Generalized Reduction of Problem Behavior of Young Children With Autism: Building Trans-Situational Interventions

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Abstract
The effects of functional communication training on the generalized reduction of problem behavior with three 4- to 5-year-old children with autism and problem behavior were evaluated. Participants were assessed in primary teaching settings and in three secondary, generalization settings. Through baseline analysis, lower effort interventions in the secondary settings were documented as ineffective when implemented alone. Higher effort interventions incorporating functional communication training were documented within a multiple baseline design to reduce problem behavior in the primary setting, but not in secondary settings until the lower effort interventions were re-introduced. Results demonstrate the need for trans-situational interventions based on a common functional assessment hypothesis across settings and including intensive interventions that enhance the effects of lower intensity interventions.

Generalization is a defining feature of applied behavior analysis (Baer, Wolf, & Risley, 1968). Typically, generalization is assessed by examining the extent to which intervention effects obtained in one context are replicated in settings in which the intervention was not delivered, with non-trained personnel, or with stimuli not included in the initial training (Stokes & Baer, 1977). A goal in applied behavior analysis is to develop a technology of behavior change that not only results in socially important improvement in behavior but improvement that (a) extends to all relevant parts of a person’s life, (b) sustains across time, and (c) results in real gains in the quality of life available to the person receiving support (Carr et al., 2002; Durand, 1990; Holburn & Vietze, 2002). To date, researchers have emphasized the generalization of newly acquired skills (e.g., academic, self-help, employment, community). Less attention has been given to the challenges associated with generalized reduction of problem behaviors (Carr, 1988; Durand, 1999; Lerman & Vorndran, 2002; Stokes, Fowler, & Baer, 1978). Our purposes here are to offer a conceptual model for studying generalized reduction of problem behavior and present one experimental example in which that model is applied.

A central distinction between generalization of acquired skills and generalization of response reduction is the assumption that for generalized response reduction, stimuli in the performance setting already control responding (albeit undesirable responding). Reduction of the existing problem behavior may be achieved through extinction and/or punishment, but these procedures may be difficult to administer with precision in applied settings and have not demonstrated compelling generalization or maintenance when used alone (Axelrod & Apsche, 1983; Lerman & Vorndran, 2002). For the past 15 years, in efforts to produce generalized reduction of problem behavior, researchers have adopted a more comprehensive, concurrent schedules model (Wacker, Cooper, Peck, Derby, & Berg, 1999) in which efforts are
made to (a) minimize presentation of stimuli discriminative for problem behavior; (b) teach new skills that will compete with the problem behavior; and (c) arrange consequences to minimize reinforcement of problem behavior, maximize reinforcement of more desired behaviors, and, where appropriate, punish problem behaviors (Carr et al., 1994; Durand, 1990; Koegel, Koegel, & Dunlap, 1996).

A schematic overview of this approach is provided in Figure 1. The shaded sequence of cells indicates the existence of problem behavior occasioned by discriminative and/or establishing stimuli and maintained by positive or negative reinforcement. In this model the problem behaviors are presumed to function as a response class, and the discriminative stimuli are presumed to be a stimulus class. Conventional behavior change efforts include independent and combined strategies for (a) modifying antecedent conditions, (b) instruction on desired and competing alternative responses, and (c) modification of consequences (Carr et al., 1994; Crone & Horner, 2003; Durand, 1990; O’Neill et al., 1997). The contingencies established for “desired,” “problem,” and “alternative” behavior form a concurrent schedules model.

When the goal of a behavior intervention is generalized and sustained reduction of problem behavior, the process for selecting behavior change procedures may take on added dimensions. First, a functional assessment may indicate the multiple stimulus conditions (e.g., routines) throughout the individual’s day in which problem behavior is, and is not, likely. Second, an intervention targeting stimulus manipulations may be designed around the type and variability of stimuli currently controlling problem behavior throughout the day. Third, an intervention targeting skill instruction may focus on new skills that will be appropriate across the situations/routines that currently occasion problem behavior. Fourth, the consequences that maintain problem behavior may be assessed across situations/routines, and consequence manipulations may be selected that are consistent with functional assessment results. Finally, the procedures associated with an intervention should be feasible across the range of situations where problem behavior is likely (Albin, Lucyshyn, Horner, & Flannery, 1996; Salentine, 2003).

These factors have direct concern not just for interventions implemented across different settings and times in a school or work setting, but for improving the generalized impact of an intervention conducted in one context (e.g., school) on behavior in another context (e.g., home or community setting). The development of a technology of generalized response reduction may, in some instances, involve simply implementing an effective intervention across all applicable contexts (Stokes & Baer, 1977). It is possible, however, that intensive and effective interventions may be implemented with high fidelity in one context but not be appropriate or feasible in other contexts where the problem behavior is performed. Comprehensive procedures that can be implemented in schools, for example, may be too demanding for implementation at home (Lerman & Vorndran, 2002). The need exists to define the features and controlling mechanisms of interventions that are both effective at reducing problem behavior under higher intensity “implementation conditions” and effective at reducing problem behavior under lower intensity generalization conditions.

One alternative is to propose the use of functional assessment information to define multiple interventions that share controlling antecedents and consequences but vary in their implementation intensity. It is possible that interventions requiring less effort to implement may be practical in one setting, but only after an intervention requiring more effort and skill from implementers is applied in another setting. The lower effort interventions would be consistent with the conceptual model and behavioral mechanisms defined by the functional assessment, yet fit easily with the skills, resources, values, and schedule of implementers in the generalization setting. The lower effort intervention may be insufficient to control responding if used alone. Yet, if the lower effort intervention is implemented at the same time, or following, implementation of a higher in-
tensity intervention, the lower effort intervention may become effective. The higher effort intervention would be designed not only to produce an effect in the primary intervention setting but to have trans-situational impact by establishing controlling conditions that also appear in the generalization settings (Harvey, Lewis-Palmer, Horner, & Sugai, 2003). Conceptually, the higher effort intervention in Setting A would change the skills or stimulus control needed to alter performance under the concurrent schedules available in Setting B, where only the lower effort intervention is available.

Durand (1999) offered an example of this pattern by documenting that functional communication training with assistive devices not only resulted in reduction in problem behavior in trained contexts but in novel community settings where the devices were also made available. Children used the devices to recruit adult attention and help in contexts where they previously had used problem behaviors to recruit adult attention and help. These data replicate earlier demonstrations that teaching functionally equivalent communication skills can be an effective strategy for both increasing use of the communication skills and decreasing problem behaviors in nontrained settings (Bird, Dores, Moniz, & Robinson, 1989; Durand & Carr, 1991, 1992). Beyond these encouraging examples, however, generalized reduction of problem behavior has proven elusive and has led to recommendations for a more complete model for obtaining generalized reduction of established problem behaviors (Iwata, Pace, Kalsher, Cowdry, & Cataldo, 1990; Koegel, Koegel, & Dunlap, 1996).

Our primary purpose in the present study was to assess the interaction effects of implementing a higher effort intervention (functional communication training) in one school context and a lower effort intervention (prompt and reward) in secondary school/home settings on (a) reduction in problem behavior and (b) increases in use of appropriate, functional communication skills.

Method

Participants

Three students enrolled in an early intervention program for children with autism spectrum disorder participated. The students were selected based on (a) nomination from their teacher as a student with significant problem behaviors, (b) enrollment in an early intervention program, (c) a formal diagnosis of autism spectrum disorder or a related developmental disability by a certified psychologist using standardized diagnostic tools (Krug, Arick, & Almond, 1980; Lord, Rutter, & LeCouteur, 1994), and (d) observed levels of problem behavior (e.g., tantrums, screaming, biting) in multiple school routines (e.g., free play, snack, one-on-one instruction) and in their home settings. Informed parental consent was obtained for all 3 students. Consent from teachers and assistants who worked directly with these students also was obtained. None of the students was taking medications to control problem behavior.

Neal (a pseudonym) was a 5-year-old boy diagnosed with autism and Charge syndrome. He used one-word utterances and nonvocal gestures to communicate, was not toilet trained, and needed considerable assistance with most self-help skills, such as dressing and bathing. His teachers and parents were concerned about his aggressive behavior toward adults (e.g., pinching, biting, hair pulling, tantrums, throwing objects).

Ellie, a 4-year-old girl diagnosed with autism, had a vocabulary of 2 to 5 words, which she used when prompted. She was not toilet trained, but could complete most age-appropriate self-help skills with minimal guidance. Her teachers and parents were mainly concerned with her high-pitched and frequent screaming and tantruming.

Kit, a 4-year-old boy with autism, used 1- and 2-word utterances. He was not toilet trained and needed full assistance with self-help skills. His teachers and parents were mainly concerned with his tantrumming and noncompliant behavior. They also reported biting, throwing objects, and hitting others as behaviors that were social and learning barriers.

Setting

Data collection occurred in three preschool settings (one-on-one intensive training, explore time, and snack) and one routine at home. The one-on-one training setting served as the primary setting for analysis. The one-on-one setting was in the preschool, and students worked one-on-one on academic and social skills with a teaching assistant in individual cubicles. The other preschool settings and the home context served as secondary settings. Explore time was in an open area of the preschool, and students engaged in free play and sensory-based activities. Students were expected to
spend a limited amount of time (5 to 7 minutes) with each activity, and then they were prompted by an assistant to move to the next activity. The snack setting was at a 1.25 m × 2.5 m table in the preschool where the students sat with the rest of their classmates. Neal’s home sessions were conducted in an extra bedroom with a desk. Ellie’s home sessions were conducted in her bedroom. Both students were asked to work on activities similar to those in their one-on-one training setting at school. Kit’s home activity involved transitions in the family room among different tasks similar to those used in explore time at school (e.g., computer time, jumping on bed/trampoline, puzzles, drawing, and work boxes).

At least one parent was present during home sessions. Parents implemented the interventions in their own homes. Assistants implemented the interventions at school. Both parents and assistants were trained in intervention procedures by the first author during two 60-minute training sessions. The first author also provided parents/assistants with a review of procedures prior to daily sessions and a review of procedural fidelity following sessions.

**Preferred Activities and Materials**

Teachers and parents were asked to nominate more preferred activities/materials and less preferred activities/materials for each student from the normal activities/materials experienced during a typical school day. Nominated activities were presented individually to each student on two occasions, with order of presentation randomized. An activity or object was determined to be “more preferred” if the student interacted with the activity or object for at least 10 seconds without engaging in problem behavior during a brief observation. Activities or objects were determined as less preferred if the student engaged in problem behavior within 1 minute of being presented with the activity or object during a brief observation.

**Measurement**

**Functional Behavioral Assessment.** A modified version of the Functional Behavioral Assessment Interview, developed by O’Neill et al. (1997), was used with a parent and a teacher to identify problem behaviors and controlling variables for each student. The purposes of these interviews were to identify (a) establishing operations, (b) antecedent stimuli, (c) problem behaviors, and (d) maintaining consequences (Carr et al., 1994; Dunlap et al., 1993; Durand, 1990). Following guidelines recommended by O’Neill et al. (1997), we summarized each interview into one or more hypothesis statements that were used to guide the design of interventions. No establishing operations were identified in the interviews as important controlling variables for the problem behaviors. For each of the students, the hypothesis statements from the parent interview and the teacher were consistent.

For Neal, the assessment interviews indicated that his pinching and whining responses were perceived as most likely in situations where he was engaged in a less preferred activity and a more preferred activity was accessible. His problem behaviors were perceived to be maintained by access to the more preferred activity. The team selected the functional communication training skill of pointing either to the more preferred activity or a picture of the more preferred activity as an instructional target for Neal. For Ellie, the functional assessment interviews indicated that her screaming was most likely to occur in situations where she was engaged in any activity in which she was being unsuccessful (e.g., unable to make pieces fit together). Her screaming was perceived to be maintained by escaping the aversive features of the activity by obtaining assistance from adults. The functional communication training skill for Ellie was to request “help” by either pointing to a 7.5 cm × 12.5 cm help card or saying the word help. For Kit, the functional assessment interviews indicated that his screaming, whining, and noncompliance were most likely to occur when an adult asked him to transition from one activity to another. The perceived preference of the activities was not identified as an important variable. A request to transition from Activity A to Activity B was perceived as equally likely to result in problem behavior as a request to transition from Activity B to Activity A. The important feature identified in the interviews was that Kit found transition to a new or unanticipated activity aversive. Kit’s problem behaviors were perceived to be maintained by avoiding transitions to unpredictable activities. His functional communication skill was to use a communication book in which a teacher’s prompt to engage in a transition was followed first by placement of a “change” card (a 5 cm × 5 cm card with a black question mark) in his book, then placement of a similar-sized card.
Functional Communication Training

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Table 1. Hypothesis Statements for Each Student

<table>
<thead>
<tr>
<th>Student</th>
<th>Presumed antecedent</th>
<th>Problem behavior</th>
<th>Presumed maintaining consequence</th>
<th>Functional communication training skill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neal</td>
<td>Engaged in less preferred activity with more preferred activity available</td>
<td>Pinch adult, whine</td>
<td>Gain access to more preferred activity</td>
<td>Point to more preferred activity or picture of more preferred activity in a communication book</td>
</tr>
<tr>
<td>Ellie</td>
<td>Engaged in an activity where she was not being successful</td>
<td>Scream</td>
<td>Escape aversive features of activity by gaining adult assistance</td>
<td>Point to “help” card and/or say “help”</td>
</tr>
<tr>
<td>Kit</td>
<td>Request to transition from one activity to another</td>
<td>Scream, whine, failure to follow transition prompt within 1 minute</td>
<td>Avoid transition to unpredictable activity</td>
<td>Use of “change” card and “activity” cards</td>
</tr>
</tbody>
</table>

depicting his current activity, and finally a card depicting the new activity. After the cards were placed in the communication book, the teacher repeated the transition prompt. Kit’s functional communication skill was intended to avoid aversive transitions by improving his ability to receive information from his teacher or parent about the onset of a transition and the specific activities involved in the transition.

A summary of the functional assessment hypotheses for each student and the functional communication responses selected based on these hypotheses are provided in Table 1.

Problem behavior. The primary dependent variable was the percentage of direct observation intervals with problem behavior. Direct observation was conducted in each of the four settings (e.g., three school settings and home setting) for each student using 10-second partial-interval scoring within 10-minute observation sessions. An interval was recorded as including problem behavior if at any point in the interval the student engaged in screaming, whining, biting, pinching, hitting, hair pulling, or object throwing.

Functional communication skills. A secondary dependent variable was the percentage of observation intervals with “functional communication skills.” Functional communication training skills were identified as socially appropriate responses that were (a) perceived as equal or more efficient than problem behaviors (cf. Horner & Day, 1991) and (b) produced the same maintaining function as the problem behaviors. These types of skills were identified per student using procedures recommended by Carr et al. (1994) and O’Neill et al. (1997) and are listed in Table 1. Measurement of functional communication skills followed the same protocol used with problem behaviors.

Perceived contextual fit. During the last week of the study, the perceived “effort to implement” and feasibility of each intervention/condition was assessed by parents and teachers/assistants. A 6-point Likert-like scale (1 = low; 6 = high) was used to assess (a) the overall effort to implement behavior support, (b) the resources (time/materials) needed to implement behavior support, (c) the technical skills needed to implement behavior support, (d) the degree to which personal values were consistent with intervention procedures, and (e) the perception that the intervention was in the best interest of the students (cf. Albin et al., 1996). Parents rated the three phases of the study in which they participated (baseline, Low Effort 1, and Low Effort 2). Teachers and assistants rated all four phases (baseline, Low Effort 1, Low Effort 2, functional communication training).

Interobserver Agreement

Interobserver agreement data were collected for problem behavior and functional communi-
cation skills during 49 of the 76 sessions (64%) distributed nearly equally across all students, settings, and phases. Interobserver agreement for problem behavior was calculated by dividing the number of intervals with exact agreement by the total number of observation intervals multiplied by 100%. Interobserver agreement for problem behavior averaged above 94% for each student, with Kappa scores of .73, .72, and .81 for Neal, Ellie, and Kit, respectively. Interobserver agreement for functional communication skills averaged above 95% for each student, with Kappa scores of .98, .95, and .76, respectively.

Design and Procedure

We employed an adapted concurrent multiple baseline across-settings design for each student to document the interaction effect associated with functional communication training (Durand, 1990; Durand & Carr, 1985) delivered in the primary setting and a low effort intervention delivered in the secondary settings. Data from the one-on-one settings also were assessed in a nonconcurrent multiple baseline across-subjects design to assess the isolated effects of the functional communication training in the one-on-one setting. Together, the two designs required four phases: (a) baseline, (b) Low Effort 1, (c) functional communication training, and (d) Low Effort 2.

Baseline. The baseline phase involved the typical activities and behavior support strategies used by parents and assistants in the setting. To ensure consistency of opportunities for problem behavior across conditions, teachers/assistants and parents were prompted to retain features of each setting that were observed during initial observations. For Neal, instructors or parents were asked to give at least two demands/requests for a nonpreferred activity during the 10-minute data-collection sessions. For Ellie, the instructors were prompted to provide her with activities that she did not perform successfully, including giving her bottles with safety seals or plastic containers, markers with difficult lids to open, or a difficult puzzle and placing something she wanted out of her reach. For Kit, instructors and parents were prompted to give one transition opportunity from a preferred activity to a less preferred activity during each 10-minute data-collection session. Parents and assistants were instructed during baseline to continue their current protocol of ignoring problem behaviors and providing assistance to the student (e.g., helping Ellie open plastic containers) to complete his or her activity.

Low Effort 1. The interventions in this condition were developed from functional assessment interviews with the parents, teachers, and assistants and were designed to require (a) minimal time to set-up or implement; (b) minimal change in procedures or effort on the part of parents, teachers, and assistants; (c) use of skills already mastered by the parents, teachers, and assistants; and (d) the prompting and rewarding of socially acceptable functional communication training skills.

Note that the effort to implement an intervention is defined here as a function of both the current skill level of the interventionist (teacher, parent) and the technical and procedural demands of the intervention. A teacher or parent who is highly trained and experienced in behavioral interventions may find complex interventions to be of low effort, whereas a different interventionist with less training and experience may find the same interventions to be very difficult or effortful. We selected the low effort interventions within this study with the active participation of the teachers and parents and with the goal of identifying procedures that would be technically consistent with the functional assessment results, yet identified by the teachers or parents as easily implemented (e.g., of perceived low effort). For each of the 3 students, the low effort intervention involved ensuring that each student’s communication book or card was present and providing a prompt from the parent or assistant to “ask the right way” when either antecedent events (e.g., presenting an activity or transition prompt) or problem behaviors occurred during a session. If problem behavior persisted, the parent or assistant used the same procedures (ignoring or providing assistance) that he or she employed during baseline.

Functional communication training. Between baseline and functional communication training phases, each student received three to five 10-minute sessions of instruction on functional communication training skills. The functional communication training skills for each student (cf. Table 1) were taught during the one-on-one training sessions using procedures recommended by Carr et al. (1994). Multiple opportunities to perform the functional communication training skill were made available, actively prompted, and followed by both teacher praise plus the presumed maintaining reinforcer (e.g., for Neal, pointing to the
picture of the more preferred activity resulted in praise and access to that activity). Problem behaviors were followed by redirection (“ask the right way”) and not followed by praise or access to presumed maintaining reinforcers. Traditional guidelines for use of shaping and fading were employed (Fantino & Logan, 1979). Before the onset of the functional communication training phase, each student demonstrated at least two consecutive one-on-one sessions in which he or she used his or her functional communication training skill correctly at least five times per session without a direct prompt. Once this criterion was met, students entered the functional communication training phase, in which they received training on the same social and academic skills they had encountered during baseline.

Low Effort 2. Procedures during the this condition replicated those in the Low Effort 1 condition. The same activities and materials were present, and the parents and assistants used the same prompts and consequences. The primary difference between the conditions was that the students had received training on functional communication training skills in the one-on-one setting.

Fidelity of Implementation

The first author was present for 90% of the class observations and 100% of the home observations to prompt teacher, parent, and/or assistant in use of appropriate procedures per condition. Prior to observation periods, the procedures for that period were reviewed, and during each 10-minute observation period, the first author observed (a) the number of opportunity trials given by the adult, (b) the presence of the communication pictures for Neal and Kit and the help card for Ellie, (c) the verbal prompt given by the adult, and (d) the response from the adult given the current intervention phase. If any procedures were inconsistent with phase requirements, the parent, teacher, or assistant was prompted to maintain protocol fidelity. This process resulted in correct implementation of phase procedures in all monitored sessions.

Results

Our primary focus was on problem behavior reduction in the three secondary settings as a function of the interaction effect of functional communication training in the one-on-one setting combined with Low Effort 2 procedures in the three secondary settings. The main analysis was the multiple baseline across settings when Low Effort 2 was implemented. To assess the interaction effect, however, the design requires demonstration that (a) low effort procedures were not associated with low levels of problem behavior when they were implemented alone (e.g., Low Effort 1) and (b) that implementation of functional communication training in the one-on-one setting was effective in the one-on-one setting but was insufficient as a strategy for achieving problem behavior reduction in the three secondary settings. Presentation of the results is provided in Figures 2, 3, and 4 and focuses first on the effects of functional communication training in the one-on-one setting; next, on the impact of Low Effort 1 in the secondary settings; and then on examining the impact of reintroducing low effort procedures after functional communication training skills were learned.

Figure 2. Percentage of observation intervals with problem behavior and functional communication training skill (FCT) performance by Neal across experimental phases.
Functional communication in the one-on-one setting. Behavior patterns in the one-on-one setting were similar for the 3 students. Problem behavior occurred at high and variable levels during baseline in the one-on-one training setting ($M = 40.6\%$, 21.4\%, and 39.8\% for Neal, Ellie, and Kit, respectively). For each student there was a reduction in both the level and variability of problem behavior when functional communication training skills were taught and used in the one-on-one training setting. During the functional communication training phase in the one-on-one setting, problem behavior was reduced to an average of 14\% for Neal, 5\% for Ellie, and 14\% for Kit. Each student also demonstrated an increase in his or her use of functional communication training skills following initiation of the functional communication training phase, from near zero levels for all students during baseline to an average of 3.1\% of the observation intervals for Neal, 6.2\% for Ellie, and 1.9\% for Kit. Note that the three one-on-one setting series (e.g., for Neal, Ellie, and Kit) form a nonconcurrent multiple baseline across-subjects design to strengthen the experimental demonstration of this well-established effect.

Secondary settings. Problem behavior in the secondary settings also followed a consistent pattern across students. High variable levels of problem behavior were observed in the Low Effort 1 phase (means per session across the three secondary settings were 53.3\%, 28.7\%, and 34.3\% for Neal, Ellie, and Kit, respectively). The Low Effort 1 procedures in the secondary settings were associated with patterns of problem behavior similar to those observed in baseline for the one-on-one setting. There was only one session in which a functional communication training skill was observed (Ses-
sion 7 for Ellie) during the Low Effort 1 phase for the 3 students.

No reliable change in the pattern of problem behavior was observed in the secondary settings when Low Effort 1 procedures were terminated and baseline was introduced. Baseline levels of problem behavior across the three secondary settings for each of the students averaged 53.9%, 23.7%, and 28% for Neal, Ellie, and Kit, respectively. Functional communication training skills were observed in 0 sessions for Neal, 7 sessions for Ellie, and 1 session for Kit during the baseline condition in the secondary settings.

The reintroduction of the low effort intervention in Low Effort 2 was associated with reduction in problem behavior and increases in functional communication training skill use for all students. Even though the same procedures had been ineffective during Low Effort 1, reintroduction of the procedures in Low Effort 2 was associated with reduction in the level and variability of problem behavior ($M$s = 9.2%, 3%, and 9.3%, respectively, for Neal, Ellie, and Kit across the three secondary settings) and an increase in the use of functional communication skills ($M$s = 5.6%, 4.3%, and 2.3%, respectively, for Neal, Ellie, and Kit across the three secondary settings).

**Contextual Fit**

A guiding assumption within the study was that when compared with the higher effort functional communication procedures, the low effort intervention would be perceived as (a) less demanding, (b) equally or more ethically acceptable, and (c) equally consistent with the best interest of each student. To assess this assumption, we collected data from the teaching assistants who implemented baseline, low effort, and functional communication procedures and from the parents who implemented the baseline and low effort procedures.

Results from teaching assistant ratings are provided in Figure 5. Teaching assistants rated the functional communication procedures as the most effortful, most time-consuming, and requiring the most skill. They were comfortable implementing the functional communication procedures and felt the procedures were in the best interest of each student. The low effort procedures were perceived as less effort than functional communication or baseline procedures and requiring less time and skill than the functional communication procedures. Teaching assistants reported being very comfortable with the low effort procedures and found them generally in the best interest of the students (especially when the procedures were more effective).

Results from parent ratings are provided in Figure 6. Parent assessments confirm that the low effort procedures were assessed as requiring limited effort, but more time and skill than baseline. Parents indexed a high level of comfort with the low effort procedures and perceived the procedures as in the best interest of their children, especially when the procedures were associated with improved child behavior.

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**Figure 5.** Mean contextual fit ratings by teaching assistants ($n = 4$) for intervention procedures. Baseline (white), Low 1 (black), Low 2 (diagonal stripes), functional communication training (horizontal stripes).

**Figure 6.** Mean contextual fit ratings by parents ($n = 3$) for intervention procedures. Baseline (white), Low 1 (black), Low 2 (pattern).
Discussion

We suggest that generalized reduction of problem behavior is a unique and important area of research. Although long acknowledged as a goal, our technical focus to date has been on primary rather than generalized reduction of problem behavior. When researchers have turned to the challenge of generalization, the emphasis has been more on generalization of acquired skills than on generalized reduction of problem behaviors. We believe the concurrent schedules model provides a useful heuristic for organizing research on the mechanisms and technical procedures that will lead to generalized response reduction.

The present results provide an application of that model for problem behavior and functional communication skills. The results document that (a) 3 young students with autism and problem behaviors engaged in high levels of problem behavior across at least three school and one home routine; (b) functional assessment outcomes indicated that the students’ problem behaviors were perceived to be maintained by consistent consequences across settings, (c) a low effort intervention was implemented initially in the secondary settings without reductive effects, (d) functional communication was effective at reducing problem behavior in the primary training setting, but not initially effective at producing generalized effects in secondary settings, and (e) when the low effort intervention was reintroduced in the secondary settings following implementation of functional communication in the primary setting, the low effort intervention was effective at both reducing problem behavior and improving the use of competing alternative behaviors (functional communication skills). Family members and teaching assistants reported that the low effort interventions had good contextual fit, and primary teachers reported that these interventions were less effortful than functional communication training.

Although these results replicate findings by Durand (1999), they offer clarification about the conditions under which augmentative communication training may be effective at producing generalized reduction of problem behaviors. In the present analysis we designed functional communication procedures to establish antecedent and consequence events in secondary settings as controlling variables that would result in functional communication skills competing successfully over problem behavior. Prior to these functional communication training interventions, the low effort interventions were ineffective. After initial success with functional communication interventions in the one-on-one setting, there was not a generalized effect in the baseline for secondary settings. Only when low effort procedures were re-introduced in the secondary setting did the interactive effect of functional communication and low effort implementation result in reduction of problem behavior.

Conceptually, these findings are consistent with the concurrent schedules model emphasized by Wacker et al. (1999). Each of the students shifted allocation of responding from problem behavior to functional communication skills following antecedent and consequence manipulations that made functional communication training skills access reinforcement. The results should not be viewed, however, as documenting a traditional demonstration of generalization. Rather, the major contribution of the present results is documentation of the interaction effect provided by the higher effort instruction in the one-on-one setting combined with the stimulus changes available in the secondary setting during the low effort intervention. It is of particular importance to note that introduction of the high effort intervention in the one-on-one setting was associated with reduction in problem behavior only in the one-on-one setting, not in the secondary settings. Only when the low effort intervention was re-introduced in the secondary settings was a clinical effect observed.

Results from the study provide two additional conceptual contributions. The first lies in documentation that an indirect functional behavioral assessment interview proved effective at identifying controlling variables for each of the participants. Interventions based on the functional assessment results were effective with each child.

The second contribution lies in the emphasis on selecting interventions based not just on the behavioral mechanisms controlling problem behavior but also on contextual fit variables that may affect whether an intervention will be implemented with fidelity in an applied context. The present results suggest that greater attention is needed to understand the link between contextual fit variables and implementation of behavioral interventions.

 Clinically, the results suggest additional considerations that may be relevant in the design of
functional assessments, clinical intervention, and program evaluation. When an individual engages in problem behavior across multiple settings, it may be useful to (a) conduct functional assessments to determine whether the problem behavior is maintained by common functions across settings, (b) develop interventions with attention to the development of control by existing stimulus and consequence features in secondary settings, and (c) ongoing assessment of the independent and interactive effects of higher and lower effort interventions.

We applaud efforts to extend applied behavior analysis to meet the complex needs of individuals with problem behavior. Developing a coherent conceptual model for understanding generalized response reduction is an important step toward meeting these needs. Elaborating the performance of problem behaviors under concurrent schedules and careful analysis of the interaction effects associated with implementation of multiple interventions are important directions to guide this effort.

References


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