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HYPOTHESIS-BASED INTERVENTIONS FOR TANTRUM BEHAVIORS OF PERSONS WITH DEVELOPMENTAL DISABILITIES IN SCHOOL SETTINGS

ALAN C. REPP

EDUCATIONAL RESEARCH AND SERVICES CENTER AND

NORTHERN ILLINOIS UNIVERSITY

AND

KATHRYN G. KARSH

EDUCATIONAL RESEARCH AND SERVICES CENTER

We conducted a functional assessment of problem behaviors of 2 students with developmental disabilities in their classroom environments. Results of the assessments showed that although there were more tantrums in demand than in no-demand conditions, the function of the behavior was to gain attention (positive reinforcement) rather than to avoid or escape demands (negative reinforcement); demand conditions apparently served a discriminative function for the availability of attention. Therefore, intervention was based on the positive reinforcement hypothesis, resulting in a substantial reduction of tantrums for both subjects.

DESCRIPTORS: hypothesis-based interventions, tantrums, functional assessment, problem behaviors, developmental disabilities

Intervention research for problem behaviors of persons with developmental disabilities has been changing its focus in recent years, moving more toward nonaversive interventions (Repp & Singh, 1990) and away from punishment procedures (Guess, Helmstetter, Turnbull, & Knowlton, 1987; Lundervold & Bourland, 1988; Matson & Gorman-Smith, 1986). Although there may be many reasons for this transition, one is the increasing recognition that most problem behaviors are environmentally based and, therefore, serve a function. Increasingly, studies employing different methodologies have been directed toward identifying the function of problem behaviors and proposing a treatment based on that function. Collectively, these procedures have been called functional analysis or functional assessment.

The analogue assessment procedure of Iwata and his colleagues has served as the groundwork for functional analysis. The procedure has involved multiple presentations of four 15-min conditions, each associated with baseline control and one of the three functions proposed by Carr (1977) (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982; Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990). The procedure has been varied by other researchers, who have decreased the exposure time within each condition as well as the number of exposures to each condition (Derby et al., 1992; Northup et al., 1991). A variation of analogue assessment has been presented by Carr and his associates (e.g., Carr & Durand, 1985; Carr & Newsom, 1985; Carr, Newsom, & Binkoff, 1980; Durand & Carr, 1987). This procedure usually involves longer assessments, is conducted in schools in rooms separate from classrooms, and revolves around demand conditions. In a series of elegantly designed studies, Carr has compared demand conditions with attention conditions, and has found behaviors like aggression, self-injury, stereotypy, and tantrums to serve an escape function in these school settings.

Another form of functional assessment, in which

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Please address correspondence to Alan C. Repp, Northern Illinois University, Department of Educational Psychology, Counseling and Special Education, DeKalb, Illinois 60115.

students have been observed in their natural school settings rather than in analogue representations of these conditions, has been developed (Karsh & Repp, 1993; Kern, Childs, Dunlap, Clarke, & Falk, 1994; Lalli, Browder, Mace, & Brown, 1993; Repp, Felce, & Barton, 1988). Hypotheses have been generated from interviews (O'Neill, Horner, Albin, Storey, & Sprague, 1990), narrative recordings, and direct observations of antecedent and consequent events. Interventions have then been based on manipulating the conditions in the environment that are maintaining the problem behaviors.

Many of these studies have found demands to be related to problem behaviors, and have proposed that the behaviors were maintained by negative reinforcement. Most interventions have used escape extinction, that is, not allowing the problem behavior to continue to remove the demand. In addition, most have followed one of two other lines for their interventions. Some have sought to reduce the aversiveness of the task, often simultaneously increasing the rate of positive attention (Carr & Newsom, 1985; Carr et al., 1980; Horner, Day, Sprague, O'Brien, & Heathfield, 1991; Weeks & Gaylord-Ross, 1981). Others have focused on replacing the aberrant behavior with an appropriate one that serves the same escape function (e.g., Carr & Durand, 1985; Durand & Carr, 1987, 1991).

The purpose of the present study was to extend the work on functional assessment of problem behaviors, in particular tantrums, that occur during instruction and other demand conditions. As indicated, prior studies have associated problem behaviors during demands with the negative reinforcement hypothesis. The present study conducted assessments of the tantrum behaviors of 2 students with developmental disabilities who engaged in greater rates of tantrums during instruction and other demand conditions. Data were collected on student behaviors and environmental conditions during ongoing classroom activities rather than during analogue conditions. The escape function as well as the positive reinforcement function of the tantrums were assessed. Hypotheses were then based on these assessments, and interventions were based on these hypotheses.

METHOD

Participants

Students. Two students served in this experiment. Alicia was a 9-year-old girl diagnosed with severe mental retardation (IQ score = 32) and Down syndrome who was able to communicate with single words and gestures. Problem behaviors were first formally noted at the age of 5 years, and included tantrums (crying, falling to floor, kicking, hitting, throwing objects, and grabbing) and finger stereotypies (e.g., finger flexions). Previous interventions, which included time-out and restraint in a Rifton chair, met with little success. As a result, she had been moved from an integrated setting to a segregated school.

Sara was a 7-year-old girl diagnosed with severe mental retardation (IQ score = 36) and mild cerebral palsy who communicated by pointing to pictures and gesturing. Problem behaviors were first formally identified at the age of 5 years, and included tantrums (falling to floor, tearing books and other task materials, resistance to physical gestures by becoming rigid and not moving her hands, crying, and running away from staff). Prior interventions included time-out, restraint in a Rifton chair, and provision of preferred items with which to play. As a result of the severity of the problem behaviors, her parents were considering residential placement. Neither subject had received medications for her problem behaviors, and no medications were prescribed during the study.

Teachers. Two teachers and two instructional aides participated in the study and administered all interventions. Both teachers were certified in special education and had taught students with developmental disabilities for at least 5 years. The aide in Alicia's class had 1 year of experience, and the aide in Sara's class had 10 years of experience.

Setting

All phases of the study (baseline, intervention, and follow-up) were conducted in the classroom under normal teaching conditions. No efforts were made to set up analogue or other special conditions to assess the functions of the tantrums. Each class-

room had 6 to 9 students who remained in the setting during the baseline and intervention phases.

Student Behavior Categories

Data were collected on both appropriate and inappropriate behaviors. Codes were developed to represent the specific problem behaviors as well as appropriate task engagement. The behavior codes for each subject are presented in Table 1.

Teacher Behavior Categories

Codes were developed to represent the teacher behaviors and the two hypotheses for the tantrum behaviors. For the positive reinforcement hypothesis, attention and no attention were recorded as a consequence of both appropriate and inappropriate behaviors. For the negative reinforcement hypothesis, the presence of demand and no-demand conditions was recorded as antecedents to appropriate and inappropriate behaviors. Because these two codes were mutually exclusive and exhaustive, we also had a record of withdrawal of demand that was used in the analysis in Figure 1. These codes allowed the experimenters to determine whether the tantrum was followed by teacher attention or teacher withdrawal of demands. The teacher behavior codes are defined in Table 1.

Data Collection

Data for Alicia were collected with a computer, and the data for Sara were collected with paper and pencil. Data for Sara were collected in several locations, including some where use of the computer might be problematic (e.g., the swimming pool area). The computer system has been described in detail elsewhere (e.g., Repp & Karsh, 1994; Repp, Karsh, Van Acker, Felce, & Harman, 1989) and will only be described briefly here. Before the study began, press-on tabs representing the codes in Table 1 were placed on keys on the keyboard. At the beginning of each session, the observer answered a series of questions identifying the subject, location, session, and so forth. Then, she began the session by pressing the TAB key, which activated the computer's 1-s timer. During the session, she pressed a key once to indicate the beginning of a code and a second time to indicate the termination. The computer then recorded the starting and beginning second of each code as well as the sequence of occurrence. Because the computer can record up to 45 simultaneously occurring codes, there was no need to prioritize the recording of simultaneously occurring codes. At the end of each session, the computer automatically calculated (a) the number of occurrences of each code, (b) the rate of occurrence in responses per minute, (c) the total seconds of occurrence for each code, and (d) the percentage of the session each code occurred. The computer also calculated the conditional probabilities in Figure 1.

Table 1
Definition of Variables

Student behavior categories	
Alicia	(a) Tantrums. Crying, kicking or hitting staff, throwing objects, grabbing materials or staff, falling to the floor.
	(b) Out of seat. Wandering around the classroom attempting to leave the classroom during activities.
	(c) Stereotypy. Moving fingers or waving hands in front of face.
	(d) Appropriate behavior. Engaging in task-related behavior.
Sara	(a) Tantrums. Crying, dropping to the floor, running, tearing books and materials, throwing materials, becoming rigid, refusing to move.
	(b) Appropriate behavior. Engaging in task-related behavior or behavior appropriate to the ongoing classroom activity.
Teacher behavior categories	
	(a) Attention to appropriate behavior. Delivering verbal or physical approval for appropriate behavior.
	(b) No attention to appropriate behavior. Does not acknowledge appropriate behavior with verbal or physical approval.
	(c) Attention to problem behavior. Delivering reprimands, restraint, etc., for problem behavior.
	(d) No attention to problem behavior. Does not acknowledge behavior with reprimands, restraint, etc.
	(e) Demand. Delivers individual demands or prompts to subject.
	(f) No demand. Does not deliver demands or prompts to subject.

ALICIA

	Demand	No Demand
Appropriate Behavior	.48	.65
Tantrums Behavior	.51	.35
Out of Seat	.01	.00

During Demands

	Appropriate Behavior	Tantrum Behavior	Out of Seat
Attention	.05	.40	.00
No Attention	.43	.12	.00
Withdraw Demand	.01	.00	.00

SARA

	Demand	No Demand
Appropriate Behavior	.42	.82
Tantrum Behavior	.58	.18

During Demands

	Appropriate Behavior	Tantrum Behavior
Attention	.03	.43
No Attention	.39	.15
Withdraw Demand	.00	.00

Figure 1. Baseline data on the relationship between behavior and demand conditions, and among demand conditions, behavior, attention, and escape from demands.

Data for Sara were all event data and were recorded continuously with paper and pencil. The observer recorded the occurrence of each code while maintaining the sequence in which the codes occurred. The observer then calculated the frequency of each code as well as the conditional probabilities presented in Figure 1.

Interobserver Agreement

A second observer collected data in 20% of the sessions for Alicia and 21% of the sessions for Sara. Agreement percentages for Alicia were calculated by the computer according to a program that compared the data collected by the two observers, counted a unit of agreement for each code for each second the two observers recorded it, counted a unit of disagreement for each second one observer recorded the code and the other did not, divided the units of agreements by the sum of the units of agreement and disagreement, and reported a percentage for each code. Agreement data for Sara were calculated for each code each session by dividing the smaller number recorded by one observer by the larger number recorded by the other ob-

server, and then multiplying by 100%. The mean for each code was calculated across sessions for both subjects. The means for Alicia ranged from 91% to 99%, and the means for Sara ranged from 92% to 100%. Agreement scores within codes ranged from 82% to 100% for Alicia and from 87% to 100% for Sara.

Design

A multiple baseline across subjects design was used in which behavior was assessed during baseline, the hypothesis-based intervention, and the 1-year follow-up. In addition, a multiple baseline across two behaviors, tantrums and out of seat, was used with Alicia.

Procedures

Teacher interview. The second experimenter interviewed each student's teacher and teaching assistant to obtain descriptive information about the student (e.g., age, diagnosis, medical history, adaptive behavior, language skills). The problem behavior was identified, and the teaching staff were asked questions regarding the conditions under which the tantrum behavior did and did not occur. For Alicia, the teaching staff identified instruction as the most likely condition in which the behavior occurred; for Sara, the teaching staff identified transition as the most likely condition. For both students, the teaching staff hypothesized that the function of the tantrum behavior was to escape demands.

Narrative recording. Following these interviews, the second experimenter conducted three informal 90-min observations in the classroom. Descriptions of the classroom activity, antecedent events, student behaviors, and consequent events were recorded in the sequence in which they occurred. These informal observations were used to identify the specific target behaviors and specific antecedent and subsequent events for formal data collection during baseline. These narrative recordings indicated that Alicia's tantrums most frequently occurred during demands in group instruction activities but seldom occurred during one-to-one instruction. These observations led to a competing hypothesis that demand conditions served a discriminative function for the availability of attention. For Sara, tantrum behavior occurred most frequently during transitions that required the class to move from one location to another (e.g., from the classroom to the school bus). When Sara's tantrums occurred, the teacher or aide left the group to attend to Sara. Therefore, the transition demands may have signaled the availability of teacher attention for Sara as well.

Baseline. Data were collected for two purposes. The first was to record baseline levels of both inappropriate and appropriate behavior exhibited by Alicia during instruction and by Sara during transitions. The second purpose was to confirm or reject the positive reinforcement hypothesis and the negative reinforcement hypothesis for the problem behaviors. Baseline data were collected using the student behavior and teacher behavior codes. The data were then used to develop the conditional probabilities that are presented in the Results section. The conditional probabilities were used to confirm the appropriate hypothesis, leading to intervention.

Intervention. The interventions for tantrum behavior were based on the positive reinforcement hypothesis. For Alicia, data on out-of-seat behavior during baseline showed that it occurred 4% of the day, but almost all the behavior in baseline occurred in 1 day (Session 9); thus, no intervention was planned for out-of-seat behavior until Session 32 (see below).

The intervention for Alicia's tantrums included several components. The first component was withdrawal of attention for the tantrum behaviors. The teacher and teaching assistant were instructed not to engage in physical struggles, verbal pleas, reprimands, or soothing comments as they had during baseline. The second component of the intervention was to increase the rate of reinforcement for task engagement (differential reinforcement of alternative behavior; DRA). At the beginning of the intervention, the teacher or assistant delivered verbal praise (or "high fives," pats on the back, etc.) for appropriate behavior approximately every 15 s. The interval was systematically increased to 90 s by the end of the intervention phase. For the third component, the teacher increased the rate of demands

and reinforcement for all the students in the group, so that each student had an opportunity to respond to the teacher every 30 s and appropriate task engagement was reinforced at the end of the trial. The fourth component was to increase opportunities for Alicia to engage in social interaction with the teacher and teaching assistant. Items representing Alicia's favorite leisure activities (e.g., music tapes, a purse with grooming items, magazines) were assembled. The teacher and teaching assistant used these materials for brief social interaction with Alicia (2 to 3 min) after Alicia had participated in an activity without tantrum behavior. When the inappropriate behaviors could not be ignored (i.e., there was potential injury to Alicia or others, or the daily schedule was disrupted), the teacher or teaching assistant used brief physical guidance for appropriate behavior without providing verbal reprimands, eye contact, or other behavior involving attention to the inappropriate behavior. When tantrums decreased in Phase 2, out-of-seat behavior increased dramatically. There was no intervention for out-of-seat behavior until Session 32. At that point, the same procedures used for tantrums were used for out of seat.

Intervention for Sara was similar to the intervention for Alicia and included (a) eliminating attention for tantrums, (b) implementing a DRA procedure in which appropriate transition behavior was praised, (c) structuring opportunities for social interactions with the teacher and teaching assistant, and (d) teaching the use of specific pictures to communicate requests for attention. A fixed-interval schedule was implemented so that at the beginning of the intervention, appropriate transition behavior (e.g., walking to the door rather than falling to the floor) was reinforced after every 5 s. The interval was systematically increased so that by the end of the intervention, appropriate transition behavior was reinforced once every minute. Photographs of staff members and students were assembled in an album and were shown to Sara during the 2- to 3-min social interaction period following transitions without tantrums. Copies of these same photographs were placed on Sara's communication board, and the teaching staff prompted Sara to point to a picture to request attention throughout the school day. When a tantrum could not be ignored, the teacher used brief physical guidance for appropriate behavior; no verbal attention was provided.

Before the intervention began, the teaching staff for both students were trained to implement the interventions by the second experimenter. During the intervention, weekly feedback was given to the teaching staff on the implementation of the interventions.

Follow-up. Data on problem behaviors for Alicia and Sara were collected 1 year after the intervention had been implemented. Data were collected for 5 days for Alicia and 3 days for Sara. Data were collected under natural teaching conditions, and no efforts were made to prompt teacher behaviors or alter the classroom environment in any way.

RESULTS

According to reports from the teachers and assistants, both subjects engaged in higher rates of problem behaviors during demand situations. A schema was therefore constructed from baseline data to show the relationship between antecedent demands and problem behaviors. As indicated in Figure 1, tantrums occurred more often in demand than in no-demand conditions for both Alicia (51% vs. 35%, respectively) and Sara (58% vs. 18%).

However, another schema suggested a positive reinforcement hypothesis. These data, also shown in Figure 1, show that during demands, Alicia's tantrums led to attention 40% of the time and to escape from demands 0% of the time. Appropriate behavior led to attention 5% of the time and escape from demands 1% of the time. During demands, Sara's tantrums led to attention 43% of the time and escape from the demand 0% of the time. Appropriate behavior led to attention 3% of the time and escape from demand 0% of the time. These data on the consequences of the tantrum behavior confirmed the possibility that tantrums did not primarily serve an escape function. Rather, the conditional probabilities for consequences following the

tantrum behavior suggested an alternative hypothesis. Demand conditions may have indicated to the student that if she behaved inappropriately, she would receive more attention than if she responded appropriately. The intervention, then, focused on changing the relationship between behavior and attention rather than on changing some aspects of the demand condition (as in prior research).

The interventions for both subjects were based on the positive reinforcement hypothesis, and reduced the tantrums of both students. As shown in Figure 2, Alicia's tantrums occurred 41% of the day during baseline. During the 42 days of intervention, this behavior averaged 4% of the day, with much of that contribution coming from five sessions; without these days, the average was less than 2%. During the 11 days of baseline for tantrums, out-of-seat behavior occurred 4% of the day; during the next 20 days, when the intervention was being used for tantrums but not for out of seat, the latter occurred 17% of the day. These 31 days represent the baseline phase for out-of-seat behavior. During the next 22 sessions, when the intervention was also used for out of seat, it occurred 0.6% of the day. Data collected at 1-year follow-up indicated that tantrums occurred 4% of the day, with much of that contribution coming from 1 day (17%). Out-of-seat behavior did not occur during the collection of follow-up data.

Figure 3 presents additional data related to Alicia's intervention, showing the percentage of the session during which the staff attended to appropriate and inappropriate behavior. The data on inappropriate behavior show that during baseline, attention was highly variable (range, 0% to 67%), mirroring the number of Alicia's tantrums each day. Attention to inappropriate behavior averaged 32% during baseline but decreased to 3% during the 42 days of treatment, with much of that contribution coming from 1 day (77%). Attention to appropriate behavior also changed, averaging 6% of the day during baseline and 16% during intervention.

Figure 2 also presents the data on Sara's tantrums. During baseline, tantrums occurred an average of 22 times per day (range, 10 to 37). During intervention, the number of tantrums remained

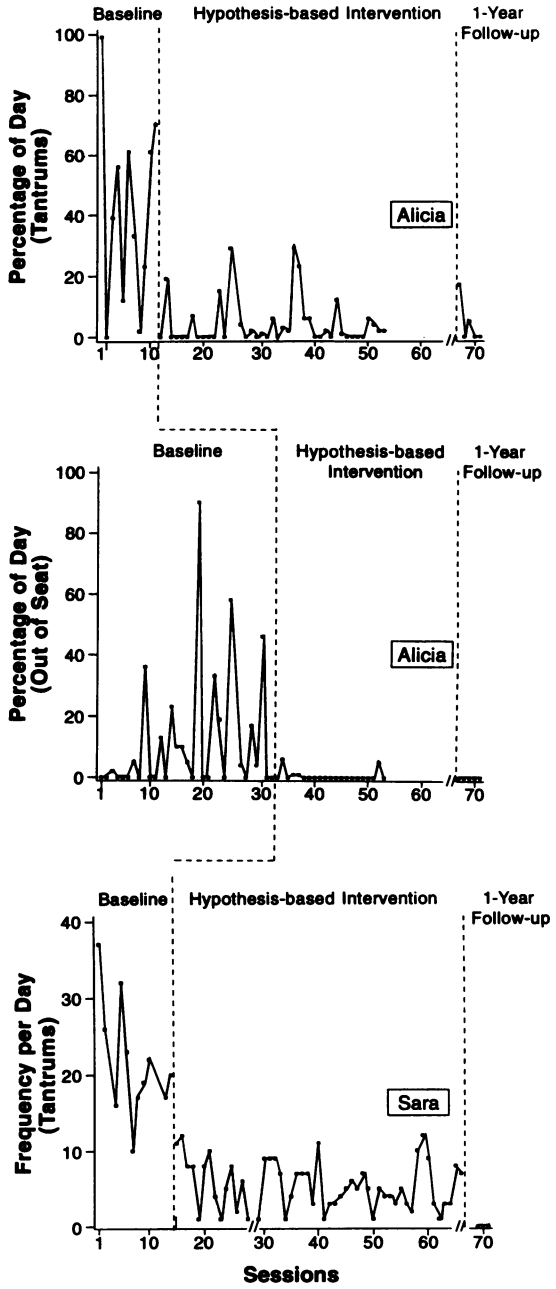

Figure 2. The percentage of intervals (Alicia) and frequency (Sara) of problem behavior during baseline, hypothesis-based interventions, and 1-year follow-up.

variable (range, 0 to 12) but were reduced to an average of four per day. During the follow-up 1 year later, tantrums were reduced to zero.

Figure 3 presents the data on staff attention to Sara's appropriate and inappropriate behaviors.

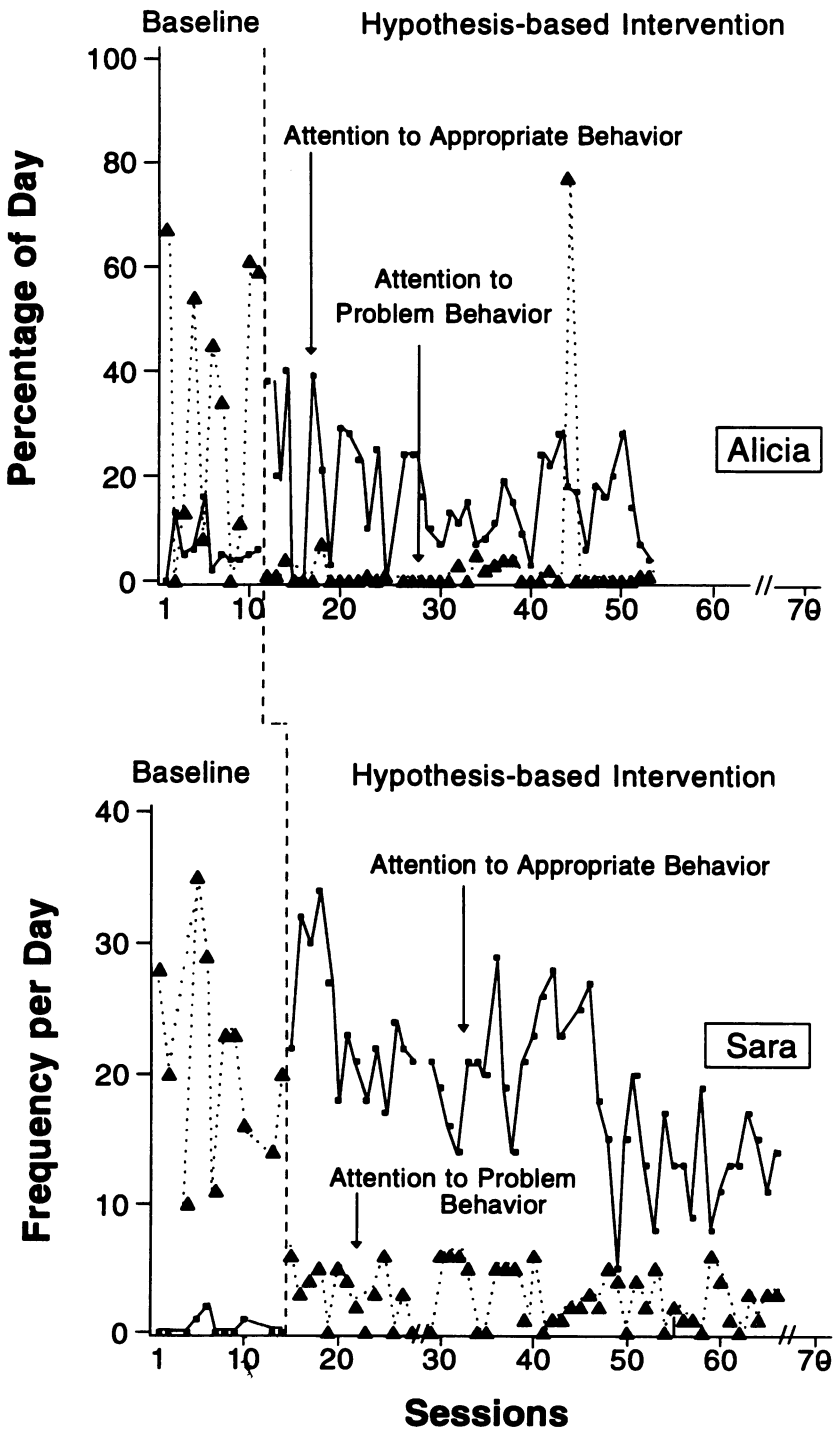

Figure 3. The amount of teacher attention for inappropriate and appropriate behavior for Alicia and Sara during baseline and hypothesis-based interventions.

These data show that during baseline the teacher and aide attended to appropriate behavior an average of 0.4 times per day. During intervention, this number increased to 19 (range, 5 to 34). Attention to tantrums occurred an average of 21 times per day during baseline (range, 10 to 35) and three times per day during intervention (range, 0 to 6).

DISCUSSION

The purpose of this study was to extend the work on functional assessment of tantrum behaviors that occur during instruction and other demand conditions. This purpose was met by developing a treatment program based on hypotheses developed from baseline data that had been collected in the natural environment. Both these students were referred to us by teachers and school psychologists who reported that the students engaged in these behaviors to avoid or escape demand conditions. Our initial informal assessment (i.e., teacher interviews and narrative recording) suggested two competing hypotheses, negative reinforcement and positive reinforcement. Baseline data across several sessions showed that the students received considerable attention for tantrums during the demand situations and suggested that these situations served a discriminative function for attention. Thus, intervention was based on the positive reinforcement hypothesis rather than the negative reinforcement hypothesis.

The results support the prediction from the conditional probabilities (Figure 1), showing considerable changes during intervention and follow-up. Alicia's tantrums were reduced from 41% of the day in baseline to 4% during intervention (1% over the last 9 days), and to 4% during a 1-year follow-up. Sara's tantrums were reduced from 22 times per day in baseline to four times per day during intervention (and once per day during the last 5 days); they never occurred during follow-up.

Neither child's tantrums were reduced to zero during intervention, and there could be many reasons for this result. One is that the behavior was under multiple control of both negative and positive reinforcement. Another is that during intervention the child learned a new function for the same behavior. A third possibility is that the behavior was influenced by the prolonged effects of extinction. Another reason could be that the behavior remained under control of positive reinforcement, and attention was still being offered for the tantrums. The data support the latter possibility. Alicia's teachers discontinued one form of attention for tantrums (i.e., cajoling, pleading, etc.) but not another; in some cases, they had to redirect Alicia by physically guiding her to return to school activities. The data in Figure 3 show that staff attention of the first form (i.e., cajoling, pleading) dropped to zero during the last several weeks of the intervention; however, the second form of attention (i.e., physical guidance) followed the occasional tantrum. Data on attention to Sara's tantrums show a very similar relation for both tantrums and the second form of staff attention. We cannot, of course, show that this second form of attention maintained the behavior.

The data on Alicia's out-of-seat behavior present a potential problem found in many intervention programs (i.e., the covariation of multiple problem behaviors). Presumably, out of seat had been serving the same function as tantrums during the baseline for tantrums, but it may have produced reinforcement less efficiently, in smaller magnitude, or of a lesser form (Horner & Day, 1991). When intervention began for tantrums but not for out of seat, the latter increased considerably (from 4% to 17% of the day). Fortunately, we had been recording this behavior and were able to implement an intervention for it as well. These results emphasize the importance of measuring multiple target behaviors during functional assessment and intervention procedures (Sprague & Horner, 1992).

Previous research has shown (or hypothesized) that problem behaviors that occurred more during conditions of demand than of no demand were maintained by negative reinforcement. The present data identified situations in which these behaviors were under the control of attention instead. The importance of functional assessment is that it allows

us to hypothesize the function of behavior before, rather than after, the success or failure of many days of treatment.

Prior studies have generally used analogue procedures, and many have been successful in developing treatments (e.g., Carr & Durand, 1985; Carr & Newsom, 1985; Iwata et al., 1990). The present study and other recent studies (Kern et al., 1994; Northup et al., 1994) extend that work by replicating its effectiveness when the assessment is conducted in natural settings (although see Lerman & Iwata, 1993, for an exception). There are several advantages to using a more naturalistic assessment in some circumstances. One is that it may be more acceptable to school personnel, whom we have found to be disinclined to set up analogue assessments intended to maximize the probability of the problem behavior. Another advantage is that there can be no concern about the behavior serving one function in the analogue condition and another in the natural setting. Behavior may be under one form of stimulus control in the analogue condition and under another form in the natural setting (which may be the basis for comments by Derby et al., 1992, on the unexpected low frequency of problem behaviors in their analogue assessments). A third advantage is that functional assessments conducted in the natural setting, comprised of all the stimuli associated with the presence and absence of the problem behavior, may lead to interventions that result in more durable maintenance of behavior change.

One approach to functional analysis or functional assessment has been to determine the amount of behavior that occurs under specific antecedent conditions (e.g., demand vs. no demand). Another approach has been to identify the consequences of the behavior (e.g., the probability that tantrum behavior leads to attention or no attention). In the approach described here, both the antecedent conditions and consequences for the behavior have been identified in the same analysis (O'Neill et al., 1990). In this investigation, this approach led to the identification of a hypothesis that may not have been considered if only the relationship between antecedent demand conditions and the tantrum behavior had been assessed.

A disadvantage of the way in which we conducted the assessment in this study is the length of time required to conduct the assessment and collect the baseline data. We presume that assessments could be conducted over fewer sessions; indeed, we have used fewer sessions with other subjects. However, there is no a priori reason to believe that a set number of sessions or total length of time is predictive of the function of problem behaviors for every subject, regardless of whether the assessment is analogue or naturalistic. A second disadvantage of this procedure is that the data for 1 subject were collected and analyzed with a computer-based system that may not be available to school personnel. However, the assessment procedure does not require the use of a computer, as shown by the data for Sara in this study. A third disadvantage of this procedure is that multiple experimental manipulations were not conducted (either in the form of analogue or treatment manipulations); as a result, the hypotheses were not tested directly. However, the hypotheses were indirectly tested through the treatment effects on the target behavior. We believe that such an effect has some validity, although we acknowledge that a test of two competing hypotheses (as in Repp et al., 1988) would have been more experimentally rigorous. The present procedure, however, is particularly advantageous for school settings in which experimental manipulations that may increase the problem behavior are not acceptable and the experimental comparison of two or more treatments is very difficult to implement.

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