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DEVELOPING STIMULUS CONTROL OF YOUNG CHILDREN'S REQUESTS TO TEACHERS: CLASSWIDE APPLICATIONS OF MULTIPLE SCHEDULES

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Children may recruit their teachers' attention at undesirably high rates or at inconvenient times. Tiger and Hanley (2004) described a multiple-schedule procedure to reduce ill-timed requests, which involved providing children with two distinct continuous signals that were correlated with periods in which teacher attention was either available or unavailable. The current study extended the application of multiple schedules by evaluating the effectiveness of the procedure when implemented by private-school teachers in 3 elementary classrooms. Following the introduction of the multiple schedules, student approaches toward their teacher were maintained during desirable periods but were minimized during undesirable periods.

DESCRIPTORS: classroom management, generality, multiple schedules, stimulus control, teacher attention

Students who recruit attention when their teacher is otherwise occupied (e.g., instructing another student, preparing upcoming lessons, grading) may disrupt other students' work or limit the teacher's ability to complete important tasks. Well-intentioned teachers who provide intermittent reinforcement of these ill-timed requests for attention may only further complicate the situation. To minimize ill-timed requests of children while promoting student initiations during appropriate times, Tiger and Hanley (2004) described a procedure to teach preschool-aged children to discriminate between periods in which an adult's attention was or was not available. This procedure is termed a *multiple schedule* (Ferster & Skinner, 1957) and was adapted from strategies used to gain stimulus control of newly acquired manding by adults with developmental disabilities as a treatment for severe problem behavior (Fisher, Kuhn, & Thompson, 1998; Hanley, Iwata, & Thompson, 2001). The procedure used by Tiger and Hanley involved providing children with two distinct continuous signals (e.g., colored floral leis) during periods in which adult attention was either available or unavailable. When combined with descriptive rules, these schedule-correlated stimuli rapidly resulted in relatively high rates of social approaches when attention was available and low rates when attention was not available.

Previous investigations of the use of multiple schedules have been conducted in highly controlled analogue situations and implemented by trained researchers (Tiger & Hanley, 2004, 2005; Tiger, Hanley, & Heal, 2006). Addi-

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tional research is needed to determine whether this procedure would promote stimulus control of children's social approaches when implemented in school settings by classroom teachers. Multiple-schedule procedures may be particularly useful in elementary school classrooms during periods in which academic lessons are assigned and individualized teacher assistance is only intermittently available. Therefore, the purpose of the current study was to assess the efficacy of a classwide application of the multiple-schedule procedure described by Tiger and Hanley when implemented by teachers during instructional periods in three elementary classrooms.

METHOD

Participants and Setting

The study was conducted in three classrooms in a private elementary school. Each classroom was staffed by two teachers who alternated shifts, such that one teacher was present in the classroom at any given time. The teachers ranged in age from 19 to 22 years and had between 6 months and 2 years of teaching experience. The number of children enrolled in Classrooms A, B, and C were 12, 12, and 10, respectively, and a broad range of skill levels (kindergarten through sixth grade) and ages (5 through 13 years) were represented in each of the three classrooms. The classrooms in this school were unique in that every student was enrolled in a self-paced, individualized curriculum rather than following a set schedule of academics. The teacher in each classroom served several simultaneous functions, including providing assistance to students as requested; promoting engagement with assignments; arranging access to preferred activities; and collecting and recording data with respect to classroom friendship, citizenship, and academic performance. Because the curriculum was self-paced, the students completed their assignments at different rates. Thus, at any given moment, it was common for some students to be engaged in independent academic assignments, others to be playing, and one to be receiving a private tutorial.

Measurement and Interobserver Agreement

The frequency of students' social approaches and the teacher's attention delivery was scored for each classroom during 5-min sessions that were conducted two to four times per day. Social approaches were scored each time a student (a) raised his or her hand over the plane of the shoulder, (b) called the teacher's name, (c) handed materials to the teacher, (d) placed materials in front of the teacher, (e) made a vocal request of the teacher, or (f) made a statement to the teacher. Data were collected on the overall number of social approaches made in each classroom rather than the number emitted by individual students. Attention delivery was scored each time a teacher gestured toward or verbally acknowledged a student's social approach within 5 s of the approach (i.e., teacher interactions not immediately preceded by a student social approach were not scored as attention delivery).

A second observer collected data simultaneously but independently during 29% of sessions across the three classrooms. Observers' records were partitioned into 30 10-s intervals and were compared on an interval-by-interval basis. Within each interval, the smaller number of responses was divided by the larger number of responses within each interval and these quotients were then multiplied by 100%. Mean interobserver agreement was 87% in Classroom A, 85% in Classroom B, and 83% in Classroom C.

Procedure

Baseline. Teachers conducted all typical routines during baseline conditions, which involved responding to student social approaches and providing academic assistance as needed. During these routines, teachers randomly alternated wearing either a green or a red lei across sessions (i.e., only one colored lei was worn during each session). There were no

differential consequences associated with each lei. This phase was arranged to ensure that ecologically valid baselines were established from which the effects of correlating the different-colored leis with the availability and unavailability of teacher attention could be evaluated (i.e., to ensure that the leis did not control responding prior to the multiple-schedule condition).

Multiple schedule. Sessions during this condition were similar to those in baseline except that the green and red leis were differentially associated with the availability of teacher attention. Immediately prior to each session, the experimenter briefly described the contingency for the teacher to implement in the impending session. For instance, prior to a reinforcement session, the experimenter said, "You are wearing the green lei this session, so do your best to answer each student when they approach you," and prior to an extinction session, the experimenter said, "You are wearing the red lei this session, so do your best to not provide attention to any student who approaches you." Sessions were alternated in a multielement design, such that a period in which teacher attention was not available (i.e., extinction, red leis) was followed by a period in which teacher attention was available (i.e., reinforcement, green leis). To facilitate control by the contingencies associated with both the green and red leis, the teacher described the contingencies associated with the relevant lei prior to each session (i.e., "While I am wearing the green lei, I will be able to answer your questions," or "While I am wearing the red lei, I will not be able to answer your questions"). The multiple-schedule procedure was sequentially introduced across classrooms in a concurrent multiple baseline design.

Procedural Integrity

We assessed the integrity of teachers' implementation of the multiple-schedule procedure by determining the correspondence between the occurrence of social approaches and the delivery of teacher attention within reinforcement and extinction sessions during the multiple-schedule conditions. During reinforcement sessions, the smaller of the two numbers was divided by the larger number (components with zero social approaches and zero attention deliveries were scored as accurate). During extinction sessions, this fraction was subtracted from one. All measures were multiplied by 100%. For example, if four social approaches and three instances of attention delivery were scored during a reinforcement session, this component would yield an integrity score of 75%. If, however, four social approaches and three instances of attention delivery were scored during an extinction session, the integrity score would be 25%.

RESULTS AND DISCUSSION

During baseline conditions in which differential consequences were not provided, mean social-approach responses per minute in Classroom A was 2.6 when the teacher wore the green lei and 3.1 when the teacher wore the red lei (Figure 1). During the multiple-schedule condition, students engaged in social approaches at rates similar to those observed in baseline when the teacher wore the green lei (reinforcement; $M = 2.7$), but rates were much lower when the teacher wore the red lei (extinction, $M = 0.6$). In Classroom B, children engaged in similar approach rates during baseline sessions in which the teacher wore the green and the red leis (Ms = 1.8 and 2.5, respectively). Students then responded at higher rates when the teacher wore the green lei (reinforcement, $M = 2.1$) and at lower rates when the teacher wore the red lei (extinction, $M = 0.5$) in the multiple-schedule condition. Finally, students in Classroom C engaged in nearly equal levels of responding during baseline sessions when the teacher wore the green and red leis (Ms = 2.8 and 2.6, respectively). Students engaged in higher rates of social approaches when the teacher wore the green lei (reinforcement, $M =$

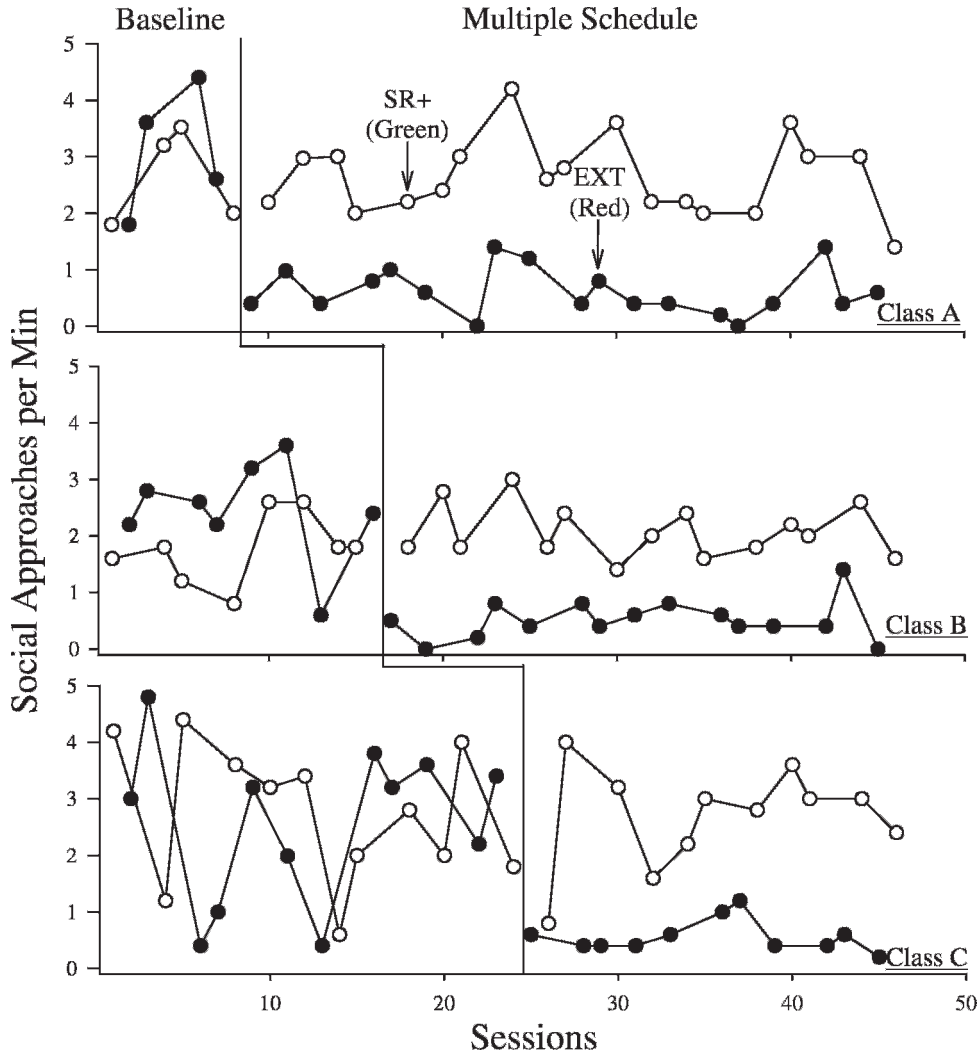

Figure 1. Social approach rates during baseline and multiple-schedule conditions across three elementary classrooms.

2.4) and lower rates of social approaches when the teacher wore the red lei (extinction, M = 0.2) in the multiple-schedule condition.

Teachers implemented extinction sessions with high levels of integrity (Ms = 97% in Classroom A, 82% in Classroom B, and 100% in Classroom C), but inconsistently attended to each child's social approach during reinforcement sessions (Ms = 61% in Classroom A, 62% in Classroom B, and 51% in Classroom C). That is, about 40% to 50% of student initiations were not responded to within 5 s, typically when several students initiated simultaneously. Despite low levels of procedural integrity on the reinforcement component, robust behavior changes were observed, suggesting that this type of integrity lapse was not deleterious to overall treatment effects. Compromised treatment integrity during reinforcement periods results in an intermittent reinforcement schedule, which may strengthen responding only during reinforcement components. Although not observed in this study, low levels of procedural integrity during the extinction component (i.e., intermittent reinforcement for interruptions) might strengthen inter-

ruptions and compromise the effects of the multiple schedules. Therefore, emphasis on the importance of the extinction procedure during teacher training appears to be essential.

The results of this study demonstrated the effectiveness of a classwide multiple-schedule procedure when implemented by teachers in a private elementary school classroom. This study differed from previously described applications in three ways. These procedures were implemented in actual classrooms rather than highly controlled analogue situations, and by teachers rather than trained researchers. Finally, a single discriminative stimulus served as the cue for the availability of attention to a group of students (as opposed to a single discriminative stimulus per child). This variation reduced the overall number of social approaches of entire classrooms of children due to the stimulus control exerted by the schedule-correlated stimuli.

The classrooms in this study differed from traditional classrooms with respect to the inclusion of students of multiple ages and the use of self-paced curricula. Therefore, future research should examine the use of multiple-schedule procedures in more typically designed classrooms with children of a single age and during relevant instructional events (e.g., free play, small-group activities, large-group instruction). These procedures may also prove to be useful with student populations such as mainstreamed children with developmental disabilities. Rich schedules of reinforcement used during acquisition of verbal behavior such as mands often are not maintained by teachers who are responsible for educating large classes of children. Thus, newly acquired or weak repertoires of verbal behavior are likely to contact extinction in these classrooms. The stimulus control exerted by the multiple-schedule procedure described herein provides a means of maintaining newly acquired verbal behavior when periods of extinction are frequent by necessity.

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