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DISTRIBUTED AND ACCUMULATED REINFORCEMENT ARRANGEMENTS: EVALUATIONS OF EFFICACY AND PREFERENCE

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Abstract

We assessed the efficacy of, and preference for, accumulated access to reinforcers, which allows uninterrupted engagement with the reinforcers but imposes an inherent delay required to first complete the task. Experiment 1 compared rates of task completion in 4 individuals who had been diagnosed with intellectual disabilities when reinforcement was distributed (i.e., 30-s access to the reinforcer delivered immediately after each response) and accumulated (i.e., 5-min access to the reinforcer after completion of multiple consecutive responses). Accumulated reinforcement produced response rates that equaled or exceeded rates during distributed reinforcement for 3 participants. Experiment 2 used a concurrent-chains schedule to examine preferences for each arrangement. All participants preferred delayed, accumulated access when the reinforcer was an activity. Three participants also preferred accumulated access to edible reinforcers. The collective results suggest that, despite the inherent delay, accumulated reinforcement is just as effective and is often preferred by learners over distributed reinforcement.

Keywords

accumulated reinforcement; choice; concurrent schedules; delay; distributed reinforcement; tokens

Studies that have examined the variables that maintain responding under concurrent schedules of reinforcement in individuals with intellectual and developmental disabilities (IDD) have identified reinforcer magnitude, delay, frequency, and quality as important dimensions that influence choice (e.g., Fisher, Thompson, Piazza, Crosland, & Gotjen, 1997; Hoch, McComas, Johnson, Faranda, & Guenther, 2002; Lerman, Addison, & Kodak, 2006; Neef, Shade, & Miller, 1994; Steinhilber & Johnson, 2007). Delay to reinforcement in particular has received considerable attention. All else being equal, an imposed delay will typically render a reinforcer less effective, a phenomenon known as *temporal discounting*. When the magnitude of the delayed reinforcer is increased however, so that it is larger than a smaller, immediate reinforcer, preference for the smaller, immediate reinforcer is termed *impulsivity*, whereas preference for the larger, delayed reinforcer is termed *self-control*. Confronted with this choice, individuals with IDD have often responded impulsively (e.g., Dixon et al., 1998; Ragotzy, Blakely, & Poling, 1988), although this preference can be reversed through various manipulations (e.g., gradually increasing the delay to the larger reinforcer; Dixon, Rehfeldt, & Randich, 2003; Schweitzer & Sulzer-Azaroff, 1988).

Research on temporal discounting and self-control has historically manipulated the length of the delay, the magnitude of the reinforcer, or both, while the reinforcer type and quality are kept constant. However, qualitative differences in the reinforcer itself may determine whether individuals prefer smaller, immediate reinforcers or larger, delayed reinforcers. For example, self-control responding has been influenced, in humans, by differences in relative quality between the immediate and delayed reinforcers (e.g., Forzano & Logue, 1995) and, in rats, by whether the reinforcer is food or water (Chelonis & Logue, 1997).

Another potentially influential qualitative difference is whether the value of the reinforcer is enhanced by continuity of access (i.e., continuous uninterrupted access through time). For example, activity reinforcers such as puzzles, videos, games, and books all have a distinct beginning, middle, and end. Thus, the reinforcing value, as well as the effectiveness of these stimuli as reinforcers, may largely depend on not only continuity of access but also on progression through each stage of the activity and on the eventual completion of the activity. In addition, procedures that interrupt that continuity through time may alter the quality of the reinforcer, thus discounting its value (Hackenberg & Pietras, 2000). Consider, for example, a child who works to earn access to a video game. One might deliver a brief period of access each time a small response requirement is met (distributed reinforcement) or deliver all reinforcement at the same time following the completion of a larger response requirement (accumulated reinforcement). In such an arrangement, the overall unit price (responses per unit of reinforcement) and the access time might be equal (e.g., either way, the child might end up with 5-min access for having emitted 10 responses). The critical difference is how reinforcement is distributed; in small allotments after each response or all at once after numerous responses. Under these conditions, the accumulated reinforcement arrangement, necessarily delayed to accommodate the larger response requirement, might be preferred over the distributed reinforcer arrangement because it permits the child to play the game continuously, and therefore does not as frequently interrupt progress towards completion of the game. Some basic studies have examined the conditions under which reinforcers tend to

be accumulated (e.g., Killeen, 1974; McFarland & Lattal, 2001), but none to our knowledge has specifically investigated the type of reinforcer as an independent variable.

Several applied studies that have examined differences in preference assessment outcomes as a function of duration of stimulus availability or engagement may lend some support for the notion that continuity of access may play an important role in determining the reinforcing value of some stimuli. In general, results of this research have suggested that relative preference for stimuli may differ according to duration of access (e.g., Kodak, Fisher, Kelley, & Kisamore, 2009; Steinhilber & Johnson, 2007) or that preference based on engagement during short durations of access may not always predict preference based on responding during extended periods of access (Rapp, Rojas, Colby-Dirksen, Swanson, & Marvin, 2010). For example, Steinhilber and Johnson (2007) compared preference for and reinforcing efficacy of various activities (e.g., music, video games) using a multiple-stimulus-without-replacement (MWSO) preference assessment (DeLeon & Iwata, 1996) when the selected stimuli were delivered for 15 s or 15 min. Different preference hierarchies were obtained when stimuli were delivered for 15 s than when delivered for 15 min for both participants. In addition, stimuli identified as highly preferred under the short- and long-duration MSWOs were found to function as reinforcers primarily when they were delivered for short or long durations, respectively. This research suggests that preference and reinforcer efficacy may vary depending on duration of stimulus availability. Furthermore, some stimuli, such as activity-based reinforcers, may be more likely to function as reinforcers given longer durations of access, conceivably because longer access allows uninterrupted engagement through time.

There also may be practical advantages to the delivery of the total quantity of reinforcement all at once rather than in a distributed fashion. For one, disfluent work schedules (i.e., those that intersperse work requirements with reinforcer access time, as with distributed reinforcement arrangements) may have an abolishing effect on reinforcers for some individuals (Fienup, Ahlers, & Pace, 2011). In addition, distributed reinforcement disrupts ongoing responding more frequently than accumulated reinforcement. When a reinforcer is delivered, some period of consumption is permitted before the response–reinforcement arrangement is resumed, and it may take some time for a person to reorient towards task-related stimuli each time they are reintroduced. If so, tasks that are interrupted more frequently might simply get completed less rapidly. Furthermore, these sorts of disruptions may be more influential with activity reinforcers than stimuli that can be delivered without much disruption, such as edible reinforcers (i.e., neither the task nor the person have to be moved to provide an opportunity to consume the edible reinforcer).

The overall purpose of the present study was to compare distributed (immediate, smaller, spaced) and accumulated (delayed, but larger and uninterrupted) reinforcement, the latter initially mediated by token reinforcement, on a number of response dimensions for four individuals who had been diagnosed with IDD. The first experiment was designed to determine whether accumulated reinforcers would support rates of responding equivalent to distributed reinforcement when the reinforcers were activities whose value might be enhanced by continuity of access. The second experiment assessed preferences between distributed and accumulated reinforcement using a concurrent-chains procedure similar to

that described by Hanley and colleagues (e.g., Hanley, Piazza, Fisher, & Maglieri, 2005; Heal & Hanley, 2007). Separate evaluations were made for two classes of reinforcers (activities and edible reinforcers) to determine if continuous availability might be more important for activities than for edible reinforcers because the value of edible reinforcers may rely less on the same sort of natural progression towards completion. Another purpose of the second experiment was to determine whether discrete-trial academic sessions were completed more rapidly during the accumulated reinforcement condition, a comparison with practical implications.

GENERAL METHOD

Participants and Settings

The participants were four individuals who had been admitted to an inpatient hospital unit for the assessment and treatment of problem behavior. Evan was a 16-year-old boy who had been diagnosed with autism, moderate mental retardation, and disruptive behavior disorder. He communicated vocally using complete sentences. Alice was a 20-year-old woman who had been diagnosed with pervasive developmental disorder, stereotypic movement disorder with self-injury, and moderate mental retardation. She communicated using gestures and some simple American Sign Language. Sam was a 16-year-old boy who had been diagnosed with autism, unspecified disturbance of conduct, bipolar disorder, and mild mental retardation. He communicated vocally using two- to three-word sentences. Jillian was a 15-year-old girl whose diagnoses included pervasive developmental disorder, disruptive behavior disorder, and attention deficit hyperactivity disorder. She communicated using complete sentences. All participants could follow simple two-step directions.

Sessions were conducted in various areas throughout the hospital where the individual's daily academics were completed. Evan's sessions were conducted at a table on the main living area of the hospital unit. The room (9.4 m by 9.4 m) contained two large tables, a couch, and several chairs. Alice's and Jillian's sessions were conducted at a table in the center of a bedroom adjacent to the main living area of the unit. The room (5.8 m by 5.8 m) contained four beds, a dresser, a small table, and several chairs. Sam's sessions were conducted at a workstation located in the classroom. The classroom (6.8 m by 6.8 m) contained several small workstations (i.e., a desk and two chairs divided by a partition). All settings also contained the relevant session materials.

Preexperimental Procedure

Paired-choice preference assessments—Separate paired-choice preference assessments (Fisher et al., 1992) were conducted to identify activity and edible reinforcers. Between 12 and 16 stimuli were used in each assessment, all having been nominated as potential reinforcers by parents or caregivers. During each trial, the two items were placed on the table in front of the participant and he or she was prompted to “choose one.” *Selection* of either item, defined as reaching towards or asking for the stimulus, resulted in 30-s access to the leisure item or a small piece of the edible item to consume. Attempts to select both items simultaneously were blocked. If the participant made no response towards

the items within 5 s, he or she was physically guided to sample each item; a second trial was then conducted.

Observers recorded the selection made on each trial or no response if the participant did not select an item on either trial. Selection percentages, used to rank stimulus preferences, were calculated by dividing the number of times each item was selected by the number of times it was presented. The edible stimuli selected included gummy bears, dried apples, Skittles, and chocolate chips for Evan, Alice, Sam, and Jillian, respectively. The activity reinforcers used in the study were ultimately chosen based on two characteristics: (a) They ranked first, second, or third; and (b) they were judged to be one whose value might be enhanced through continuous access (e.g., there was a natural progression towards completion of the activity, such as from the start of the puzzle to its completion).

Selected activities included puzzles for Evan, Walt Disney's Cinderella for Alice, Who Wants to be a Millionaire videos for Sam, and a Gameboy for Jillian. Evan's puzzles ranged from 70 to 100 pieces and consisted of various cartoon characters and nature scenes. If Evan completed a puzzle at any point during the analysis, he was given the opportunity to begin a new puzzle. Alice's video was approximately 75 min long, and Sam's video was approximately 120 min long. When Jillian earned access to her Gameboy, she was given the opportunity to choose between one of four video games and was permitted to change video games at any point during her reinforcer access time.

During any given session block, two forced-exposure trials and five choice trials could be completed. Five minutes of reinforcer access time could be earned for each forced-exposure trial and for each choice trial, for a total of 35 min of reinforcer access in a given session block. This provided ample time for Evan to complete a puzzle. Although data were not collected on puzzle completion, he frequently completed a full puzzle during a session block and was given a new puzzle to begin. Puzzles that were not completed in a given session block were continued during the next session. Because the videos were longer than 35 min, Alice and Sam were unable to complete their videos in a single session block. Therefore, during each new session block, the videos were continued from the point at which they ended from the preceding block. Similarly, Jillian was unable to complete an entire video game in the time allotted for a given day's sessions. Therefore, at the end of each day, a password provided by the video game was recorded and entered in during the next session block to allow Jillian to begin the video game where she left off.

Token training—Token training was conducted to teach participants to exchange tokens for the selected reinforcers independently. Materials included 10 tokens (simple plastic poker chips affixed with Velcro), a token board (a laminated sheet of card stock) affixed with the corresponding Velcro, a timer, activity reinforcers, and task materials. Participants exchanged each token for 30-s access to the activity reinforcer. *Independent token trading* was defined as the participant removing the token from the token board and handing it to the therapist within 10 s of the therapist placing her open hand palm side up in front of the token board.

During each trial, participants were required to complete a designated academic task or an activity of daily living (ADL) to earn a token. Academic or ADL tasks used during this and all subsequent analyses were those that the individuals' teachers nominated as tasks the participants could readily complete, because the purpose of the current study was to assess preference for accumulated or distributed reinforcement and not to promote skill acquisition. These tasks were chosen to minimize the frequency of prompts provided and to ensure that differences in rate or time of task completion could not be attributed to task acquisition.

Tasks used during token training (and subsequent analyses) are listed in Table 1. A three-step prompting procedure (verbal, gestural, and physical prompts) was used to prompt participants to complete the tasks. For Evan's vocal response, the verbal prompt consisted of the question, "What color is this?" If he did not respond or responded incorrectly, a second prompt was added in which the therapist told him the name of the color and the question was repeated (e.g., "Evan, this is the color red. What color is this?"). If he still failed to respond or again responded incorrectly, the therapist repeated the answer while gently tapping his chin with her index and middle fingers. Compliance following the verbal or gestural prompt resulted in the therapist placing one token on his token board.

Initially, the token-exchange requirement was one earned token. After the token was delivered, the therapist waited for the participant to exchange the token independently. If the participant did not exchange the token independently within 10 s, the therapist used the same three-step prompting procedure to prompt him or her to exchange the token. The requirement for token exchange was systematically increased across sessions to five and then to 10 earned tokens. The criterion to increase the token-exchange schedule was two consecutive sessions with 100% independent token exchange. All participants met mastery criteria for independent token trading for each token-exchange requirement.

Data Collection and Interobserver Agreement

A second observer independently collected data during all preference assessment trials for all participants. An agreement was scored if both observers recorded the same selection, or no response, during each trial. Mean agreement across participants was 99% for edible preference assessments (range, 96% to 100%) and 99% for activity preference assessments (range, 97% to 100%). During token-training sessions, observers collected data on prompts delivered by the therapist, compliance with the prompts, independent token trading, and token trading following the verbal, gestural, or physical prompts. A second observer independently collected data during 85% of token-training sessions. Again, an agreement was scored if both observers recorded the same response during each trial. Agreement on all data collected across participants was 100%.

EXPERIMENT 1: EFFECTS OF ACCUMULATED OR DISTRIBUTED REINFORCEMENT ON RESPONSE RATES

In Experiment 1, we evaluated the relative effects of accumulated and distributed reinforcement on free operant rates of responding.

Method

Procedure

Reinforcer assessment (Evan, Alice, and Jillian): A different task was selected for Evan because the token-training task relied to some extent on the therapist's behavior, in that response rates could be influenced by how rapidly the therapist acted. A new task was selected that lent itself to measurement of free-operant rates (i.e., constructing matching rows of colored blocks; see Table 1). The task selected for Alice was identical to that used during token training. A different task was also selected for Jillian because she frequently made errors on the math problems used during token training and required additional prompts by the experimenter (see Table 1).

Before each session, the therapist described the contingencies in place for the specific session and provided a single verbal prompt to complete the task. No additional prompts were given. During baseline, the following instruction was given to the participant: "You can do [task] if you want to." No programmed consequences were provided for task completion. During the distributed reinforcement condition, the participant was told, "You can do [task] if you want to. When you do your work, you will get 30 s with [activity] right away each time you complete [task]." Contingent on task completion, 30-s access to the activity was immediately provided on a fixed-ratio (FR) 1 schedule. For Jillian only, a token was added to the distributed reinforcement condition. After completion of the task, a token was placed on a token board on an FR 1 schedule. Immediately after earning the token, Jillian was given the opportunity to exchange the single token for 30-s access to the video game. During the accumulated reinforcement condition, the participant was told, "You can do [task] if you want to. When you do your work, you will earn a token each time you complete [task]. Each token is worth 30 s with your [activity]. You can trade your tokens after you have finished working." After task completion, a token was immediately placed on the token board on an FR 1 schedule. The participant could exchange earned tokens at the end of the session for access to the activity by removing them from the token board and handing them to the therapist. Each token was worth 30 s of access to the activity. All sessions ended after 5 min of the opportunity to complete the tasks (session time was adjusted by removing time spent trading tokens and reinforcer access time) or the completion of 10 tasks, whichever came first. Three to six sessions were conducted daily.

The analysis involved an ABAB reversal design, where A is baseline and B is the multielement comparison of the effects of distributed and accumulated reinforcement on response rates. The reinforcer assessment was initiated with all four participants. However, an effective baseline was not established to determine the reinforcing efficacy of the activities with Sam. Therefore, the reinforcer assessment was discontinued (data available from the first author). A separate analysis was initiated with Sam to examine his preference for either reinforcement condition over the no-reinforcement control condition. He always selected a context in which an activity was earned rather than one in which no activity was available, thus demonstrating that each reinforcement arrangement was at least preferable to a no-reinforcement control.

Data Collection and Interobserver Agreement: During reinforcer assessments, trained observers used laptop computers to collect data on the frequency of task completion and reinforcer delivery (tokens, distributed, and accumulated). A second observer independently collected data during 56% of sessions during the reinforcer assessment sessions across participants. Interobserver agreement data were calculated using interval-by-interval agreement percentages. Sessions were divided into consecutive 10-s intervals. Intervals in which the same number was scored by both observers were assigned a value of 1. Intervals in which one observer scored no target responses and the other scored anything other than no target responses were assigned a value of 0. For intervals in which different numbers were scored, the smaller number of responses scored was divided by the larger number. These quotients were summed, divided by the total number of intervals in the session, converted to a percentage, and averaged across sessions. The mean agreement coefficients during the reinforcer assessment across participants were 97% (range, 91% to 100%) for task completion and 97% (range, 71% to 100%) for reinforcer delivery.

Results and Discussion—Figure 1 depicts the results of the reinforcer assessment for Evan, Alice, and Jillian. During baseline, Evan completed an average of 0.1 responses per minute. Response rates increased during both the accumulated and distributed reinforcement conditions. During the initial reinforcement phase, rates were higher during the accumulated reinforcement condition ($M=1.7$) than during the distributed reinforcement condition ($M=0.9$). During the second reinforcement phase, rates during the distributed condition remained at levels similar to the previous reinforcement phase ($M=0.8$), but decreased in the accumulated reinforcement condition ($M=0.8$). The mean amount of reinforcement (in minutes) earned during the accumulated condition was greater than that earned in the distributed condition ($M_s=3.1$ min and 2.4min, respectively).

Similar results were obtained for Alice; however, a reverse pattern of responding was observed across reinforcement phases. No responding was observed during baseline. Responding during the distributed condition increased relative to baseline and was similar across reinforcement phases ($M_s=0.8$ and 0.6 responses per minute). However, responding during the accumulated condition was lower in the first reinforcement phase ($M=1.2$) than during the second ($M=1.8$). Like Evan, Alice's mean amount of reinforcement earned in the accumulated condition ($M=3.7$ min) was greater than that earned in the distributed condition ($M=1.8$ min).

Jillian engaged in high levels of responding during baseline ($M=1.5$ responses per minute). Relative to baseline, similar levels of responding were observed during the distributed reinforcement condition ($M=1.4$) and slightly higher levels of responding were observed in the accumulated condition ($M=1.8$). Again, the mean amount of reinforcement earned in the accumulated condition ($M=4.6$ min) was greater than the mean amount earned in the distributed condition ($M=3.4$ min).

Overall, the highest mean rates of responding were observed in the accumulated reinforcement conditions for all three participants, suggesting that not only can delayed, accumulated reinforcement support rates as high as immediate, distributed reinforcement but may in fact support higher rates. To the extent that response rates are sometimes taken as an

index of relative reinforcer value, the data suggest that there may be added value in arranging accumulated reinforcement. However, it should be noted that the differential effects of the two reinforcement conditions were not replicated with Evan or Alice. Thus, the superiority of the accumulated condition over the distributed reinforcement condition can be found only when one compares the means of the two conditions, suggesting the need to evaluate further the differential effectiveness of accumulated and distributed reinforcement arrangements.

Interpretation of the current results may be limited in some other ways. First, responding may have been influenced by the presentation of instructions before each session. Specifically, zero rates of responding were observed in three of the four baseline phases for Evan and Alice, and higher rates of responding were immediately observed during the reinforcement conditions for these two participants. Thus, it is unclear whether responding was under the control of the contingencies in place (i.e., contingency-shaped behavior), under the control of the verbal instructions (i.e., rule-governed behavior), or some combination. Second, it is possible that the differences between rates of responding in the distributed and accumulated reinforcement conditions may be an artifact of the disruption of ongoing responding by the delivery of the reinforcer that occurs more frequently during distributed reinforcement arrangements than in accumulated reinforcement arrangements. Specifically, the overall lower rates of responding observed in the distributed condition may be a result of what can be described as *handling costs*, loosely, the time and effort required to reorient towards a task after reinforcer delivery. In the distributed condition, the participants had to reorient towards the task materials, examine the materials, and so on; these were collateral responses that added time to the denominator of the run-rate calculation but were not incurred during the accumulated condition. Thus, even though the clock was stopped to eliminate reinforcer access from the calculation of rates, the time required for completing these collateral responses may have deflated the response rates in the distributed condition.

The addition of the tokens in the accumulated condition may have also influenced responding. Stimuli such as tokens may enhance discrimination between situations that result in delayed reinforcement versus no reinforcement, resulting in increased tolerance to delayed reinforcers (Stromer, McComas, & Rehfeldt, 2000). Jackson and Hackenberg (1996) further showed that stimuli presented during the delay, such as tokens, may increase the likelihood of selection of larger, delayed reinforcers over smaller, more immediate reinforcers. In the current study, more than one thing varied across reinforcement conditions for Evan and Alice: (a) The manner in which the reinforcers were delivered differed and (b) tokens were included only in the accumulated condition. For these two participants, higher levels of responding were observed in the accumulated reinforcement condition than in the distributed condition. However, tokens were included in both reinforcement conditions for Jillian, and differentially higher levels of responding were still observed in the accumulated reinforcement condition. Jillian's results suggest that responding was influenced by the reinforcement arrangement rather than the inclusion of tokens. However, because the inclusion of tokens in both reinforcement conditions was only evaluated with one participant, it remains unclear whether (or to what degree) the supplemental reinforcement

or signals to delayed reinforcement arranged by the tokens in the accumulated reinforcement condition were responsible for the overall higher levels of responding in the accumulated reinforcement condition. Specific procedures used in the current study (e.g., providing tokens only in the accumulated condition) were selected to maximize the similarity between our procedures and typical reinforcement arrangements observed in school settings. However, to strengthen the demonstration of experimental control, future research should control for the influence of tokens by including tokens in both reinforcement conditions.

The reinforcer assessment completed with each participant was conducted to address a question that was secondary to the main purpose of the current study. Specifically, we wanted to assess the effects of accumulated and distributed reinforcement arrangements on responding. Therefore, these assessments were usually brief and typically consisted of two or three sessions. Evidence of the effects of these conditions on responding would have been strengthened had each phase been replicated and conducted for more sessions.

EXPERIMENT 2: PREFERENCES FOR ACCUMULATED OR DISTRIBUTED REINFORCEMENT

The second experiment was conducted to determine whether participants preferred the accumulated or the distributed reinforcement arrangements. This was accomplished via a concurrent-chains schedule arrangement in which relative response allocation in the initial links was used as an index of relative preference for either accumulated or distributed reinforcement arrangements in the terminal links. In addition, Experiment 1 suggested that the accumulated condition, overall, supported higher responses rates than the distributed condition. However, much educational activity with individuals with IDD uses a discrete-trial rather than free-operant format. Thus, it remained unclear whether these differences would be obtained in a more typical teaching arrangement. A second purpose was therefore to examine whether the accumulated reinforcement arrangement was more efficient than distributed reinforcement in terms of the total amount of time required to complete an equivalent number of tasks.

Method

Procedure—In the initial link of the concurrent-chains analysis, the participants were presented with a choice between two cards that represented the accumulated and distributed reinforcement conditions. *Choice* of one of the arrangements was defined as touching a card that depicted one of the conditions. A large picture (9 cm by 14 cm) of the relevant reinforcer placed on an index card represented accumulated access to the activity, whereas a small picture of the reinforcer (5 cm by 8 cm) placed on the same sized index card represented distributed access to the activity. During edible reinforcer phases, the two cards presented different series of events. To represent the accumulated reinforcement condition, the card depicted an image of task-relevant stimuli (e.g., colored blocks) next to an arrow, next to a picture of the token. This series was repeated 10 times down the page, with an image depicting 10 tokens next to an arrow pointing to a picture of 10 of the edible items at the bottom. The card for the distributed reinforcement condition depicted an image of task-relevant stimuli next to a picture of the edible item. This series was repeated 10 times down

the page. During the distributed conditions for Jillian (and later in the analysis for Alice), a single token was earned for compliance. Therefore, the card for Jillian's (and later for Alice's) distributed condition depicted an image of task-relevant stimuli next to an arrow pointing to a picture of the token next to another arrow pointing to the edible reinforcer. This series of events was then repeated 10 times.

New tasks were chosen for each participant so that differences in the materials could aid in discriminating between the conditions (see Table 1). For Evan, identification of objects was used during the accumulated reinforcement condition, and animal identification was used during the distributed reinforcement condition. For Alice, sorting blue and green foam shapes was used during the accumulated reinforcement condition, and sorting large (approximately 8 cm wide) and small (approximately 3 cm wide) binder clips was used for the distributed reinforcement condition. Sam's task was to demonstrate prepositions using different colored blocks (green and yellow for accumulated; red and blue for distributed).

Initially, Jillian's tasks involved telling time. During the accumulated condition, her task was to draw the hands on the face of a clock that corresponded to the time written below the clock. During the distributed condition, her task was to write the time that corresponded to the hands on the clock. After conducting several trials with the time telling tasks, she began to say that she disliked the tasks and wanted to do something different. She then began to display aggression and disruption. To decrease the likelihood of problem behavior, the remainder of the analysis was modified in several ways (starting at Trial 31). First, new scheduling tasks were added. For the scheduling tasks, Jillian was presented with a piece of paper with a school schedule for three children. The days of the week were listed across the top of the schedule, with student names and times of the day (ranging from 8:00 a.m. to 3:00 p.m.) along the left side. During the time slots for each child, an activity was listed (e.g., gym, math, history). She could look up any day and time to determine what activity a given student would complete. Below each schedule were 10 questions related to student-specific activities at different times throughout the day (e.g., "At what time does Bobby have math on Thursday?"). Jillian was required to write or match the activity to the student's name. Second, she was given a choice of task during each trial to minimize the possibility that she would lose interest in the schedule worksheets. Third, if she said she was finished at any point in a given session block, the trial ended and resumed the following day where the previous day ended (e.g., if she completed both forced-exposure and two of the five choice trials during 1 day, the remaining three choice trials were completed the next day).

Before each series of five choice trials, the participants experienced forced exposure to the terminal-link conditions associated with each initial-link card to demonstrate the contingencies associated with each choice. During forced-exposure trials, the participants were prompted to choose the card associated with one condition; 10 demands were then issued and followed by the relevant contingencies. They were then prompted to choose the card associated with the other available option, followed by 10 more demands and their corresponding consequences. After prompted selection of the distributed reinforcement card, compliance after the verbal or gestural prompt resulted in 30-s access to the activity or a small piece of food on an FR 1 schedule. After prompted selection of the accumulated reinforcement card, they received a token for completion of each demand after the verbal or

gestural prompt. After 10 demands were issued, they traded their tokens for access to the accumulated time with the activity (30 s for each token with a maximum of 300 consecutive seconds) or accumulated amounts of food (one piece of food for each token for a maximum of 10 pieces of food). All demands were issued using three-step prompting that was identical to that described during token training. Beginning with Trial 1 for Jillian and Trial 46 for Alice, a token was delivered on an FR 1 schedule after a correct response after the verbal or gestural prompt in the distributed condition. Token trading occurred immediately after the single token was earned.

Choice trials began immediately after the two exposure trials. At the start of the choice trial, the therapist presented the two cards and instructed the participant to “pick one.” After a choice, the therapist initiated the tasks and contingencies associated with the selected arrangement using the same procedures described for the exposure trials. After the final distributed reinforcement period or the accumulated reinforcement period ended, the cards were again presented, and the procedures repeated, until five choice trials and corresponding terminal-link procedures had been conducted. A maximum of two forced-exposure and five choice trials were conducted each day.

Insertion of conditioned reinforcers into the delay period may enhance the effectiveness of delayed reinforcers (see Stromer et al., 2000, for discussion of various mechanisms through which this might happen), and token reinforcement has also been found to increase the likelihood that pigeons will accumulate reinforcers (Yankelevitz, Bullock, & Hackenberg, 2008). The tokens were therefore eliminated in the final phase for all participants to determine if choices between accumulated and distributed reinforcement conditions would be altered if the sort of supplemental reinforcement or signals to delayed reinforcement arranged by the tokens did not support choice for that condition.

The design of the analysis varied across participants. For Evan, the analysis was carried out by alternating activity and edible reinforcer phases, with tokens eliminated in the final phase. The design for the remaining participants included at least one activity phase and one edible phase, but also involved variations in one or the other for the reasons described below.

For Alice, Sam, and Jillian, choices were so uniform during the first activity phase that attempts were made to rule out irrelevant control over responding by the choice stimuli and the tasks. Thus, stimulus and task reversals were conducted. During the stimulus reversal, selection of the card with the large picture was now associated with distributed reinforcement, and selection of the card with the small picture was now associated with the accumulated condition. During the task reversal, the task (Alice and Jillian) or colored blocks (Sam) that had been previously associated with the accumulated condition were now associated with the distributed condition, and vice versa (e.g., for Alice, sorting color was now associated with the distributed condition and sorting size with the accumulated condition). These manipulations were not made with Evan, who showed more varied initial choices.

Starting at Trial 46, a token arrangement was inserted into the distributed reinforcement condition for Alice. This manipulation was designed to determine if supplementation of distributed edible reinforcers with token reinforcement would shift some choices to the distributed condition. The token system for the distributed condition remained in place throughout the rest of the analysis (with the exception of the final phase).

Another change was made during the sixth phase (edible: longer exchange delay [LED]) for Alice's and Jillian's choice analysis in a further attempt to shift their initial preference for accumulated edible reinforcers to distributed access. It seemed possible that preference for accumulated reinforcement was related to the absolute length of the delay to reinforcement. A quantitative analysis was conducted after the first two phases for both participants to determine the amount of time it took Alice and Jillian to access reinforcement in the distributed and accumulated conditions. In the distributed reinforcement condition, it took an average of 10 s and 22 s for Alice and Jillian to complete one demand and earn the reinforcer, respectively. In comparison, it took Alice and Jillian an average of 102 s and 138 s, respectively, to complete all 10 demands during the accumulated reinforcement condition and receive the total quantity of reinforcement. Although the delay to accumulated reinforcement was roughly 10 times greater for Alice and 6.5 times greater for Jillian, this difference may have been relatively small in absolute terms (e.g., Alice could wait about 10 s for one reinforcer or just another 90 s for 10 times as large a reinforcer).

Prior studies have shown that responding for the larger, delayed reinforcer decreases as a function of increases in the absolute difference in the delay value (e.g., Schweitzer & Sulzer-Azaroff, 1988; Snyderman, 1983). For example, Snyderman (1983) observed that pigeons' response rate to access 6 s of grain versus 1 s of grain was far higher when the larger reinforcer was delayed by 12 s versus 2 s for the smaller reinforcer than it was when the larger reinforcer was delayed by 120 s and the smaller by 20 s. Even though the delay ratio remained constant, the discrepancy in the absolute temporal difference forced more impulsive responding. One way to alter this absolute difference in the context of a token reinforcement system is to manipulate the delay to exchange (e.g., Hyten, Madden, & Field, 1994; Jackson & Hackenberg, 1996). This approach was adopted with Alice and Jillian during the LED phases. During the distributed reinforcement condition, a 30-s delay was imposed after the verbal prompt so that participants could not exchange their token until 30 s had elapsed, regardless of how quickly they completed the task. The token-exchange period therefore was held constant at 30 s after the issuance of each verbal prompt rather than immediately after it was earned. During the accumulated reinforcement condition, the same 30-s delay was imposed after the verbal prompt so that both participants had to wait 30 s before the next verbal prompt was delivered. This continued for all 10 demands. The token-exchange period was therefore held constant at 5 min after the issuance of the initial verbal prompt. For both conditions, the tokens were delivered immediately after compliance with the demand; the only manipulation was in the delay to the exchange period. For Jillian, an additional LED of 1 min in the distributed condition and 10 min in the accumulated condition was assessed using the same procedures described above. The LED was also implemented with activity reinforcers for Alice.

Data Collection and Interobserver Agreement—Observers used laptop computers to collect data on choices for accumulated reinforcement and distributed reinforcement conditions, task completion, and reinforcer delivery (tokens, distributed, and accumulated). A second observer independently collected data during 36% of the concurrent-chains schedule trials across participants. Interobserver agreement data were calculated using the same interval-by-interval agreement method previously described. Mean interobserver agreement across participants was 99% (range, 91% to 100%) for choice of distributed reinforcement, 98% (range, 73% to 100%) for choice of accumulated reinforcement, 95% (range, 56% to 100%) for task completion, 95% (range, 49% to 100%) for token delivery, 94% (range, 67% to 100%) for delivery of the distributed reinforcer, and 98% (range, 86% to 100%) for delivery of the accumulated reinforcer.

Results and Discussion

Figure 2 depicts cumulative initial-link selections made during the choice trials of the concurrent-chains schedule analysis for all participants. Throughout the activity phases of the analysis, Evan selected the accumulated reinforcement condition more often than the distributed condition (80% vs. 20%, respectively). This preference for the accumulated condition became stronger during the second and third activity phases. During the edible phases, his choices for the accumulated and distributed reinforcement conditions were nearly equal (53% and 48%, respectively). When the tokens were removed from the activity phase, he continued to select the accumulated condition more often (93%).

During the initial activity phases, Alice exclusively chose the accumulated reinforcement condition, even when the tasks and stimuli were reversed. During the first edible phase, she again exclusively chose the accumulated reinforcement condition and continued to do so following the addition of tokens to the distributed condition (starting at Trial 46). However, after manipulation of the exchange delay (LED phase), responding towards the distributed condition increased to 40% during the last 15 trials. Response allocation was nearly equal during the subsequent withdrawal of the LED with edible reinforcers (accumulated $M=57\%$; distributed $M=43\%$). She again displayed exclusive preference for the accumulated condition during the return to the activity phase and when the LED was added. The LED may have altered her choices when edible reinforcers were available, but not when the video was available. After token removal from both reinforcement conditions during the final activity phase, she continued to choose the accumulated condition across 100% of trials.

Similar to Alice, during the first activity phase of the analysis, Jillian responded exclusively towards the accumulated condition. Near exclusive responding was also observed during the task and stimulus reversals and when the task was changed. During the first edible phase, Jillian's almost exclusive selection of the accumulated condition ($M=90\%$; distributed $M=10\%$) suggested an overall preference for accumulating edible reinforcers. She continued to allocate 100% of her choices to the accumulated edible condition during both the 30-s/5-min and 60-s/10-min LED phases and when the tokens and LED were removed in the final phase of the analysis.

During the activity and edible phases, Sam exclusively chose the accumulated reinforcement condition, even when the stimuli and tasks were reversed in the activity phase. When the

tokens were removed in the final phase of the analysis, he continued to allocate 100% of his choices towards the accumulated condition. We were unable to evaluate the LED with Sam because he was discharged from the inpatient hospital where he was receiving treatment for problem behavior.

Figure 3 depicts the average latency to completion of 10 tasks across participants and conditions during the forced-exposure trials that preceded each series of five choice trials throughout the entire analysis (Evan and Sam), during all phases except those that included a LED (Jillian), or during the first two phases (Alice). To enable valid comparisons, these specific forced-exposure trials were selected for several reasons. First, selection of the distributed condition was nonexistent or very limited for Alice, Sam, and Jillian, thus providing little to no data to calculate time to task completion during the choice trials for the distributed reinforcement condition. Second, for Alice, token reinforcement was added in to the distributed condition at the end of the second phase. Therefore, token delivery during the distributed conditions in that phase and thereafter would have artificially elevated the duration. Third, accurate completion of tasks after the verbal or gestural prompt was not uniformly 100% during all forced-exposure trials for Evan and Alice. Task completion during the accumulated and distributed forced-exposure trials, respectively, was 93% and 95% for Evan and 100% and 99.7% for Alice. To ensure that the sporadic absence of task completion did not influence the results, trials that did not result in 100% compliance were eliminated from data analysis. Latency to task completion was then calculated by subtracting the time spent in reinforcement and the time before the first prompt was issued from the total time of the trial to yield an estimate that reflected the amount of time that it took each participant to complete all 10 tasks.

For all participants, time to task completion was uniformly longer in the distributed condition than the accumulated condition during the activity phases. The average completion times during the accumulated condition for Evan, Alice, Sam, and Jillian were 80 s, 82 s, 171 s, and 95 s, respectively. The average time to completion during the distributed condition was 93 s (Evan), 119 s (Alice), 199 s (Sam), and 193 s (Jillian). These results corroborate the rate data in Experiment 1; regardless of whether the task was arranged as a free-operant task or as a discrete-trial task, the task was completed more rapidly during the accumulated reinforcement condition than the distributed reinforcement condition when the reinforcer was an activity. In the edible condition, Sam and Jillian continued to complete the tasks more rapidly in the accumulated condition (111 s and 187 s, respectively) than in the distributed condition (128 s and 265 s, respectively). In contrast, longer mean times were observed in the accumulated condition of the edible phase for Evan and Alice (76 s and 91 s, respectively) than in the distributed condition (52 s and 54 s, respectively).

The results of Experiment 2 suggest that the preference for certain types of stimuli (e.g., videos, puzzles, or video games) may be enhanced when they are delivered for continuous periods, even when doing so involves a delay. All participants consistently chose the accumulated reinforcement conditions over the distributed reinforcement conditions when the reinforcer was an activity. By contrast, when the reinforcer was an edible item, choice allocation was initially mixed across participants. Evan's responding was characterized by

indifference, whereas Alice, Sam, and Jillian showed an initial preference for accumulated edible reinforcers. However, Alice's choices approached indifference after exposure to the LED and remained that way after the delay was removed. The LED did not have the same influence on the activity reinforcer for Alice. This finding may extend the generality of prior findings that have shown that manipulations of exchange delays can shift preference in self-control token arrangements (e.g., Jackson & Hackenberg, 1996; Yankelevitz et al., 2008). The results of Experiment 2 also suggest practical advantages to the delivery of accumulated reinforcement. The participants uniformly took less time to complete 10 tasks during the accumulated condition than during the distributed condition when the reinforcers were activities. This suggests that accumulated reinforcement may provide a more efficient use of work periods without detriment to the overall effectiveness of the teaching program.

For several reasons, the results of the current study should be interpreted with caution. For one, task and stimulus reversals were not conducted with Evan. Without these controls, it remains unclear whether Evan's responding was influenced by the reinforcement arrangements or whether his responding was biased by preference for the tasks or stimuli associated with the accumulated condition. In addition, although task and stimulus reversals were conducted with the remaining participants, these analyses were brief. Future research should attempt to rule out further the potential sources of response bias. This may involve the use of less controlling stimuli in the initial links as well as randomly assigning tasks of the same concept class across conditions (e.g., a task such as animal identification may be used across both conditions in lieu of animal identification during the distributed reinforcement condition and object identification during the accumulated reinforcement condition). In addition, although an increased preference for the distributed condition was observed during the LED phase with Alice, the LED did not have the same effect on Jillian's responding and was not conducted with Sam. Furthermore, a shift in preference back towards the accumulated reinforcement condition with edible reinforcers was not observed when the LED was removed for Alice. Therefore, conclusions regarding the effects of the LED are limited. It is also unclear why the results regarding time to task completion were inconsistent across the types of stimuli. Although all four participants completed the tasks more rapidly during the accumulated reinforcement condition when the tasks were associated with activities, only two of the four participants continued to complete the tasks more rapidly during accumulated reinforcement when tasks were associated with edible stimuli. It is possible that delivery of edible stimuli may disrupt ongoing responding to a lesser degree than delivery of activities, thus decreasing the effects of the sort of handling costs previously described.

GENERAL DISCUSSION

When activity reinforcers were available, accumulated reinforcement arrangements (a) produced, on average, higher response rates than distributed reinforcers, (b) were preferred by all participants, and (c) were associated with less time to complete an equivalent amount of tasks during a discrete-trials teaching format. In the present experiment, accumulated access to a reinforcer produced higher rates or was more preferred even though the accumulated reinforcer necessarily resulted in longer delays to reinforcer delivery. These results thus suggest that duration of access is an important determinant of reinforcing

efficacy for activities. This interpretation is further supported by the present finding that duration of access, rather than frequency of delivery, controlled choices in Experiment 2.

Several variables may have contributed to the general preference observed for the accumulated reinforcement condition. First, preference for delayed, accumulated access to activity reinforcers over segmented, distributed access may not be surprising if one considers the sort of handling costs (i.e., the cost in terms of time spent on acquiring and preparing a reinforcer for consumption; Lacourse & Blough, 1998) associated with consuming activity reinforcers. In the case of video, for example, these costs may take the form of orienting to both the ongoing visual and auditory stimuli and plot-related variables. Disruption to ongoing viewing results in repeated reorientation to the video (i.e., increases the handling costs associated with video consumption). Handling costs may also account for why most participants also preferred to accumulate access to edible reinforcers. Very small bite sizes may result in higher handling costs (e.g., more pieces of food to place in one's mouth and chew). In the present study, handling costs were minimized by choice of the accumulated condition (i.e., less time spent reorienting to the activity or consuming several small pieces of the food simultaneously) and may therefore have motivated participants to choose delayed but accumulated access to the reinforcers rather than immediate but distributed access.

Second, requiring the participants to complete tasks to gain accumulated reinforcement may have influenced preference for that arrangement, in that prior investigations have suggested that intervening activities during the delay may promote self-control (e.g., Dixon et al., 2003). However, if task completion during the delays promoted preference for the accumulated reinforcement conditions, one would have expected it to affect choices during the edible reinforcement phases similarly. Still, a more direct test of the effects of continuity might eliminate differences in work requirements by requiring a single response to produce reinforcement in both conditions but delivering reinforcement in a distributed fashion in one condition (e.g., 30 s of reinforcement, 30 s of no reinforcement, etc.) and in an accumulated fashion in the other (e.g., waiting for an amount of time equivalent to the total of the interreinforcement intervals experienced in the distributed condition, then delivering an equivalent total amount of reinforcement at the end). Such a comparison, however, would quickly deviate from common teaching arrangements, a factor that drove the design of the current experiment.

Third, token delivery could have influenced preference for the accumulated condition. The tokens were removed during the final phase to eliminate the possible influence of tokens in mediating delays. Although this did not alter preference for accumulated reinforcement, extensive histories with the tokens in place may have established response patterns that would not have been established if tokens had not been part of the procedures from the beginning.

Finally, the activities were specifically selected because they were stimuli whose value might be enhanced by continuity. Future research could compare preferences for dissimilar types of reinforcers that may not be sensitive to the qualities associated with continuous access (i.e., those with no natural progression to completion). Other investigators have

observed that conditioned reinforcers may be discounted less steeply than primary, consumable reinforcers such as food and beverages (Estle, Green, Myerson, & Holt, 2007; Odum & Rainaud, 2003). Money was the conditioned reinforcer in these studies, which does not lend itself to continuity as a relevant characteristic, so there may be some property of delayed conditioned reinforcement, independent of continuity, that makes it more likely to retain value across delays than edible reinforcement.

It is tempting to suggest that preference for accumulated reinforcement is simply a function of reinforcer magnitude. However, it is important to note that there was an equivalent amount of reinforcement in each condition (300 s or 10 pieces of food). Again, the major difference was how the distribution of reinforcers was arranged. Still, it is difficult to rule out all local effects of magnitude.

This effect has been characterized thus far as a preference for the way in which reinforcers are arranged. An alternative explanation may be that participants actually exhibited preferences for the ways in which the tasks themselves were delivered. For example, Fienup et al. (2011) used a three-choice concurrent-operants arrangement to assess preference for working for access to a high-preference (HP) activity, working for access to a low-preference (LP) activity, and working in the absence of reinforcement (control condition). After selection of either reinforcement condition, a predetermined number of demands were issued followed by access to either the HP or LP stimulus for 3 min; then the next trial was initiated. Selection of the control condition resulted in delivery of the demands followed immediately by the presentation of the next choice trial. Unexpectedly, one individual consistently chose the control condition. Further analyses were conducted to determine whether the results could be attributed to preference for fluent work (completion of all required tasks first) to disfluent work (i.e., distribution of work and reinforcement intervals). A concurrent-operants arrangement was again conducted to allow the participant choices between fluent work with reinforcement (i.e., completion of six worksheets consecutively followed by access to the HP activity, similar to accumulated reinforcement in the current study), disfluent work with reinforcement (i.e., interspersing completion of the worksheets with access to the activity, similar to distributed reinforcement from the current study), and fluent work without reinforcement (i.e., completion of all six worksheets consecutively and no access to the activity). Results of their analysis revealed that the participant consistently selected the fluent work with reinforcement over disfluent work with reinforcement and fluent work without reinforcement, suggesting that preference or reinforcer efficacy may be influenced by the fluency of the work schedule itself.

It is possible that results from the current study may be better attributed to preference for a fluent work schedule rather than preference for continuity of reinforcer access. However, if work schedule was the only variable that controlled choices, one would have expected all responses to be allocated to the accumulated (fluent work) condition, regardless of reinforcer type. However, in Experiment 2, Evan and Alice (during and after the LED) responded almost equally for distributed (disfluent work) and accumulated (fluent work) access to the edible reinforcer. In addition, an abbreviated concurrent-chains analysis was conducted with Sam to assess his preference for either distributed or accumulated reinforcement over a no-reinforcement control condition (similar to the fluent work without reinforcement from

Fienup et al., 2011). Procedures were nearly identical to those employed in Experiment 2, with the exception that Sam was given a choice of the control condition (no reinforcement) and one of the reinforcement conditions (either accumulated reinforcement or distributed reinforcement). In this arrangement, the control condition used a fluent work schedule, and the distributed condition used a disfluent work schedule. If preference for fluent work were controlling his responding, then one would have expected Sam to select the control condition over the distributed reinforcement condition. However, this never occurred (data available from the first author). Additional analyses should be conducted to tease apart more directly the effects that work schedule and reinforcer distribution have on preference.

Certain limitations of the study should be noted. The study included four participants with somewhat different results observed with the edible choice analysis. In addition, during Experiment 1, the mean amount of reinforcement (in minutes) earned by all participants was greater in the accumulated reinforcement condition than in the distributed reinforcement condition. Given these results, it is possible that later preference for the accumulated reinforcement condition in Experiment 2 may have been influenced by the participants' histories of earning, on average, more reinforcement in the accumulated reinforcement condition during Experiment 1.

The instructions and arrangements used in this study were fairly complex. They required that participants attend to the stimulus (e.g., large vs. small picture), the manner of task delivery (i.e., fluent vs. disfluent), the duration of reinforcer access, and token delivery and accumulation. This complexity may call into question the generality of our findings beyond individuals with relatively sophisticated verbal repertoires. Evan, Sam, and Jillian all communicated using short (i.e., two to three words) or complete sentences. Although Alice displayed little functional vocal verbal behavior, she could communicate using idiosyncratic gestures and some American Sign Language. Furthermore, all participants could easily follow multistep directions. It is unclear how results may have differed had the participants' verbal repertoires been more limited.

Several variables differed across the reinforcement conditions that may have influenced participants' preferences. First, under specific stimulus arrangements, increased delays to reinforcement are often associated with a decrease in stimulus value. Delays across conditions necessarily differed in the present arrangement, a parameter that may also affect choices among concurrently available reinforcers. Second, tokens were delivered only in the accumulated condition for two of the four participants. As mentioned above, these tokens may have functioned as conditioned reinforcers or as signals to delayed reinforcement, which may have attributed to differential responding in favor of this condition (e.g., Jackson & Hackenberg, 1996; Stromer et al., 2000). Third, the schedules of reinforcement were not consistent across conditions and may have similarly affected response allocation in the present analysis. These differences may have functioned to partially control participants' responding and should be considered along with the effects of accumulated versus distributed reinforcement.

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Figure 1. Responses per minute during the baseline, distributed reinforcement, and accumulated reinforcement conditions of the reinforcer assessment.

Figure 2.

Cumulative initial-link selections made during the choice trials of the concurrent-chain schedule analysis. LED=longer exchange delay; Stim Rev=stimulus reversal; Task Rev=task reversal.

Figure 3.
Time to complete tasks during the forced-choice exposure trials for the accumulated and distributed reinforcement conditions.

Table 1

Academic and Activities of Daily Living Tasks Used During Each Phase of the Study

Participant	Preexperimental procedure: Token training	Experiment 1: Reinforcer assessment	Experiment 2: Concurrent-chains analysis
Evan	Color identification: Vocally state color presented on an index card.	Construct matching rows of colored blocks: Place five blocks in a row of same color and order as sample row of blocks.	Object and animal identification: Vocally state name of object or animal presented on an index card.
Alice	Fold towels: Fold towel in half twice.	Fold towels	Sort by size or color: Place correct colored shape or sized binder clip in corresponding cup.
Sam	Stuff envelope: Fold paper in three equal parts and place paper in envelope.		Prepositions: Place colored blocks in manner to correctly demonstrate preposition (e.g., place red under blue)
Jillian	Two-digit addition and subtraction math problems: Write correct sum or difference under corresponding math problem.	Sort office supplies: Place prespecified number and type of office supplies in envelope.	Telling time: Draw hands on clock or write correct time under clock. Scheduling: Write or match the scheduled activity with student's name.