

*USING DIFFERENTIAL REINFORCEMENT OF LOW RATES TO
REDUCE CHILDREN'S REQUESTS FOR TEACHER ATTENTION*

JENNIFER L. AUSTIN AND DEBORAH BEVAN

UNIVERSITY OF GLAMORGAN

We evaluated the effectiveness of full-session differential reinforcement of low rates of behavior (DRL) on 3 primary school children's rates of requesting attention from their teacher. Using baseline rates of responding and teacher recommendations, we set a DRL schedule that was substantially lower than baseline yet still allowed the children access to teacher assistance. The DRL schedule was effective in reducing children's requests for assistance and approval, and the teacher found the intervention highly useful and acceptable. The possible mechanisms that account for behavior change using full-session DRL schedules are discussed.

Key words: classroom management, differential reinforcement of low rates, elementary school, general education, typically developing children

Differential reinforcement of low rates of behavior (DRL) was described by Ferster and Skinner (1957) as a schedule in which a minimum amount of time must elapse between responses in order for reinforcement to occur. This schedule reduces rates of behavior by imposing a minimum interresponse time (IRT); the IRT can be gradually increased to further decrease responding over time. This type of schedule, often referred to as spaced-responding DRL in applied settings (Deitz, 1977), has been used to reduce rates of behavior across several response topographies and populations. For example, it has reduced rapid eating (Lennox, Miltenberger, & Donnelly, 1987; Wright & Vollmer, 2002) and stereotypy (Singh, Dawson, & Manning, 1981) in participants with profound developmental disabilities and inappropriate question asking in primary school children with behavioral disorders (Deitz, 1977).

In addition to spaced-responding DRL, Deitz (1977) described two procedural variations of DRL for use in applied settings.

Interval DRL (also described by Ferster & Skinner, 1957) involves dividing a session into intervals, and behavior is reinforced if it occurs less often than a prescribed number of times per interval. Like spaced-responding DRL, the interval duration may be increased to further reduce behavior. Deitz (1977; Deitz et al., 1978) showed that interval DRL reduced a range of problem behaviors, from failing to raise one's hand before speaking to engaging in physical aggression and property destruction. In each of the studies, teachers told children with special needs the maximum number of responses that they could make within each interval (usually 2 to 5 min) and provided rewards contingent on meeting the criterion for a particular number of intervals. Handen, Apolito, and Seltzer (1984) used a similar procedure to reduce repetitive speech in an adolescent with autism, in which the participant earned tokens for emitting fewer than the target number of repetitions per interval.

Full-session DRL, on the other hand, involves delivering a reinforcer if a behavior occurs less often than a specified number of times during the entire session. Deitz and Repp (1973) conducted a series of studies that showed the effectiveness of full-session DRL, implemented as both individual and group contingencies, in reducing talk-outs of elementary

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Correspondence concerning this article should be addressed to Jennifer L. Austin, Division of Psychology, University of Glamorgan, Pontypridd CF37 1DL, United Kingdom (e-mail: jlaustin@glam.ac.uk).

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school children with developmental disabilities. The procedure also was effective in reducing the number of times a group of typically developing high school girls engaged in conversations unrelated to classroom tasks. In applications outside the classroom, Turner, Green, and Braunling-McMorrow (1990) used full-session DRL to reduce inappropriate verbal and physical behavior of a 21-year-old man with traumatic brain injury. By gradually reducing the number of responses allowed per session and increasing the total session time, the authors achieved lower rates of inappropriate behavior across a range of settings. Using similar procedures, Alderman and Knight (1997) demonstrated the utility of full-session DRL in reducing physical and verbal aggression in three participants with brain injuries.

Although no studies have directly compared the effectiveness of spaced-responding, interval, and full-session DRL arrangements, the latter schedule may be preferable in classrooms. Deitz and Repp (1973) noted that full-session DRL "may provide a more manageable method for teachers to lower student rates of responding" (p. 457), because this arrangement has the advantage of requiring fewer time-based observations of behavior when compared to spaced-responding or interval DRL (Deitz, 1977). In other words, teachers need not monitor the amount of time from one response to the next, reset the interval if the minimum IRT is not met, and provide reinforcement each time the criterion is met (as is required by spaced-responding DRL). They also do not need to divide a teaching period into intervals, monitor the number of responses during those intervals, and deliver reinforcement if the criterion has been met at the end of the session (as is required by interval DRL). Rather, teachers can carry on with teaching during an instructional session, simply record the number of responses for the session, and then deliver the reinforcer at the end of the session if the criterion has been met. It is also likely that procedures incorporating an

easy method of keeping track of the number of responses (e.g., tokens, marks on a card) potentially can improve the ease of implementing the DRL schedule.

It is interesting to note that many applied textbooks and clinical handbooks present DRL as an intervention strategy that is best used when the target behaviors are problematic not because of the nature of those behaviors, but because the behaviors occur too often (Alavosius, Dagen, & Newsome, 2009; Alberto & Troutman, 2009; Cooper, Heron, & Heward, 2007; Martin & Pear, 2010; Miltenberger, 2008). Further, some note that DRL might be inappropriate for behaviors that one wants to eliminate. However, many of the studies employing DRL have targeted behaviors that would probably not be considered acceptable, even at reduced rates. Examples include physical and verbal aggression (Alderman & Knight, 1997; Shaw & Simms, 2009; Turner et al., 1990), property destruction (Shaw & Simms, 2009), and classroom disruptions (Deitz, 1977; Deitz & Repp, 1973). Although a specific benefit of DRL schedules is that they lend themselves to changes in criteria so behavior may be gradually reduced to zero levels (and thus the schedule can be switched to differential reinforcement of other behavior; DRO), it seems important to provide empirical validation of interventions for the range of behaviors they are intended to address (e.g., those behaviors that are acceptable at low rates but not at high rates).

Most previous DRL studies also have omitted details regarding the consequences for individual instances of behavior. For instance, Deitz (1977) and Deitz and Repp (1973, 1974) targeted talking out, but their procedures did not specify whether individual instances of these behaviors were reinforced by the teacher. Similarly, Alderman and Knight (1997) speculated that the verbal and physical aggression of their participants was maintained by escape from demands. However, their procedures did

not specify whether individual occurrences of behavior resulted in brief escape or if they were exposed to extinction. In situations in which behaviors are unacceptable at any level, an ongoing extinction contingency for individual behaviors combined with access to reinforcement for not exceeding a specified number of behaviors seems warranted. However, for behaviors one wishes to maintain at lower rates, it may be necessary to provide reinforcement for at least some individual instances of behavior.

The purpose of the present study was to evaluate the efficacy of full-session DRL on elementary schoolchildren's requests for teacher attention, thereby targeting a behavior that was acceptable and desirable provided it did not occur at rates the teacher considered to be excessive. Therefore, we specifically implemented two DRL arrangements: Individual instances of the behavior produced reinforcement (up to a limit), while reductions in overall rates of behavior also produced reinforcement. We also sought to update and improve the methodology of prior school-based DRL studies by evaluating treatment integrity, as well as the acceptability and utility of the procedures from both the teacher's and the children's perspectives.

METHOD

Participants and Setting

Three girls in a Year 3 elementary school classroom in South Wales participated in the study. Carys and Elin were both 8 years old at the start of the study, and Jenna was 7 years old. All children in the class had been grouped by their teacher according to one of three ability levels. Carys and Jenna were in the high-ability group, and Elin was in the middle group. Participants were identified by their teacher as engaging in excessive attention seeking (i.e., noticeably more often than other children of their same age and ability) that often interfered with completing their work in a timely manner. Bids for attention generally involved repeated requests for assistance when the children should

have been working independently on tasks matched to their ability levels, but also included requests for approval (e.g., "Do you like how I did this?"). The teacher noted that most of the children's requests for assistance were unnecessary and that each child was capable of completing the work using other available classroom resources (e.g., a dictionary, written instructions for the assignments, peers, etc.). Data were collected in the children's classrooms during independent work times, which included a range of subject areas (e.g., math, English, Welsh, geography, and history).

Response Measurement and Interobserver Agreement

The definition of a *request for attention* (which was constructed in cooperation with the teacher) included raising one's hand, calling out to the teacher, or leaving one's seat and going to the teacher to make a request for assistance or approval after the student had been instructed to work independently. After the first session, the definition was expanded to include requests to go to the bathroom, which were observed at least once from each of the girls during the first DRL session (despite the session occurring just after the class had returned from a bathroom break). Data were collected by trained research assistants, unfamiliar to the participants, who were seated in a corner of the classroom where they could easily observe all participants. Frequency data were collected on a minute-by-minute basis for 20 min (i.e., the data sheet was partitioned into 20 consecutive 1-min intervals) during independent work periods (independent work periods on a particular subject rarely exceeded 20 min). No more than two observations were conducted per day. If more than one observation was conducted in a single day, the observers waited until a new independent activity had begun prior to starting data collection for the second session. Data were collected two to three times per week.

Two observers simultaneously but independently collected data for 35% of the observations of Elin, 38% of the observations of Jenna, and 36% of the observations of Carys. Occurrence and nonoccurrence interobserver agreement was calculated for each participant on an interval-by-interval basis by dividing the number of agreements by the number of agreements plus disagreements and converting that number to a percentage. Mean occurrence agreement was 96% (range, 83% to 100%) for Elin and 98% (range, 83% to 100%) for Jenna. Nonoccurrence agreement was 96% (range, 88% to 100%) for Elin and 99% for Jenna (range, 93% to 100%). Occurrence and non-occurrence agreement for all of Carys' observations was 100%.

Procedure

Baseline. The teacher responded to students as she normally did, which typically included attending to children when they engaged in the target behaviors. The teacher employed a classroom management system in which students intermittently earned points for their teams by doing exceptional work, engaging in prosocial behaviors, or following classroom rules. The team with the most points was awarded a special privilege at the end of the week, such as playing with special toys or having extra computer time. The classroom management system remained in place during the course of the study.

DRL. Each participant's initial baseline data were examined to determine the mean rate of requesting attention across the phase. The experimenters, in consultation with the teacher, then set the number of requests for attention that each participant was allowed within a 20-min session. We arranged the DRL schedule to reflect not only a reduction in baseline rates but also the number of requests the teacher thought was reasonable for each child to make in a 20-min work period. Elin's mean rate of requesting attention during baseline was 0.45 responses per minute (nine responses per 20 min). During the

DRL condition, only Elin's first three requests for attention were available for attention from the teacher (0.15 per minute). Jenna's mean rate of requesting attention during baseline was 0.36 responses per minute (approximately seven responses per 20 min). Although Jenna's baseline rate was similar to Elin's, Jenna was considered to be more capable than Elin of completing assignments independently. Therefore, during the DRL condition, only the first two requests for attention were available for attention from the teacher (0.10 per minute). Carys' mean baseline rate was 0.28 responses per minute. Given that she was in the same ability group as Jenna, Carys' DRL schedule also was set at 0.10 per minute (i.e., two responses per 20-min session).

The treatment was implemented as a full-session DRL in which the teacher delivered a reinforcer if requests for attention occurred less often than the specified number of times across the entire session. At the beginning of independent work sessions, each child received a small index card with boxes corresponding to the number of requests allowed during the session plus one (e.g., Elin was allowed three bids for attention, so her card had four boxes). Each time the child requested attention from the teacher, the teacher responded to the child's request (up to the number of responses allocated for the session) and initialed one of the boxes on the child's card. If the child exceeded the number of allowable requests, the teacher was instructed to initial the remaining box but not to interact with the child. However, none of the children ever exceeded the number of responses eligible for attention during the DRL conditions. If the child had at least one blank box at the end of the work session, she earned a point for her team. No additional points were awarded if more than one box was left empty, because we wanted the children to use the opportunities for assistance or attention that were available to them. Prior to the first DRL session, the second author met with each

of the participants independently and explained how the cards would be used. She provided examples and nonexamples of requests for attention and asked the children to differentiate between the two (e.g., "Would your teacher mark your card if you went to show her your work and asked if you did it properly?" [yes] "Would your teacher mark your card if you got up and checked the wall chart to make sure you were doing the work correctly?" [no]). She also explained what would happen if they exceeded the number of spaces on their cards (i.e., their teacher would initial the remaining box and ignore their requests for attention, and their team would not earn a point) and that there was no additional benefit to having more than one box left blank at the end of the work period. Participants also were eligible to earn team points in ways specified by the teacher's classroom management system, as were other children in the class.

Return to baseline. During the reversal, the teacher told the children they would no longer be using the cards but they could still earn points for their teams according to the contingencies set forth by the classroom management system (e.g., following classroom rules, being a good classroom citizen, etc.). No additional explanation was provided. The teacher was instructed to respond to the children as she would have done prior to the DRL contingency and not to impose a set limit on her responses to the children's requests for attention. However, she was not asked to respond to every request.

Treatment Integrity

During DRL sessions, observers noted whether the teacher responded to the allowable requests and marked the children's cards each time attention was provided. Treatment integrity was then calculated by dividing the number of instances in which the teacher responded to a request for attention and marked the card by the total number of requests for attention and multiplying by 100%. The observers also noted

whether the teacher awarded a team point if the children did not exceed the allowable number of responses. Teacher adherence to the DRL protocol was 100% for all participants.

Design

The effects of the DRL schedule on requests for attention were evaluated using a reversal design. The schedule for the second implementation of DRL was identical to the first (i.e., new rates were not calculated based on the second baseline phase), because the mean rates in the second baseline were only slightly lower than the first and the initial rates were deemed appropriate by the teacher.

Social Validity

At the end of the study, the second author asked both the teacher and the participants about their satisfaction with the goals, procedures, and outcomes of the study (Wolf, 1978). The teacher was asked such questions as whether, prior to the implementation of the DRL schedule, the children tended to seek help or attention more frequently than their peers, and whether they asked for more assistance than they actually needed. We also asked her whether the procedure was easy to implement, whether it could be easily integrated into classroom routines, whether she would continue to use it, and whether she thought the children worked more independently and completed more work when the intervention was in place. The participants were asked if they liked using the cards, if they liked earning points for their group, and if they wanted their teacher to continue using the cards. The teacher questionnaire was formatted as a 5-point Likert scale, with 5 = *strongly agree* and 1 = *strongly disagree*, whereas the children's social validity responses were recorded using a 3-point smiling faces scale.

RESULTS

Figure 1 (top) shows the results for Elin. During baseline, Elin's mean rate of requesting

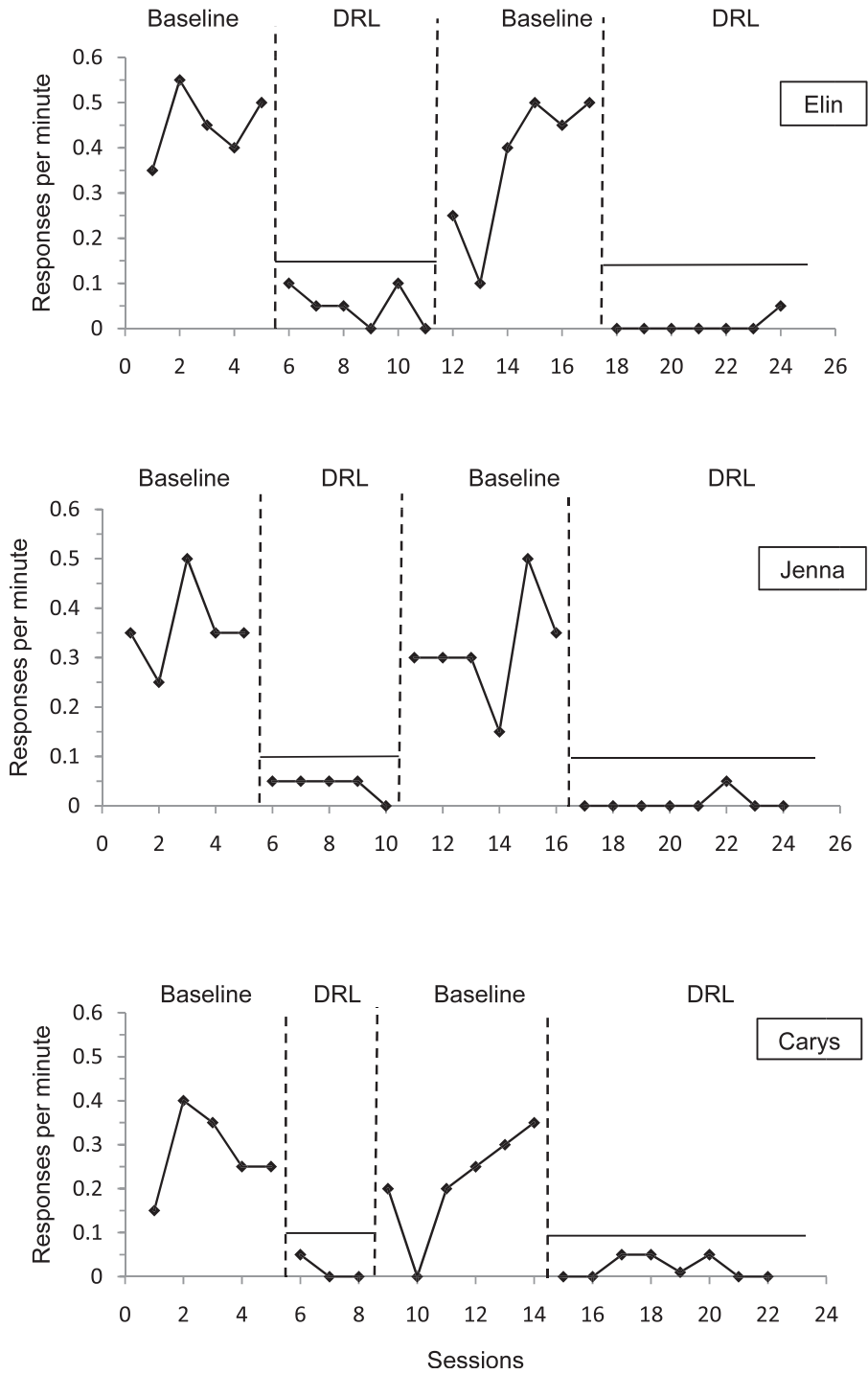


Figure 1. Rates of requesting attention across conditions. The solid horizontal line in the DRL phases represents the limit on responding specified by the DRL schedule.

attention was 0.45 per minute ($SD = 0.08$). After the introduction of the intervention, she maintained a rate of requesting below the 0.15 responses per minute specified by the DRL schedule ($M = 0.05$, $SD = 0.04$). During the return to baseline, rates eventually increased and were consistent with the previous baseline ($M = 0.37$, $SD = 0.16$). The second treatment phase resulted in a near elimination of requesting attention, with all data points falling below the target rates ($M = 0.01$, $SD = 0.02$).

Figure 1 (middle) shows Jenna's results. Her baseline rates of requesting attention averaged 0.36 responses per minute ($SD = 0.09$). Implementation of the DRL schedule reduced responding to a mean of 0.04 responses per minute ($SD = 0.02$), and she never exceeded the specified limit of responses (0.1 per minute). During the reversal, her responses immediately increased to prior baseline levels ($M = 0.32$, $SD = 0.11$); requests immediately decreased to near-zero levels during the second treatment phase ($M = 0.01$, $SD = 0.02$).

Figure 1 (bottom) shows Carys' results. Her baseline rates of requesting attention averaged 0.28 responses per minute ($SD = 0.1$). After implementation of the DRL schedule, she immediately reduced the frequency of attention seeking and never exceeded the specified rate of 0.1 per minute ($M = 0.02$, $SD = 0.03$). During the return to baseline, all but one of the data points were substantially above the limit and displayed an upward trend toward the end of the phase ($M = 0.22$, $SD = 0.12$). Reimplementation of the DRL schedule again reduced response rates to below the limits imposed by the schedule ($M = 0.02$, $SD = 0.03$).

Results of the teacher's social validity questionnaire confirmed that, before the implementation of the DRL schedule, she strongly agreed that all the participants tended to recruit attention more often than their peers and that they often requested assistance that was not genuinely needed. She also strongly agreed that

these behaviors distracted the children from their work. The teacher's responses to the treatment acceptability of the intervention also were strongly positive and indicated that she found the intervention easy to implement and easy to integrate into ongoing classroom routines (rating for both items = 5). She also reported that she planned to continue using it (and in fact did so at other times during the days when data were not being collected). The teacher also indicated that she believed the children engaged in more appropriate levels of attention seeking and that they worked more independently and efficiently during the intervention (rating for both items = 5). All three of the participants circled the smiling face for each item on the questionnaire, indicating that they were happy to use the check-box cards, that they liked earning points for their group, and that they wanted their teacher to continue using the cards.

DISCUSSION

The full-session DRL was an effective classroom management procedure for reducing excessive requests for attention by all three participants. The teacher reported that the DRL strategy was easy to implement and that she planned to continue using it after the study concluded. Further, the students reported that they enjoyed the intervention, which suggests that limiting their requests for attention did not adversely affect the quality of their classroom experience.

This study updates and extends previous classroom-based DRL studies (Deitz, 1977; Deitz & Repp, 1973, 1974; Deitz et al., 1978) in its use of more rigorous interobserver agreement procedures, assessment of treatment integrity, and inclusion of social validation measures. Moreover, the current study targeted a behavior that teachers are likely to view as appropriate for a DRL intervention. Categories of behavior such as "talking out" or "inappropriate behavior" that have been targeted in

previous classroom studies (Deitz, 1977; Deitz & Repp, 1973; Deitz et al., 1978) have included topographies such as calling other children names, hitting or shoving them, and destroying classroom materials. Based on our classroom experience, these are behaviors that teachers generally do not want to occur at *any* level. Unfortunately, the absence of treatment acceptability measures in previous studies makes it difficult to discern whether teachers viewed a DRL intervention as acceptable for these topographies. Although it is true that teachers often tolerate a certain amount of disruptive behavior in their classrooms (and that DRL schedules can eventually be thinned to DRO schedules), it is unknown whether teachers would select interventions that specifically allow a certain number of these behaviors. Future researchers may assess whether teachers select DRL for behaviors they think should occur at zero rates or whether they prefer to arrange contingencies for the absence of problem behavior from the outset.

Perhaps a more important distinction between this study and previous research on full-session and interval DRL was our use of concurrent reinforcement schedules as part of the DRL contingency. In the current study, the teacher responded to each of the children's requests for attention (within the limit), thereby providing an immediate consequence for the behavior. An additional session-based reinforcer (earning a team point), consistent with procedures used in prior DRL studies, was available if the rate of requests did not exceed a particular limit. In our study, extinction was programmed only for responses that exceeded the limit (although none of the participants ever contacted this contingency). This seems to be a more appropriate choice for maintaining lower rates of appropriate behavior, because it guarantees that at least some responses will be directly reinforced. DRL schedules that provide reinforcement only at the end of a session or interval may inadvertently extinguish appropri-

ate responding. However, future research should examine whether acceptable behaviors will maintain at reduced rates without the immediate response-reinforcer contingency.

Although our goal was to reduce the rate of requesting attention, the observers and teacher anecdotally noted collateral improvements during the intervention phases. Specifically, the children persisted at their work for longer periods of time and were more likely to utilize resources other than the teacher (e.g., dictionary, wall charts, peers) when they had questions. These findings suggest that DRL schedules for behaviors such as the ones targeted in this study might help to establish more appropriate behaviors that result in children working more consistently and independently. Future experimenters could measure the duration of time children spend actively engaged in the task, as well as the number of times they use alternative sources of assistance to help them complete their work.

Deitz (1977) noted that a specific benefit of using full-session DRL in classrooms is that it is probably easier for teachers to implement. However, full-session DRL has the additional benefit of allowing participants to choose when they engage in the target behaviors. This was particularly important in the present study, because it was expected that at least some of the children's requests for attention were because they genuinely needed help. By consulting with the teacher to ensure the DRL criterion was consistent with the maximum number of requests for help the children might actually need, we arranged a situation in which children could make decisions about when and if they needed to ask their teacher for help. This ensured that help or other forms of attention were available when the children wanted or needed them. However, whenever valuable stimuli are contingent on a reduction in behavior, it is always possible that individuals will not engage in those behaviors even when they should (e.g., the child needs help but does

not ask for it). We attempted to prevent this problem by not providing additional reinforcement (i.e., team points) for requests below the criterion; however, it is interesting that the children never used the total number of requests for attention that were allocated to them, even though there was no additional benefit for doing so. Therefore, it is possible that the children did not ask for assistance that they genuinely needed. Although the teacher reported nothing in the children's work that suggested that the quality or the amount completed was reduced during the DRL phases, future research should investigate this possibility.

The finding that the children never used all the requests for attention available to them during the DRL phases is interesting in light of previous comments by Deitz (1977), who speculated that children would be likely to use all the available responses if feedback was provided on the number of responses emitted. However, this was not the case in the present study, because the children could easily see how many responses were available to them at any given time. It is possible that the teacher overestimated the amount of help the children needed, such that when the contingency was in place, the children asked for help only when they encountered a problem that they genuinely found difficult to solve. However, this does not explain why children chose a thinner schedule of reinforcement for all types of attention (e.g., approval from the teacher). The children's tendencies not to use all of the response opportunities available to them could perhaps be explained by contingencies surrounding the reinforcer for not exceeding a specified number of responses. Although children earned points for their teams throughout all phases of the study, the participants were guaranteed to earn a team point if they did not exceed the response limit during the DRL phases. Therefore, it is possible that the children earned positive attention from peers for earning points (and thus not having their boxes marked) or perhaps

negative attention when boxes were marked. Although the DRL contingency was never announced to the participants' classmates, it is possible that the children told them or that peers simply observed the children's cards being marked and responded accordingly. We never observed this, but we also did not monitor the children's conversations with their peers. In future studies that employ individualized behavior programs in classroom contexts (particularly if individual programs are linked to group contingencies), it would be helpful to evaluate the influence of peer interactions on the success (or failure) of the interventions employed.

Although response feedback did not result in criterion-level requesting, as suggested by Deitz (1977), it is possible that the provision of response feedback contributed to the effects of the DRL schedule. Previous DRL studies have approached feedback in different ways. Some studies have provided an explanation of the contingency but have not provided ongoing feedback on how many responses the participant had emitted (Deitz, 1973; Deitz & Repp, 1974). Other studies, like ours, provided verbal or visual feedback after every response so that the participants could more easily monitor their standing relative to the limits on responding imposed by the DRL (Alderman & Knight, 1997; Deitz et al., 1978; Handen et al., 1984; Knight, Rutterford, Alderman, & Swan, 2002). Kostinas, Scandlen, and Luiselli (2001) assessed the effectiveness of full-session DRL with and without response cost on the perseverative, inappropriate verbalizations of a man with developmental disabilities and obsessive compulsive disorder. When response cost was implemented, the participant was given tokens equaling the allowable number of responses plus one additional token; a token was subsequently removed each time the problem behavior occurred. The DRL schedule was more effective in reducing behavior when a response cost was added; however, it is possible that the response cost served as a feedback mechanism that helped

the participant “keep track” of the number of responses he had left, rather than as a punisher for inappropriate responding. These results suggest that there may be advantages to providing ongoing response feedback, particularly for certain populations. Although it seems evident that DRL schedules can be effective both with and without response feedback, more research is needed to determine whether this component is necessary and how it affects the efficiency of the intervention.

The results of this study support previous research aimed at decreasing children’s requests for attention; specifically, when the availability of reinforcement is clearly specified for children, these arrangements have reliably brought requests for attention under stimulus control. For example, Tiger and Hanley (2004) demonstrated discriminative control over preschoolers’ requests for attention via the use of schedule-correlated stimuli combined with contingency-specifying stimuli (i.e., rules). Initially, multiple schedules (fixed ratio and extinction), in which the contingency was specified by a colored stimulus (a lei worn by the experimenter), failed to control children’s mands. Discriminated responding occurred when the contingency for responding in the presence of each colored lei was described prior to sessions. In a follow-up study, Tiger and Hanley (2005) showed that discriminated responding in the presence of the experimenter could be maintained after contingency-specifying stimuli were removed and the provision of attention alone signaled a change in schedule (i.e., an end to extinction).

Given these results, another interesting avenue for future DRL research is to examine how rule-governed behavior factors into the success of DRL interventions. In the current study and others (Alderman & Knight, 1997; Deitz, 1977; Deitz & Repp, 1973; Handen et al., 1984; Knight et al., 2002; Kostinas et al., 2001; Turner et al., 1990), participants were told the limit on responding, making it difficult to determine how much of the behavior change

was accounted for by the contingency and how much was accounted for by the rules associated with the contingency. It is possible (and probable) that rules speed up the effectiveness of the intervention, but the extent to which they do so is presently unclear. It also is interesting to note that the majority of studies with severely disabled participants have employed spaced-responding DRL procedures (Lennox et al., 1987; Singh et al., 1981; Wright & Vollmer, 2002). Thus, further research is needed on the effectiveness of interval and full-session DRL with severely disabled individuals.

Despite the potential of different types of DRL schedules to address a range of behavior problems, they have remained underresearched when compared to other reinforcement-based interventions. Although the existing research provides a wealth of information regarding the types of behaviors and the populations in which DRL interventions are likely to be successful, more research is needed, particularly with regard to the mechanisms that underlie the effectiveness of different types of DRL schedules and the necessary components of those interventions.

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