*THE TREATMENT OF SEVERE BEHAVIOR PROBLEMS IN
SCHOOL SETTINGS USING A
TECHNICAL ASSISTANCE MODEL*

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We evaluated the feasibility of local school personnel conducting functional analysis and reinforcement-based treatment procedures within actual classroom settings. Following an initial in-service workshop on functional assessment and differential reinforcement procedures, on-site technical assistance was provided two to four times per month to local school personnel working in trans-disciplinary teams. Overall results suggest that local school personnel were able to implement all procedures adequately with periodic technical assistance. In addition, functional analysis was effective in identifying individual maintaining contingencies, the derived treatments were effective, and the results were maintained throughout the approximate 18 months of this investigation.

DESCRIPTORS: functional analysis, severe behavior disorders, severely handicapped, classroom settings, treatment integrity

Recent investigations have demonstrated that severe self-injury and aggression can be treated successfully through the use of proactive treatments derived from prior functional analyses (e.g., Carr & Durand, 1985; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982; Steege, Wacker, Berg, Cigrand, & Cooper, 1989). Although experimental (functional) analyses are generally accepted as providing the most conclusive information (Lennox & Miltenberger, 1989), these analyses have also been criticized as being too complex, time consuming, and burdensome (Axelrod, 1987). Durand and Crimmins (1988) suggested that due to the necessity for stringent environmental control over both measurement and environmental events, functional analysis may be too complex for use in typical settings such as classrooms. Paisey, Whitney, and Hislop (1990) estimated that effective functional

analysis would require two to four highly trained professionals capable of managing multiple, concurrent, and subtle contingencies each day. They concluded that no matter how extensive the consultation or training, expecting regular caregivers to assume anything more than a maintenance role is unrealistic. Paisey et al. (1990) also suggested that as the cost for a comprehensive functional analysis and proactive treatment becomes more formidable, the likelihood of the use of more aversive and punitive (and less expensive) treatments increases.

Recent investigations, however, have demonstrated that functional analyses need not be overly time consuming and that meaningful results can be obtained even in an outpatient setting in as little as 90 min (Cooper, Wacker, Sasso, Reimers, & Donn, 1990; Northup et al., 1991). Yet, the complexity of these procedures, their applicability to typical settings, and the long-term maintenance of treatments derived from functional analysis all remain of substantial concern to many direct-care staff members and teachers. Therefore, systematic evaluations of the applicability of functional analysis procedures and the resultant treatment recommendations are needed. These evaluations should address the effectiveness of treatments derived from a prior functional analysis and should include as-

Portions of this paper served as the PhD dissertation for the first author. This study was funded, in part, by the Iowa Department of Special Education and the Iowa University Affiliated Facility. However, the opinions expressed in this paper should not be considered as reflecting the positions of either agency. We would like to thank Steve Maurer, the proactive treatment teams in Cedar Rapids and Dubuque, and the participating students and their families.

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assessment of the long-term maintenance of treatment effects as well as direct observation of treatment integrity. The primary purpose of this investigation was to study these outcomes with 5 children who displayed severe behavior problems in two local school settings. The primary research questions were: (a) Could local school personnel, with provision of in-service training and technical assistance, conduct functional analyses within the practical constraints of a school setting? (b) Did the results of a prior classroom-based functional analysis lead to the subsequent development of individualized treatments that were effective? (c) Given that an individualized treatment was developed and was initially effective, did local personnel continue to implement the treatment with integrity over time? (d) If so, were the initial treatment effects durable over time?

METHOD

Students and Teachers

The students were 5 children from 5 to 11 years of age. Each student functioned in the severe to profound range of intellectual disability. At the time of referral, all students were served in self-contained special education classrooms for students with severe to profound disabilities. One student (Rebecca) was integrated into a multicategorical classroom for half the day.

Students were selected for participation by trans-disciplinary teams consisting of local professional school personnel from two school districts. The teams selected students for participation on the basis of the following criteria: (a) The student displayed severe, challenging behavior; (b) the behavior presented a substantial risk of imminent harm to the student or others; (c) the student was being considered for a more restrictive educational placement because of challenging behavior; and (d) the student was under 12 years of age. The 5 students in this study were the first 5 identified by the local teams. Each was placed in a different classroom and had a different teacher.

Mike was 5 years old and was referred for severe self-injury, which consisted of repeatedly banging

his head against any available surface. Mike also hit his head with his hand, but with greater variability in frequency and intensity. He had no formal means of communication. Mike received Dilantin® for seizure control and Nembutal®, as needed, for sedation. At school he was restrained in a chair with lap and leg straps, and attempts at self-injury were blocked. Mike resided at home with his parents.

Rebecca was 6 years old and was referred for severe self-injury. Rebecca had Goltz syndrome and was severely visually impaired in her left eye; development of her palate and right leg were incomplete. Corrective surgery for her palate was completed during the course of this investigation. She had been previously fitted with a prosthesis for her right leg and was able to walk with assistance. Rebecca repeatedly banged her head on any available hard surface, struck herself in the face with her prosthesis, and hit herself in the face and head with a closed fist. These behaviors often caused bruising and lacerations. Rebecca did not speak but had a repertoire of manual signs. At school, restraint consisted of lap and leg straps and one-on-one staffing by an aide to block attempts at self-injury. Rebecca was not receiving medication during the course of this investigation. She resided at a local residential facility.

Heidi was 11 years old and was referred for aggressive behavior, which consisted of attempts to pull hair, hit, and grab adults and peers. Heidi was verbal and used single-word utterances. She had no physical impairments or medical concerns, did not receive medication during this study, and resided at her parents' home.

Kit was 9 years old and was referred for self-injury, which consisted of repeated hits to the side of her head with a closed fist. Kit had no formal means of communication. She was also visually impaired, had a slight hearing loss, and was non-ambulatory. She resided at a local residential care facility, and did not receive medication.

Jane was 8 years old and was referred for self-injury, which consisted of frequent hand mouthing. This behavior resulted in reddening of the skin, tissue breakdown, and the development of calluses. She had no formal means of communication, and

was blind and nonambulatory. She did not receive any medication and resided at a local residential care facility.

The participating teachers were all certified in special education, with a range of experience from 1 to over 10 years. None had previously used functional analysis or functional communication training procedures. All were volunteers in the study. The remainder of the teams in each school district consisted of other certified teachers, a speech therapist, a school psychologist or psychology associate, and a building principal.

Setting and Materials

All assessments and interventions were conducted in each child's special education classroom. A standard VHS video recorder was used to record all sessions. Battery-activated microswitches were used to activate taperecorded messages and to activate various sensory stimuli (e.g., music, fans, toys).

Response Definitions

Target behaviors of students. Up to five different classes of responses were recorded for each student: (a) one or two topographies of self-injurious or aggressive behavior, (b) appropriate behavior, (c) other inappropriate behavior, and (d) manding. The topographies of self-injurious or aggressive behavior were individually defined for each participant.

Appropriate behavior was defined as active engagement with a task, toy, or other materials; compliance with requests; or any positive social interaction. *Inappropriate behavior* included engaging in any maladaptive behavior or nonfunctional behavior other than self-injury or aggression. Non-compliance, crying, and stereotypy were always defined as inappropriate. *Manding* was defined as the occurrence of any recognizable verbalization, the display of any sign or previously learned idiosyncratic gesture, or activation of a taped message via a microswitch that requested attention, task termination, or a tangible item.

Target behaviors of teachers. Five possible behaviors were recorded for each teacher. These re-

sponses were recorded after the occurrence of a target behavior (self-injury, aggression, or manding) and included (a) ignore (no interaction during at least one 10-s interval), (b) attention (the presentation of social attention), (c) tangible (the presentation of any prespecified object or item), (d) escape (the termination of any ongoing task or activity), and (e) physical guidance.

Treatment integrity. The five teacher responses to student target behaviors were scored to assess the integrity of all assessment and intervention procedures. Each assessment and intervention procedure always specified a particular consequence that was to follow any occurrence of target behavior immediately. The percentage of student target behaviors that were followed (within two 10-s intervals) by the specified consequence served as an index of treatment integrity and provided a measure of the accuracy with which assessment and intervention procedures were implemented. Treatment integrity was scored only when the behavior for which a consequence was prescribed occurred.

Data Collection

All observations were videotaped by local school personnel and were scored by the authors using a 10-s partial-interval recording procedure. All analogue assessments were videotaped in their entirety. During treatment, weekly videotaped probes were collected by local staff. Initially, data were collected only during times of active treatment. Following acquisition of the alternative response, videotaped data were collected randomly at various times and across school activities.

Interobserver Agreement

A second observer independently collected data on an average of 36% of all functional analysis sessions and 26% of all treatment sessions. Interobserver agreement was scored separately for each target behavior on an interval-by-interval basis. An agreement was scored when both observers recorded the occurrence of a student or teacher target behavior. Interobserver agreement was calculated by dividing the number of agreements for each interval by the number of agreements plus disagreements

for each interval and multiplying by 100%. Overall agreement was 93% during the functional analyses (range, 86% to 98%) and 85% during treatment (range, 78% to 94%).

Design

A within-session alternating treatments design was used to evaluate analogue assessment results. For 4 of the 5 participants, the contingencies for appropriate and inappropriate behavior were reversed during at least one treatment session (Northup *et al.*, 1991). A reversal was not conducted for Heidi, because treatment effects that were acceptable to local personnel were not obtained.

Training and Technical Assistance

All participating teachers attended an initial 2-day workshop on behavioral assessment and treatment of severe behavior disorders. The workshop was conducted by the authors, who emphasized functional analysis procedures. The workshop consisted primarily of lecture and discussion by the authors in each of the following areas: (a) identifying and defining severe behavior problems; (b) motivational sources for severe behavior problems; (c) behavioral assessment, including descriptive recording of target behaviors (ABC assessment) and functional analysis using analogue conditions; and (d) single-case design and evaluation procedures. Following the presentation, participants worked in teams (called proactive treatment teams) to develop a sample assessment and intervention procedure for a particular student. At least one analogue assessment with children not targeted in this study was conducted in each school by the first author to model the assessment procedures. Further coaching and suggestions were provided as needed and were gradually decreased as individual team members became proficient in developing and implementing the procedures. The first author provided on-site technical assistance to each of the schools. Weekly half-day visits were made to one of the schools, and full-day visits were made every other week to the other school. Technical assistance consisted of student-specific consultation, the development and modeling of specific interventions, and participation in

weekly or bimonthly team meetings. All consultation was collaborative, and a choice of appropriate assessment and treatment procedures was provided in response to specific requests for direction. The first author was present throughout all brief functional analyses (with the exception of Kit) and briefly observed treatment procedures during each school visit.

Preassessment

A review of each child's school and medical records, teacher interviews, and informal classroom observations were conducted prior to all analogue assessments. Preassessment observational data were collected during naturally occurring classroom activities that typically varied in the degree of structure, task demands, or teacher attention. These observations were conducted by the authors using a 6-s partial-interval recording procedure, and the results were reviewed by the child's teacher and the treatment team. Information collected during preassessment was used by the treatment team to develop specific functional hypotheses concerning potential maintaining contingencies (Repp, Felce, & Barton, 1988) and to select the specific tasks, materials, people, and procedures to be used in later analogue conditions.

Mike. Preassessment observations for Mike were conducted during morning opening activities (a minimally structured group activity), a task from his individual education plan (IEP) (a highly structured one-on-one "tactile stimulation" activity), and free play. Self-injury occurred most frequently during the IEP task, leading to a hypothesis of negative reinforcement.

Heidi. Preassessment observations for Heidi were conducted during morning opening activities, grooming, vacuuming (an IEP task), and free play. Heidi displayed aggressive behavior only during the grooming and vacuuming activities, a result that was consistent with her teacher's report of her resistance to demands. Thus, negative reinforcement was the hypothesized operant mechanism.

Rebecca. Preassessment observations were conducted for Rebecca during art, math, and free-play activities. Rebecca consistently displayed high rates

of self-injury during all activities. However, math instruction appeared to result most consistently in high rates of self-injury, and substantially lower rates were observed when she received nearly continuous attention (play with her teachers). The treatment team hypothesized that self-injury occurred most frequently, and with greatest severity, during demand conditions; however, they also suggested that attention might be a maintaining variable in at least some circumstances.

Kit. Preassessment observations were conducted during mealtimes, tooth brushing, and when she was alone with toys. Self-injury did not appear to vary systematically across these conditions. Nevertheless, it remained her teacher's opinion that self-injury occurred most frequently in demand situations. Kit's teacher also identified music as a likely reinforcer.

Jane. Preassessment observations were conducted when Jane had access to a switch to activate music (the treatment at that time), when she had to wait (alone), and during a play activity with her teacher. Her teacher had reported that hand mouthing was not a problem during demanding activities. No tangible reinforcers were identified during preassessment, and access to music had been unsuccessfully used as a consequence prior to this investigation. Preassessment observations suggested that access to sensory stimuli typically resulted in an immediate but brief reduction in hand mouthing, and the possibility of attention as a maintaining consequence was unclear. Thus, although the treatment team hypothesized that Jane's hand mouthing was maintained primarily by sensory or automatic reinforcement, an attention condition was included in the functional analysis.

Brief Functional Analysis

A brief functional analysis followed preassessment to confirm or disconfirm the functional hypothesis. Assessment conditions were based on those used by Iwata et al. (1982), Carr and Durand (1985), and Wacker, Northup, and Cooper (1992). All functional analyses were conducted in the students' classrooms; for each student, the classroom teacher or an educational consultant presented all

activities and was responsible for all contingencies for the occurrence of a target behavior. Other students remained in the classroom and continued with scheduled activities. All functional analysis sessions lasted 10 min. We recommended that analogue assessments be continued until the results were clear and convincing, but the decision to continue or terminate assessment was up to the local team. For 3 students (Mike, Heidi, and Rebecca), attention, escape, and tangible reinforcement were manipulated as consequent events. For 2 students (Kit and Jane), attention and sensory stimuli were assessed as antecedent events.

Mike. Analogue assessment conditions, consisting of attention, escape, tangible, and free play, were conducted as described by Iwata et al. (1982). The escape condition, which resulted in the highest occurrence of the target behavior, was presented three times. Each of the other analogue conditions was presented twice.

Heidi. Only escape and attention analogue conditions were conducted to test the negative reinforcement hypothesis most efficiently. A total of four escape conditions and three attention conditions were completed.

Rebecca. Escape, attention, and alone conditions were assessed for Rebecca. Because it was not possible to leave Rebecca unattended, an examiner remained present during the alone condition, and self-injury was either ignored or blocked. Due to the severity of her self-injury, analogue conditions were terminated following one session of each condition.

Kit. The brief functional analysis consisted of escape, attention, and free-play conditions, as well as two conditions that assess different levels of sensory stimuli. A "high sensory" condition consisted of providing a fan, battery-activated toys, music, and preferred tangible items continuously throughout the session. A "low sensory" condition consisted of providing only continuous music.

Jane. Analogue assessment consisted of a high sensory condition (as with Kit), and high and low social-attention conditions. The high social-attention condition consisted of both the teacher and the first author interacting enthusiastically with her and

providing tactile stimulation (i.e., stroking her hair, lightly touching her arm or back). The low social-attention condition consisted of quietly reading a story to her with no tactile stimulation. Both the sensory stimuli and attention were provided continuously throughout the conditions.

Treatment

For 4 of the 5 students, the results of the analogue functional analysis were used to develop individualized interventions. For Mike and Heidi, the operant mechanism identified was negative reinforcement, and treatment consisted of escape extinction and mand training. For Kit and Jane, the antecedent events that resulted in the lowest frequency of target behavior were incorporated into the intervention by providing the students with an appropriate way to obtain them (music and attention) on a differential reinforcement schedule. The intervention for Rebecca was based primarily on preassessment information and her teacher's hypotheses. Mand training was initiated to both take breaks and gain attention. Following the students' independent use of the targeted mand, observations were conducted across different activities to assess generalized use of the mand by the student and generalized use of the treatment by the teacher.

Mike. Mike was given a brief break (30 s to 1 min) contingent on pressing a button microswitch that activated the taped message, "I'd like a break now, please." The button switch, placed on his shirt, was positioned so that pressing the switch approximated use of the "please" sign; the switch was later removed. The same task used during the analogue assessment was used in treatment. Mike was seated at a small table and the teacher provided hand-over-hand prompting to assist him with handling the various tactile items. Approximately once per minute, Mike was prompted to use the manding response, beginning with a verbal prompt ("Would you like a break?"), followed by a partial physical prompt, and finally complete physical guidance. Immediately following any display of the manding response, prompted or unprompted, Mike was provided with the break; he left the table, lay on a pillow, and listened to music. When self-injury occurred, Mike was immediately returned to

the activity, and a break was not allowed for an additional 30 s. These structured treatment sessions were conducted once or twice daily for 10 to 20 min. When Mike began to consistently use the manding response independently, treatment was extended throughout the school day.

At the beginning of the next school year, a brief contingency reversal was conducted for one session, in which all signing was ignored and Mike was allowed to escape or delay a demanding task via self-injury.

Heidi. A very similar treatment occurred for Heidi. A brief break was provided contingent on her display of the "please" sign. The sign was taught during structured teaching sessions that were initially conducted daily for approximately 10 min during a personal grooming time. All other procedures were similar to those described for Mike.

Rebecca. Treatment addressed both attention and escape as possible maintaining variables. Rebecca already had a repertoire of signs; therefore, it was not necessary to teach new signs to request a break or attention. During demand situations, Rebecca could briefly terminate the activity, for approximately 30 s, by signing "no." Approximately every minute, Rebecca was given the verbal prompt to "Sign no if you want a break." If she signed "no," she was then immediately given a brief break. If she did not sign "no," the teacher simply continued with the task. If Rebecca made any attempt to engage in self-injurious behavior, the attempt was blocked if possible, accompanied by the statement "no hitting," and the task continued without opportunity for a break for at least an additional 30 s. During free time or preferred activities, Rebecca could request assistance or continued attention by signing either "help" or "more." Brief time-out, consisting of turning her chair away from everyone present and all activities for approximately 30 s, followed self-injury. The use of time-out or physical guidance was always dependent on the context (demand times or free times) and Rebecca's most recent mand (to receive a "break" or "attention"). However, a degree of inference was required of the teacher.

At the beginning of the next school year, a contingency reversal was implemented for one session.

During this session, Rebecca was given a 10- to 15-s break from an IEP task after any occurrence of self-injury, and all signs were ignored.

Kit. Treatment for Kit consisted of providing her with a microswitch that activated music on a cassette player. During alone or unstructured times, Kit was positioned near the cassette player and was provided with the switch. Because the optimal volume was at times disruptive to ongoing classroom activities, Kit was taught to wear headphones. Initial training sessions were conducted in which all attempts at head hitting were blocked and prompts to use the switch were provided approximately every 30 s. When a switch could not be made accessible, Kit was given continuous access to music on a differential reinforcement (DRO) schedule; the music was briefly shut off if she hit herself. Reversals, involving removal of access to music, occurred after Sessions 14, 24, 35, and 43.

Jane. A small cassette player and microswitch were fastened to the lap tray of her wheelchair. The cassette player was activated by the microswitch and played the prerecorded message, "Please come here." Initially, structured teaching sessions were conducted for approximately 10 min daily. During these sessions, Jane was prompted to use the microswitch approximately every 30 s with a least-to-most prompt sequence. If Jane used the switch, prompted or unprompted, the teacher attended to her for 15 to 30 s. The teacher then gave the verbal prompt, "If you want me, just use the switch," and ignored her until the next prompt. Any attempts to place her hand in her mouth were blocked, or her hand was removed from her mouth, with no verbal statements or other interactions. When Jane began to use the switch independently, the switch and cassette player were made available throughout the day. As with Kit, a DRO schedule (for attention) was added when a switch could not be made available. A reversal involving removal of the switch to request attention was conducted after Session 20.

RESULTS

Individual results are provided for each participant in Figures 1 through 5, and include the results

of the brief functional analyses, overall treatment effects, and treatment integrity.

Mike. During the functional analysis, the greatest percentage of intervals of Mike's head banging occurred during the escape condition ($M = 55\%$; range, 29% to 78%). There was an initial substantial reduction in self-injury during treatment, followed by a gradual decline to zero or near-zero occurrence (Figure 1). However, some mild self-injury continued to occur occasionally. A corresponding increase in general appropriate behavior was also observed, along with generalization of Mike's use of the please sign across different (untrained) activities at school. The reversal session resulted in an immediate increase in head banging from 15% to 39% of intervals, followed by an immediate decrease to 14% when treatment was reinstated. All restraint was discontinued.

Assessment of treatment integrity indicated that physical guidance was implemented during a mean of 52% of the intervals after instances of self-injury. Provision of a brief break occurred during 80% of the intervals after Mike's use of the "please" sign.

Heidi. The percentage of intervals of aggression during the functional analysis was greatest during the escape conditions ($M = 13.5\%$; range, 8% to 24%). The mean percentage of intervals for the attention conditions was 1.3% (range, 0 to 2%). During treatment, there was an initial reduction in the percentage of intervals of aggression; however, no further reductions were achieved, and aggression continued to occur occasionally (Figure 2). Given the severity of the aggression, the results were not acceptable to the teacher. In addition, Heidi rarely displayed the "please" sign without prompting. As a result, the treatment was not continued during the 2nd year, and ongoing evaluation was terminated. The percentage of intervals that were videotaped was also low (less than 50% of that requested) and resulted in a substantially reduced amount of data. Physical guidance was used an average of 72% of the time after any instance of aggression, and a brief break was provided after use of the "please" sign during an average of 76% of the intervals.

Rebecca. For Rebecca (Figure 3), self-injury occurred at a high rate across all analogue conditions

Figure 2. Results of the functional analysis (top panel), percentage of intervals of aggression and appropriate behavior (middle panel), and treatment integrity (bottom panel) for Heidi.

Figure 3. Results of the functional analysis (top panel), percentage of intervals of self-injury and appropriate behavior (middle panel), and treatment integrity (bottom panel) for Rebecca.

Figure 4. Results of the functional analysis (top panel), percentage of intervals of self-injury and appropriate behavior (middle panel), and treatment integrity (bottom panel) for Kit.

during the brief assessment, with a slightly higher percentage of intervals during the escape and attention conditions (63% and 58% of intervals, respectively). Treatment resulted in an immediate reduction in overall self-injury. However, continued reductions occurred very gradually and with considerable variability. Overall, a downward trend was maintained, and self-injury began to reach zero or near-zero levels after approximately 9 months of treatment. A corresponding increase in general appropriate behavior was also observed.

The reversal session resulted in an immediate increase in both the occurrence and severity of self-injury; self-injury occurred during 89% of the intervals. Self-injury was again reduced to zero when treatment was reinstated. Treatment was continued during the following school year, and zero to near-zero rates of self-injury continued. Rebecca used the "no" and "help" signs progressively less throughout this investigation; however, she did continue to use them sporadically. More important, Rebecca's overall appropriate behavior increased substantially, and all physical restraint was discontinued. Physical guidance was used an average of 27% after self-injury, and a brief break (or "more," as appropriate) was provided during an average of 80% of the intervals.

Kit. The functional analysis indicated that zero to near-zero levels of head hitting could be consistently obtained by providing Kit with mildly loud music. Treatment results showed an immediate substantial reduction in head hitting, with some variability (Figure 4). Informally, it was noted that the continued variability occurred primarily during times when music could not be made available (e.g., while turning the cassette over). Treatment results also indicated substantial increases in general appropriate behavior and switch activation that continued throughout the investigation. During each reversal, head hitting substantially increased and general appropriate behavior decreased. Treatment integrity was 100%.

Jane. The results of the functional analysis indicated that hand mouthing was lowest when Jane was provided with noncontingent attention. The mean percentages of intervals during high and low

attention conditions were 12% and 16% of intervals, respectively, in comparison to a mean of 72% of intervals during the alone conditions (Figure 5).

Treatment produced an immediate reduction in hand mouthing, and hand mouthing occurred at zero or near-zero levels throughout the course of treatment. There was a substantial increase in general appropriate behavior, and the percentage of intervals of switch activation remained relatively consistent. The reversal resulted in an immediate increase in hand mouthing ($M = 37\%$) and a corresponding decrease in general appropriate behavior ($M = 66\%$). Treatment integrity was 100%.

DISCUSSION

This investigation demonstrated that useful (experimental) functional analyses were conducted by local school personnel, treatments were based on the results of the assessment, and, for 4 of 5 students, durable results were obtained for approximately 17 months. In each case, the functional analysis was brief; however, each resulted in the development of a unique (individually matched) effective treatment.

The preassessment activities in this investigation appeared to be essential for hypothesis development and may have greatly enhanced the efficiency of subsequent analogue assessments (e.g., Heidi). For Mike and Heidi, the probable behavioral function was relatively clear given the preassessment, and treatment was consistent with the teacher's initial hypotheses. An effective treatment was also developed for Rebecca based largely on her teacher's hypotheses. However, for Kit and Jane, the results of the analogue assessments suggested effective treatments that would not have been recommended based on initial hypotheses. Thus, the brief functional analyses were necessary to confirm or disconfirm initial hypotheses and yet were efficient. The necessity of conducting functional analyses has been discussed in detail elsewhere (Iwata, Vollmer, & Zarcone, 1990), as has the utility of brief functional analysis (Cooper et al., 1990). Overall, the present results replicate these previous findings. The current results extend previous findings by

Figure 5. Results of the functional analysis (top panel), percentage of intervals of self-injury and appropriate behavior (middle panel), and treatment integrity (bottom panel) for Jane.

showing the efficacy of local school-based treatment teams. In addition, for each participant, the local treatment teams chose to conduct a brief functional analysis although they were given no explicit directions that this was necessary. Anecdotally, teachers commented that they preferred the brief functional analysis over descriptive assessment because changes in behavior were often more clearly observable. Similar results were reported by Sasso *et al.* (1992).

The results of this study also support previous findings concerning the durability of treatment effects with functional communication training (Bird, Dores, Moniz, & Robinson, 1989; Durand & Carr, 1991). For 3 of 4 students, functional communication was a major component of the treatment, and these mands were maintained for an extended period of time. However, the frequency of the target mands was often low, and for 2 students (Mike and Rebecca), there was a consistent downward trend in the use of the mands. Although rather puzzling, this is consistent with previous findings that functionally equivalent responses need not be used at rates equal to that of the inappropriate behavior in order to maintain treatment effects (Durand & Carr, 1992).

The high degree of variability in treatment integrity raises a number of questions. The literature currently does not address the issue of deviations from treatment protocols and subsequent behavior change. It is probable that there is a range in which treatment must be implemented with integrity to obtain meaningful results, although currently there is neither a rational nor an empirical basis for determining what that range might be (Gresham, 1989). The treatment integrity data in this investigation illustrate that treatment is not a unitary phenomenon, but rather consists of multiple components. In this investigation, treatment integrity varied greatly across even the two classes of components (for appropriate and inappropriate behavior) of the treatment that were considered most essential. In general, when treatment integrity is known to be low, it may be difficult, if not impossible, to reach conclusions about treatment effectiveness. However, the reversals that were ob-

tained in this study strongly support the effectiveness of treatment. It is also unlikely that these results would have occurred spontaneously for these students. Thus, it appears that integrity, as measured in this study, can vary substantially without total disruption of treatment effectiveness. In future analyses of long-term maintenance, it may be useful to study the relationship between integrity and effectiveness.

Although in some instances local treatment teams effectively functioned independently of any technical assistance, this investigation did not demonstrate that technical assistance can be completely withdrawn. Ongoing access to "expert" consultation, even if brief, may be essential to facilitate integrity of the procedures over time and across replications. However, our results demonstrated that it is possible to transfer functional analysis technology to classroom settings and that there may be clear benefits for doing so.

REFERENCES

- Axelrod, S. (1987). Functional and structural analysis of behavior: Approaches leading to reduced use of punishment procedures? *Research in Developmental Disabilities*, 8, 165-178.
- Bird, F., Dores, P. A., Moniz, D., & Robinson, J. (1989). Reducing severe aggressive and self-injurious behaviors with functional communication training. *American Journal of Mental Retardation*, 94, 37-48.
- Carr, E. G. & Durand, M. V. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis*, 18, 111-126.
- Cooper, L. J., Wacker, D. P., Sasso, G., Reimers, T. B., & Donn, L. A. (1990). Using parents as therapists to evaluate appropriate behavior. *Journal of Applied Behavior Analysis*, 23, 285-296.
- Durand, M. V., & Carr, E. G. (1991). Functional communication training to reduce challenging behavior: Maintenance and application in new settings. *Journal of Applied Behavior Analysis*, 24, 251-264.
- Durand, M. V., & Carr, E. G. (1992). An analysis of maintenance following functional communication training. *Journal of Applied Behavior Analysis*, 25, 777-794.
- Durand, M. V., & Crimmins, G. (1988). Reducing severe behavior problems among persons with dual sensory impairments: An evaluation of a technical assistance model. *Journal of the Association for Persons with Severe Handicaps*, 12, 2-10.
- Gresham, F. M. (1989). Assessment of treatment integrity

- in school consultation and prereferral intervention. *School Psychology Review*, 18, 37-50.
- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1982). Toward a functional analysis of self-injury. *Analysis and Intervention in Developmental Disabilities*, 2, 3-20.
- Iwata, B. A., Vollmer, T. R., & Zarcone, J. R. (1990). The experimental (functional) analysis of behavior disorders: Methodology, applications and limitations. In A. C. Repp & N. N. Singh (Eds.), *Perspectives on the use of nonaversive and aversive interventions for persons with developmental disabilities* (pp. 301-330). Sycamore, IL: Sycamore.
- Lennox, D. B., & Miltenberger, R. G. (1989). Conducting a functional assessment of problem behaviors in applied settings. *Journal of the Association for Persons with Severe Handicaps*, 14, 304-311.
- Northup, J., Wacker, D. P., Sasso, G., Steege, M., Cigrand, K., Cook, J., & DeRaad, A. (1991). A brief functional analysis of aggressive and alternative behavior in an out-clinic setting. *Journal of Applied Behavior Analysis*, 24, 509-522.
- Paisey, T. J., Whitney, R. B., & Hislop, P. M. (1990). Client characteristics and treatment selection: Legitimate influences and misleading inferences. In A. C. Repp & N. N. Singh (Eds.), *Perspectives on the use of nonaversive and aversive interventions for persons with developmental disabilities* (pp. 175-197). Sycamore, IL: Sycamore.
- Repp, A. C., Felce, D., & Barton, L. E. (1988). Basing the treatment of stereotypic and self-injurious behaviors on hypotheses of their causes. *Journal of Applied Behavior Analysis*, 21, 281-289.
- Sasso, G. M., Reimers, T. M., Cooper, L. J., Wacker, D., Berg, W., Steege, M., Kelly, L., & Allaire, A. (1992). Use of descriptive and experimental analyses to identify the functional properties of aberrant behavior in school settings. *Journal of Applied Behavior Analysis*, 25, 809-821.
- Steege, M. S., Wacker, D. P., Berg, W. K., Cigrand, K. K., & Cooper, L. J. (1989). The use of behavioral assessment to prescribe and evaluate treatments for severely handicapped children. *Journal of Applied Behavior Analysis*, 22, 23-33.
- Wacker, D. P., Northup, J., & Cooper, L. (1992). Behavioral assessment. In D. E. Greydanus & M. L. Wolraich (Eds.), *Behavioral pediatrics* (pp. 57-68). New York: Springer-Verlag.

Received October 13, 1992

Initial editorial decision November 25, 1992

Revisions received March 26, 1993; July 14, 1993;

September 8, 1993

Final acceptance September 8, 1993

Action Editor, Robert Horner