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AN INVESTIGATION OF THE EFFECTS OF DIFFERENTIAL REINFORCEMENT
OF ALTERNATIVE BEHAVIOR ON STUDENTS WITH MILD/MODERATE
DISABILITIES IN A SCHOOL CLASSROOM

by

Katrina Spangenberg

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Special Education

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2008

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ABSTRACT

An Investigation of the Effects of Differential Reinforcement
of Alternative Behavior on Students with Mild/Moderate
Disabilities in a School Classroom

by

Katrina Spangenberg, Master of Science

Utah State University, 2008

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Department: Special Education and Rehabilitation

This study investigated the effects of differential reinforcement of alternative behavior (DRA), a behavior reduction procedure, on problem behavior exhibited by three elementary school students in a general education classroom. DRA involves reinforcement of an alternative behavior while withholding reinforcement for the inappropriate behavior. The three participants were classified as experiencing mild/moderate disabilities but received most services (and participated in this research) in a general education classroom. Problem behaviors included off-task, talk-outs, and inappropriate touching. Alternative behaviors included on-task and hand-raising to get teacher attention. Results indicated that DRA decreased off-task and talk-out behavior for two participants, although effects were variable. Results for a third participant indicated minimal effects on reduction of both off-task and inappropriate touching behaviors. For two participants, differential reinforcement of lower rates of behavior

(DRL) was implemented following DRA in attempt to establish stimulus control over problem behavior. However, results of the DRL intervention were mixed. Results are discussed in terms of differences between investigating the effects DRA in classroom versus clinic settings and establishing and maintaining contingencies for reinforcement.

(40 pages)

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INTRODUCTION

The number of students within the educational system exhibiting problem behavior has increased dramatically in recent years. With this increase in problematic behaviors, the ability for many of these students to progress socially and academically is impacted. The treatment of problem behavior maintained by positive and negative reinforcement continues to be at the forefront of applied behavioral research (Alberto & Troutman, 2006). The purpose of the research is to ascertain the effectiveness of approaches in decreasing problem behaviors and increasing alternatives that are exhibited in order to provide the best educational setting for the student.

Several studies have been conducted regarding effectiveness of interventions for problem behavior (e.g., Goh, Iwata, & DeLeon, 2000; Lerman, Kelley, Vorndran, Kuhn, & Larue, 2002; Ringdahl et al., 2002; Vollmer, Roane, Ringdahl, & Marcus, 1999). One approach, differential reinforcement of an alternative behavior (DRA), is defined as reinforcement of an alternative behavior while withholding reinforcement for the inappropriate behavior (Utah State Office of Education, 2001). Using DRA, problem behavior can be reduced by programming reinforcement contingent on the occurrence of an alternative, socially appropriate behavior. Therefore, DRA becomes an acceptable alternative to punishment procedures in decreasing problem behavior (Goh et al.; Lerman et al.; Ringdahl et al.; Vollmer et al.). Research on DRA has demonstrated a reduction in the intensity and duration of problem behavior (Vollmer et al.). However, most of the research focuses on severe and potentially dangerous behavior, namely, self-injurious behavior exhibited by students with severe intellectual disabilities. There is limited

research on the effects of DRA in reducing problem behaviors of groups of students who have mild/moderate cognitive disabilities or more common problem behaviors (e.g., disruptiveness).

A similar procedure, differential reinforcement of incompatible behavior (DRI), involves reinforcement of an incompatible alternative behavior while ignoring the inappropriate behavior (Friman, 1990; Jones & Baker, 1989). When programming DRI, participants cannot engage in the incompatible behavior at the same time as the problem behavior. DRI was not a part of this literature review because the behaviors that are being exhibited by the proposed participants do not have corresponding incompatible behaviors. For example, if a student's problematic behavior is turning off classroom lights to seek peer and/or adult attention, there is not a behavior that is incompatible. However, there are alternative behaviors that may be introduced that will provide the student with the desired consequence.

REVIEW OF LITERATURE

Research on DRA was identified using online ERIC databases and GOOGLE internet search engines. A secondary search involved reviewing references from the initial article and by reviewing all issues of *Journal of Applied Behavior Analysis* and *Behavior Disorders* from 1980-2007 to allow for a more thorough and complete search of DRA. Due to the limited research on DRA, various descriptors were used in order to obtain the most information as possible. Descriptors in the search included differential reinforcement (DRA), differential reinforcement of alternative behavior(s) and reinforcement plus extinction. Ten studies were found researching the effects of DRA with participants who had significant cognitive disabilities, severe/dangerous behavior and/or were studied in a treatment setting. Five representative studies from the literature are described below.

Study 1: Differential Reinforcement With and Without Instructional Fading

A study conducted by Ringdahl et al. (2002) utilized a differential-reinforcement-based treatment package for the reduction of problem behaviors during an instructional setting with an 8-year-old girl diagnosed with autism functioning in the moderate range of mental retardation. Through the completion of a functional analysis, it was determined that her problem behavior was maintained by escape from instruction. Differential reinforcement of alternative behavior (DRA) was utilized across two conditions with the alternative behavior being compliance. The researchers intended to compare the use of a

DRA package with and without instructional fading in the treatment of a young girl's task-related problem behavior.

Through all sessions involving DRA with instructional fading were conducted in a separate therapy room with each session lasting 45 minutes. Each session was conducted with the behavior specialist. The same instructional material and positive reinforcement materials remained consistent throughout both conditions. The contingencies related to the condition were identical under both conditions so that if problem behavior occurred during the break, the break was halted, the student was required to clean up the room and was then presented with an academic instruction.

Researchers found DRA without instructional fading resulted in an initial increase in problem behavior, but it decreased across sessions. Conversely, DRA with instructional fading resulted in problem behavior in only 2 out of 13 sessions. Researchers indicated the key component of using DRA with instructional fading was the schedule of instruction altering the value of escape as a reinforcer (Ringdahl et al., 2002).

Ringdahl et al. (2002) noted two limitations of the study. The first limitation was that only one subject was observed, therefore generalizations were not possible. The second limitation was associated with the research being conducted in a "unique setting," a hospital day treatment program with the study being conducted in a therapy room or classroom located in the facility, resulting in the possibility of the behaviors being unique to the setting (Ringdahl et al.).

Study 2: DRA and Demand Fading in the Treatment of Escape-Maintained Behavior

A study similar to Study 1 was conducted by Piazza, Moes, and Fisher (1996). In this study, researchers discuss the use of physical guidance during instruction and how it is difficult to use this procedure. As a result, combinations of using demand fading (i.e., gradually introducing demands) and an increase in rate of reinforcement for compliance were examined as the independent variable.

Piazza et al. (1996) studied an 11-year-old boy, Jon, with autism and mild retardation who was hospitalized for treatment of destructive behaviors, self-injury and disruption (property destruction, throwing objects, and kicking and banging surfaces). The sessions were conducted in a clinic room with a one-way mirror. Treatment sessions continued until Jon completed a specified number of academic trials while seated at a table with session durations ranging from 30 s to 68.6 min.

During the functional analysis, destructive behaviors occurred at high rates in social attention ($M=6.6$), demand ($M=4.6$), and tangible ($M=4.8$) conditions but low rates were observed in toy play ($M=0.2$) and alone ($M=1.2$) conditions. During treatment, destructive behavior was highest in escape extinction with physical guidance ($M=9$), next highest in baseline ($M_s=3.2, 6.3, \text{ and } 3.7$ in the first, second and third phases, respectively) and lowest during DRA plus demand fading ($M_s=0.3, 0.5 \text{ and } 0.6$ in the second, fourth, and fifth phases, respectively). Low levels of compliance were observed in escape extinction with physical guidance ($M=33.2\%$) and baseline phases ($M_s=36.6\%, 31\% \text{ and } 24.6\%$, respectively), whereas substantially higher levels of compliance were

observed for DRA plus demand fading ($M_s=100\%$, 90.8%, and 100% respectively).

(Piazza et al., 1996)

Throughout this study, Piazza et al. (1996) found that the results they obtained support those of an earlier study conducted by Pace, Ivancic, and Jefferson in 1994, indicating that it may not be necessary to physically guide clients to complete a task in order to decrease escape-maintained destructive behavior and increase compliance. The results of the current study indicate destructive behaviors were highest in escape extinction with physical guidance and lowest during DRA plus demand fading.

Piazza et al. (1996) stated that several factors may have contributed to the success of DRA plus demand fading. First, when compliance was gained, it resulted in access to highly preferred items. Second, when latency to compliance was long, Jon did not have access to attention and the tangible items which might have established the effectiveness the reinforcers used, and demand fading may have increased the possibility that Jon contacted reinforcement for compliance because the response requirement was initially low. Finally, the response-reinforcer relationship for destructive behavior was discontinued by not allowing Jon to escape a task by engaging in noncompliant behavior.

Study 3: Reinforcement Magnitude and Responding During Treatment with Differential Reinforcement

Lerman et al. (2002) reviewed research on DRA and found problem behavior was often maintained by social reinforcement. For example, a subject would engage in a problem behavior such as self-injurious or destructive behavior to gain social attention from others. The researchers stated that as part of treatment with DRA, the functional reinforcer for problem behavior is used to shape and maintain appropriate behavior. As a

result, the effectiveness of utilizing DRA is ideal in that, if done correctly, it will no longer produce the inappropriate behavior, especially if it is not receiving reinforcement.

This study (Lerman et al. 2002) consisted of two experiments studying the relation between reinforcement magnitude and adaptive behavior across three subjects. Each session was conducted in unused rooms containing tables, chairs and any materials needed for the experiment in the participant's school. In the first experiment, the dependent variable, communication response, was shaped and maintained by the same reinforcement found to maintain the inappropriate behavior. Two reinforcement magnitudes of 20 s to 60 s were used with access to toys or escape from demands. The two reinforcement magnitudes were compared and found to be associated with similar levels of resistance to extinction (Lerman et al.).

The three subjects were very similar in that all exhibited aggressive behaviors whether self-injurious or directed at others or property. The first subject, Timmy, was a 4-year-old boy diagnosed with moderate mental retardation who had been referred for assessment and treatment of disruption. The second subject, Rachel, was a 20-year-old woman diagnosed with profound mental retardation who had been referred for assessment and treatment of self-injury and aggressive behavior. The third subject, Gary, was a 10-year-old boy diagnosed with autism and severe mental retardation who had been referred for aggression.

Touching a communication card was chosen as the alternative behavior for all subjects. A subject was required to touch the card without verbal, model or physical prompts from the therapist. Definitions of problem behaviors were different for each subject. Timmy's problem behavior was defined as disruption as evidenced by throwing

objects more than 0.3 m from the placement on the table. Rachel and Gary engaged in aggression defined as hitting, kicking, biting or pinching the therapist. Additionally, Rachel engaged in self injurious behavior consisting of audible contact between her hand and head.

The reinforcement selection was escape from instruction for Timmy and Gary and access to toys for Rachel. The reinforcement was initiated to maintain alternative behavior during experiments 1 and 2. However, Gary was taught a second alternative behavior, touching a different communication to obtain access to tangible reinforcers. As a result of an additional alternative behavior being introduced with Gary, experiments 1 and 2 were conducted again with a tangible reinforcer.

The overall finding of the relation between reinforcement magnitudes and responding during DRA indicated this variable may only minimally influence resistance to extinction or overall response rates within the context of a single free operant arrangement (Lerman et al., 2002). Using a reversal design, researchers found that, with the exception of post reinforcement pause (PRP), the characteristics of behavior exposed to different duration of social reinforcement are similar prior to and during extinction. Additionally, researchers found relatively short duration reinforcement maintained appropriate behavior as well as longer periods of reinforcement. With this, the shorter the reinforcement, the longer the academic session may be (Lerman et al.).

Study 4: Evaluating Treatment Challenges with Differential Reinforcement of Alternative Behavior

Vollmer et al. (1999) conducted a study reviewing DRA at less than optimal parameters. One of the main concerns discussed regarding DRA was that, to date, no studies have evaluated methods for examining the integrity or the reliability of DRA. The purpose of the research would be to ensure that perfect or near-perfect integrity of treatment was conducted. The participants in the study were three individuals who had been referred by their parents and teachers for treatment of their problem behaviors and were functioning at profound mental retardation level (Vollmer et al.). Dependent variables were problem and appropriate behaviors. The study was conducted in a therapy room of the participants' school. The researchers would reinforce a problem behavior after some of the occurrences, and would not at other times. Findings indicated that when exposed to DRA at full implementation, the participants showed an inclination toward appropriate behavior in subsequent conditions during which "mistakes" were intentionally introduced (Vollmer et al.). Vollmer et al. state that if the reinforcement schedule caters to the DRA, responding should be allocated toward appropriate behavior and away from the problem behavior, thus ensuring the problem behavior should extinguish.

The results of the study (Vollmer et al., 1999) indicate that at full implementation, DRA virtually replaced inappropriate behavior for all participants. During partial reinforcement of alternative behavior, if the reinforcement favored the inappropriate behavior, the efficacy of the treatment was questioned, regardless of the fact that there was a bias toward appropriate behaviors.

The overall usage of full and partial implementation of differential reinforcement is acceptable from a clinical perspective. However, if partial implementation is utilized it should be used with fading of the implementation levels prior to generalizing a treatment plan. Future research should also evaluate the manipulation of other variables that constitute full or partial treatment implementation (Vollmer et al., 1999)

Study 5: Competition Between Noncontingent and Contingent Reinforcement Schedules During Response Acquisition

Goh et al. (2000) examined noncontingent and contingent reinforcement schedules during response acquisition. Two participants engaged in self-injurious behavior. Two different experiments were conducted with the first utilizing noncontingent reinforcement (NCR) and differential reinforcement of an alternative behavior and the second utilizing a thinning of NCR and differential reinforcement of an alternative behavior. In both experiments, researchers sought a decrease in self-injurious behavior and an increase in appropriate mands (replacement behavior).

Unlike the previous studies, the participants in this study were adults. The study involved two participants who both lived in a residential facility for persons with developmental disabilities and had been referred to a day treatment program for assessment and treatment of self-injurious behavior (Goh et al., 2000).

The dependent variable in the study for both participants was self-injurious behavior (slapping, biting, etc). Data were collected on the frequency of the self-injurious behavior and mands (replacement behavior) by trained observers. Phase 1 consisted of the functional analysis to determine what reinforcers, both tangible and non-

tangible, would work best. Phase 2 consisted of noncontingent reinforcement (NCR) plus DRA then thinning the schedule of NCR while DRA was continued. In order to gain adequate data, both treatments, NCR and DRA, began simultaneously. The alternative behavior, mand training, was provided to the participants by verbal and physical prompts to engage the alternative response at 30-s intervals (Goh et al., 2000).

The overall conclusions of the study show that NCR plus DRA were associated with a decrease in self-injurious behavior but resulted in little or no increase in appropriate mands. In the subsequent phase when the NCR schedule was thinned while the DRA continued, a decrease was observed in the self-injurious behavior while an increase in appropriate mands was noticed. The overwhelming findings of the Goh et al. (2000) study indicate that the strengthening of socially appropriate behavior as replacement for problem behavior during NCR might best be achieved if the NCR schedule is first thinned.

Summary

Each investigation utilized differential reinforcement of an alternative behavior in order to decrease a problem behavior, typically self-injurious or destructive behavior. The first study by Ringdahl et al. (2002) utilized DRA in a treatment package in order to increase compliance during an instructional setting. The second study conducted by Lerman et al. (2002) investigated extinction of the problem behavior through reinforcing the alternative behavior of utilizing a communication card to seek reinforcement. The third study conducted by Vollmer et al. (1999) examined DRA under less-than-optimal circumstances in that reinforcement was not utilized regularly. The alternative behavior

was to complete a task independently. The last study reviewed, by Goh et al. (2000) sought replacement behaviors (mands); the behavior being sought was not clearly defined over self-injurious behavior.

All studies reported the similar cognitive functioning level of the participants with the exception of Kyle (Vollmer et al., 1999) who had not been diagnosed. The use of DRA appeared to be appropriate in that in experiment found the use of DRA decreased problem behavior. Three of the articles reported significant decreases in problem behavior.

Throughout the review, with the exception of one study, problem behaviors were ignored while the alternate behaviors were reinforced. The duration of reinforcement for the alternative behavior was surprisingly short, anywhere from 20 s to 300 s; however, it appeared that regardless of the duration, the reinforcement proved to be enough to decrease the problem behavior in order to increase the alternative behavior. This occurred whether the alternative behavior was task completion, touching a communication card or engaging in an appropriate behavior. In the study by Vollmer et al. (1999), DRA with NCR proved to increase the desired alternative behavior.

DRA is appropriate to educational settings because reinforcement (particularly social attention) is used as a contingent consequence for alternative behavior while problem behavior simply remains on extinction (Alberto & Troutman, 2006). Although researchers recommend that future research should be conducted under the same or similar conditions in order to make further determinations on the effectiveness of DRA, one is not able to generalize effects of DRA to multiple functioning levels of students. In

order to create a skill that is able to be generalized to multiple settings, the study setting needs to be conducted in an environment more natural and functional for students.

While appropriate for implementation in educational settings, existing research on DRA provides no evidence of its effectiveness in special education classrooms. Existing research on DRA exposes three omissions: research on students with mild/ moderate disabilities, research in school classrooms, not clinical settings, and research conducted by a teacher. With the experiments reviewed being conducted in clinical settings, the research does not inform educational practitioners with information needed in order to provide teachers with evidence-based approaches necessary to change behaviors.

Although it was found that DRA was successful with most study participants with severe disabilities in clinical settings, or with students in settings inconsistent with normal day to day schooling, further research needs to be conducted. In particular, research needs to be conducted with students who have mild/moderate disabilities in the typical classroom settings. Many of the studies reviewed consisted of one participant and the researchers in a one on one session. Research needs to be conducted with students in a school setting who have multiple distracters such as other students and adults present in a classroom. Therefore, the purpose of this research is to investigate the effectiveness of DRA on decreasing problem behavior and increasing alternative behavior in a regular education classroom setting with students who have mild/moderate disabilities. This study will examine the extent to which extraneous variables in a general education classroom can be controlled in order to evaluate the effects of the treatment, which will extend existing research conducted primarily in clinic settings.

METHOD

Participants and Settings

The study involved three participants who were classified as having mild to moderate disabilities consisting of Autism Spectrum Disorder (ASD) or developmental delays. Three participants, Annie, Mark, and Billie have been placed in a mild/moderate unit specializing in academic improvement and behavior management. Most special education services are provided in regular education settings with assistance of special education personnel.

Annie, a 6-year-old girl diagnosed with ASD, exhibits delays in academics, social interactions with peers and behavior problems limiting access to the regular education classroom. Annie's assessment on the Gilliam Autism Rating Scale/GARS Autism Quotients are 64¹ (parent) and 85 (teacher). Adaptive behavior scores on the Scales of Independent Behavior – Revised (SIB-R) include Broad Independence Standard Score of 76 (parent) and 78 (teacher). Additional communication testing consisted of Receptive One-Word Picture Vocabulary Test (ROWPVT) Standard Score of 85, Expressive One-Word Picture Vocabulary Test (EOWPVT) Standard Score of 73, Oral and Written Language Scales (OWLS) composite score of 81 and Comprehensive Assessment of Spoken Language (CASL) composite score of 71.

Mark, also six years old with ASD, excels academically but exhibits social and obsessive behaviors inhibiting his access to the regular education setting. Mark's

¹ Standard scores reported in this section have a mean of 100 and a standard deviation of 15. A score of 64 falls below the first percentile, i.e. about 99% of scores of students who received this assessment were higher than this score. Scores of 75 fall at about the 5th percentile. Scores of 85 fall at about the 15th percentile.

assessment on the Gilliam Autism Rating Scale/GARS Autism Quotient is 70 (teacher) and 90 (parent). The Social Skills Rating System (SSRS) Standard Scores are 64 (parent) and 66 (teacher). Adaptive testing according to the SIB-R reflect Broad Independence Standard Scores of 95 (parents) and 82 (teacher). Additional communication testing consisted of Clinical Evaluation of Language Fundamentals-Preschool (CELF-Preschool), Receptive Language Standard Score of 70, CASL Standard Score of 74, Peabody Picture Vocabulary Test III Standard Score of 64.

Annie and Mark are able to access the regular education setting with teacher or para-professional assistance but Annie requires accommodated academics to ensure progress in reading and writing.

Billie is seven years old and has developmental delays. Billie's cognitive testing according to the Mullen Scales of Early Learning, reflects an Early Learning Composite of 55. Adaptive skills based on the Vineland Adaptive Behavior Scale reflect Motor Skills Standard Score of 71, Daily Living Skills Standard Score of 78 and Socialization Standard Score of 82. Behavior ratings on the SIB-R are Standard Scores of 91 and 97 based on teacher responses. Additional communications testing consisted of CELF-Preschool, Receptive Language Standard Score of 71. The setting for Billie was the regular education classroom with 20 other students present. Billie is placed in the regular classroom for all academic instruction but due to social behavioral delays requires intermittent monitoring by the special education teacher or paraprofessional. The teacher or para-professional typically check on his performance at 90 min intervals.

The setting for Annie and Mark was also a regular classroom but a special education teacher or para-professional are continually present to monitor academic

performance and social behavior. The study was conducted at Hill Field Elementary School in Clearfield, Utah, a school in the Davis School District.

Target Behaviors: Participant 1 (Billie)

Problem behavior: Talking out. Definition: Talking without first receiving teacher permission. Making verbal statements or vocal sounds without teacher permission to gain teacher and/or peer attention. The behavior typically occurred during academic instruction but was not limited to instructional settings only.

Alternative Behavior: Seeking teacher or peer attention appropriately.

Definition: Raising his hand to seek teacher attention in order to talk while not verbalizing or whispering and keeping hand raised until teacher acknowledgement.

Target Behaviors: Participant 2 (Mark)

Problem behavior: Off-task and inappropriate touching (hands in nose, eyes, mouth or ears). Definition: Inappropriate touching consisting of putting hands in nose, eyes, mouth or ears in order to get a reaction from peers or adults or not being physically oriented to the task at hand or manipulating materials related to the task in a purposeful way leading to completion of the task. This behavior occurred across all school settings.

Alternative Behavior: On-task behavior.

Definition: Remaining physically oriented to the task at hand (i.e., eye contact with materials on desk, eye contact with materials displayed in front of group or eye contact with instructor, or eye contact with a student who has been recognized by the teacher to speak) or manipulating materials related to the task in a purposeful way leading to completion of the task.

Target Behaviors: Participant 3 (Annie)

Problem behavior: Off-task. Definition: Not being actively engaged at the task at-hand by moving around, talking to peers or seeking teacher or staff attention by whining or tantruming. If Annie did not get teacher attention immediately, she would whine and/or vocalize using volume above conversational level in order to get the response or attention she was seeking from the teacher or staff. The problem behavior consisted of being out of her seat, falling to the floor or following the teacher or staff around the classroom. This behavior occurred across all settings.

Alternative Behavior: On-task Behavior.

Definition: Remaining physically oriented to the task at hand (i.e., eye contact with materials on desk, eye contact with materials displayed in front of group or eye contact with instructor, or eye contact with a student who has been recognized by the teacher to speak) or manipulating materials related to the task in a purposeful way leading to completion of the task.

Dependent Variable

Prior to the beginning of the study, dependent variables were determined after conducting functional behavioral assessments on each participant. The functional behavioral assessments consisted of teacher and para-professional interviews; academic and behavioral record review and observation. The researcher anticipated the dependent variables to be problem behaviors to be decreased and alternative behaviors to be increased using DRA as treatment. The function of the problem behaviors for all the

participants was getting teacher and/or peer attention. The problem behaviors for each participant were measured as follows.

Participant 1 (Billie)

Frequency data were obtained recording the number of times talk-outs and hand raises occurred during the observation period. Time sampling records were collected concurrently for problem and alternative behaviors.

Participant 2 (Mark)

Time sampling data was obtained regarding on-task behavior and off-task behavior with specific coding for off-task behavior consisting of inappropriate touching during the observation period.

Participant 3 (Annie)

Time sampling data for on-task behavior and off-task behavior was obtained during the observation period.

Data and Instruments

Data were collected prior to any teaching of specific alternative behaviors. Time Sampling and event recording (depending on the participant) were used during the 15-minute time period. Each time the problem behavior occurred during baseline and after presentation of the intervention, it was represented by a tally mark. The data were then graphed to show trends in the baseline and intervention treatments within a multiple baseline design.

Social Validity

According to Cooper, Heron, and Heward (2007), social validity can be assessed in three areas: social significance of the target behavior, appropriateness of the procedures and social importance of the results. The significance of decreasing the described problem behaviors will improve student success in day to day schooling. This will allow more access to the regular education setting for students with disabilities.

The social validity of the intervention was assessed through a pre and post survey on the social significance of treatment effects. Eight observers (i.e., six classroom teachers, one school counselor and one Title I aide) were asked to observe a video sampling of Annie's behaviors. Both baseline and end of intervention behaviors (i.e., "pre" and "after" treatment) were shown in video segments in order to determine if the teachers and staff were able to correctly identify which segments showed effects of the DRA intervention. Teachers and staff who were both familiar and unfamiliar with Annie were included in the video sampling. After observing 1 min of baseline and intervention video segments of Annie, the teachers were asked to identify "pre-intervention" and "after intervention" segments. The order of "pre-intervention" and "after intervention" video segments were randomized. Three "before" segments and three "after" segments were used in order to better determine whether or not the teachers were able to see a difference in Annie's behavior. Video samples were collected only for Annie due to an inability to obtain adequate video and sound for observation on the other two participants.

Inter-Observer Agreement Procedures

Inter-observer agreement data were conducted to ensure consistent measurement of the dependent variable. Each participant had data collected at different times. Data for Annie and Mark were collected in the same regular education classroom and Billie was in a different regular education classroom. The observers were Katrina Spangenberg (the special education teacher and researcher) and a special education para-professional. The second observer was trained by the special education teacher in sessions prior to starting baseline. The teacher and second observer began by working together to observe behaviors of the three participants while another teacher conducted a lesson. The purpose of the initial session was to confirm or modify the definitions of problem and replacement behaviors. In a second session, the teacher and second observer independently collect data on a sample of problem and alternative behaviors, then frequencies or time sampling data were compared. Inter-observer agreement was calculated on two ways. First, on frequency counts, a formula of “small count/large count x 100” will provide an index of inter-observer agreement. Second, on time sampling, a formula of “agreements/agreements plus disagreements x 100” in order to provide an index of inter-observer agreement. The teacher and second observer continued training until frequency and time sample agreements were both 80% or higher. At this point, baseline data collection commenced. Inter-observer agreement data were collected 25% of all baseline and intervention sessions for both problem and alternative behaviors.

Inter-observer agreement results show mean agreement percentages for Billie of 95% for off-task behavior (range 91%-100%), 88% for number of talk-outs (range 80%-100%) and 93% for the number of hand raises (range 83%-100%). Mark’s agreement

percentages were 95% for off-task behavior (range 88%-98%) and 76% (range 75%-100%) for inappropriate touching. The lowest agreement result (i.e., 75%) resulted from a difference in one incident of the target behavior across observers (i.e., three incidents counted by one observer versus four incidents by the other observer). Annie's mean agreement percentages were 94% for off-task behavior (range 87%-98%).

Independent Variable

The independent variable was the effect of DRA (reinforcement for the alternative behavior plus extinction for the problem behavior). For each participant, the function of the problem behavior was gaining attention. Interventions included individual teacher attention when the alternative behavior was exhibited by the student and tokens that were used in the classes' token economy system. Students were able to exchange their tokens for desired items from the classroom on a daily basis. However, Mark elected to turn in his tokens only on Fridays. Occurrences of problem behavior resulted in extinction procedures, that is, the teacher, para-professional, and students directed their attention away from the target student and resumed attention only after the problem behavior ceased.

Research Design

The research design was a multiple baseline across three participants (Alberto & Troutman, 2006). Baseline data were obtained during 15-min periods using event recording for both the problem behaviors of inappropriate touching and talk-outs and the replacement behaviors of hand raising and seeking attention. Time sampling was used

for recording both the problem behavior of off-task and the proposed replacement behavior of on-task.

Baseline data were obtained until a steady representation or increasing trend in problem behaviors was achieved. At this point, participants began the intervention at different points in time. When criterion levels were attained by the initial participant, the next student's participated in the intervention. This process continued with each participant until all participants received intervention procedures. Data were recorded on both the problem behavior and the replacement behavior throughout the study in order to accurately determine if the effects of DRA.

Intervention Procedures

Treatment consisted of DRA with components targeting social behaviors to increase (e.g., hand raising or on-task behavior depending upon the participant) and problem behaviors to decrease (e.g., talk outs, whining/tantrum and inappropriate touching). The same treatment occurred for each additional participant; however, the specific skill taught for the alternative behavior was ascertained through the functional behavioral assessment. The DRA procedures were functionally equivalent to each participant's problem behavior. That is, reinforcement procedures were consistent with the function of the problem behavior. For example, if the problem behavior functioned to establish teacher attention, the student received teacher attention for exhibiting the appropriate behaviors each time they occurred. If the problem behavior functioned to avoid a high demand academic task, the teacher reduced the assignment length or complexity.

The alternative behaviors for all the participants were readily observable. Given this, it was easy for all the participants to receive reinforcement for exhibiting the desired alternative behaviors. Reinforcement in the form of tokens was given daily, at the end of the day. The daily, fixed interval schedule of reinforcement was maintained until a pattern of decreased problem behavior and an increase in alternative behavior was observed for a participant. At this point, contingent on high rates of desired behavior, the rate for turning in tokens was decreased to every-other-day and continued until token reinforcement was provided on a weekly basis. Conversely, if the participant exhibited increased rates of problem behavior, daily reinforcement will be reinstated.

The alternative behavior for each participant was taught in individualized teaching sessions. The participants participated by reciting and role playing the actions involved in their specific alternative behavior. After individual training sessions, the alternative behaviors were reviewed and role played again with each participant in various school settings to increase the probability of occurrence. Participants were encouraged to perform their respective alternative behavior through positive verbal statements and teacher modeling of the appropriate behavior as needed.

As shown in the Results section, DRA produced mixed results for two of three students, i.e., problem behaviors continued to occur although at reduced levels. Given mixed results, a procedure involving differential reinforcement of low rates (DRL) was introduced in attempt to further reduce problem behavior. In DRL, reinforcement is delivered at the end of a specified interval if the target behavior has occurred at a criterion rate; in this case, at zero level or low rates (Turner, Green, & Braunling-McMorrow, 1990). For Billie, DRL contingencies required two or less talk-outs during

the observation time to earn Play Station time. For Mark, DRL required no more than two occurrences of inappropriate touching and no more than two observations of off-task were allowed for delivery of reinforcement.

During baseline and intervention phases, class and school wide rules were in force. Rules consisted of following directions the first time given, keeping hands feet, mouth and objects to oneself, always using an inside voice, raising one's hand before talking, and walking in the halls and asking permission before leaving the classroom. The class and school rules were enforced with positive reinforcement given through gold star tickets and positive praise with edible reinforcers depending upon the given task and student.

RESULTS

Baseline data were collected at the same time for each participant. Baseline data on Billie showed the problem behavior (talk-outs) increased from 6 to 36 occurrences from Sessions 1-3. The number of incidents of hand raises varied, ranging from 3 to 8. Off-task behavior ranged from 10-25% of observations.

With the presentation of the DRA intervention, Billie's frequency of talk-outs decreased from 20 occurrences in Session 4 to 5-10 occurrences in Sessions 5-14. The frequency of hand raises varied depending on the activity, ranging from 5-12 occurrences. Overall, these frequencies were slightly higher than Baseline levels. A steady decrease in problem behavior was observed during the DRA intervention, occurring at levels of 10% or less.

Although the problem behavior was decreased with the presentation of DRA, the behavior was not eliminated. In an attempt to further decrease the problem behavior, DRL was introduced. With the presentation of DRL in Sessions 19-22, Billie decreased the frequency of talk-outs to the required amount. As shown in Figure 1, talk-outs in DRL decreased to levels of 2 or less occurrences. Off-task behavior was at zero percent throughout all DRL sessions. Data was not collected during session 16 due to an absence.

The second panel in Figure 1 presents Mark's behavior. The focus for Mark was to decrease inappropriate touching and to increase on-task behavior (or decrease off-task behavior). As shown in Figure 1, Mark's mean for off-task behavior in baseline was 66% (range 49%-98%) over six sessions. During baseline, the mean for inappropriate touching

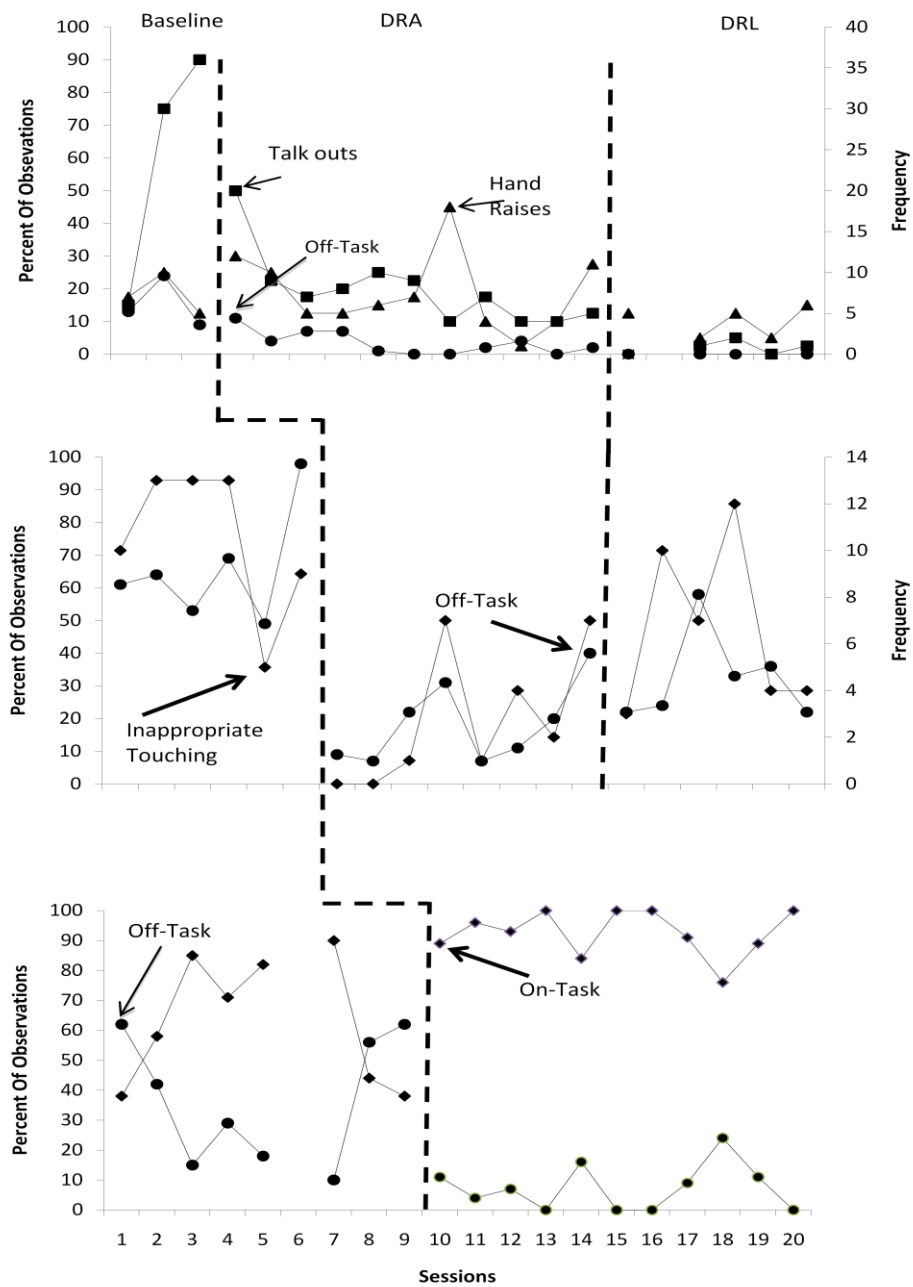


Figure 1. Effects of differential reinforcement of alternative (DRA) behavior and differential reinforcement of low rates (DRL) across three participants in a multiple baseline design.

was 10.5 occurrences (range 5-13). With the presentation of the intervention in Sessions 7 and 8, Mark showed a substantial decrease in off-task behavior (below 9%) and zero incidents of inappropriate touching. In Sessions 9 and 10, off-task behavior increased to 22% and 31%. In the same sessions, inappropriate touching increased to one and seven occurrences.

In Session 11, Mark decreased off-task behavior to 7% and had only one occurrence of inappropriate touching. However, from Sessions 12 to 14 Mark's off-task behavior and incidents of inappropriate touching increased. During these sessions, Mark was observed to have a runny nose associated with a suspected virus.

Due to the increased occurrences of the problem behavior, on Session 15, DRL was introduced. As shown in Figure 1, Mark decreased his off-task behavior during Sessions 15 and 16 to 22% and 24% with the introduction of DRL, but increased off-task behavior during sessions 17-20 with an average of 37% (range 22%-58%). During this time, inappropriate touching averaged 7 incidents per session, far more than the low rate requirement to receive reinforcement.

The third panel in Figure 1 presents Annie's behavior. During baseline, Annie's mean for off-task behavior was 36% with a range of 10%-62%. Although the same activity was presented throughout each session, off-task behavior remained variable throughout baseline. With the presentation of the intervention, off-task behavior decreased to below 16% of all observations with one spike on Session 18 to 24%. No DRL intervention was implemented for Annie because DRA had substantially decreased her off-task behavior. Data was not collected during session 6 due to an absence.

Eight observers watched video of Annie's behavior pre- and posttreatment as presented in randomized order. Of 48 trials (i.e. three pre- and three posttreatment videos per observer), 45 were correctly identified. Of the three incorrectly identified, two were of the same posttreatment scene. While observing the video, most teachers commented that they readily recognized the pre- and posttreatment video.

DISCUSSION

This study examined the effects of DRA on problem and alternative behaviors of three participants with mild/moderate disabilities in a resource special education setting. Results indicated that DRA can be used effectively to decrease some problem and increase alternative behaviors but, for these participants, problem behaviors remained at low but, variable levels.

Unlike previous studies, the participants experienced mild/moderate disabilities and participated in an educational setting with other students in the classroom. The present study extends research on DRA to students with these characteristics in a new setting. Although similar activities were scheduled during each observation period, the environment could not be controlled like it would be in a clinical setting.

Prior research examined participants classified with severe disabilities. The current study examined students with less severe disabilities and more common behavior excesses/deficit that are found in an educational setting and not a common in a clinical setting.

DRA was relatively effective in decreasing problem behavior for Annie and Billie, but not for Mark. Even in Annie's and Billie's cases, problem behaviors were variable and usually occurred at non-zero levels. Mixed results may have been partially due to the treatment integrity limitations (i.e., partial vs. full implementation) or lean schedules of reinforcement in the classroom setting. Further, distractions from other students in the classroom may have contributed to mixed results (Vollmer et al., 1999).

Vollmer et al. (1999) discussed that in application, DRA effectiveness may be compromised due to integrity failures, stating it is doubtful that all instances of alternative behavior will be reinforced or that all instances of problem behavior will be ignored due to less-than-optimal implementation. Under these circumstances, it is likely that DRA is only partially implemented, or implemented with less-than-optimal integrity. The results of the study (Vollmer et al.) indicate that at full implementation, DRA virtually replaced inappropriate behavior for all participants. During partial reinforcement of DRA, inappropriate behaviors continued to occur, although at reduced levels compared to baseline. Vollmer's et al. results involving one participant (i.e., Rachel) were similar to results obtained with Billie and Annie. That is, with partial implementation of DRA, problem behavior decreased to relatively low but non-zero levels. For Billie and Mark, DRA initially decreased the frequency of problem behavior and increased the alternative behavior. For Billie, DRA decreased talk-outs but not to zero levels. When DRL was presented, Billie was able to meet the requirement for reinforcement for the prescribed, low levels of talk-outs.

Mark's behavior was noteworthy in that he decreased off-task behavior to earn teacher attention, therefore the programming of DRA appeared consistent with the function of the off-task behavior. Although inappropriate touching decreased initially with the presentation of DRA, occurrences gradually increased over time, particularly when he was observed with a runny nose. When DRL was introduced, Mark's behavior did not meet criteria for reinforcement in any session. Either the low rate requirement was set too stringently, the function of the problem behavior was misidentified, had

multiple functions, and/or setting events (i.e., virus) interceded to delimit the effects of the DRL intervention.

DRL established contingencies that decreased talk-outs for one student (Billie) but had no effect on inappropriate touching for another student (Mark). These data suggest the importance of periodic functional behavior assessment to pinpoint the controlling reinforcers for problem behavior and calibrating the DRL contingencies carefully. Future research should consider these issues relative to implementation of DRL.

The data across three participants present variable results regarding effects of DRA in a classroom setting with students who have mild/moderate disabilities. Effective use of DRA, in retrospect, probably requires full implementation with high levels of treatment integrity and specific identification of behavior function. Interestingly, despite this range in treatment effectiveness, social validity results were compelling. Most video observers readily distinguished pre- and posttreatment videos, suggesting the social significance of the DRA intervention for Annie.

The current study found that DRA was successful for two students in a school setting. A denser schedule of reinforcement may have produced better results. However, dense schedules of reinforcement are difficult to program in a school classroom setting due to the ever-changing environment. Future research should examine the issue of lean vs. dense reinforcement schedules in classroom settings.

Differences between the current study and previous research include the setting in which the study was conducted, characteristics of participants, schedules of reinforcement, and levels of implementation. Although DRA was relatively successful at

full and partial implementation for Vollmer et al. (1999), the clinical setting lends itself to denser schedules of reinforcement and increased control of the environment. Additional research is needed on the effects of DRA in a school setting with students who have mild/moderate disabilities in order to better determine the variables to be manipulated increasing the effectiveness of DRA.

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