or most of the contingencies of technical writing and acquire the necessary writer cusps. Students of reader and writer status function at higher levels of verbal behavior and classical stimulus-stimulus pairing procedures may not be practical

or ethical for conditioning new reinforcers. The present study builds upon the emerging body of research on conditioning new reinforcers through observation, specifically if more academic reinforcers like math activities (O'Rourke, 2006) and writing can be conditioned via observation. Further, it discusses the two different kinds of reinforcement examined here, and discusses conditioned reinforcement for writing in the context of today's educational practices.

Research Questions

I seek to investigate whether writing activities, like math, can be conditioned as a reinforcers for second graders with a relatively long instructional history of aversion to or low preferences for writing. These students do not have language or phylogenic deficits which contribute to difficulty in writing; rather, they simply do not prefer writing.

I will investigate if, following a social condition, the opportunity to write will indirectly reinforce learning new operants and performance behaviors, and if writing is directly reinforced by the natural contingencies of writing. I distinguish between direct and indirect reinforcement to clearly define the dependent variables, but also to answer research questions about different kinds of reinforcement.

Direct reinforcement encompasses writing as reinforced by the features of writing implicit within the behavior, such that emitting the behavior results in continuous and automatic reinforcement. Indirect reinforcement encompasses behaviors reinforced by writing, and the changes that occur in performance and learning as a result of reinforcement with writing tasks. With indirect reinforcement, writing tasks can function as reinforcers that increase the frequency of behavior or increase correct responding.

In addition, I am investigating the social condition as a socially appropriate intervention for conditioning new reinforcers. In the Verbal Behavior Development Theory of social

development (Greer & Du, 2014; Greer & Keohane, 2005; Greer & Ross, 2008; Greer & Speckman, 2009), the shift in social reinforcement from the teacher to peers begins in or around second grade. Not only is it evolutionarily advantageous to change behavior through observation, but it is often socially advantageous to have the newest toy or wear the latest fashionable accessory. I propose that a social procedure, conducted in a group setting with two peer confederates and one target participant, could function to condition an academic and socially powerful reinforcer for students at this level of verbal development.

Chapter II

EXPERIMENT I

Method

Participants

Three second graders were selected from a Comprehensive Application of Behavior Analysis to Schooling® Accelerated Independent Learner (CABAS® AIL) second grade classroom (Selinski, Greer, & Lodhi, 1991). All students were typically developing and were performing on grade level for reading and math. Participant 2 had an Individualized Educational Plan (IEP) for receiving speech services. This did not impact his learning and writing because his speech supports were specifically articulation-based rather than language-based. All participants functioned at the reader and emergent writer levels of verbal behavior. Participants were under the experimenter's instructional control and had no difficulty writing letters. Transcription and dictation were also in repertoire. That is, participants could accurately write printed or written stimuli from a model and write accurately based on a vocal model. The experimenter chose the participants because their rates of writing were slow for technical and aesthetic writing tasks. In addition, they emitted high numbers of incorrect responses for both structural and technical components. Moreover, tests of conditioned reinforcement for writing showed that no participants preferred writing. Peer confederates were selected because they had conditioned reinforcement for writing in repertoire. Table 1 lists each participant and peer confederate's relevant cusps and capabilities in repertoire.

Table 1

Participant Characteristics and Verbal Behavior Developmental Levels for Experiment I

	Age	Gender	Grade	Level of Verbal Behavior	DRA Score at Mid-Year	Math Grade Level at Mid-Year	Relevant Cusps and Capabilities
Participant 1	7.6	M	2	Listener/ Speaker/ Reader	24 (On)	2	Observational Learning, Naming, Transcription
Participant 2	8.6	M	2	Listener/ Speaker/ Reader	28 (Above)	2	Observational Learning, Naming, Transcription
Participant 3	8.1	M	2	Listener/ Speaker/ Reader	24 (On)	2	Observational Learning, Naming, Transcription
Confederate 1	8.1	F	2	Listener/ Speaker/ Reader	24 (On)	2	Observational Learning, Naming, Transcription Conditioned Reinforcement for Writing
Confederate 2	8.0	M	2	Listener/ Speaker/ Reader	30 (Above)	2	Observational Learning, Naming, Transcription, Conditioned Reinforcement for Writing

Note. DRA refers to the *Developmental Reading Assessment*, used to assess fluency and comprehension. A DRA score of 24 corresponds to performance on grade-level for the middle of second grade, with scores below signifying below grade level (i.e. 1.8) and scores above signifying performance above grade level (i.e. 3.2).

Participants were involved in a class-wide token economy in which they traded in tokens for backup reinforcers at least two times per day. Backup reinforcers included toys and games as well as academics such as writing and math activities. In addition to a class-wide token economy, the classroom employed several research-based tactics from the behavior analytic literature aimed at increasing self-management repertoires and accelerating learning. These tactics included choral responding, observational system of instruction, Personalized System of Instruction, learning pictures, Teacher Performance Rate Accuracy (Ingham & Greer, 1999), small group instruction, peer tutoring, response boards, and peer-yoked contingencies. See Table 2 for a complete listing of AIL components and Table 3 for a complete definition of each component.

Table 2

Accelerated Independent Learner (AIL) Model Research-Based Tactics and Class-wide Contingencies as outlined in Greer (2002)

AIL Standard Tactics and Procedures			
Class-wide Point System	Peer-Yoked Contingencies	Comportment Graphs Available	Teacher Performance Rate Accuracy (TPRA) Observations
Rules in Place	Peer Tutoring	Permanent Product Book	Token Menu
Names on Desk	Observational System of Instruction	Learning Pictures	CABAS® Ranks Posted
Transitions Timed and Graphed	Personalized System of Instruction	Four Approvals per Minute Delivered by Teachers	Class-wide Data Posted
	Choral Responding	Response Boards	

Table 3

AIL Components Defined

Term	Definition
Class-wide Point System	Teachers distribute points to students contingent upon specific pre-determined behaviors, understood by both students and teachers. These behaviors are posted for students, teachers and visitors to see easily. Students collect, count, and exchange points during "trade-in" times on the classroom schedule for preferred items. Teachers deliver points and approvals at a mean of four per minute, assuring high rates of reinforcement for students by teachers or peers.
Peer-Yoked Contingencies	Behaviors of two or more students are linked together such that access to or toward a reinforcer is determined by both participants emitting the target behavior or behaviors.
Comportment Graphs Available	Teachers collect data on students' individual behaviors requiring additional intervention beyond the class-wide point system. Data are then graphed and analyzed using CABAS® Decision Protocol (Keohane & Greer, 2005) in order to ensure that Behavior Intervention Plans are as effective as possible. Graphs are available for review by supervisors and teachers.
Teacher Performance Rate Accuracy (TPRA) Observations	Supervisors and teachers conduct TPRA observations on at least a weekly basis so that teachers receive immediate feedback on teaching repertoires. Supervisors ensure that Learn Units (Albers & Greer, 1991) are in tact, approvals and points are delivered at a high rate, and that point systems and behavior intervention plans are implemented with fidelity. TPRAs can solve curricular or teaching problems.
Rules in Place	Teachers and students collaboratively create a list of classroom rules that are mutually agreed upon and signed through a contract. The contract is posted publicly so that teachers, students, and visitors to the classroom are aware of behavior expectations. Following

	classroom rules is reinforced through approvals and points, and undesired behavior is ignored unless detrimental to student or teacher safety.
Peer Tutoring	Students receive and deliver instruction in learn units to each other during peer tutoring sessions. Research shows that both tutor and tutee acquire academic objectives through this activity, and it can be used as a tactic when problems in learning occur. Students acquire critical self-management skills such as accurate data collection and delivering contingent approvals to peers, in addition to acquiring academic objectives.
Permanent Product Book	Permanent products for each student are systematically stored for review by teachers and supervisors and data collection.
Token Menu	A list of "backup" reinforcers, or preferred items, and their associated point costs is displayed for students. Token menus change to avoid satiation, as well as the values associated with each item.
Names on Desk	Each student has a designated space or desk with their name affixed, such that visitors, teachers and peers can deliver behavior-specific approvals using the student's name.
Observational System of Instruction	Students in the AIL classroom have met the prerequisite of having the Observational Learning capability in repertoire, such that corrections and reinforcement delivered in learn units to peers are observed and function the same as corrections and reinforcement delivered directly to the student. This ensures the highest rate of acquisition of new academic objectives as possible.
Learning Pictures	Data collected within academic groups are graphed on a CABAS® AIL Learning Picture. Learning Pictures are a combination of line and bar graphs. The bar represents the number of learn units delivered to a student versus the number of learn units required for errorless mastery of an objective. The line represents the rate of acquisition across all objectives across time, demonstrating the student's relative rate of learning for the school year. Events that may further accelerate a student's rate of learning, such as the induction of a Verbal Behavior

	Developmental Cusp or Capability are depicted in the style of a phase change line. Use of the CABAS® AIL Decision Protocol is also depicted in a similar fashion, when teachers implement instructional tactics within-session to remediate problems in mastery of objectives. Learning Pictures are continuously updated and available for parents, teachers, and administrators to view.
CABAS® Ranks Posted	The three or more teachers in a classroom each lead an instructional group for each subject and are continuously working toward achievement of CABAS® ranks. CABAS® ranks are posted on the class-wide data display. Each CABAS® rank corresponds to the completion of a variety of objectives across Contingency-Shaped teacher repertoires, Verbally-Mediated repertoires, and Verbal Behavior About the Science. These objectives are met through coursework and practicum.
Transitions Timed and Graphed	Students are placed in homogenous instructional groupings and thus students must transition between academic subjects. Students also transition for classwide activities such as lunch and recess and specials. Transitions are timed, graphed and analyzed according to CABAS® Decision Protocol (Keohane, 1994) to maximize instructional time and efficiency.
Personalized System of Instruction (PSI)	Students with Verbal Behavior Developmental reader/writer status cusps engage in a personalized system of instruction (Keller, 1968). PSI consists of written antecedents and models such that students can learn new objectives through written content scripted by their teachers. This system enhances learner independence and allows students to acquire objectives at their own rate of mastery. Students who do not have the prerequisites for true PSI may also practice mastered skills in PSI format.
Four Approvals per Minute Delivered by Teachers	Teachers deliver four approvals or points per minute on average to ensure that students continuously receive feedback for appropriate behavior. This often functions to condition academic subjects and self-management behaviors.

Class-wide Data Posted	Each teacher collects data on academic and self-management objectives and graphs it for the student and for the teacher. A summary of these data are graphed and posted in the class to display trends in learning across the class.
Choral Responding	Some instruction takes place in the form of choral responding, where all students in the group respond to a teacher's antecedent following a signal. Students are taught to respond to the signal first before acquiring new objectives through choral responding. Choral responding maximizes learner and teaching efficiency by delivering one learn unit to a group of students. Students engage in active responding simultaneously. Teachers must learn to attend to each student's vocal response, distinguish correct responses from incorrect responses, and collect data on responses.
Response Boards	Students each have a dry-erase board that allows them to engage in active responding for written responses. Students respond immediately to the teacher's antecedent, and learn to cover their boards and wait for a teacher's signal to show their responses. Teachers provide immediate feedback according to Learn Unit Protocol (Albers & Greer, 1991) and students may collect data on their own responses and teachers collect data on student responses.

Setting

The study was conducted in a Comprehensive Application of Behavior Analysis to Schooling® Accelerated Independent Learner (CABAS® AIL) second grade classroom (Selinski, Greer & Lodhi, 1991). The classroom was located in a publicly funded Title I school district in a suburb of a major metropolitan city. The student population was highly diverse culturally and socio-economically. Participants received instruction in small, homogenous groups throughout the day in a classroom with 17 students, two teaching assistants, and one lead teacher. Teachers in the classroom used tactics for learning and performance based on the principles of behavior analysis (Greer, 2002) and all instruction was delivered in learn units (Albers & Greer, 1991). The experimenter conducted all sessions at participants' desks or at a table in the classroom while other students in the classroom completed independent work or engaged in academic instruction in small groups. See Figure 1 for a photo of the experimental setting for the social condition.

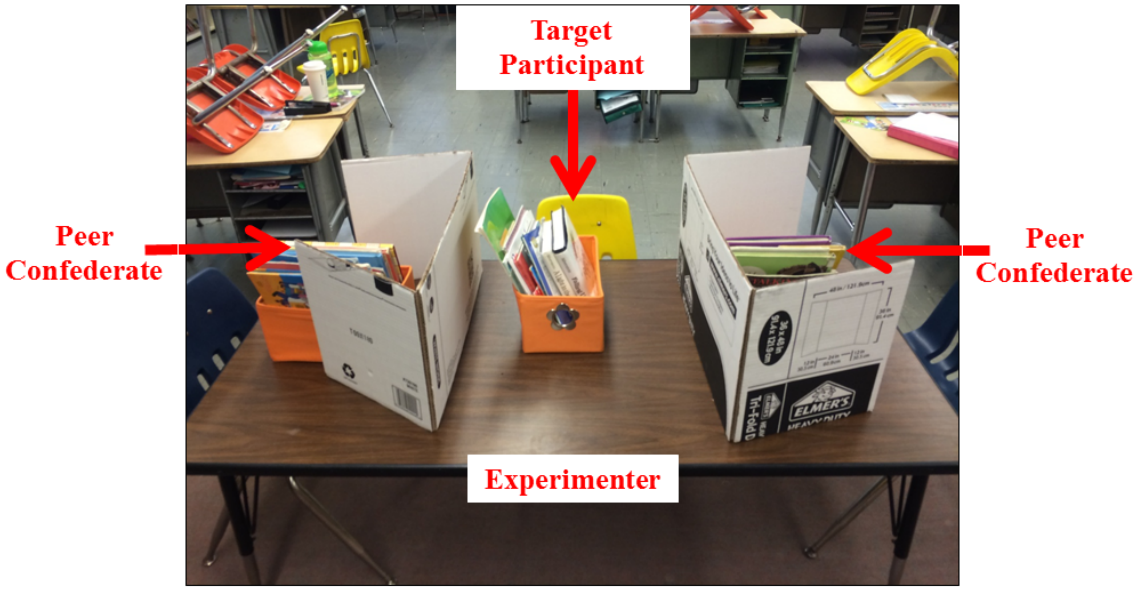


Figure 1. The experimental setting where the social condition took place. The target participant sat in the middle of the table, while peer confederates sat at the ends.

Materials

The experimenter used 21.59 cm x 27.94 cm sheets of wide-ruled paper with dotted lines, pencils, and data sheets for all indirect and direct measures of conditioned reinforcement.

For the tests of indirect reinforcement for performance, the experimenter used count-down timers and green and red tickets. Red and green construction paper squares measured 2.54 cm by 2.54 cm. Participants each had one open-top, plastic 20.32 cm x 16.51 cm x 5.08 cm bin. The experimenter determined the sequence of treatment sessions for the test of performance tasks with a 7.62 cm x 7.62 cm x 7.62 cm opaque box. The experimenter and trained observer used a basic function calculator to calculate rate of writing.

During the tests of indirect reinforcement for learning tasks, the experimenter presented stimuli on an HP ENVY® laptop screen using stimuli created on Microsoft® PowerPoint. Slides were white with two letters for the stimuli in the center of the screen in Calibri font size 100. See Table 4 for a list of the stimuli used.

For the social condition, the researcher cut a tri-fold cardboard poster display into 27.9 cm high dividers for each peer confederate. These dividers prevented target participants from observing confederates' responses and any changes in behavior that may occur based on their observation. Each participant had one 25.4 cm x 12.70 cm x 12.70 cm book bin with 10-15 grade-level texts of varying topics on the table in front of him or her. The experimenter directed the participant and confederates to engage in a performance task using these bins, further detailed in the social condition procedure.

Table 4

Instructional Stimuli Used for the Tests of Writing as Indirect Reinforcement for Learning New Repertoires

	Chemical Symbol	Element Name
Pre- Intervention	Ag	Silver
	Au	Gold
	Na	Sodium
	Fe	Iron
	W	Tungsten
Post-Intervention	Br	Bromine
	Be	Beryllium
	Bi	Bismuth
	Ba	Barium
	Br	Bromine

Definition of Variables

Direct and indirect conditioned reinforcement for writing were measured in this study. Indirect reinforcement was measured in two dimensions, correct responses to learning tasks (rate of learning) and rate of responding to a performance task.

Dependent variable – Direct reinforcement (Conditioned reinforcement for writing). The experimenter conducted 5 min observations of writing where the numbers of whole, 5 s intervals in which the target participant wrote continuously were recorded. The researcher defined automatic reinforcement for writing as writing taking place under conditions where writing is the immediate reinforcer for the target participant. That is, the participant did not access any other reinforcers during or after completion of the writing task. The researcher defined writing to include looking up and then looking down within 5 s, erasing, asking about spelling, asking questions about the antecedent, and reading what is previously written, in addition to the intervals where the participant formed letters on the paper. The experimenter recorded whole, 5 s intervals of writing as a plus (+), as per the response definition. The experimenter recorded all other responses as incorrect responses with a minus (-).

Data were reported in number of whole intervals of writing and other behaviors. Two pre-intervention sessions were conducted for Participant 1 and 2. Follow-up probes were collected eight months to one year after the social condition for all participants. The presence of direct conditioned reinforcement for writing was defined as 54 of 60 intervals (90%) where the participant wrote continuously.

Procedure. Participants sat with a pencil at a table in the classroom or at their desk without peers present. The experimenter gave the participant a page of lined paper with a printed writing antecedent at the top, such as "Write a summary of your favorite book." The

experimenter told the participant to respond to the question. The experimenter then set a timer for 5 min, unknown to the participants, and gave no additional attention or verbal behavior toward participants, unless they asked questions related to writing. If participants stated they were finished before the timer sounded, the experimenter told participants to try their best to keep writing. The experimenter collected data behind the participant to eliminate the possibility of reactivity. At the end of the 5 min, participants were told to check their work for correct capitalization, punctuation, and spelling.

The experimenter conducted follow-up probes eight months to one year after the post-social condition probes were completed. These probes were conducted with the same participants during January of the following school year. Participants responded to the same writing prompt, "One dark and stormy night…" in a classroom setting at their desks.

Dependent variable – Indirect reinforcement measure of performance. The performance task was writing the letters of the alphabet. The experimenter selected green or red tickets from an opaque box before each session, naïve to the participant. A green ticket signaled free play as the consequence for writing letters, and a red ticket signaled an opportunity to write as the consequence for writing letters. The experimenter directed the participant to write the letters of the alphabet continuously until a timer sounded. The researcher then measured the number of letters written per minute when play or writing were delivered immediately following completion of a writing task, depending on what the experimenter drew from the opaque container at the start of the session. Only legible letters were included as correct responses and crossed out letters were not included in correct responses. Researchers calculated the number of letters written per minute by counting the total number of letters written and dividing by 60 s (1 min) or 120 s (2 min) and multiplying that number by 60. Data were displayed in letters per min

written. Sessions continued until there were three sessions at stable state responding for each condition, or responses were in extinction in the writing condition.

Procedure. The experimenter placed ten red and ten green tickets into an opaque box. The experimenter randomly selected treatment sessions from the box before each session, naïve to the participant. At the start of the session, the experimenter gave the participant a blank sheet of lined paper and presented a basket of red or green tickets, determined by the treatment selected from the opaque box. The performance task chosen for all participants was writing the letters of the alphabet continuously as many times as possible in 1 or 2 min. For Participant 1, the rate of writing letters did not change for either condition. Participants were given a vocal antecedent, such as, "Write the letters of the alphabet as many times as you can until I tell you to stop." The experimenter told participants that he or she would be able to trade in their tickets for a surprise at the end. The experimenter set a timer for 1 or 2 min and began the timer immediately upon delivery of the vocal antecedent. When the timer stopped, the experimenter directed the participant to stop or put his or her pencil down. Due to high variability in responding for Participants 1 and 2, the experimenter increased the duration of the performance task to 2 min sessions from 1 min sessions to allow participants more exposure to the contingency.

The experimenter then looked at the participant's responses and said, "You got all of your tickets, you can trade them in for a surprise!" and then told the participant what his or her surprise was. If the experimenter chose a red ticket from the box at the beginning of the session, the participant immediately received 5 min of a writing task. If the experimenter chose a green ticket at the beginning of the session, the participant engaged in free play for 5 min. No additional communication took place between the experimenter and the participant during the

letter writing or during the writing or play consequence. Sessions continued until there were three sessions at stable state responding for each condition, or responses were in extinction for the writing treatments.

Dependent variable – Indirect reinforcement measure of learning – Rate of learning. Correct responses to chemical element symbols were used as a measure of writing as reinforcement for learning new operants. Correct responses (+) included responses with complete vocal correspondence with the name of the stimulus or consistent approximations within 5 s of presentation. Any other name was considered incorrect (-). Mastery criterion was set at 90% correct responses within 20 learn units. Conversely, the experimenter established a termination criterion such that sessions stopped if participants emitted the same numbers of correct responses for two consecutive sessions, or emitted decreasing numbers of correct responses per session.

The experimenter recorded and graphed the number of correct responses per session. The experimenter later graphed the data as the cumulative number of correct responses across responses and sessions.

Procedure. Participants sat at a table next to the experimenter in front of a laptop computer or an iPad®. The experimenter told the participant to look carefully at the screen and try his or her best. Participants were given 5 s to vocally respond following presentation of a chemical symbol, and consequences were delivered according to the learn unit protocol. The experimenter delivered a writing prompt immediately following a correct response, such as "Write the steps to go to the main office." The participant could write one sentence following each correct response. If the participants ran out of ideas to write, they were prompted to try to include more detail one time, followed by a new prompt if they stated they were finished a second time. Incorrect responses were followed by the experimenter saying the correct name of

the element, and then requiring the participant to respond independently. The experimenter limited her verbal and non-verbal social contact with the participants to control the possibility of her attention as a reinforcer. Two different sets of stimuli were used before and after intervention.

The number of cumulative correct responses across opportunities was graphed in Microsoft® Excel. The experimenter added a trend line to the data points and then displayed the line equation for the trend line created by Excel.

Independent variable – Social condition. The social condition consisted of the observational and denial procedures used in prior studies (Greer, Singer-Dudek, Longano, & Zrinzo, 2008; Singer-Dudek, Greer, & Schmeltzkopf, 2008; Oblak, 2010; Oblak et al. 2015; O'Rourke, 2006; Singer-Dudek, Oblak, & Greer, 2011). Such procedures were called "observational procedures" (Greer & Singer-Dudek, 2008) or "valuation alteration" (Oblak et al. 2015).

The researcher denied participants access to functional writing tasks while the participant observed peer confederates participating in a turn-taking writing task. The participant and confederates engaged in 20 opportunities of a performance task. For the performance task, the experimenter delivered a simple antecedent to both the target participant and the peer confederates such as, "Find me a book with a boy on the cover." The experimenter non-systematically interspersed five functional writing tasks to peer confederates within those 20 performance tasks. Confederates alternated writing a sentence for two turns each while the target participant observed. That is, they interacted with each other exclusively via writing and did not include the target participant. The target participant could not engage in the writing at any time during the social condition.

During the social condition, the experimenter recorded correct responses to the experimenter's antecedent with a plus (+), such as selecting a book matching the experimenter's parameters. Any other response, or no response was recorded as a minus (-). The experimenter collected frequency data on the number of mands to participate in a writing activity using a tally system. Mands included any response that could be reinforced by a listener with the delivery of a writing prompt, such as "When's my turn?" or "Why don't I get to write?"

Procedure. The participant sat in the middle of a rectangular table with a bin of 10-15 books. The same two peer confederates sat at the ends of the table for every participant. Each participant and confederate had his or her own bin of books and a tri-fold divider in front of him or her so the target participant could not see his or her responses. Prior to the start of intervention, and outside the presence of the target participant, the experimenter explained the procedure to the peer confederates. All participants had a pencil and blank piece of paper at their section of the table.

For the performance task, the experimenter told the group to select one or two books with varying characteristics, such as "Find me two books with a hard cover." When all participants completed the task, the experimenter told the participant and confederates to place the books back in the bin. The experimenter then delivered a turn-taking writing prompt as reinforcement to the peer confederates non-systematically within the 20 performance directions. For example, the confederates and target participants engaged in three performance directions and then the experimenter removed the partitions and told the confederates and participant to place their bins on the floor. Peer confederates received a piece of paper with the first sentence of the story or an antecedent, and the experimenter told them to take turns completing the piece. Confederates

were told beforehand that they could react (laugh, smile, make facial expressions) to what was written on the prompt and each others' writing.

The experimenter denied the target participant participation in the writing activity. The experimenter did not deliver any additional praise or comments during the writing and the target participant was required to sit quietly with his or her hands folded. If the target participant touched the books, stood up, or engaged in any other activity, the experimenter directed him to sit nicely. The experimenter collected data on the frequency of mands for the writing activity ("Why don't I get to write?" or "When is my turn?"). The experimenter ignored any vocal verbal behavior from the target participant, but answered any questions relevant to writing from the peer confederates. Criterion for termination of the intervention was extinction of the performance responses or stable responding for mands emitted across sessions.

Experimental Design

For the test of performance behaviors, the experimental design was an alternating treatments design (Barlow & Hayes, 1979), also referred to as a multiple schedule design. The experimenter chose the design because the rapid alternation between treatments would be sensitive to changes in rate across conditions and therefore show the relative value of each treatment (writing and play) in increasing or decreasing rate of writing letters. In addition, there were several replications across each condition, intended to strengthen internal validity. Further, the experimenter chose red and green tickets out of an opaque box and drew one ticket per session for each participant to control for sequence effects. If the experimenter drew two tickets of the same color consecutively, the opposite condition was presented for the next session to ensure the same number of sessions for each color. The color of the tickets was a discriminative

stimulus for the availability of writing (red tickets) or free play (green tickets) as a consequence following the performance task.

The experimenter used a delayed multiple probe design across participants (Horner & Baer, 1978) to determine the effects of the social condition. The experimenter selected the design to test the validity of the observational procedure such that the effects of the dependent variables could be replicated across participants, because it was not possible to remove the effects of the social condition.

Interobserver Agreement and Interscorer Agreement

Interobserver agreement (IOA) and interscorer agreement (ISA) sessions were conducted in order to ensure fidelity of procedures and data collected for all variables, dependent and independent, and across all participants.

Direct reinforcement. A trained second observer collected data with the primary researcher for all participants. Point-by-point IOA was calculated by dividing the number of intervals of agreement by the number of intervals of agreement plus disagreements and multiplying by 100%. IOA was collected for 41.7% of pre-intervention, post-intervention, and follow-up sessions across all participants with a mean agreement of 98.34% and a range of 96.7% to 100.0% agreement.

Indirect reinforcement – Performance. A second independent observer scored participants' letters written during each session for all participants. ISA was calculated by dividing the smaller total number of correct responses by the larger number of total correct responses collected by each observer and multiplying that number by 100%. ISA was 100% agreement for 100% of sessions.

Indirect reinforcement – Learning. IOA was collected for 50% of sessions of the indirect reinforcement learning measure across all participants with a range of 91.7% to 100% agreement and a mean agreement of 94.16%.

Social condition. Interobserver agreement (IOA) was collected for 100% of sessions of the social condition with 100% agreement for all participants.

Results

Figure 2 shows the number of whole intervals of writing for all participants. Participant 1 emitted 30 and 31 whole intervals of writing prior to intervention, while Participant 2 emitted 57 and Participant 3 emitted 0. Following intervention, Participant 1 emitted 55 intervals of writing in one observation and 59 whole intervals of writing in a second observation. Participant 2 emitted 57 whole intervals of writing in the first observation, and 60 intervals of writing in the second observation. Participant 3 emitted 52 intervals of writing in the post-intervention probe. All participants increased in intervals of direct reinforcement for writing, however the data for Participant 2 show some ceiling effects. Follow-up probes were conducted six months to one year following the intervention for all participants. Participant 1 emitted 60 out of 60 whole intervals of writing, Participant 2 emitted 58 and Participant 3 emitted 58 out of 60 intervals of writing.

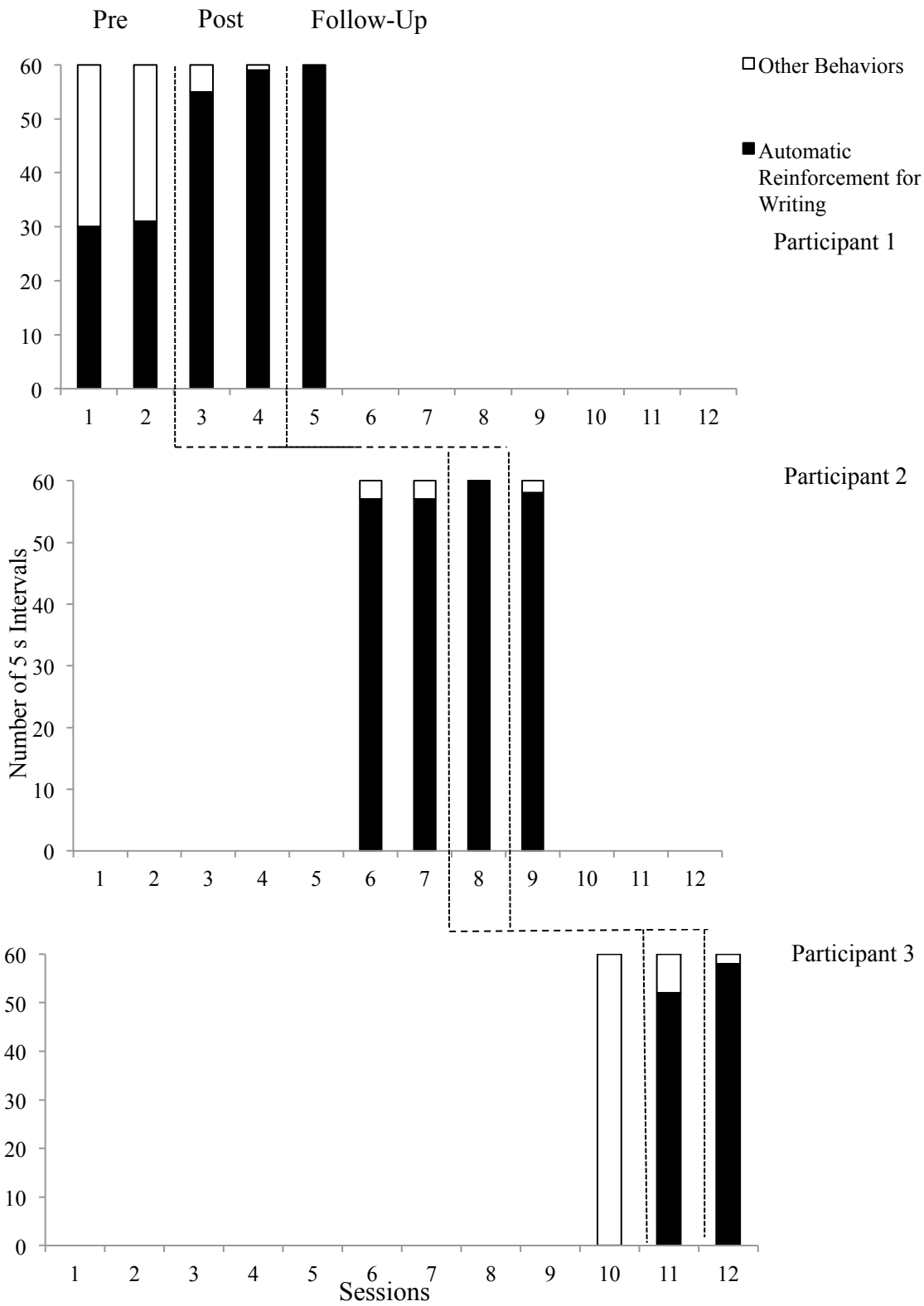


Figure 2. Pre-, post-, and follow-up social condition direct reinforcement for writing for Participants 1-3, measured in whole 5 s intervals of writing. The black bar shows intervals of writing and the white bar shows intervals of behaviors other than writing.

Figure 3 shows the number of whole 5 s intervals where Participant 1 engaged in a writing task before intervention. He wrote for 30 and 31 intervals of writing in pre-intervention conditions. During intervention, the participant traded in for writing four times with 49, 52, and 52 whole intervals of writing. During post-intervention probes, the participant wrote for 55 and 59 whole intervals of writing. Participant 1 was the only participant who chose to spend points to write during and after the social condition.

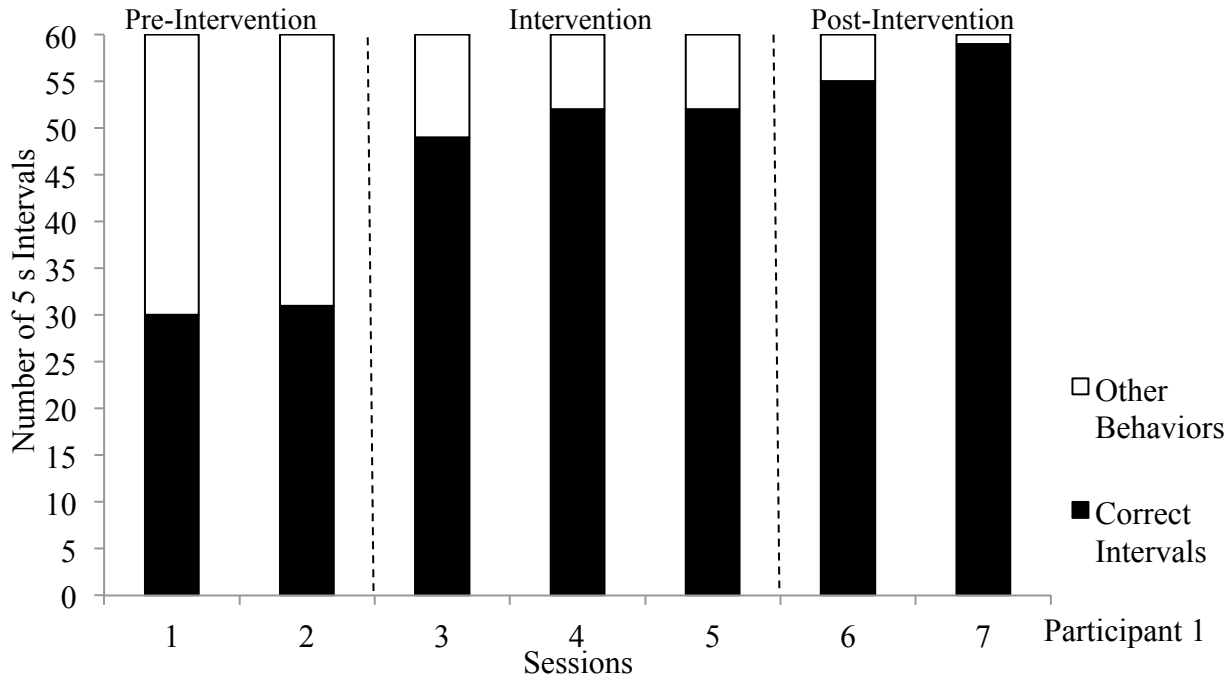


Figure 3. Pre-and post-intervention automatic reinforcement for writing for Participant 1, measured in whole 5 s intervals of writing, including incidental observations where the participant began to choose writing during free time while the intervention was ongoing. The black bar shows whole intervals of writing and the white bar shows engagement in other behaviors unrelated to writing.

Figure 4 shows the rate of correct responding for Participants 1-3 respectively, for the tests of writing as indirect reinforcement for performance. These data showed low levels for B phases and higher levels of responding for A phases prior to intervention. Participant 1 emitted a mean of 33.80 letters per min in play phases with a range of 31 to 35.80 correct per minute. In writing phases, Participant 1 emitted a mean of 26.44 letters per min with a range of 17.80 to 33.20 letters per min. Following intervention, he emitted a mean of 44.30 letters per min for A phases (range: 39 – 49.50) and 43.80 letters per min in B phases (range: 37 – 49.50).

Participant 2 emitted a mean of 46.70 letters per min in play phases with a range of 37.80 to 58 letters per min. In writing phases, Participant 2 emitted a mean of 41.60 letters per min with a range of 37.50 to 40.50 letters written per minute. Following intervention, he emitted a mean of 43.30 correct responses per minute for play phases (range: 31.50 – 51.50) and 41.40 letters per min in writing phases (range: 25 – 49.50).

Participant 3 emitted a mean of 58.2 letters per min with a range of 46.50 to 64.50 letters per min for play phases and a mean of 59.80 and range of 52 to 63.50 for writing phases, as shown in Figure 4. Following intervention, he emitted a mean of 77.4 letters per min for play phases (range: 72 – 83) and 81.3 letters per min in writing phases (range: 78 – 91).

Overall, Participants 1 and 3 showed differences in pre- and post-intervention levels of data, while Participant 2 showed marginal differences between writing and play as indirect reinforcement for writing letters, a performance task.

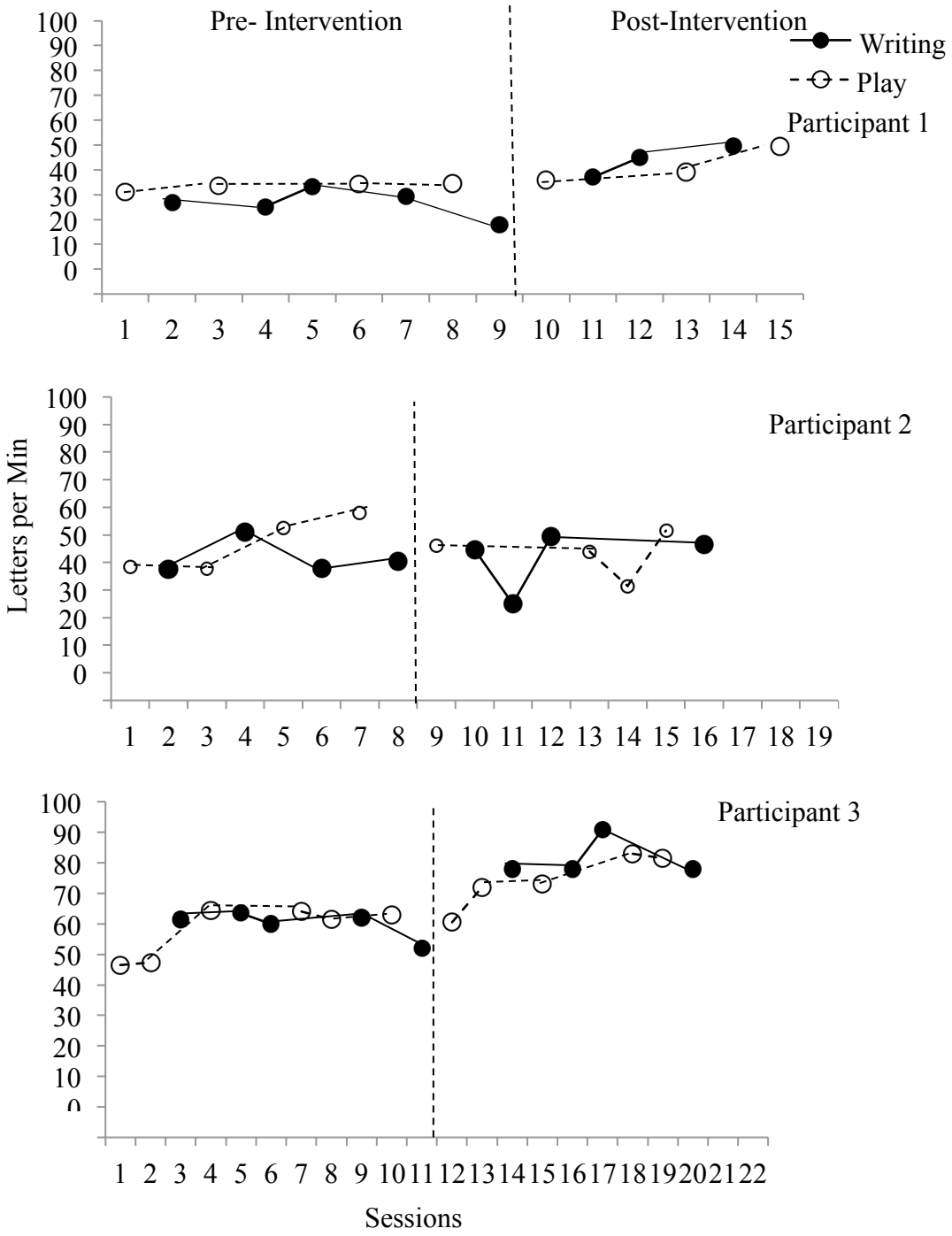


Figure 4. Letters per minute written as a performance task (indirect reinforcement**)** for Participants 1-3 before and after the social condition. The closed circles show the rate when red tickets (opportunities to write) were delivered upon completion. The open circles show the rate when green tickets (free play) were delivered upon completion.

Figure 5 shows correct responses to the indirect reinforcement learning task before and after the social condition for Participants 1-3. Participant 1 emitted 4, 6, 8 and 8 correct responses out of 20. Following intervention, he emitted 0, 6, 8, 10, 15, and 18 correct responses per session. Participant 2 emitted 1, 4, 12, 13, 16 and 14 correct responses out of 20 before intervention, while he emitted 3, 9 and 16 correct responses following intervention. Participant 3 emitted 1, 3, 11 and 11 correct responses prior to intervention and 4, 11, 12 and 13 correct responses following intervention. Overall, Participants 1 and 3 showed accelerated acquisition of new operants following the social condition, with marginal increases for Participant 3.

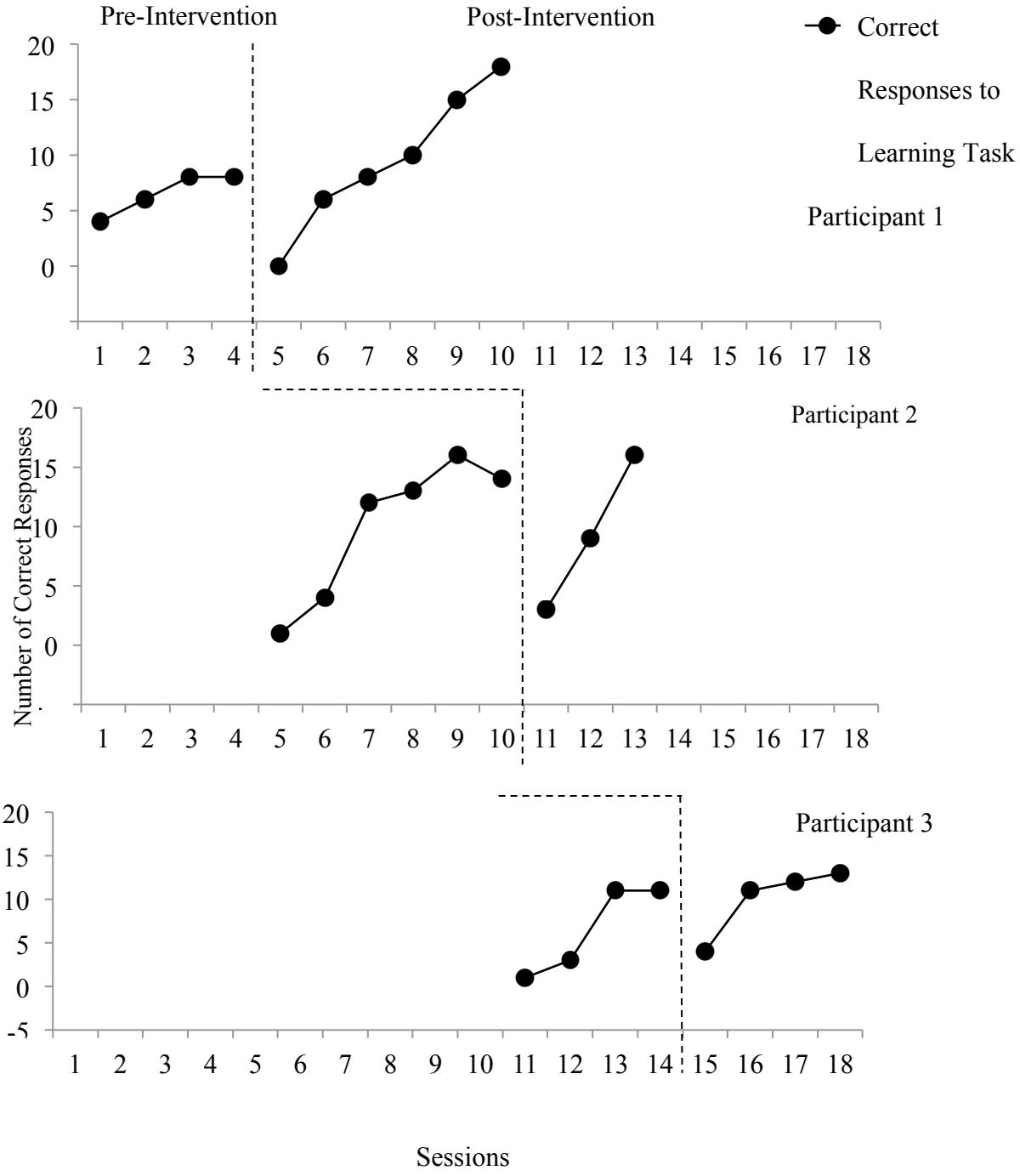


Figure 5. Number of correct responses to pre- and post-intervention tests of indirect reinforcement for learning (acquisition of chemical element symbols) reinforced by opportunities to write for Participants 1-3.

Figure 6 shows a cumulative record of Participants 1-3's responses across sessions. The cumulative record shows rate of learning by each response with a steeper trend or slope (x-coefficient) indicating a faster rate of learning. Participants 1 and 3 show a faster rate of learning in the post-intervention measure of indirect reinforcement for writing with the slope of the line for Participant 1 equal to 0.33 at pre-intervention (y = 0.3283x - 3.0644) and 0.49 post-intervention (y = 0.486x - 10.729). The slope of line for Participant 3 was 0.34 at pre-intervention (y = 0.3442x - 5.9266) and 0.53at post-intervention (y = 0.5338x - 5.182).

The slope of the line for Participant 2 was steeper at pre-intervention at 0.54 (y = 0.5059x - 5.713) and 0.51 at post-intervention (y = 0.5363x - 11.164), but the participant achieved mastery in a fewer number of sessions and did not reach mastery at all in the pre-intervention. Overall, the cumulative record to mastery or end of phase shows differences in the rate of learning, both mathematically and visually that cannot be seen on a session-by-session display.

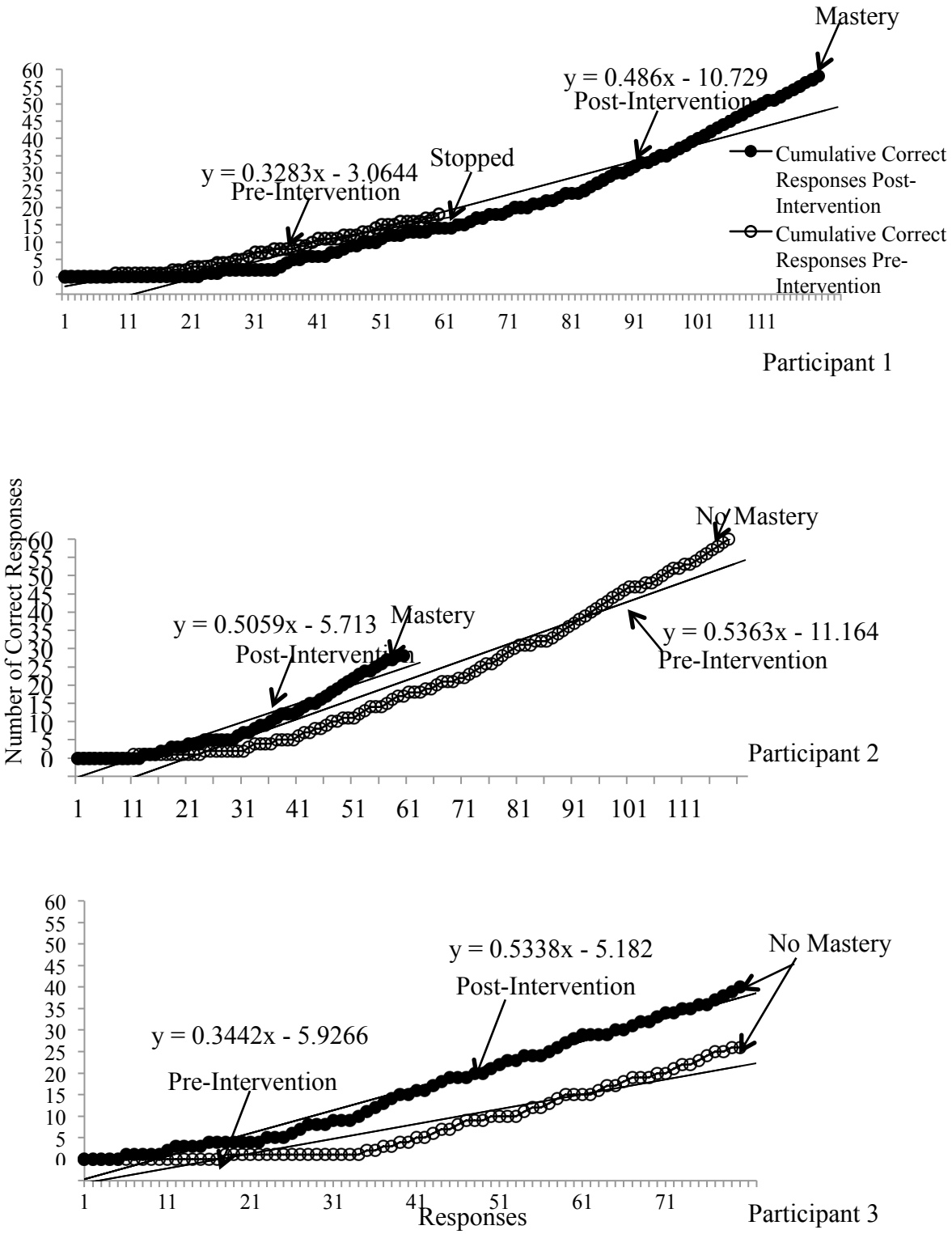


Figure 6. Cumulative record of Participants 1-3's correct responses to the indirect reinforcement measurement. Learning new operants was reinforced by opportunities to write before and after the social condition. Larger x-coefficients indicate a faster rate of learning.

Figure 7 shows the intervention data, consisting of 1 session at 17 correct responses with 1 mand and 2 sessions at 20 correct responses with 4 and 5 mands for the writing task for Participant 1. Participant 2 had two intervention sessions with 20 correct responses each and 5 and 2 mands, respectively. Participant 3 had three intervention sessions and emitted no mands or incorrect responses.

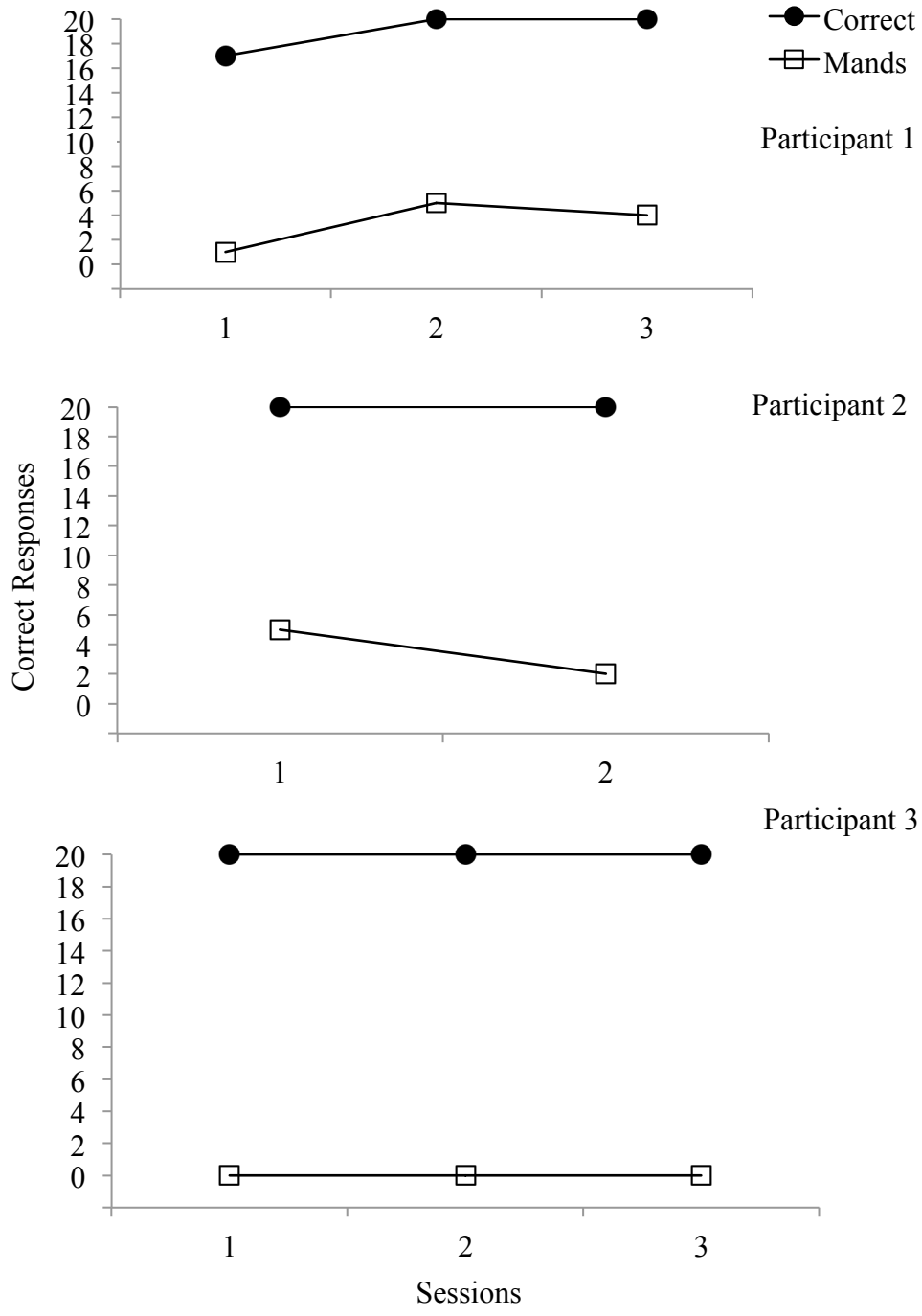


Figure 7. Intervention sessions for Participants 1-3. The closed circles are number of correct responses to the performance task (sorting books according to the experimenter's vocal direction) and open squares are the number of mands or requests emitted for a writing task.

Discussion

Results show that the social condition did increase intervals of writing for two of three participants across direct reinforcement. Indirect reinforcement for learning and performance increased for all participants. However, weaker effects were present for Participant 2, possibly due to ceiling effects. Participant 1 chose to write for leisure when the intervention was ongoing, and demonstrated conditioned reinforcement for writing through high numbers of intervals where he engaged in writing during these incidental writing observations. Participant 1 was the only participant who began to choose writing while intervention was ongoing, giving the researcher an indication that the intervention was effective.

For the indirect performance measure, I carefully selected the alternating treatments design and performance tasks to show changes in performance based on the consequence upon completion of the task. Before the social condition, all participants showed decreasing rates of letters written per minute during writing treatments and high and consistent rates of letters written per minute during play conditions. Following the social condition, all participants showed increased rates of letters written per minute, such that the rates were at least equal to the rate of letters written during play conditions. The overall level of the data were higher for Participant 1 and Participant 3 in post-intervention probes for both writing and play treatments, possibly indicating that the reinforcement value for the alphabet writing performance task may have increased as well.

The indirect learning measure indicates increased rates of learning for all three participants, which I showed in two ways. The data graphed in 20 learn unit sessions show a steeper overall increase in trend in post-intervention sessions as opposed to pre-intervention sessions. In pre-intervention sessions for all participants, the numbers of correct responses across

sessions either stagnated or decreased. In post-intervention sessions, the total number of correct responses continued to increase across all sessions. The cumulative record showed the exact rate of learning across both pre and post-intervention sessions. Post-intervention sessions showed a faster rate of learning in post-intervention sessions for two out of three participants. Participant 2 had more trials in pre-intervention sessions than in post-intervention sessions, and the differences in the number of trials made comparisons less accurate. In Experiment 2, 60 learn units were compared across pre- and post-intervention probes to accurately compare the rate of learning.

Increasing writing repertoires in second graders is critical to shaping their repertoires as strong technical and aesthetic writers. Increases in direct reinforcement indicate that more research needs to be conducted on the social condition to determine its efficacy as a writing intervention. Further, the differences between direct and indirect reinforcement have implications for the nature of conditioned reinforcement, and need to be investigated further. For example, what are the differences in reinforcement value between direct and indirect conditioned reinforcement and how does each type emerge? Moreover, are there similar differences between indirect reinforcement for performance and learning?

Limitations

Though more post-intervention probes needed to be conducted, the numbers of whole 5 s intervals of writing increased from pre-intervention probes. In future studies, perhaps at least three pre- and post-intervention probes showing steady-state responses would strengthen overall results. Ceiling effects were present in the results for Participant 2 and multiple probes may address and prevent this effect in future studies.

Follow-up probes for direct reinforcement were conducted as a means of testing the effects of the intervention beyond the immediate context and time immediately following the

intervention. However, no other measures were taken to control for writing instruction received over the course of the year.

During the intervention, participants' responding to performance tasks did not go into extinction (Greer & Singer-Dudek, 2008) nor did the number of mands emitted serve as an effective termination criterion. Therefore, it was necessary to establish a new criterion for Experiment 2. Participant 1 began to show effects of the intervention following three sessions in Experiment 1, and Birch (1980) showed that children began to consume non-preferred foods after three days of observing a peer consume those foods. Therefore, I implemented a treatment package of three sessions for each participant in Experiment 2, where participants received a total of 15 exposures to the social condition across three days.

Behaviors other than mands, such as attempts to escape the social condition, and attempts to assist the peer confederates' writing was anecdotally noted during the social condition. These behaviors were more systematically measured and defined in Experiment 2, to further analyze the effects of the social condition.

During the test of writing as indirect reinforcement for emitting a performance behavior, despite the research design, participants' responses did not initially come under the control of the ticket colors. To address this, I doubled the performance task duration from 1 min to 2 mins in Experiment 1. In Experiment 2, I implemented a variable ratio schedule of delivery of tickets, to allow for more immediate contact with the contingency. In addition, participants selected the condition from the opaque container, instead of the experimenter selecting the condition from the container. Similarly, in Experiment 2, participants were given a red ticket in a basket that equaled 30 s of writing during indirect reinforcement for learning tasks, to increase the efficiency of the probe procedure and maintain consistency across indirect reinforcement variables. The

same sets of stimuli were used before and after intervention for all participants, which also contributes to the limitations for this measure. Sets of stimuli were counterbalanced to address this in Experiment 2.

For Participant 3, the experimenter did not complete post-intervention probes for testing if opportunities to write reinforced learning to 90% mastery, however, cumulative record graphs demonstrated that the participant acquired the operants at a faster rate during post-intervention sessions. Overall, the cumulative records provided a more clear and objective measure of indirect reinforcement through rate of learning and are used in Experiment 2.

Experiment 2 is a replication of Experiment 1 with four new participants in the same setting, meeting the same inclusion criteria as in Experiment 1. Participants included in Experiment 2 also emitted low numbers of intervals of continuous writing prior to intervention. There are five additional dependent variables in Experiment 2. Experiment 2 includes the numbers of characters and words written in 5 min direct reinforcement probes. Further, a dependent samples t-test comparing the means of naïve readers' scores of pre- and post-intervention writing samples was conducted as a measure of social validity. In addition, Experiment 2 includes structural and technical measures of the quality of writing as dependent variables.

Chapter III

EXPERIMENT II

Method

The setting, materials, participant entrance criterion and experimental design were the same as in Experiment 1. The differences were in the addition of four dependent variables – number of words and characters written, and the number of correct structural components and technical components of a technical writing probe. Differences in procedures for dependent variables included in Experiment 1 are listed in the dependent variables section.

Participants

Four second graders were selected from the same setting as in Experiment 1. Participants performed on grade level for at least one subject. Participant 1 received speech services for articulation. Table 5 lists each participant and peer confederate's relevant cusps and capabilities in repertoire.

Table 5

Participant Characteristics and Verbal Behavior Developmental Levels for Experiment II

	Age	Gender	Grade	Level of Verbal Behavior	DRA Score at BOY	Math Grade Level at BOY	Relevant Cusps and Capabilities
Participant 1	7.9	M	2	Listener/ Speaker/ Reader	18 (Above)	2	Observational Learning, Naming, Transcription
Participant 2	8.0	M	2	Listener/ Speaker/ Reader	18 (Above)	2	Observational Learning, Naming, Transcription
Participant 3	7.11	M	2	Listener/ Speaker/ Reader	16 (On)	2	Observational Learning, Naming, Transcription
Participant 4	7.7	M	2	Listener/ Speaker/ Reader	18 (Above)	2	Observational Learning, Naming, Transcription
Confederate 1	7.7	F	2	Listener/ Speaker/ Reader	18 (Above)	2	Observational Learning, Naming, Transcription, Conditioned Reinforcement for Writing
Confederate 2	7.4	F	2	Listener/ Speaker/ Reader	16 (On)	2	Observational Learning, Naming, Transcription, Conditioned Reinforcement for Writing
Confederate 3	8.2	F	2	Listener/ Speaker/ Reader	18 (Above)	2	Observational Learning, Naming, Transcription, Conditioned Reinforcement for Writing

Confederate 4	8.3	F	2	Listener/ Speaker/ Reader	16 (On)	2	Observational Learning, Naming, Transcription, Conditioned Reinforcement for Writing
Confederate 5	7.7	F	2	Listener/ Speaker/ Reader	16 (On)	2	Observational Learning, Naming, Transcription, Conditioned Reinforcement for Writing

Note. BOY refers to the Beginning of the Year assessment scores. DRA refers to the *Developmental Reading Assessment*, used to assess fluency and comprehension for all students. A DRA score of 16 corresponds to performance on grade-level for the beginning of second grade, with scores below signifying below grade level (i.e. 14) and scores above signifying performance above grade level (i.e. 34). Cusps and capabilities in repertoire refer to Verbal Behavior Developmental stages (Greer & Ross, 2008) that accelerate learning. Naming refers to the ability to learn language incidentally. Observational learning refers to the ability to learn by observing a peer. Transcription consists of copying a written visual stimulus.

Setting

The setting in Experiment 2 was identical for pre- and post-intervention sessions and intervention sessions as in Experiment 1 for all participants. Some pre- and post-intervention probes and intervention sessions were conducted in a small room adjacent to the school library.

Materials

Materials in Experiment 2 were identical stimuli as used in Experiment 1. Participants learned sets of stimuli for the writing as indirect reinforcement for learning. Table 6 lists the sets of stimuli used for this measure. The experimenter created a data sheet consisting of 60 5 s intervals to measure writing as direct reinforcement. See Appendix A for a sample of this data sheet. The experimenter also used a data sheet for recording correct responses, mands, attempts to participate in writing, and responses to being denied the opportunity to write. See Appendix B for a sample of this data sheet.

Table 6

Instructional Stimuli Used for the Tests of Writing as Indirect Reinforcement for Learning New Repertoires

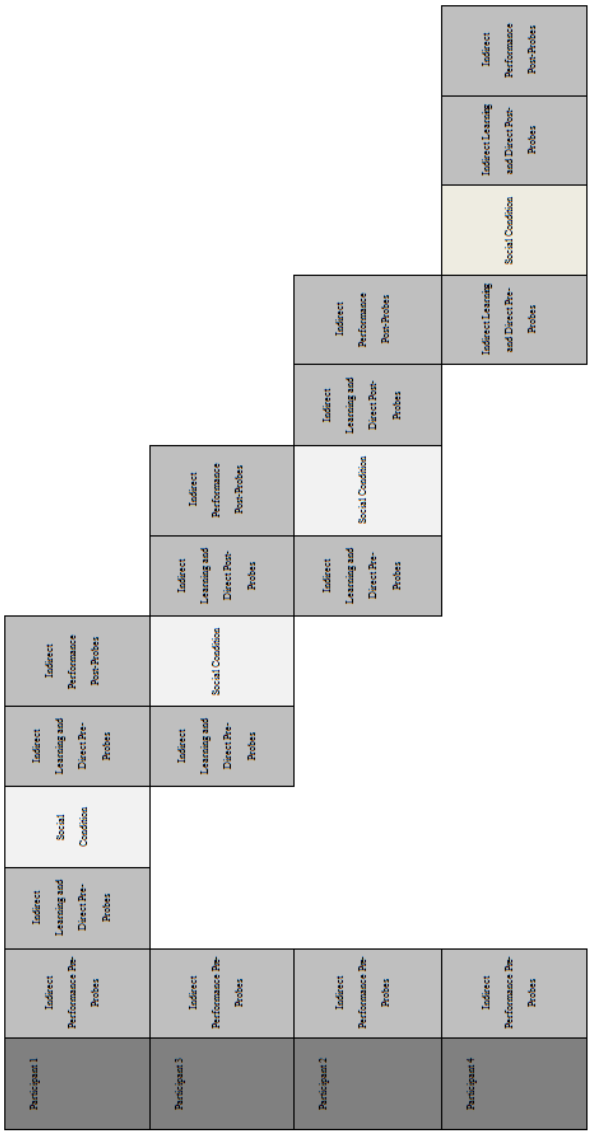
		Chemical Symbol	Element Name
Set 1	Participant 2 - Pre	Cs	Cesium
	Participant 3 – Pre	Ce	Cerium
	Participant 1 - Post	Cr	Chromium
		Cm	Curium
		Cd	Cadmium
Set 2	Participant 1 – Pre	Br	Bromine
	Participant 4 - Pre	Be	Beryllium
	Participant 2 – Post	Bi	Bismuth
		Ba	Barium
		Br	Bromine
Set 3	Participant 3 - Post	Pd	Palladium
	Participant 4 - Post	P	Phosphorus
		Plu	Plutonium
		Po	Polonium
		Pt	Platinum

Experimental Design

The experimental design was identical to Experiment 1. See Table 7 for a visual display of the research design sequence.

Table 7

Design Sequence



Definition of Variables

Dependent variables – Direct reinforcement (conditioned reinforcement for writing), indirect reinforcement for performance (rate of responding to a performance task), indirect reinforcement for learning (correct responses to chemical symbol presentations).

The experimenter defined these dependent variables exactly as in Experiment 1. Data were collected using identical procedures to Experiment 1. Additionally, data were collected and displayed using a cumulative record within session for the indirect reinforcement for learning measure.

Procedure – Writing as direct reinforcement. For the writing as direct reinforcement measure, procedures were conducted identically to Experiment 1. The experimenter conducted pre- and post-probes until responses were stable across sessions and at least one probe stimulus consisted of a technical writing task that included directions for how to complete a task. Table 8 lists the writing prompts given to participants during pre- and post-intervention probes and to peer confederates during intervention. See Appendix C for the visual stimulus used.

Table 8

Writing Antecedents Used to Measure Direct Reinforcement During Pre- and Post-Social Conditions

1	Finish the story. Bobby walked to the mailbox and …
2	Describe anyone in this room.
3	What would your dream house/car look like?
4*	Write all the steps for making a peanut butter and jelly sandwich.
5	Write a summary of your favorite book or movie.
6	Write the steps for solving this math problem: 35 + 16
7	Write the steps to get to the second grade playground.
8	Write about the last time you did something kind.
9	How have you improved this year in school? What are your goals for the rest of the year?
10	Write about what you did this weekend.
11	Invent the best toy you can think of. Describe it.
12	If you could live anywhere in the world, where would it be and why?
13	Picture yourself in a scary castle, exploring it with two friends. You find a door that is not locked and enter. Write about what happens next.
14	What would it be like if your dog spoke to you, but only when there was nobody else around? What would the dog say and how would you prove he could talk?
15	Which is your favorite season and why?

Note. The asterisk denotes a technical writing prompt consisting of a sequence of steps used for the structural and technical component dependent variable.

Social validity – Statistical analysis of naïve readers' scores of pre-/post-intervention writing samples. The experimenter collected data from 36 naïve adult readers. These readers ranked permanent products from three out of four participants (Participant 1, Participant 2, and Participant 3). The permanent product scores were the ordinal ranks assigned by a naïve reader from worst to best on a mixed sample of two pre-intervention direct reinforcement permanent products and two post-intervention direct reinforcement permanent products. The researcher then conducted a dependent samples t-test comparing the means of pre- and post-intervention scores across participants.

The experimenter took two pre- and two post-intervention permanent products collected for the direct reinforcement dependent variable and typed them into a document exactly as written. See Appendix D for the samples used in this measure. The samples were sent to 50 male and female naïve readers of varied age, socio-economic status, education levels, and professions. The experimenter wrote the directions for ranking the permanent products as follows:

> "You can help by reading and ranking the writing samples attached in order from best to worst (1-4, respectively). I don't anticipate that this should take more than 15 minutes of your time. You would be reading the writing samples and then marking 1-4). These are writing samples from second graders (7-8 years old) and they have a wide range of functioning. That means that some of them are better spellers and some have better language skills than others. Everything is typed so that you don't have to spend time deciphering their writing. They were all chosen because they didn't like to write. Try not to compare the three participants against each other - just compare the four samples each participant wrote."

Naïve readers ranked the best response for each participant as a 1 and the worst response for each participant as a 4. Therefore, the researcher expected most pre-intervention probes to be scored with a 3 or 4, and post-intervention scores to be a 1 or a 2. See Appendix E for the data sheet naïve readers used. If the naïve readers did not rank the samples correctly (i.e. they only scored 1s and 2s) their data were not included in the analysis.

A total of 36 naïve readers scored four samples for three participants. A dependent samples t-test was then conducted to answer the research question of whether or not there was a significant difference in the means of the scores assigned by naïve readers for pre- and post-intervention samples, beyond differences in means attributed to chance.

The experimenter conducted a dependent samples t-test comparing the means of naïve readers' scores of pre- and post-intervention writing samples as a measure of social validity. The dependent samples t-test revealed a statistically significant difference between the means of pre-intervention scores ($M = 3.13$, $SD = 0.94$) and post-intervention scores ($M = 2.2$, $SD = 1.00$); $t(144) = -6.80$, $p < .001$.

Procedure – Writing as an indirect reinforcer for performance - Rate of responding to a performance task. For the measure of the opportunity to write as indirect reinforcement for performance, participants wrote the letters of the alphabet while the experimenter delivered red or green tickets on a variable ratio 2-4 schedule. For every second and fourth letter written, the experimenter, standing behind the participant, delivered a single red or green ticket into a basket placed beside the participant's writing space, depending on which ticket was drawn at the start of the session.

The experimenter told the participant to stop when the timer sounded, and the experimenter counted the tickets with the participant, such that each ticket was worth 10 s of writing (red tickets) or free play (green tickets). The participant immediately received access to writing or free play following the session and started the timer for writing or for free play. The writing antecedents given to the participants are listed in Table 8. The experimenter did not engage with the participant during this time unless the participant asked questions related to writing, except in post-intervention probes for Participant 2, who manded to write with the

experimenter in an alternating fashion as was conducted with peer confederates in the social condition intervention. The experimenter terminated this condition for pre- and post-intervention sessions when participants demonstrated three sessions at stable responding for each condition.

Procedure – Writing as indirect reinforcement for learning – Rate of learning. For the indirect reinforcement for learning, the experimenter used a cumulative record of correct responses to determine rate of learning. Each correct response was marked with a plus (+) and the cumulative number of correct responses across sessions until that point. For example, if the participant emitted no correct responses for the first four learn units and a correct response for the fifth, the experimenter recorded -0, -0, -0, -0 and +1 on her data sheet. Three sessions of 20 learn units were conducted across all participants to compare the rate of learning across pre- and post-intervention conditions.

The experimenter delivered a red ticket into a basket for each correct response during the test of the opportunity to write as an indirect reinforcer for learning. As in the performance condition, each correct response corresponded to 30 s of writing, to be counted following 20 learn units. The experimenter delivered the antecedent in a manner identical to Experiment 1, but delivered a red ticket into a basket for each correct response. No verbal responses were emitted by the experimenter. Incorrect responses were consequated using learn unit protocol, as in Experiment 1. At the end of the session, the experimenter counted by 30 s for each red ticket, and then calculated the number of minutes and seconds for which the participant would access writing. The experimenter set a timer to the allotted time, and delivered a writing antecedent such as "Write the steps to get to the second grade playground." See Table 8 for a list of writing antecedents used in this condition. The participant sat and wrote until the timer stopped. The

experimenter did not deliver any additional praise, attention, or redirections back to work, and only answered questions relating to writing.

Number of words written and number of characters written – Additional dependent variables. Pre- and post-intervention direct reinforcement permanent products were typed for the statistical analysis exactly as participants wrote them, complete with spelling and punctuation errors. The number of words written and number of characters written without spaces was calculated from one pre- and one post-intervention sample from each participant. These variables were defined and calculated using the word count function in Microsoft Word®. Permanent products that were not technical writing samples and which were only 5 min in duration (i.e. participants did not mand to continue writing) were used for this measure.

Correct structural components – Additional dependent variable. The researcher defined the correct structural components as correct capitalization, punctuation, and spelling of words in permanent products from one pre- and one post-social condition direct reinforcement observation. The samples used were the technical writing tasks for "How to Make a Peanut Butter and Jelly Sandwich." The experimenter recorded the number of correct capitalizations (at the beginning of the sentence, proper names and other nouns) and punctuations (periods at the end of the sentence) out of the total across all permanent products, and then converted these data into percentages by dividing the number correct by the number total and multiplying by 100. The experimenter marked any other capital letters as incorrect responses, and marked missing capitalization as a minus. The experimenter marked any other punctuation outside the end of a sentence as an incorrect response, and marked missing punctuation as a minus (-).

The experimenter graded one technical writing sample each from pre- and post-intervention probes ("How to Make a Peanut Butter and Jelly Sandwich") and calculated the total

possible correct responses and correct responses present within the sample. Structural components included capital letters at the beginning of the sentence and a period at the end of the sentences, as well as words spelled correctly.

Correct technical components – Additional dependent variable. Correct technical components consist of responses that were necessary to make a peanut butter and jelly sandwich, taken from pre- and post-social condition direct reinforcement observations. These were the same writing samples used for the structural writing dependent variable. Writing tasks had a set number of steps that could be read and followed by a reader if all technical steps were included. Incorrect steps included responses which do not lead a reader toward the goal or the omission of a necessary step. Any steps that matched the rubric were considered correct (+), while steps that were excluded or were not listed in the rubric were marked with a minus (-).

The researcher recorded the number of correct technical components out of 10 steps determined by the researcher, and then converted these data into percentages by dividing the number correct by the total number and multiplying by 100. See Table 9 for the total correct responses for the technical writing prompt.

Table 9

Correct Steps to the Technical Writing Prompt Given Before and After the Social Condition

1	Get the bread.
2	Get the peanut butter and jelly.
3	Get a knife.
4	Open the peanut butter.
5	Put the knife in peanut butter.
6	Spread the peanut butter on the bread.
7	Open the jelly.
8	Put the knife in the jelly.
9	Spread the jelly on the bread.
10	Put the two pieces of bread together.

Independent variable – Social condition. During the social condition, the experimenter collected data on 1) correct responses to the performance task (sorting books), 2) mands for writing (attempts to access writing such as, "When is my turn?" or "Do I get to write now?"), 3) attempts to contribute to writing ("You should write this.") and reading peer confederates' writing, and 4) other responses to being denied the opportunity to write (playing with a pencil, delayed responses to antecedents delivered by the experimenter, escape attempts such as leaving the intervention area). These data were graphed across sessions of 20 performance opportunities (5 observations each). The experimenter also wrote the participant's verbal operants emitted during the task, such as "When is this over?" and "I want to write." Each participant received three sessions of the social condition, with five opportunities to observe peer confederates' writing. Responses were graphed cumulatively across sessions.

Procedure. The procedure in Experiment 2 was identical to Experiment 1. Based on Experiment 1, the experimenter determined that the social condition would be delivered in three sessions, each with five opportunities to observe peer confederates' writing for a total of 15 exposures to the observation or denial of writing. Rather than an intervention with a criterion, the social condition was a treatment package. Peer confederates were selected from a group of five available confederates, based on the students' availability during the sessions.

For Participants 2 – 4, the experimenter alternated treatment sessions with non-contingent attention, such as playing games or talking with the target participants. The experimenter implemented this strategically to offset the effects of the experimenter's presence as a punishing factor. This eliminated the possibility that the participant's responding to the experimenter during pre- and post-probe sessions would be punished due to the experimenter denying and ignoring the participant during intervention sessions.

Interobserver and Interscorer Agreement

The experimenter collected interscorer agreement (ISA) and interobserver agreement (IOA) data for all dependent variables and for the intervention.

Direct reinforcement. The experimenter and a trained independent observer collected data simultaneously for the direct conditioned reinforcement for writing measure for all participants. The experimenter calculated point-by-point IOA by dividing the number of intervals of agreement by the number of intervals of agreement plus disagreements and multiplying by 100%. IOA was collected for 36.0% of sessions with a mean of 94.2% agreement (range = 81.0% - 100%) across all participants.

Indirect reinforcement – Performance. The experimenter collected interscorer agreement (ISA) for all participants in the indirect reinforcement performance measure, where a second independent observer scored participants' letters written during each session. The experimenter calculated ISA by dividing the larger total number of correct responses by the smaller number of total correct responses collected by each observer and multiplying that number by 100%. ISA was calculated for 38.0% of sessions with a mean agreement of 99.8% (range = 97.5% – 100%).

Indirect reinforcement – Learning. IOA data were collected for the indirect reinforcement for learning measure for 37.5% of sessions with 100% agreement across all participants.

Number of words written and number of characters written. A second scorer typed the exact words from permanent products into Microsoft® Word, complete with errors and capitalization and punctuation. The scorer then used the word count function to determine the number of words and characters without spaces to report those data. The scorer graded 62.5% of

pre- and post-intervention samples for number of words and number of characters with a mean agreement of 100% for number of words and 99.2% (range = 98.6% – 100%) for number of characters.

Structural components. The experimenter collected ISA for all participants for structural components. The independent scorer graded the samples separately and found the total number correct and incorrect responses. ISA data were collected for all participants across 75% of pre- and post-intervention samples with 99.7% agreement (range = 98% - 100%).

Technical components. A second scorer graded permanent products against a rubric to determine the total number of correct technical steps. The experimenter calculated ISA based on the same formula as above. ISA data were collected for all participants across 75% of pre- and post-intervention samples with 100% agreement.

Social condition. IOA data were collected for the social condition for 30% of sessions with 100% agreement across all participants.

Results

Figure 8 shows pre- and post-intervention probes for direct reinforcement. Direct reinforcement was measured in whole, 5 s intervals of writing, or related behaviors as defined by the experimenter out of 60 possible 5 s intervals. In pre-intervention probes, Participant 1 emitted 30, 47, and 26 intervals of writing. Following intervention, Participant 1 emitted 58, 53, and 48 whole intervals of writing. Due to the descending trend of the post-intervention data, the experimenter conducted a fourth post-probe as a follow-up a month after the end of the intervention. The participant emitted 56 whole intervals of writing during this probe.

Participant 2 emitted 15, 16, and 31 whole intervals of writing in pre-intervention probes, and 52, 52, and 60 whole intervals of writing in post-intervention probes. Participant 3 emitted

45, 6, 42, and 6 whole intervals of writing in pre-intervention probes. A fourth pre-intervention probe was conducted due to the high variability of the data, and subsequently, four post-intervention probes were conducted. Participant 3 emitted 59, 57, 45, and 56 whole intervals of writing in four post-intervention probes. Four pre- and four post-intervention direct reinforcement probes were conducted for Participant 4 also. In pre-intervention probes, Participant 4 emitted 48, 19, 26 and 39 whole intervals of writing and 50, 56, 56, and 54 intervals of writing in post-intervention probes.

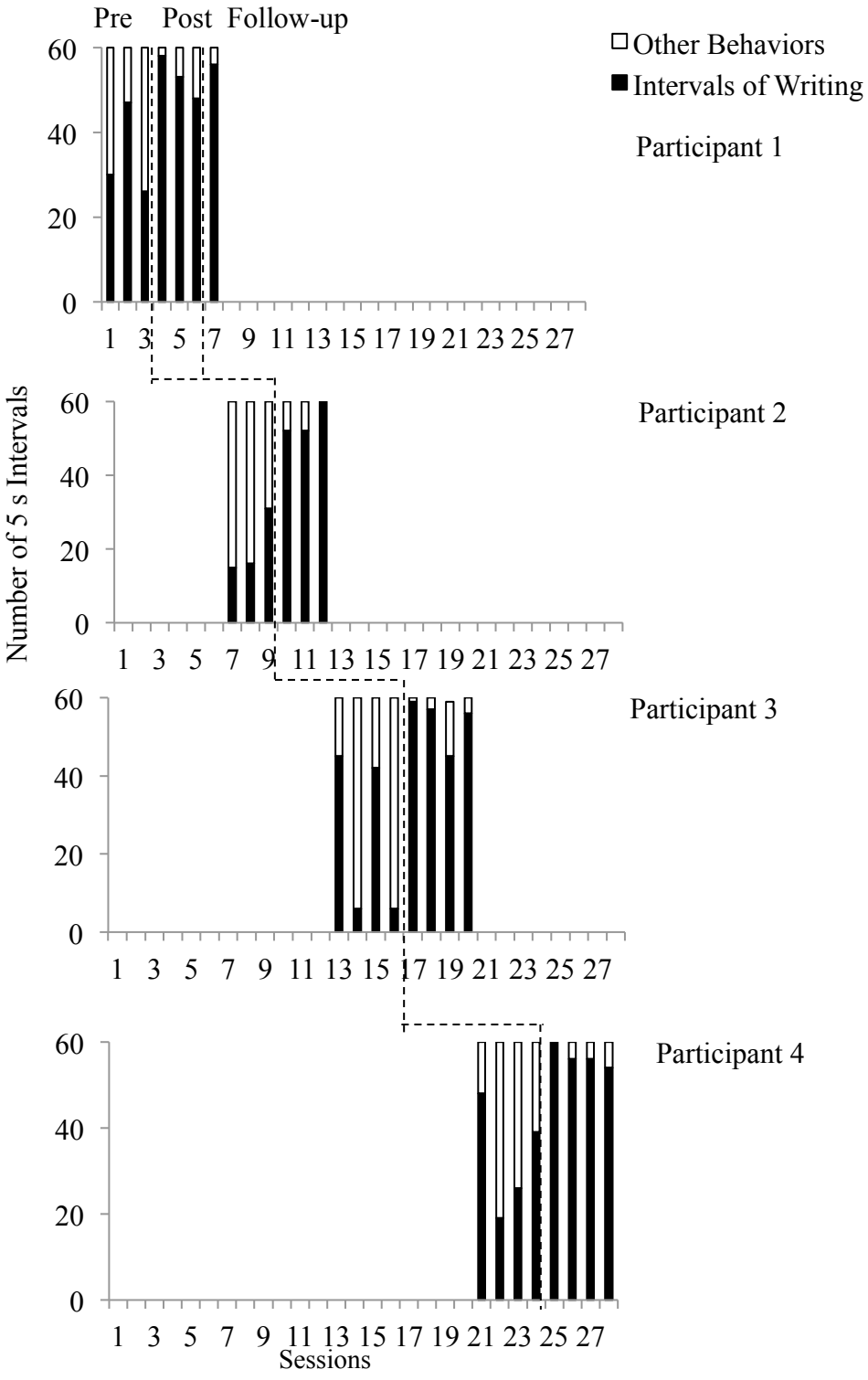


Figure 8. Number of whole intervals of writing emitted during pre- and post-intervention probes by Participants 1-4. The black bars show whole, 5 s intervals of writing and the white bars show other behaviors.

Figure 9 shows the first three direct reinforcement probes for each participant, blocked together to show responding across three sessions prior to and following intervention. Participant 1 emitted 103 intervals of writing in pre-intervention probes and 159 in post-intervention probes, while Participant 2 emitted 62 and 164 intervals of writing in pre- and post-intervention probes, respectively. Participant 3 emitted 93 intervals of writing in pre-intervention probes and 161 in post- intervention probes. Participant 4 emitted 93 intervals of writing in pre-intervention probes and 172 in post-intervention probes.

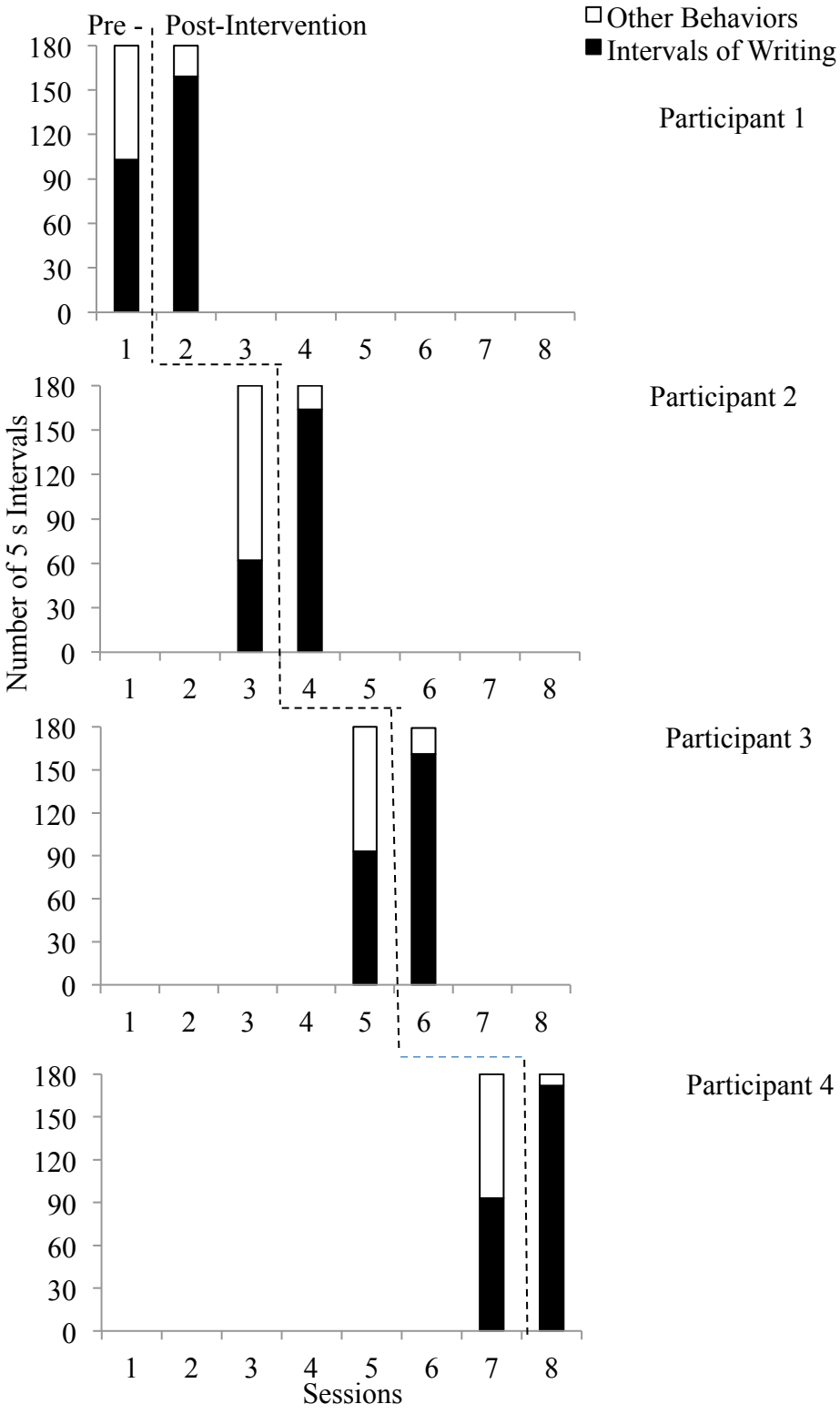


Figure 9. The cumulative number of whole intervals of writing emitted during pre- and post-intervention probes by Participants 1-4 across three probes. The black bars show whole, 5 s intervals of writing and the white bars show other behaviors.

Figure 10 shows the rate of letters of the alphabet written under two conditions – indirect reinforcement with a writing task and indirect reinforcement with free play, a preferred activity. Participant 1 wrote a mean of 62.2 letters per min in play conditions prior to intervention with a range of 56.0 to 69.0 letters per min. He wrote a mean of 47.9 letters per min when indirectly reinforced with a writing task in pre-intervention probes (range = 26.4 – 61.0 letters per min). Following intervention, Participant 1 wrote a mean of 49.0 letters per min (range = 45.5 – 51.5 letters per min) in the play condition and a mean of 28.3 letters per min in the writing condition (range = 26.0 – 33.0 letters per min).

Participant 2 wrote a mean of 78.6 letters per min in play conditions prior to intervention with a range of 62.5 to 99.5 letters per min. He wrote a mean of 60.2 letters per min when indirectly reinforced with a writing task in pre-intervention probes (range = 50.0 – 68.6 letters per min). Following intervention, Participant 2 wrote a mean of 75.2 letters per min (range = 74.5 – 76.0 letters per min) in the play condition and a mean of 79.7 letters per min in the writing condition (range = 73.0 – 88.0 letters per min).

Participant 3 wrote a mean of 54.3 letters per min in play conditions prior to intervention with a range of 48.3 to 55.5 letters per min. He wrote a mean of 49.4 letters per min when indirectly reinforced with a writing task in pre-intervention probes (range = 39.5 – 57.0 letters per min). Following intervention, Participant 3 wrote a mean of 46.5 letters per min (range = 41.0 – 50.5 letters per min) in the play condition and a mean of 45.0 letters per min in the writing condition (range = 44.0 – 46.5 letters per min).

Participant 4 wrote a mean of 97.9 letters per min (range = 83.5 – 107.0 letters per min) in the play condition and a mean of 88.0 letters per min in the writing condition (range = 86.0 – 90.5 letters per min). Following intervention, he wrote a mean of 96.5 letters per min when

indirectly reinforced with free play (range = 93.5 – 99.0 letters per min) and a mean of 97.2 letters per min when indirectly reinforced with free play (range = 95.5 – 100.5 letters per min) when indirectly reinforced with an opportunity to write.

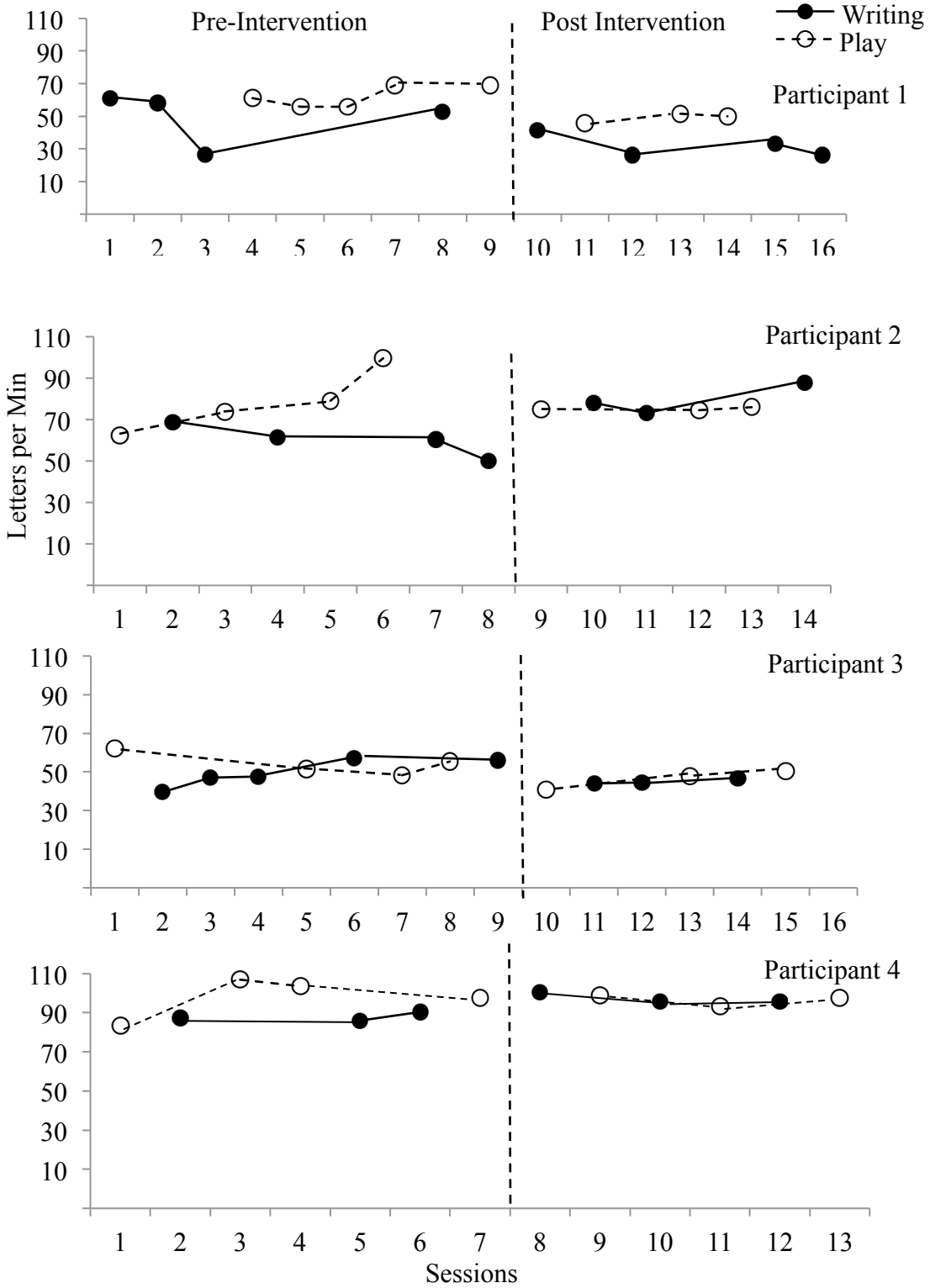


Figure 10. Letters per min written as a performance task for Participant 1, 2, 3, and 4 before and after the social condition. The closed circle represents letters written per minute when the participant wrote immediately after the 2 min task, and the open circle represents letters written per minute when the participant accessed free play immediately after the 2 min task.

Figure 11 shows a cumulative record of Participant 1 – 4's responses across sessions. All participants show a faster rate of learning in the post-intervention condition than in the pre-intervention. The slope of the line for Participant 1 was equal to 0.22 at pre-intervention (y = 0.2199x - 1.8656) and 0.26 post-intervention (y = 0.26x - 4.1098). The slope of line for Participant 2 was 0.44 at pre-intervention (y = 0.4464x - 4.5262) and 0.61 at post-intervention (y = 0.6059x - 4.8639). For Participant 3, the rate of learning was 0.13 at pre-intervention (y = 0.1279x - 1.9454) and 0.32 post-intervention (y = 0.3248x - 2.2474). The slope of line for Participant 4 was 0.06 at pre-intervention (y = 0.0584x – 0.9889) and 0.33 at post-intervention (y = 0.3274x - 2.7139).

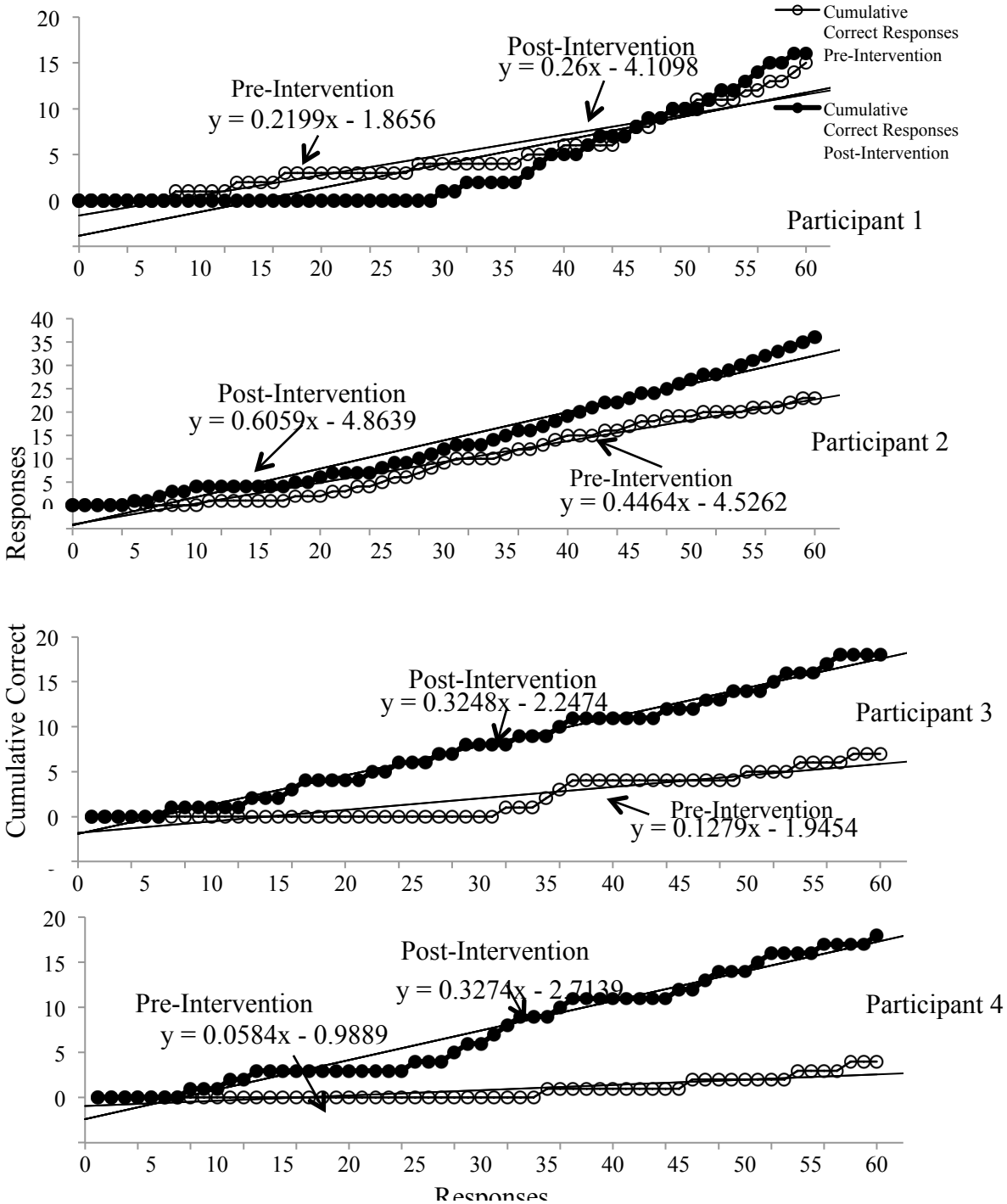


Figure 11. Cumulative record of responses to opportunities to learn new operants (chemical element names), as a measure of indirect reinforcement for writing. The closed circles represent cumulative correct responses when writing was delivered immediately following a 20 learn unit session of learning chemical element names in post-intervention sessions, and the open circles represent the pre-intervention responses. The slope of the line and x-coefficient show rate of learning.

Figure 12 shows the number of words written by each participant in one pre- and one post-social condition 5 min probe session. Participant 1 wrote 13 words and 71 characters in pre-social condition probe sessions, and 40 words and 157 characters following intervention. Participant 2 wrote 19 words and 72 characters in pre-intervention probes, and 59 words and 187 characters in post-social condition probe sessions. Participant 3 wrote 5 words and 21 characters before the social condition, and 35 words and 125 characters following intervention. Participant 4 wrote 36 words and 138 characters before the social condition and 60 words and 239 characters following the social condition.

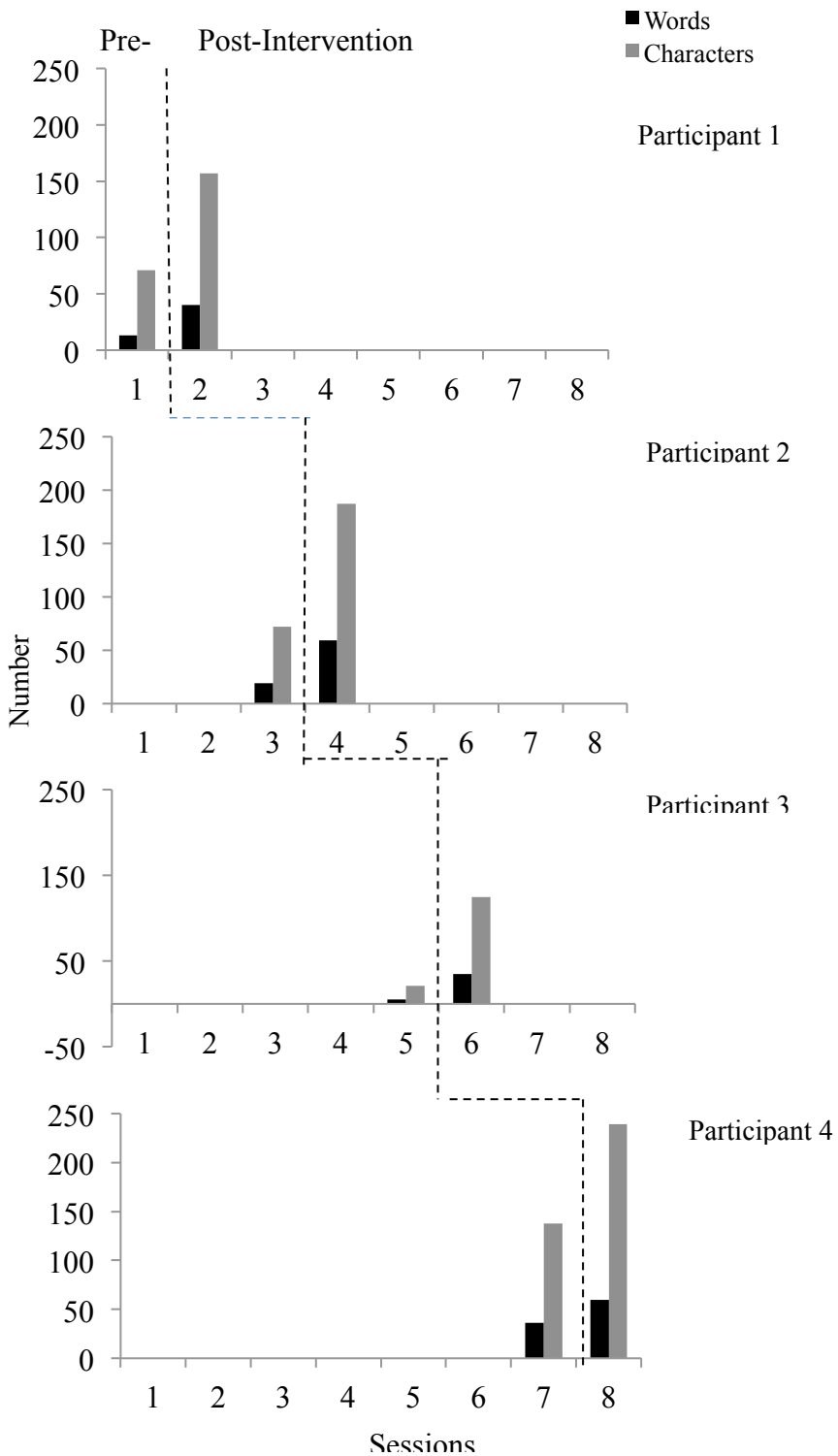


Figure 12. The number of words and characters written in one pre- and one post-intervention 5 min direct reinforcement observation. The number of words written is represented by black bars and the number of characters written is represented by gray bars.

Figure 13 shows the percentage of correct and percentage of incorrect structural components written by Participants 1-4. In pre-intervention probes, Participant 1 wrote sentences with a total of 54 spelling, capitalization, and punctuation components in the pre-intervention probe. He wrote 50 correct structural components out of those responses, yielding 99.6% correct and 7.4% incorrect. In post-intervention probes, Participant 1 wrote 46 total structural components and 42 correct components, for a total of 91.3% correct components and 8.7% incorrect components.

Participant 2 wrote sentences with a total of 37 spelling, capitalization, and punctuation components in the pre-intervention probe. He wrote 24 correct structural components out of those responses, equalling 64.9% correct and 35.1% incorrect. In post-intervention probes, Participant 2 wrote 44 total structural components and 41 correct components, for a total of 93.2% correct components and 6.8% incorrect components.

Participant 3 wrote sentences with a total of 40 spelling, capitalization, and punctuation components in the pre-intervention probe. He wrote 26 correct structural components out of those responses, equalling 65.0% correct and 35.0% incorrect. In post-intervention probes, Participant 3 wrote 44 total structural components and 35 correct components, for a total of 79.5% correct components and 20.5% incorrect components.

Participant 4 wrote sentences with 58 capitalization, punctuation, and spelling components in the pre-intervention probe and 66 components in the post-intervention probe. 98% (57/58) of pre-social condition probes were correct and 100% of post-intervention probes were correct.

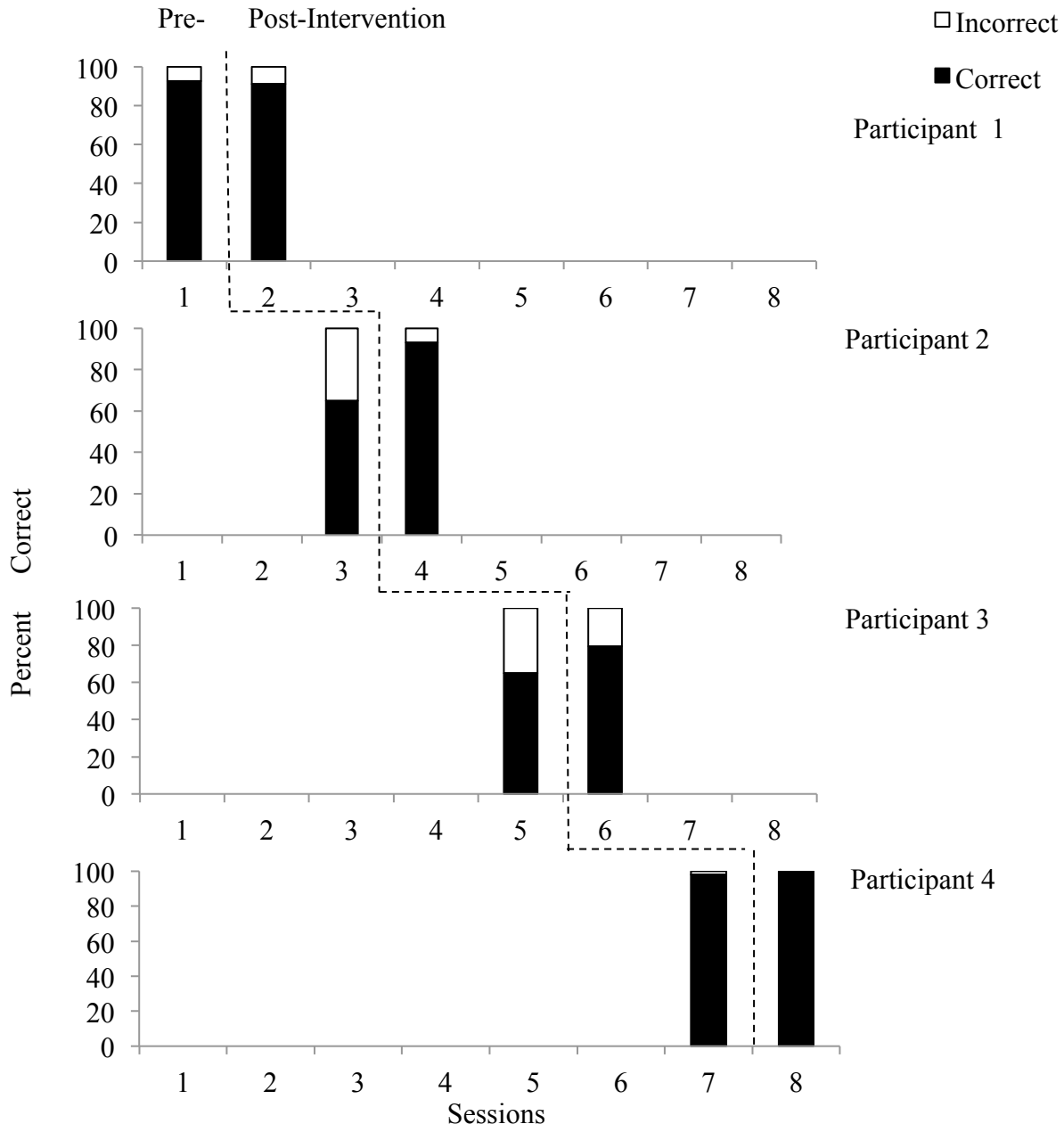


Figure 13. The number of correct and incorrect structural components emitted in a technical writing task, "How to Make a Peanut Butter and Jelly Sandwich." The number of correct structural components (words spelled correctly, capitalization, and punctuation) is represented in the black bars, and the number of incorrect components is represented in the white bars. Both together reflect the total number of structural components, based on the writing sample the participant provided in response to the antecedent.

Figure 14 shows the number of correct and incorrect technical components for all participants out of a possible 10 technical steps. In the pre-intervention probe, Participant 1 included 5 correct steps. He included the same number of correct steps in the post-intervention probes. Participant 2 included 3 correct components out of 10 in the pre-intervention probe and 4 correct in the post-intervention probe. Participant 3 included 4 correct components out of 10 in the pre-intervention probe and 4 correct in the post-intervention probe. Participant 4 emitted 5 correct responses in both pre- and post-intervention probes.

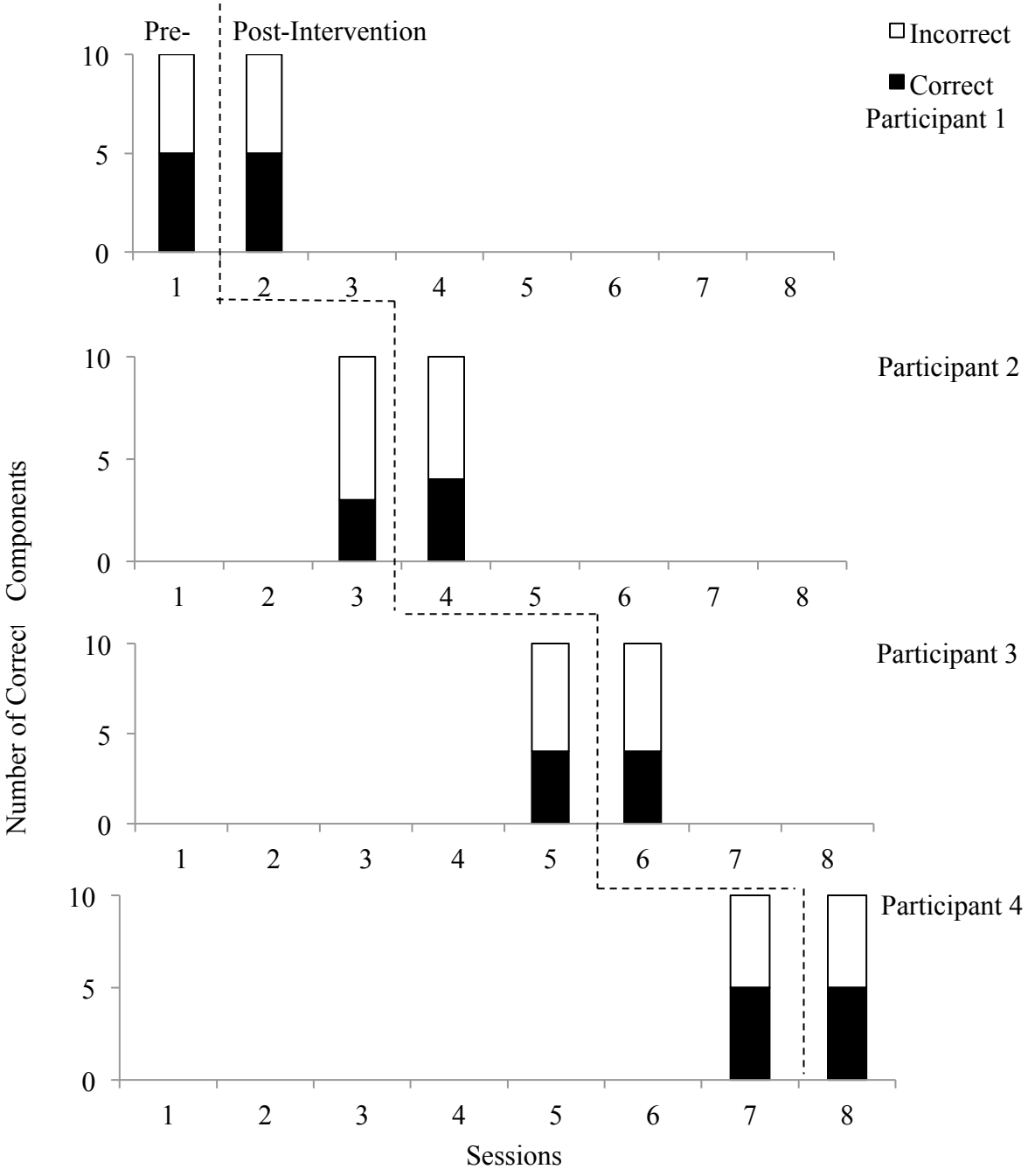


Figure 14. The number of correct and incorrect technical components emitted in a technical writing task, "How to Make a Peanut Butter and Jelly Sandwich." The total number of possible correct responses is 10 steps, as devised by primary researcher and as listed in Table 9. The number of correct technical components each participant included in his writing sample is represented in the black bars, and the number of incorrect components is represented in the white bars.

Figure 15 shows intervention data from the social condition. The data collected were mands to write, responses to denial of participation in the writing activity, and reading and contributions to peer confederates' writing. Participant 1 emitted 20, 19, and 19 correct responses to the performance task (sorting books). Cumulatively, the responses were 20, 39, and 58 correct responses. He emitted 4, 3, and 3 mands per session and 4, 7, and 10 mands cumulatively. For reading and contribution, he emitted 8, 6, and 8 responses per session, or 8, 14, and 22 cumulatively. He also emitted 21, 8, and 21 responses to being denied participation during intervention, or 21, 29 and 50 cumulative responses across sessions.

Participant 2 emitted 20, 20, and 20 correct responses to the performance task (sorting books). Cumulatively, the responses were 20, 40, and 60 correct responses. For mands, he emitted 2, 12, and 9 mands per intervention session and 2, 14, and 23 mands cumulatively. For reading and contribution, he emitted 33, 12, and 16 responses per session, or 33, 45, and 61 cumulatively. Participant 2 emitted 18, 25, and 23 responses to being denied participation during intervention, or 18, 43 and 66 cumulative responses across sessions.

For the performance task, Participant 3 emitted 20, 20, and 20 correct responses. Cumulatively, the responses were 20, 40, and 60 correct responses. Participant 3 emitted no mands during any intervention sessions. For reading and contribution, he emitted 3, 6, and 12 responses per session, or 3, 9, and 21 cumulatively. Participant 3 emitted a high number of responses to denial during intervention, with 35, 16, and 48 responses to being denied participation during intervention, or 35, 51 and 99 cumulative responses across sessions.

Participant 4 emitted all correct responses to the performance task. He emitted a total of 3 mands for the writing task, all within the second intervention session. He made 36 total attempts

to contribute to peers' writing with 1, 25, and 10 attempts per session. He emitted 34 responses to denial in session one, followed by 15 in the second session and 23 in the third session.

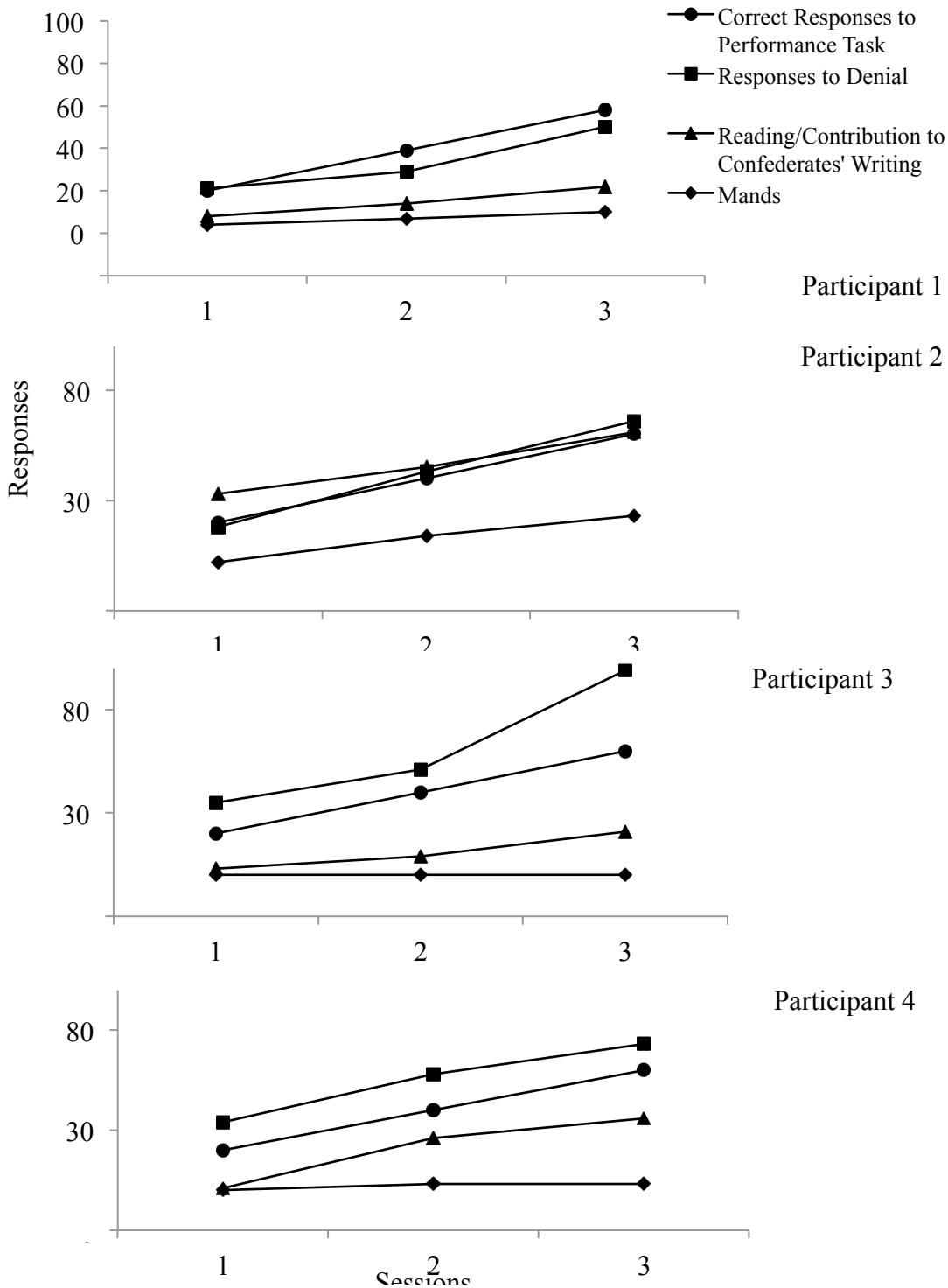


Figure 15. The social condition intervention graph, where closed circles represent the total number of cumulative correct responses to a performance task across sessions. Closed squares represent cumulative responses to denial during intervention sessions, closed triangles represent cumulative attempts to read or contribute to peer confederates' writing, and closed diamonds represent the number of mands for the writing activity emitted across sessions.

Discussion

Results show that direct reinforcement for writing increased for all four participants, and that indirect reinforcement for writing during learning tasks increased for three of four participants. Indirect reinforcement for writing during performance tasks increased for two of four participants. These results expand upon those presented in Experiment 1. Further, the number of words and characters written increased following the social condition for all participants. Finally, the number of correct structural components increased for Participant 2 and 3, but stayed the same during the pre- and post-social condition probes for Participant 1 and 4, due to the high number of correct responses in the pre-intervention probes. Technical components did not change for any participants following the intervention.

The increases in direct reinforcement show that participants wrote for longer periods of time following intervention. However, the data were variable for Participants 3 and 4 across pre-intervention probes and were descending for Participant 1 during post-intervention probes. Combining the data across three sessions shows participants' possible responses, had the probe sessions been 15 min or longer instead of 5 min. Five min direct reinforcement probes were selected because it is a grade-level expectation to write for at least 5 min at a time. However, the study could benefit from longer probe sessions for direct reinforcement in future studies.

The descending trend in post-intervention data for Participant 1 was possibly due to spill-over effects from the intervention to the post-intervention probes. During the intervention, the participant emitted unusual behaviors such as noncompliance toward directions. The experimenter's denial of her attention to the participant could have functioned to decrease the participant's responding to the probes, delivered by the primary researcher. The CABAS® AIL model of instruction involves high rates of praise, attention, and points for appropriate school

behavior throughout the day, and the dramatic change in contingencies for the participant during the intervention could have had adverse effects, as seen in the direct reinforcement probes and possibly in Participant 1's probes for the indirect reinforcement for writing performance task. These effects were unseen in Experiment 1 because intervention sessions were spread out across several weeks. To address this issue, Participants 2-4 received the experimenter's attention non-contingently outside of intervention sessions, and a 1-month follow-up probe was conducted for Participant 1.

Increases in the indirect reinforcement for writing with learning show that all participants increased their rate of learning when the consequence for correct was opportunities to write. By contrast to Experiment 1, all participants received three 20 learn unit sessions and rates were compared across these sessions. This provides a more accurate measure of rate of learning, whereas in Experiment 1, rate of learning was not experimentally isolated as a dependent variable. The indirect reinforcement for writing with performance reflect more immediate effects of the switch between two conditions when the variable ratio schedule was introduced. The data for writing and free play conditions were stable for Participants 2-4 following the intervention condition. However, in pre-intervention probes, the data were more variable for Participant 3. These data suggest that some participants with a higher level of verbal behavior and who have a specific instructional history of instructional control by the teacher may always perform under any circumstance. This is an area that should be empirically tested in the future, to perhaps analyze and isolate the rule or verbally-governed behaviors that result in this performance.

The lack of differences between pre- and post-social condition probes for structural components may be due to ceiling effects. However, the increases in number of characters and words written are an indication that participants simply wrote more in the post-intervention

probes. This supports the idea that when students produce more writing, teachers are more readily able to provide immediate feedback and shape writing. Technical components did not increase from pre- to post-intervention, which may indicate that the technical writing task, "How to Make a Peanut Butter and Jelly Sandwich" was not sensitive enough or appropriate for second graders. However, it may also indicate that the function of writing can be taught when conditioned reinforcement for writing is present and a functional writing motivational operation is present (Madho, 1997).

Finally, increases in the number of characters written were higher than the number of words written, though all participants showed increases in both. This may indicate that participants wrote longer words in post-intervention probes than in pre-intervention probes. Further, their writing may have been more concise, using longer, more effective words to convey the same meaning. The study would benefit from a more thorough analysis of the words and language written across pre- and post-intervention probes to determine if this is true a possibility.

CHAPTER IV

GENERAL DISCUSSION

Experiment 1 and Experiment 2 determine if observational procedures could condition writing as a reinforcer, and the effect these changes in reinforcers have on rate of learning, rate of performance, and writing behavior. The purpose of Experiment 1 was to determine if an activity, such as writing, could be conditioned through an observational procedure, or a social condition, as in O'Rourke (2006). When this was established in Experiment 1, Experiment 2 was conducted to expand and replicate these results, but also to determine how writing permanent products are different in number of words and characters, structure, and function following the intervention designed to condition writing as a reinforcer.

Experiment 1 showed that the social condition, with two peer confederates, was an effective means of conditioning writing as a direct reinforcer for two of three participants. Prior studies had the denial component of the observational interventions but did not have two peer confederates present (Greer, Singer-Dudek, Longano, & Zrinzo, 2008; Singer-Dudek, Greer, & Schmeltzkopf, 2008; Oblak, 2010; Oblak et al. 2015; O'Rourke, 2006; Singer-Dudek, Oblak, & Greer, 2011). However, one other study (Greer et al. 1991) used a peer-mediated procedure with three peers to condition consumption of non-preferred food items through observation. This suggests that observational interventions with more than one peer confederate could be effective. Thus, this condition was termed a "social condition" for the present study. The social condition was also applied to an activity, as opposed to the conditioning of a tangible item or token as in previous studies. O'Rourke (2006) conditioned math activities through a similar procedure, however math activities are often more discrete and objective than writing. Therefore, Experiment 1 demonstrated that observational procedures, and social conditions, are effective in

conditioning complex behaviors such as writing. This is possible because the target participant observes the inherently social nature of writing, through the peer confederates' rotation of serving as reader and writer. In previous experiments, the denial of access to an item or activity that a peer accepts as a reinforcer was critical to the efficacy of the procedure. Thus, this study determined that when the target participant observed the natural reinforcement contingency of writing, while being denied the opportunity to participate, an activity as complex as writing could be conditioned through observation. Future studies could include both confederates simultaneously writing to each other, to further enhance this feature of the social condition.

Experiment 1 also tested the effects of writing as a direct and indirect reinforcer. There is an extensive amount of research on conditioned reinforcement (Kelleher & Gollub, 1964), however few research studies apply conditioned reinforcement to complex human behavior (Williams, 1994) outside of select research models such as Verbal Behavior Development Theory (Greer & Ross, 2008, Greer & Du, 2014). Though much is known about conditioned reinforcers, two areas of further research are the acquisition of conditioned reinforcers through observation and the distinction between direct and indirect conditioned reinforcers. This study adds to the research that demonstrates the acquisition of new reinforcers through observation. Further, it demonstrates that conditioned reinforcers can function in different ways and have different effects on behavior.

Direct reinforcement, defined as an individual emitting a behavior and accessing reinforcement intrinsic to the stimulus and is most often what is referred to when referring to conditioned reinforcers. However, especially in an academic context, it becomes relevant to determine and discuss the possibility that conditioned reinforcers can reinforce other behaviors as prosthetic reinforcers. Two broad categories of behaviors are behaviors that result in learning

and behaviors that are a result of performance (Greer, 2002). Conditioned reinforcers delivered as a consequence for emitting either of these types of behaviors are analogous to prosthetic reinforcers, or educational reinforcers (Skinner, 1957). Results of the present study show that conditioned reinforcers can reinforce learning and the emission of performance behaviors differently, and this is a critical area of research. For example, all dimensions of direct and indirect reinforcement increased for Participant 2 and 4. However, Participant 1 increased direct reinforcement for writing, but the rate of performance and learning did not change following the social condition. Participant 3 increased direct reinforcement and indirect reinforcement for learning, but not performance. It follows then, that conditioned reinforcement for a stimulus is not simply present or absent within an individual; rather its function as a reinforcer is dependent upon the type of behavior for which it is delivered as a consequence – directly and intrinsic to the stimulus, or indirectly as a result of learning or performance. Similarly, a study using a stimulus-stimulus pairing procedure to condition adult voices found that direct reinforcement for listening rate of learning (indirect reinforcement) increased for three participants after adult voices were conditioned (Greer et al. 2011). However, observing responses and intervals of listening to a story in a group only increased for two participants. Therefore, as in the present study, not all dimensions of reinforcement (direct and indirect) were conditioned for every participant. Why and how this is the case should be further researched. Through conditioned reinforcement is largely perceived as understood (Williams, 1994), little is known about different types of reinforcement. This discussion of direct and indirect reinforcement is one that has just recently begun, and should be systematically and empirically tested.

Experiment 2 largely replicated and expanded upon results of Experiment 1, with similar findings, but more closely analyzed the differences in permanent products in number of words

and characters, structure and function. That is, how are writing samples different from pre-social condition compared to after? Direct reinforcement measures inherently measured the quantity of participants' responses as "better" responses, because the measure was duration of writing. Thus, more intervals of writing result in more writing on the page. However, upon examining the number of words and characters written, and finding that the number of characters increased much more than the number of words written, suggests that direct reinforcement for writing results in more than just quantity of words. Perhaps, the overall length of words or quality of vocabulary written improved with the acquisition of direct conditioned reinforcement for writing. Future studies should more critically analyze, perhaps using linguistic measures, the differences in quality of writing following the social condition.

Experiment 2 also adds an interesting discussion point to the termination criterion for observational procedures. In previous experiments, the termination criterion for the intervention was when mands for the neutral stimulus increased or when responses went into extinction (Greer & Singer-Dudek, 2008). However, participants in the present experiments and in other experiments resisted extinction, perhaps because their level of audience control prevented them from stopping responding, or engaging in behaviors that were incompatible with the performance task, such as crying or tantrums. As such, results from Experiment 1 and previous studies (Birch, 1980) showed that three exposures to the intervention condition could possibly suffice to condition writing. Participant 3 also found a piece of paper in the intervention room and began writing to his peer confederates during the third session. Similarly, several participants attempted to contribute to peer confederates' writing by vocally stating what they could write, or making suggestions on what to write. This raises the question of the difference between a mand for a

writing assignment, and attempting to access reinforcement alternatively, by suggesting vocally what the confederates should write.

Social and observational procedures, by contrast to other VBDT protocols, are not teaching procedures, and thus it is difficult to determine a mastery criterion. Perhaps future studies should examine if contributions toward peer confederates' writing could be a possible intervention criterion, or systematically test if the number of exposure sessions vary across replications of the study. One way to do this would be to collect cumulative data on mands and responses to denial across responses and sessions, or to systematically measure voluntary attempts to write in non-experimental settings.

Implications

This study adds to the body of research on the acquisition of conditioned reinforcers through observation and social conditions. It expands upon the research because it suggests that complex social behaviors, such as writing, can be conditioned through social observational procedures. These findings also contribute to the notion that the ability to acquire reinforcers through observation is a verbal behavior development cusp that accelerates learning. To date, it is understood that some aspect of denial (Greer & Singer-Dudek, 2008) plays a role into the mechanisms by which conditioned reinforcers are acquired through observation. The results of the present study support this theory, in that the social condition denied the target participant of opportunities to write. Results also suggest that the target participant must observe the reinforcement effects on the peer confederate. In the present study, the natural reinforcer for writing is its effect on the reader, which participants observed in the peer confederates' writing exchanges during the intervention.

In this study, participants were not only able to acquire writing as a reinforcer through observation, but the writing was a possible foundation for several VBDT writer status cusps. Beyond the mechanics of writing, such as formation of letters, students must be taught to write to affect their reader. Participants in Experiment 2 could write to affect the reader (Helou-Care, Lai, & Sterkin, 2007; Madho,1997; Reilly-Lawson & Greer, 2006), as demonstrated by the high number of correct responses in pre-intervention technical writing probes. However, they lacked conditioned reinforcement for writing, that prohibited them from receiving teacher feedback in writing, and possibly deterred them from acquiring higher-level writing cusps such as writer self-editor (Marsico, 1998) and aesthetic writing affecting a reader's emotions (Jodlowski, 2000). If students have conditioned reinforcement for writing, they may be able to acquire other writer status cusps such as these and learn writing objectives faster as a result. Greer and Du (2014) stated that each VBDT cusp has a specific conditioned reinforcer associated with its emergence. Perhaps conditioned reinforcement for writing is the associated reinforcer for one or more writer cusps.

Another important implication of the study is that direct and indirect conditioned reinforcers are, in fact, two subcategories of conditioned reinforcers that can be effectively analyzed and manipulated in instructional settings. Further, they are two subcategories of conditioned reinforcers that have not yet been defined in the behavior analytic literature, but have clear effects on behavior. The contingencies through which direct and indirect conditioned reinforcers are established needs further research. The social condition in the present experiment successfully conditioned direct and indirect reinforcers, however, there may be certain dimensions of pairings or observational exposures which result in the establishment of these reinforcers, such as immediacy of pairings or number of pairings.

The study also has applied implications, relevant to the CCSS initiative for increasing writing fluency in students today. Students who initiate writing tasks immediately and produce more written products can obtain valuable feedback from their teacher and shape their writing to better affect the reader, or to have correct structural components and mechanics. The results of the experiment suggest that this specific set of procedures may be effective in increasing students' writing behaviors in an efficient and socially appropriate manner. Just as students can access VBDT writer status cusps with conditioned reinforcement for writing in repertoire, students may also have greater access to writing curricula offered in schools today.

Limitations

This study is not without limitations. One major limitation is that participants continued to access regular writing instruction during the intervention and probe sessions. This was accounted for in the experimental design with the delay of probes across participants. However, there is a possibility that writing instruction could have had some effect on the intervention as well, as is the case for the follow-up probes that were conducted for all of the participants in Experiment 1 and Participant 1 in Experiment 2.

Another limitation is that direct reinforcement probes were 5 min in duration and showed variability across sessions for two participants in Experiment 2. A limitation of Experiment 1 was that there were not enough pre-intervention or post-intervention probes collected, however upon collecting more data in Experiment 2, it is evident that it is necessary to increase both the number of observations and the duration of the observations to ensure more stable responding across participants.

Future Research

Results of the present study point to several possibilities for future research. First, more empirical testing of the mechanisms by which direct and indirect reinforcers are conditioned is necessary to add to the wealth of knowledge on conditioned reinforcement. Next, procedures like the social condition implemented here, and the observational interventions implemented in earlier studies should be applied to other activity-based reinforcers, and conditioning other tangible items within the population studied here. Students of this level of verbal behavior present a unique and complex set of social repertoires that can possibly be utilized to accelerate academic achievement and social awareness.

Specific to conditioned reinforcement for writing, future studies should examine the presence of conditioned reinforcement for writing as the associated conditioned reinforcer for writer cusps, such as writer immersion (Greer, 2002; Greer, 2008; Greer & Du, 2014). Such studies could answer research questions regarding conditioned reinforcement as a prerequisite to writer status cusps, or if conditioned reinforcement for writing emerges as a function of the emergence of writer status cusps.

Conclusion

Results of the present study show that the social condition was effective in increasing direct conditioned reinforcement for writing, and increasing rate of learning and responding to performance behaviors when writing was an indirect reinforcer for emitting those behaviors. Further, the intervention increased direct reinforcement for writing such that participants wrote more words and characters following intervention, and such that naïve adult readers ranked post-intervention samples higher than pre-intervention samples. There is still much that is unknown about several parts of this study – the ability to acquire reinforcers through observation, direct

and indirect reinforcement, and the most effective ways to teach writing to struggling students. However, the present study offers the social condition implemented here as a means of conditioning a complex social behavior through observation, while increasing both direct and indirect reinforcement for writing, and providing the foundation for learning to be an effective writer.

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Appendix A

Participant _____ Direct Reinforcement Data Sheet

Probe # _____ IOA _____ By _____

Total ____/ 60

Probe # _____ IOA _____ By _____

Total ____/ 60

Probe # _____ IOA _____ By _____

Total ____/ 60

Probe # _____ IOA _____ By _____

Total ____/ 60

Appendix B

Intervention Data Sheet

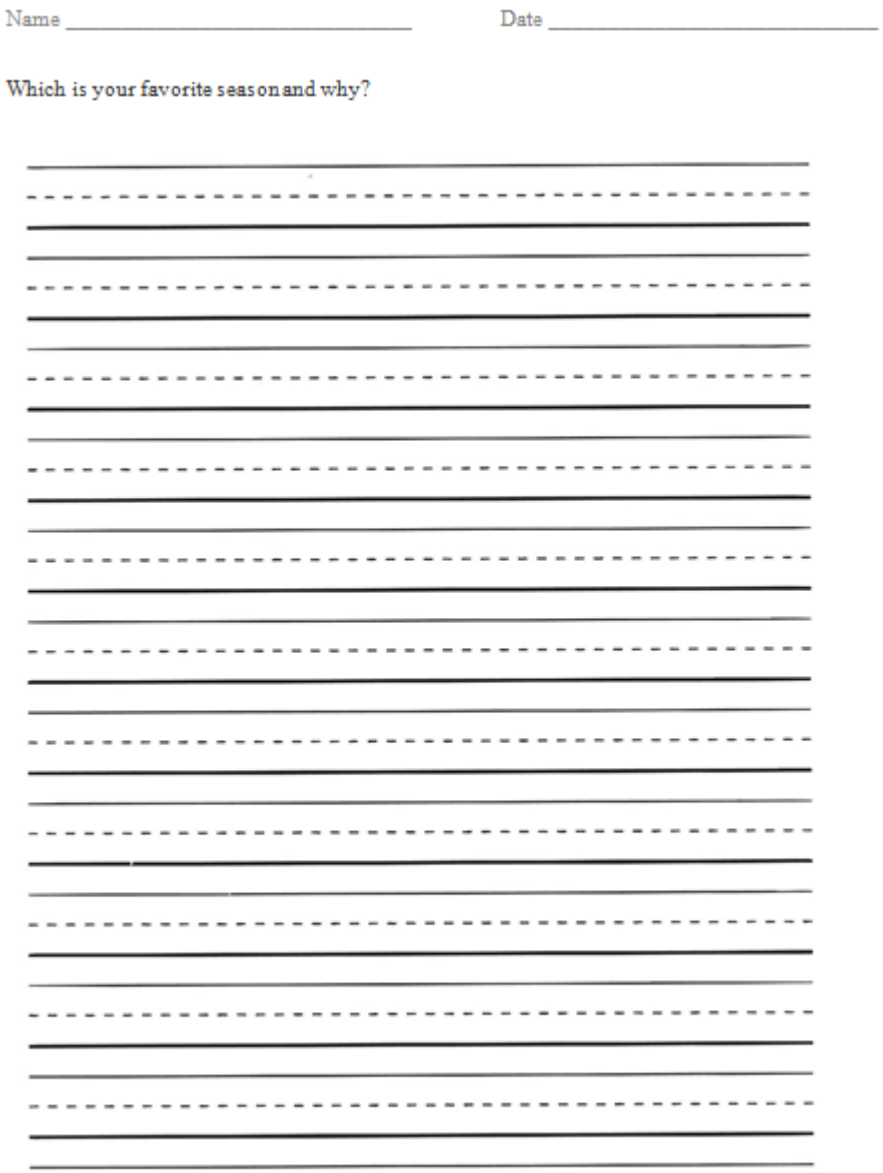
Participant _____ Date _____

Frequency Data

	Correct	Mands	Responses to Denial	Attempts to Escape	Other/Notes
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Appendix C

The permanent product and visual stimulus delivered to peer confederates during intervention and target participants during probe sessions.



Appendix D

Writing Samples for Permanent Product Rankings

Participant 1

Sample A: What would your dream vehicle look like?

My dream motorcycle would look like really cool. It would be red with sticker allover it. It would g 500 miles in hour. It would have off roading wheels. So I could go on jump and ride in the mud.

Sample B: Write a summary of a book you're reading.

My book is about a volcano erupting. So much ash came out that it buried houses and biuldings. One thousand people died. They froze in the ashes cause there was so much. The city was buried in ashes now they built an city aboave the old one. The volcano was so loud an island close by herd it. The volcano was very deadly. It was quiet for cetruies.

Sample C: Describe anyone in this room.

Charlie. He's nice. He's friendly. He's cool. He's tall. He's funny. He's energenik

Sample D: Write all of the steps for how to get to the second grade playground.

First you turn right. Next you go straight then turn left. Then you go up the stairs. After the stairs you go straight intill you get to the end of the hallway.

Participant 3

Sample A: Write about the last time you did something really kind.

When I let my brother itto my new fort. fo it was fun to sleep in but the bad news is that we are right next door to rosie so be qiute. it is the size of a daddy and a baby

Sample B: Write a story.

Once upon a time there was a clown that was silly. He liked to put a pie in other peoples faces He always liked to is flip of a bull. He could eat 4 pies in a row and sipt out 4 pies in a row. Then at the end he liked to turn into a Lion a roar.

Sample C: What would it be like if your dog spoke to you, but only when there was nobody else around? What would the dog say and how would you prove he could talk?

the dog would say to play video games every day and never stop untill you are 17 years old

Sample D: Write about what you did this weekend.

On Saturday I made a new world in minecraft! Next in lithiting punch in minecraft my brother Joined my world. Then I had pancakes. Then I watched a movie. Then I went to bed On Sunday I went to play monoply. Then I played hovercraft. After I watched night at the museum 1, 2, 3, and 4. Then I was eating oreo's while taking a nap. Then I woke up and my brother went into see a broadway show. Then I took a shower. Then I took medicen and went to bed. On Monday I went to the docter. I was sick. I had strep my brother didn't. Then we went home and played hovercraft and minecradt. Then I watched Teen Titans go! Then I to a shower. Then I went to bed and drank water. On tesday I had to take lots of water. Then I rode my bike. After I played monoply. Then I had a bagel with egg salad. Next I played fottball with my brother in the basement. Then I rode my bike and got ready for batting practice. Then I took a shower and went to bed. I had a good weekend.

Participant 3

Sample A: If I had 100 _____ I would…

if I had 100 chickens that were nice to cats and me It would make them give me caats and me meat. And give avry

Sample B: What would your dream house look like?

chickens are runing avrywar. you will be smact with a hammer if you cant goin. The house is shapt lika chicken. theres latters and Doors.

Sample C: Write a summary of your favorite book or movie.

I like Kingdom of fatasy.

Sample D: Write a summary of your favorite book, movie or video game.

In cookie clickers you click a big cookie you can get stuf to get cookeis fer you. If you get a gold cookie clik the big cookie a lot. if a cookie that’s not a

Appendix E

Naïve Reader Data Sheet

Social Validity Rankings 1 - Best sample 4 - Worst sample

Please assign 1-4 to each sample for each participant

Participant 1	A	B	C	D
Score				
Participant 3	A	B	C	D
Score				
Participant 3	A	B	C	D
Score				