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USE OF A LAG DIFFERENTIAL REINFORCEMENT CONTINGENCY TO INCREASE VARIED SELECTIONS OF CLASSROOM ACTIVITIES

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The present study evaluated the effects of a lag differential reinforcement contingency on 2 students' activity selections using reversal designs. Results showed that the lag contingency was responsible for promoting increased novel selections, engagement in diverse activities, and greater progress with respect to programmed academic activities.

DESCRIPTORS: preference, reinforcer assessment, restriction, differential reinforcement, lag schedules, conditioned reinforcement, variability

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Wacker (1996) advocated the publication of bridge studies in the *Journal of Applied Behavior Analysis* as a means to communicate preliminary results of the applicability of procedures that originate from basic research to more naturalistic settings. Basic researchers have highlighted the importance of behavioral variability in the shaping of complex repertoires, noting that in its absence, selection by consequences (i.e., differential reinforcement) would not be possible. As such, basic research has contributed multiple procedures for promoting behavioral variability (e.g., Page & Neuringer, 1985), including lag schedules of reinforcement, which are characterized by the delivery of reinforcement for a response that is either different from the previous response (Lag 1) or a number of previous responses (Lag 2 or more). In the present study, we investigated the use of a lag contingency to promote varied activity selections in an analogue classroom environment.

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METHOD

Setting, Participants, and Activities

The experiment was conducted in an unused classroom in a private elementary school. Two typically developing girls served as participants. Tina was 5 years old; Carol was 7 years old. These students were selected because teachers indicated that these students often chose activities that emphasized only one particular set of skills from the curriculum. A vacant classroom was used to control for unwanted sources of variability (e.g., other children present in the various activity options). Two complete sets of 12 activities were available during each session. Each set included both programmed and nonprogrammed activities. The programmed activities were academically oriented, systematically designed, and likely to result in measurable progress with respect to a specific set of skills (see Table 1), whereas the nonprogrammed activities were not systematically designed to result in any one particular set of skills (see Table 2).

Data Collection and Interobserver Agreement

Data were collected during 60-min observations during which three response categories

Table 1
Programmed Activities and Frequency Measures

Programmed activities	Description	Performance measure
Grammar	A computer-based instructional sequence in which participants learn the definitions of parts of speech and how to identify those parts of speech in sentences.	Number of levels completed
Math facts	A computer-based instructional sequence in which participants learn to solve basic addition, subtraction, multiplication, and division facts.	Number of levels completed
CCC Math©	A commercially available computer-based instructional sequence in which participants learn a wide variety of math concepts and skills.	Number of levels completed
Programmed Math	A commercially available math curriculum in workbook form.	Number of pages completed
Programmed Reading	A commercially available reading curriculum in workbook form.	Number of pages completed
New Practice Reader	A commercially available reading curriculum that covers a wide array of topics. (approximately 150 words per story)	Number of stories completed
Reading About Science	A commercially available reading curriculum devoted to science. (approximately 150 words per story)	Number of stories completed

were scored. *Activity selection,* defined as touching an index card on which the name of an activity was printed, was recorded using a 10-s partial-interval measurement system, and was used to determine the number of novel activity selections. Selections were considered novel if the activity had not been selected during the previous 12 choice opportunities within a single observation. *Activity engagement,* defined as touching activity-related materials, was scored separately for each of the 12 activities using a 5-s momentary time-sampling procedure. The number of academic units completed was recorded for the programmed activities (Table 1).

Interobserver agreement was assessed in all conditions by having a second observer collect data for all target responses simultaneously but independently during at least 30% of observations per condition. Mean occurrence and nonoccurrence agreement was 100% for activity selections and 93% and 99.8% for activity engagement, respectively. Mean agreement for units completed was 87.5%.

Procedure and Design

Twelve index cards noting the available activities were present on a table located in the center of the classroom. At the onset of each session the student was told that she could select any activity and that she could switch activities at any time. Activity choices were prompted to occur every 5 min by the sound of a resetting timer. During baseline, there were no programmed consequences for selecting a particular activity.

Intervention sessions were the same as those described above, except that the first activity selection and subsequent novel selections in each 60-min session resulted in the teacher handing the student a green card that could be traded for 2 min of teacher attention (i.e.,

Table 2
Nonprogrammed Activities

Nonprogrammed Activities	Description
Nobby Nuss©	An Internet-based computer game in which the player navigates a squirrel through a series of levels collecting food while trying to avoid predators.
Monkey Maze©	An Internet-based computer game in which the player navigates a monkey through a series of mazes collecting diamonds while trying to avoid predators.
Free reading	An activity in which participants may select any book to read from a bookshelf of children's books.
Blocks	An activity in which participants may construct large structures by combining smaller wooden pieces.
Other	Using the bathroom, wandering in the classroom.

a lag differential reinforcement contingency was arranged and reset following the selection of all 12 activities). Contingency-specifying statements regarding the relation between teacher attention and novel activity selections were not provided at any time.

RESULTS

The top panel of Figure 1 shows that Carol made few novel activity selections during baseline sessions (M = 0.9). Following the intervention, the number of novel activity selections sharply increased (M = 7.8). Near baseline levels of responding were recovered (M = 1.8) during the reversal, and high levels of novel activity selections were again observed when the intervention was reintroduced (M = 8.6). During baseline, Carol's engagement with programmed materials was negligible; she was engaged primarily with nonprogrammed activities (M = 95%). Following the intervention, Carol's response allocation became more variable. That

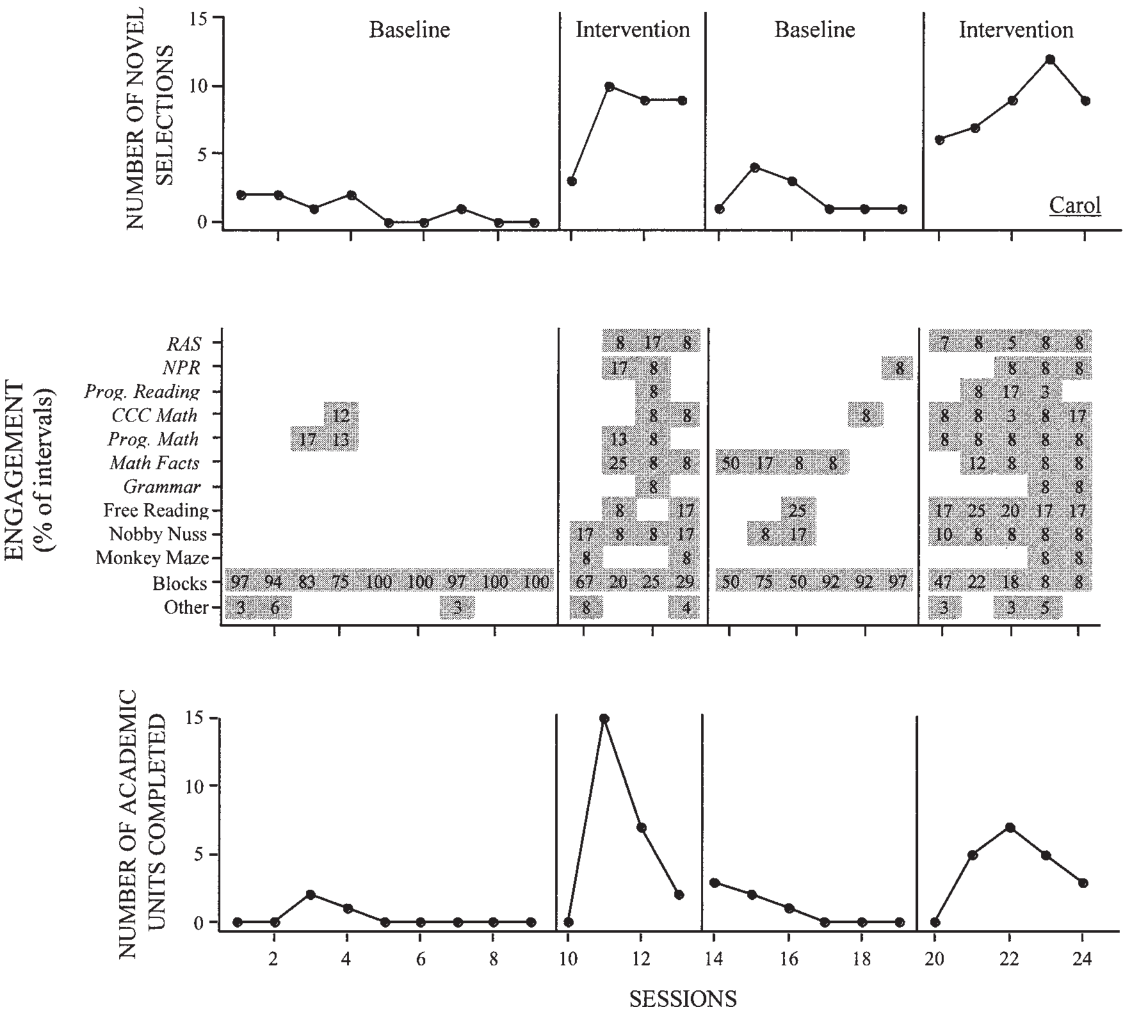

Figure 1. The number of novel selections (top panel), the percentage of intervals of engagement (middle panel; shaded cells indicate activities for which there was some engagement), and the number of units completed (bottom panel) are depicted for Carol.

variability subsided when the intervention was removed, but was recovered during the second intervention phase. The bottom panel of Figure 1 shows that throughout each of the phases, the number of academic units Carol completed covaried with the number of novel activities selected.

Figure 2 shows that Tina made few novel activity selections during baseline sessions ($M = 1$); however, novel activity selections immediately increased ($M = 8.4$) following the intervention, and this effect was replicated in the subsequent baseline ($M = 1.3$) and intervention phases ($M = 11.6$). Like Carol, Tina engaged in the blocks activity almost exclusively during baseline ($M = 83\%$). During the first intervention session, engagement was reallocated across a much wider range of activities, including both programmed ($M = 46\%$) and nonprogrammed ($M = 54\%$) activities. Although more diversity in time allocation was observed in the return to baseline, original levels of engagement with programmed ($M = 7\%$) and nonprogrammed ($M = 93\%$) activities

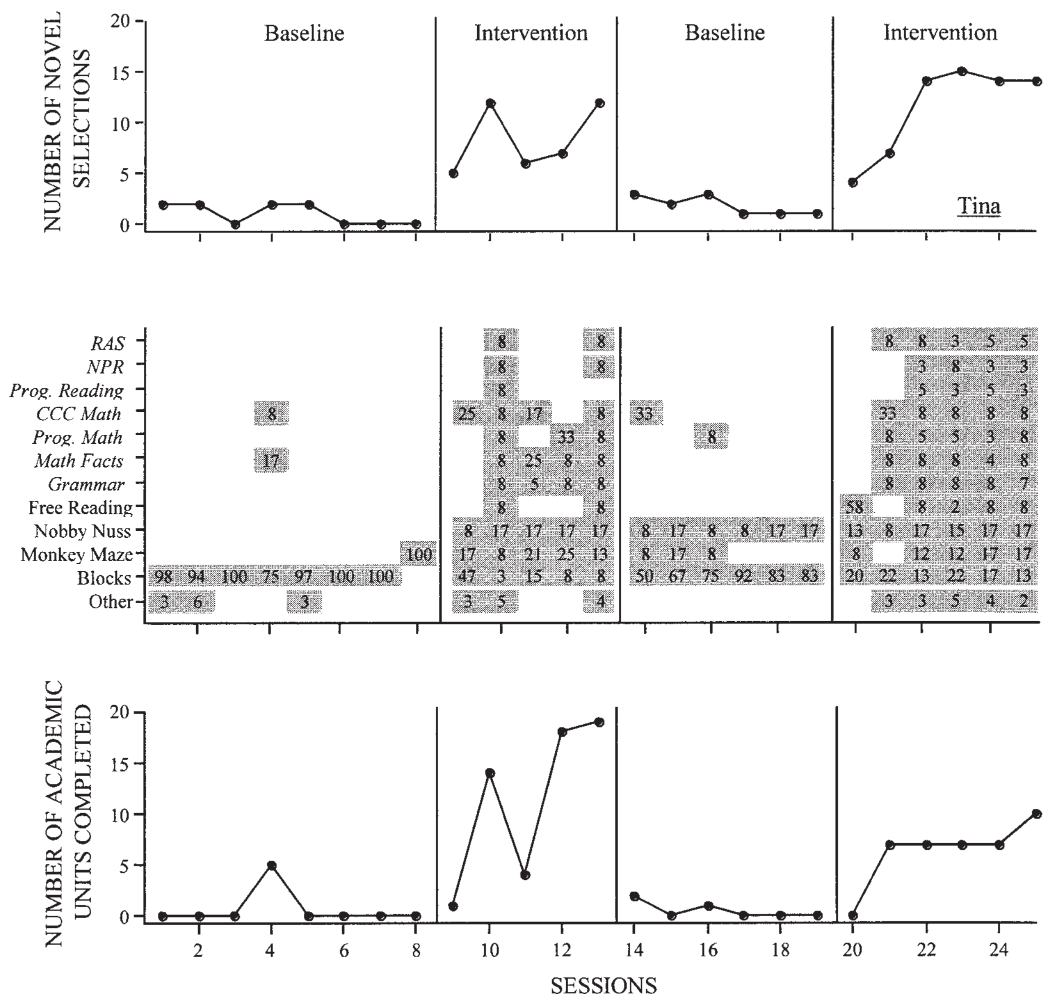

Figure 2. The number of novel selections (top panel), the percentage of intervals of engagement (middle panel; shaded cells indicate activities for which there was some engagement), and the number of units completed (bottom panel) are depicted for Tina.

were recovered. Effects of the intervention on engagement with programmed ($M = 40\%$) and nonprogrammed (60%) activities were replicated during the final phase. Again, like Carol, increasing diversity of activity selections during the intervention phases was associated with increases in the number of academic units Tina completed.

DISCUSSION

Our results indicate that a lag differential reinforcement contingency was effective in increasing novel activity selections. Specifically, given a 12-item array of both programmed and nonprogrammed activities from which to choose during baseline sessions, students showed little variability in the types of activities selected. In fact, strong preferences were shown for the nonprogrammed activity category (in particular, the stackable blocks activity). When the lag contingency was introduced, both students immediately began to select and engage in more diverse activities. An indirect but important outcome of this shift in time allocation was a marked increase in the number of academic units completed.

The present experiment departed from traditional choice procedures in that 12 different response options were simultaneously available. This arrangement more closely approximated the participants' early education classrooms, and therefore allowed for an understanding of response allocation under more complex conditions. Although the study was not conducted in the students' classroom by their teacher, the preliminary results obtained in the analogue classroom provide promise for the use of lag schedules of reinforcement to promote children's selection of a variety of classroom activities.

There are several limitations of the current study that have direct implications for further research. First, differentially reinforcing the selection of the same activity or a noncontingent reinforcement reversal condition may have better controlled for the effects of attention on novel selections, because the presence of the reinforcer would have been retained across assessment conditions. Although it is unlikely that increasing the general level of attention in classrooms will promote more variable activity selections, the phenomenon deserves evaluation with control conditions other than extinction. A second limitation is that the contingencies promoted a high rate of switching, which may be contraindicated in educational situations in which behavioral persistence is the goal. Future studies could be designed to promote a balance between both varied activity selections and persistence in particular activities. A third limitation is that the conditions that would promote maintenance of varied activity selections were not identified (i.e., performance returned to baseline levels immediately after the contingency was removed). Future studies should attempt to transfer the control exerted by the lag contingency to the more natural consequences associated with the particular activities.

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