

*FUNCTIONAL COMMUNICATION TRAINING USING  
ASSISTIVE DEVICES: RECRUITING NATURAL  
COMMUNITIES OF REINFORCEMENT*

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We evaluated the effectiveness of functional communication training (FCT) as an intervention for the problem behavior exhibited by 5 students with severe disabilities both in school and in the community. Following an assessment of the function of their problem behavior, the students were taught to use assistive communication devices in school to request the objects and activities that presumably were maintaining their behavior. Multiple baseline data collected across the students indicated that not only did the students use their devices successfully, but the intervention also reduced their problem behavior. In addition, data from community settings showed generalization to untrained community members. These results replicate other successful efforts to use FCT with individuals having limited communication skills, and demonstrate the value of teaching skills to recruit natural communities of reinforcement in order to generalize intervention effects to meaningful nontraining environments.

DESCRIPTORS: functional communication training, functional analysis, generalization, assistive technology, self-injurious behavior

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Behaviors such as aggression, self-injury, and severe tantrums continue to test the best efforts of those charged with the habilitation of persons with autism and other developmental disabilities. Fortunately, research on the nature of these behaviors has progressed over the years, resulting in significant gains in our understanding of problem behavior (Carr, 1988; Horner, Dunlap, et al., 1990). As a result of this expansion of knowledge, work on interventions with persons who exhibit severe problem behavior has increased in areas such as environmental and curricular changes (Dunlap, Kern-Dunlap, Clarke,

& Robbins, 1991; Horner, Day, & Day, 1997; Meyer & Evans, 1990) and teaching specific alternative skills (Durand, 1990; Northup et al., 1994; Wacker et al., 1990).

One intervention that has received recent empirical support involves teaching functionally equivalent responses, such as communication, that serve the same function as the student's problem behavior (e.g., functional communication training [FCT]; Carr & Durand, 1985). FCT has been demonstrated to significantly reduce the problem behavior of a variety of individuals (Doss & Reichle, 1989; Durand, 1990; Wacker et al., 1998). The targets of this research have included severe aggression and self-injurious behavior (e.g., Bird, Dores, Moniz, & Robinson, 1989; Durand & Kishi, 1987; Hagogian, Fisher, Sullivan, Acquisto, & LeBlanc, 1998; Steege et al., 1990), less severe but disruptive behavior (e.g., Hunt, Alwell, & Goetz, 1988; Hunt, Alwell, Goetz, & Sailor, 1990), stereotyped behaviors (e.g., Wacker et al., 1990), and a diversity of com-

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munication problems (e.g., Carr & Kemp, 1989). Research on FCT has also focused on maintenance (e.g., Bird et al., 1989; Derby et al., 1997; Durand & Carr, 1991) and on the role of response efficiency (Horner & Day, 1991; Horner, Sprague, O'Brien, & Heathfield, 1990).

With growing evidence of the value of this intervention approach in reducing a variety of problem behaviors, it is important to evaluate how FCT compares with other interventions. Hanley and colleagues, for example, recently compared the effectiveness of FCT with noncontingent reinforcement (NCR) on the multiple behavior problems of 2 children (Hanley, Piazza, Fisher, Contrucci, & Maglieri, 1997). They found that both interventions initially reduced problem behaviors, but that the participants demonstrated a preference for FCT. Durand and Carr (1992) compared the effectiveness of FCT with time-out from positive reinforcement for the attention-maintained behavior problems in two groups of children. An initial finding was that both interventions were successful in reducing these problem behaviors. However, further analysis showed that when the students were in the presence of a teacher who was unaware of the different interventions that had been used, only students who had received FCT continued to display low levels of problem behavior. These students continued to request (and receive) attention, which appeared to account for the effectiveness of this intervention with untrained individuals.

The development of interventions that are effective outside of specially designed environments is essential for efforts at full inclusion (Carr & Carlson, 1993). Toward this end, one of the factors necessary for the success of FCT as an intervention lies in the person's ability to request and obtain the stimuli that maintain challenging behavior (Durand, Berotti, & Weiner, 1993). Recruiting natural communities of reinforcement

(Craft, Alber, & Heward, 1998; Stokes, Fowler, & Baer, 1978), particularly reinforcement previously obtained through problem behavior, may be a key factor in promoting generalization and maintenance of intervention success. In order to provide students who have severely limited communication skills with the ability to request reinforcers, the present study incorporated the use of vocal output communication devices for use with FCT. The present project was designed to use this technology to provide students with a means of communicating that, in turn, should result in reduced rates of problem behavior. Several previous studies have documented the potential of using vocal output systems with FCT (Durand, 1993; Steege et al., 1990).

The present study extends these results by assessing whether the use of these communication systems facilitates recognition of the student's communicative requests by untrained community members. This goal differs from previous work on FCT by attempting to demonstrate that problem behavior can be reduced in novel settings and with untrained individuals if students are given the skills to contact natural communities of reinforcement, specifically, to obtain those reinforcers hypothesized to maintain their problem behavior. It was hypothesized that reductions in problem behavior would generalize outside specific training settings as a result of teaching students to request functionally matched stimuli using vocal output devices.

## OVERVIEW

Three studies were conducted to assess the effectiveness of FCT in a training setting (school) as well as outside this setting (various community settings). Study 1 involved functional assessment (including a functional analysis) of the problem behaviors exhibited by these students. Study 2 included

teaching the students to use assistive devices to request the stimuli that maintained their behaviors and an assessment of the effects of this training on their problem behavior in the classroom. Finally, Study 3 assessed whether the students would use their new communication skills with community members, whether these untrained persons would respond to the students' requests, and whether the students' problem behaviors would be reduced as a consequence of this interaction.

## GENERAL METHOD

### PARTICIPANTS

The participants in this series of studies were selected from students throughout Pennsylvania and New York as part of a larger study on FCT. All students participated in all of the studies. Criteria for inclusion included the presence of frequent problem behavior (e.g., self-injury, aggression, tantrums) as well as a demonstrated need for an assistive device for communication (determined through evaluations and nominations by speech-language professionals). Five students referred to the project who met these criteria and whose parents or guardians provided permission to participate were included in the present study. Diagnoses and other assessments were determined by psychologists and speech-language professionals independent of the present project. Mental age was determined through the administration of the Vineland Adaptive Behavior Scales, and language age was assessed using the Gesell Expressive Language Scale.

Matt was a 5½-year-old boy who lived at home with his parents and attended a school for students with developmental disabilities during the day. He had been diagnosed as having moderate cerebral palsy and moderate mental retardation (language age = 18 months, mental age = 55 months). He had

no verbal language ability but could point to express his desires. He displayed frequent hand biting and screaming. Allison was 15 years old at the start of this study and attended school in a segregated class at her neighborhood high school. She had severe cerebral palsy and severe mental retardation and spent her day in a variety of adaptive chairs (language age = 15 months, mental age = 15 months). She could follow one-step commands and could communicate simple preferences through eye gaze and head nods. Her problem behaviors included crying and screaming. Mike was 3½ years old and had been diagnosed with severe mental retardation (language age = 15 months, mental age = 22 months). He was attending an integrated preschool program and lived at home. His communication skills consisted mainly of nonverbal gestures, and he frequently bit his hand and threw objects around the room when he was upset. Ron was a 9½-year-old boy who had received diagnoses of autism and severe mental retardation (language age = 45 months, mental age = 38 months). He occasionally said words, but often these were out of context, and he did not use words if prompted. Ron was very aggressive and hit his teachers, other students, and family members. David was 11½ years old and had been diagnosed with autism and severe mental retardation (language age = 42 months, mental age = 21 months). Like Ron, David could say a few words, but these were typically nonfunctional. David often slapped his face and banged his head on tables.

A variety of behavioral interventions had been used with these students prior to this study in attempts to reduce their problem behaviors. These included differential reinforcement of other and incompatible behavior (DRO and DRI), time-out from positive reinforcement, overcorrection, restraint, and medical interventions (e.g., Mellaril, Hal-dol). None of these interventions had re-

sulted in significant improvements in problem behavior, and none of them were being used at any point during the present study.

#### PROCEDURES AND DESIGN

All assessments and interventions were carried out in the students' classrooms and in their local communities by their teachers. In preparation for this study, teachers, parents, and other related staff attended a series of workshops on FCT. These workshops were conducted by the author over 3 days (18 hr) and involved (a) discussion of the functional nature of problem behavior, (b) instruction in various functional assessment procedures, (c) instruction in teaching students to use assistive devices, (d) instruction in FCT, and (e) assistance in developing individualized intervention plans for each student (see Durand, 1990, for more details).

#### *Response Definitions*

*Student behavior.* *Problem behavior* was recorded in all three studies and was individually assessed. Matt's hand biting was defined as any time his teeth touched the back of his hand. Screaming was defined as any loud vocalization. Allison's crying was defined as interrupted vocalizations accompanied by tears, and screaming was defined as any loud vocalization. Mike's hand biting was defined as any time his teeth touched the back of his hand, and throwing objects included picking up and throwing objects away from his table. Ron's aggression was defined as any attempt or successful forceful contact (using his hands) with another person. David's face slapping included hitting his face with his open palm, and head banging involved forceful contact with his head to objects.

*Unprompted communication* was recorded in Studies 2 and 3 and was defined as the students' use of their device (i.e., pressing the pad) without verbal or physical prompts from the teacher (i.e., no verbal or physical

prompts occurred in the interval or in the one preceding the communicative response).

*Adult behavior.* *Appropriate adult response* was recorded in Study 3 and was defined as any appropriate verbal or motor response to a student's communicative attempt. For example, if Allison used her communication device at the food court in the mall to say "Coke® please," and the person behind the counter said "OK" and brought her a Coke®, this was scored as an appropriate adult response. These data were scored as the percentage of responses per request by the student (e.g., if only 4 of 10 student requests were followed by an appropriate adult response, appropriate adult response was scored as 40% for the session). To obtain these data, a second scoring of the tapes was performed to identify each instance of an appropriate request by a student and the adult's response.

Consequences for problem behavior were monitored in Studies 1, 2, and 3 and included *social attention* (any verbal statements, such as "Stop that!" or "Put your hands down!," or physical contact, such as holding a child's hand, that were responses to an instance of problem behavior), *tangible* (any time one of the identified favorite tangible items was presented to the student following an instance of a problem behavior), and *escape* (any time a task or demand was terminated following an instance of problem behavior). A consequence was scored if it occurred within 5 s of an instance of problem behavior. These data were scored as the percentage of consequences per problem behavior for each student (e.g., if 5 of 10 instances of problem behavior were followed by access to the student's favorite tangible item, tangible was scored as 50% for the session). To obtain these data, a second scoring of the tapes was performed to identify each instance of problem behavior and the adult's response.

*Independent variable check.* Adult behaviors during Studies 1, 2, and 3 were recorded to ensure the integrity of the independent variable manipulation. *Praise* was defined as any form of verbal approval (e.g., “That’s right!”). *Easy-task presentation* was defined as the placement of the easy task materials (previously assessed as achieving 100% correct responding) in front of the student or any easy-task-related statement made by another person (e.g., “Which one is the number 2?”). *Difficult-task presentation* was defined as the placement of the difficult task materials (previously assessed as achieving 33% correct responding) in front of the student or any difficult-task-related statement made by another person (e.g., “How many trucks are on the table?”). *Tangible items* were defined as any time the student’s favorite tangible item was placed within reach.

#### *Data Collection and Interobserver Agreement*

Videotapes were made of the sessions at each site. Because of the demands of this project on the teachers, they were requested to tape baseline, intervention, and community samples when possible. The only requirement was that these times (e.g., in the late morning before lunch for Matt) be the same during each phase of the study. Every session was videotaped, and all tapes were scored.

The videotapes were scored by trained undergraduate psychology majors at the author’s university. A continuous 10-s interval observation procedure was used. Each 10-min session was rated by the observers separately using this procedure for the presence or absence of the targeted behaviors. In addition, tapes were scored for instances of unprompted communication and adult responses, as well as problem behavior and adult consequences (i.e., social attention, tangible, and escape).

Observer agreement was assessed independently during 100% of the sessions by

trained undergraduate observers. Training was conducted prior to this study until observers reached a criterion of 75% agreement on all responses with the standard observer (an undergraduate with prior observer experience). Observer records were compared on an interval-by-interval basis. For problem behavior, unprompted communication, and the independent variable checks (praise, easy task, difficult task, and tangible), an agreement was scored if two observers recorded the behavior in the same interval, and a disagreement was scored if only one observer scored the behavior in an interval. Exact agreement was also assessed for appropriate adult response and the consequences (social attention, tangible, and escape), with an agreement occurring when both observers recorded the same frequency of the unprompted communication—appropriate adult response sequence or the problem behavior—consequence sequence in a given 10-s interval, and a disagreement occurring when only one observer scored this sequence in an interval or observers recorded different frequencies in the same interval. Occurrence and nonoccurrence agreement coefficients were calculated for all behaviors. An occurrence agreement was defined as a 10-s interval in which both observers recorded the target response. A nonoccurrence agreement was defined as a 10-s interval in which both observers did not record the target response. Agreement scores were computed as the number of agreements divided by the number of agreements plus disagreements.

## STUDY 1: FUNCTIONAL ASSESSMENTS

### METHOD

Two forms of functional assessment—a functional analysis and administration of the

Motivation Assessment Scale (MAS)—were conducted to determine the variables that may have been maintaining the students' challenging behavior. (This information was used in Study 2 to select an alternative communicative behavior to teach.)

### *Design and Procedure*

*Functional analyses.* Following the workshops, teachers were instructed to conduct a brief functional analysis modeled after the one used in Durand and Crimmins (1988), consisting of four different conditions: low attention, reduced tangible items, difficult tasks, and control. Each session was 10 min in length and was presented to the participants randomly (a random assignment of sessions was made for each student by the author, and the order of presentation was given to the teachers). Each of the four different sessions was conducted from two to three times each (Derby et al., 1992), conforming with an alternating treatments design.

During the low-attention condition, the participants were presented with an easy task (previously assessed as achieving 100% correct responding). In addition, the participants were given access to a preferred tangible item (assessed prior to this study through a choice assessment with each student) throughout the 10-min session. Attention in the form of praise was presented briefly once every 2 min. All challenging behaviors were ignored during this and subsequent conditions.

The reduced tangible items condition included the easy task and continuous one-to-one attention but the preferred tangible item was presented only twice, for 10 s, during the 10-min session.

During the difficult tasks condition, one-to-one attention was presented continuously and the preferred tangible item was constantly available, but the task was more de-

manding (previously assessed as achieving approximately 33% correct responding).

During the control condition, the preferred tangible item was constantly available, the experimenter was present and interacted with the participant if solicited verbally or nonverbally, and the easy task materials were present if the participant chose to work.

*Motivation Assessment Scale.* Prior to the intervention, the students' teacher and assistant teacher were given copies of the MAS to complete. This scale includes 16 questions about the possible influence of social attention, escape from unpleasant situations, tangible items, and sensory feedback on problem behavior (Durand & Crimmins, 1988, 1992). Respondents are asked to rate the likelihood of the target behavior occurring in these and other situations on a 7-point Likert-type scale (i.e., from *never* = 0 to *always* = 6). The scores are then totaled and ranked, and a top rank in a particular category is used to assume that the influence may be important in the maintenance of the problem behavior (e.g., escape). Each of the instructors was given multiple copies of the scale for each of the students. They were requested to complete the scales separately for each of the identified problem behaviors.

*Interobserver agreement.* The mean occurrence and nonoccurrence agreement scores across students for problem behavior during the functional analysis sessions were 91% (range, 79% to 100%) and 97% (range, 88% to 100%), respectively. For purposes of the present study, an agreement on the MAS was scored if Teacher 1 and Teacher 2 both ranked the same category for a behavior (e.g., escape) as the highest. Using this criterion, there was 100% agreement between the teachers for each of the student's problem behaviors. The mean occurrence agreements for the independent variable checks across students were 100% for praise, easy task, and difficult task, and 97% (range, 95% to 100%) for tangible; the mean non-

occurrence agreement coefficients were 100% each for praise, easy task, and difficult task, and 98% (range, 97% to 100%) for tangible. No instances of consequences occurred during Study 1. The mean nonoccurrence agreement for the problem behavior–consequence sequence across students was 100% for social attention, tangible, and escape.

## RESULTS AND DISCUSSION

### *Independent Variable Manipulation*

Group means are reported here; however, individual data are consistent with the group means and may be obtained from the author. Mean percentages of intervals including praise were 8.3% (range, 6.7% to 10%) for low attention, 100% for reduced tangible items, 100% for difficult tasks, and 76.7% (range, 33% to 100%) for control. Mean percentages of intervals including the easy task were 100% for low attention, 100% for reduced tangible items, 0% for difficult tasks, and 30% (range, 8% to 100%) for control. Mean percentages of intervals including the difficult task were 0% for low attention, 0% for reduced tangible items, 100% for difficult tasks, and 0% for control. Mean percentages of intervals including tangible were 100% for low attention, 5% (range, 3.3% to 6.7%) for reduced tangible items, 100% for difficult tasks, and 100% for control. These data were consistent with our efforts to present the students with lower rates of praise during low attention, reduced access to tangible items during reduced tangible items, and a more difficult task during difficult task conditions.

### *Student Behavior*

Data on problem behavior from the functional analyses are depicted in Figure 1. Matt displayed hand biting and screaming more frequently during the difficult tasks sessions, with the mean percentages being 6% for low attention (range, 2% to 12%), 34% (range,

23% to 48%) for difficult tasks, 6% (range, 0% to 12%) for reduced tangible items, and 4% (range, 3% to 5%) during control. Allison displayed crying and screaming more often during reduced tangible items, with the mean percentages being 15% for low attention (range, 11% to 20%), 2% (range, 2%) for difficult tasks, 46% (range, 43% to 50%) for reduced tangible items, and 0% during control. Mike's hand biting and object throwing occurred more often in reduced tangible items, with the mean percentages being 19% for low attention (range, 17% to 20%), 6% (range, 5% to 6%) for difficult tasks, 74% (range, 60% to 88%) for reduced tangible items, and 7% (range, 4% to 10%) during control. Ron's aggression was most frequent during low-attention sessions, with the mean percentages being 46% (range, 30% to 67%) for low attention, 2% (range, 1% to 3%) for difficult tasks, 3% (range, 1% to 4%) for reduced tangible items, and 2% (range, 2%) during control. David's face slapping and head banging were most frequent during difficult tasks sessions, with the mean percentages being 0% for low attention, 42% (range, 35% to 50%) for difficult tasks, 22% (range, 12% to 31%) for reduced tangible items, and 2% (range, 2%) during control.

The mean MAS scores combined across teachers and behaviors mirrored the results from the functional analysis. The highest mean scores were in the escape category for Matt (hand biting = 4.00 for Teacher 1 and 4.00 for Teacher 2; screaming = 5.50 for Teacher 1 and 4.75 for Teacher 2), tangible for Allison (crying = 4.25 for Teacher 1 and 3.75 for Teacher 2; screaming = 4.75 for Teacher 1 and 4.75 for Teacher 2), tangible for Mike (hand biting = 5.00 for Teacher 1 and 5.50 for Teacher 2; throwing objects = 4.75 for Teacher 1 and 4.25 for Teacher 2), low attention for Ron (hitting others = 3.00 for Teacher 1 and 3.25 for Teacher 2), and escape for David (face slapping = 5.25 for

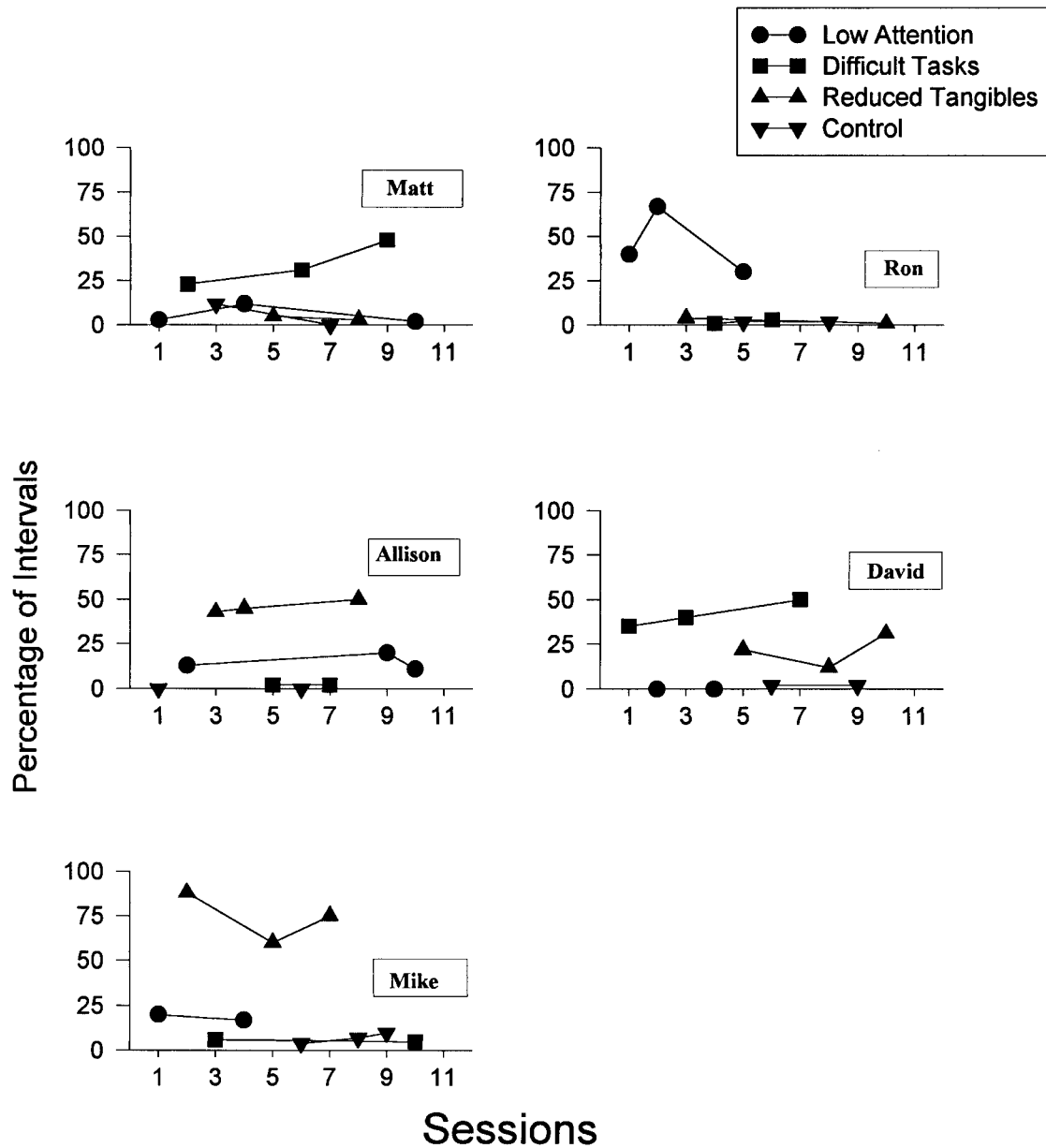


Figure 1. The percentages of intervals of challenging behavior are displayed for the four experimental conditions (i.e., reduced tangible items, control, difficult tasks, and low attention) for each participant.

Teacher 1 and 5.25 for Teacher 2; head banging = 5.25 for Teacher 1 and 5.50 for Teacher 2).

*Consequences*

There were no recorded instances of any of the three types of consequences (i.e., so-

cial attention, tangible, and escape) for any of the problem behaviors displayed by the students.

The results from Study 1 suggested that the teacher-conducted functional analyses and administrations of the MAS pointed to social influences on the students' behaviors.



This information was used in Study 2 to select alternative communicative behaviors to teach the students.

### STUDY 2: CLASSROOM INTERVENTION

This study involved having the classroom teachers train the students to use their communication devices to request access to the variables presumably maintaining the problem behavior.

#### METHOD

The 5 students who participated in Study 1 were included in Study 2.

#### *Design and Procedure*

*Communicative response selection.* Data from the functional assessments identified the variables that may have been maintaining these students' problem behavior. This information was used to select communicative responses to teach each student. Matt's and David's behaviors were recorded most frequently during difficult tasks, so they were taught to use their devices to request assistance with their work ("I need help"). Allison's and Mike's behavior problems were presumably maintained by their tangible consequences, and their devices were programmed to request additional food at meal and snack times (e.g., "I want more, please"). Ron's problem behaviors appeared to be maintained by attention from others, so his device was programmed to make a request that would result in attention (e.g., "Would you help me with this?"). These communicative responses were programmed into the devices for each student during all phases of Studies 2 and 3.

*Device selection.* The student's parent, teacher, and speech professional met with the author and a staff member from the PA Assistive Device Center twice during the workshop times. The goal was to select a

device that, as best as possible, matched the student's current and future skill levels (e.g., ability to point to one or more symbols) and produced acceptable output, but was also within the budget limitations of the granting agency (average approximately \$750 per device).

The Introtalker (Prentke Romich) was used for each student, primarily because it requires less force to press, and pressing was a problem for some of the students. For example, a head pointer was used for Allison because using her hands was difficult for her. The Introtalker uses digitized speech, which is more natural sounding than other devices. From 1 to 16 messages can be programmed in the device at one time.

*Baseline.* Teachers videotaped the students for 2 hr per week during instructional sessions modified to resemble the functional analysis session that resulted in the most problem behavior for each student. The videotaped observations were made in blocks of approximately 30 min each that were later divided into 10-min observational sessions by the experimenter for data scoring. This schedule was continued during intervention. For example, Matt's behaviors were most frequent during the difficult tasks condition. Therefore, his teacher was instructed to conduct instructional sessions in the classroom using typical tasks that were difficult for him to complete. The teacher was also instructed to provide continuous attention and provide access to favorite tangible items, conforming to the procedures used in the functional analysis sessions. The number of sessions the teachers were asked to tape in baseline were staggered to correspond to a multiple baseline across students. The normal routines were not changed, and the students engaged in a variety of academic activities as outlined in their individualized education plans. The student's assistive device was placed within his or her reach during this time, although no specific training on its use was provided.

Data on problem behavior and unprompted communication were collected from the videotaped samples during these times. Throughout the study, the teachers were instructed not to respond to the students' problem behaviors as much as possible. In other words, teachers were requested not to physically block or verbally respond to these behaviors (e.g., saying "stop that" or "put your hand down") unless such action was needed to protect themselves, the student, or other classmates. Teachers reported being generally successful with these instructions, although they did report having to respond to the behaviors as described on occasion.

*Functional communication training.* Following baseline, each student was taught to use his or her device by the classroom teacher. Training took place over approximately 4 weeks during normal classroom routines that were appropriate for the requests being taught. For instance, to teach students to request help with work, training began with the presentation of work materials. After a short time, the students were prompted to press the pad on the device, and then were given additional assistance. For example, one of David's tasks involved assisting with meal preparation. The teacher engaged him in this task for several minutes, introduced a step that she knew was difficult for him (e.g., spreading peanut butter), and then verbally and physically prompted him to press the pad on the device (e.g., saying "Tell me that you need help" and simultaneously move his hand to the device). After he pressed the pad and it played the recorded phrase ("I need help"), his teacher used graduated guidance to help him. Following the assistance, he was prompted to return to work, and the pattern was repeated. For each student, teachers were instructed to respond to their communicative attempts with only the consequences requested, and in a manner that seemed appropriate for the context (i.e., assistance on difficult tasks for Matt

and David, requested tangible reinforcers for Allison and Mike, and brief periods of attention for Ron). The schedule of presentation of the prompts was determined by each individual teacher depending on the student.

Prompts were withdrawn for each student using a combination of fading techniques including delayed prompting. Because the teachers were not directly supervised by the author during these training sessions, their use of prompts and fading techniques varied across teachers and sessions. In general, teachers were instructed to wait 3 to 5 s before prompts to allow students to respond, and they tended to follow these guidelines. Fading continued until the students used their devices without any physical or verbal prompts by the teachers (see Durand, 1990, for a detailed description of the steps involved in FCT). This criterion was considered to be met when the students activated their devices in the appropriate context five consecutive times without physical, gestural, or verbal prompts. This occurred for all students within a 4-week period (Matt, Allison, and Ron met criterion over 10 school days, Mike required 19 days, and David required 16 days of training). As in baseline, teachers were asked not to respond to problem behaviors as much as possible given safety considerations.

When the students reached criterion, teachers again videotaped the students for approximately 2 hr per week as in baseline. The timing and procedures for videotaping were identical to baseline. Videotaping of training was not possible due to the difficulty of trying to initiate training opportunities as well as engage the other students in the classroom.

*Interobserver agreement.* The mean occurrence and nonoccurrence agreement scores across students were 93% (range, 84% to 100%) and 95% (range, 89% to 100%), respectively, for problem behavior and 97% (range, 92% to 100%) and 98% (range,

92% to 100%) for unprompted communication. The mean occurrence and nonoccurrence agreements for the independent variable checks across students were both 100% for praise, easy task, difficult task, and tangible. The mean occurrence and nonoccurrence agreements for the problem behavior–consequence sequence across students were 90% (range, 85% to 100%) and 88% (range, 78% to 100%), respectively, for social attention. There were no instances of tangible or escape for any student, and the mean nonoccurrence coefficient was 100% each for these behaviors.

## RESULTS AND DISCUSSION

### *Independent Variable Manipulation*

Mean percentages of intervals including praise were identical across baseline and intervention and were 100% for Matt, Allison, Mike, and David and 8.3% (range, 6.7% to 10%) for Ron. Mean percentages of intervals including easy task were also the same across baseline and intervention and were 100% for Allison, Mike, and Ron and 0% for Matt and David. Mean percentages of intervals including difficult tasks were the same across baseline and intervention and were 0% for Allison, Mike, and Ron and 100% for Matt and David. Mean percentages of intervals including tangible items were the same across baseline and intervention for Mike, Ron, and David at 100%. Mean percentages of intervals including tangible items for Allison were 5% (range, 3.3% to 6.7%) for baseline and 4% (range, 1.6% to 6.7%) for intervention. Mean percentage of intervals including tangible items for Mike was 5% (range, 3.3% to 6.7%) for baseline and intervention. These data were consistent with our efforts to present Ron with lower rates of praise, Allison and Mike with reduced access to tangible items, and Matt and David with a more difficult task during both baseline and intervention.

### *Unprompted Communication*

Data on unprompted communication were similar for each student. Prior to the intervention, none of the students used their devices without prompts. Following FCT, each student engaged in some level of unprompted device use. The mean percentages of intervals of unprompted communication after intervention were 13% (range, 7% to 23%) for Matt, 14% (range, 8% to 24%) for Allison, 16% (range, 4% to 30%) for Mike, 9% (range, 0% to 23%) for Ron, and 15% (range, 5% to 34%) for David. Figure 2 illustrates these data during all sessions. The students appeared to learn to use their communication devices successfully as a function of the training.

### *Problem Behavior*

Figure 2 also shows the individual data on problem behavior for each student. The mean percentages of intervals of Matt's problem behaviors were 41% (range, 15% to 55%) prior to intervention and 2% (range, 0% to 7%) following FCT. Allison's problem behavior averaged 42% (range, 29% to 65%) prior to FCT, and was 7% (range, 0% to 25%) following FCT. Mike's problem behavior averaged 18% (range, 7% to 31%) prior to FCT and was 2% (range, 0% to 8%) following FCT. Ron's problem behavior averaged 42% (range, 33% to 47%) prior to FCT and was 0.5% (range, 0% to 8%) following FCT. Finally, David's problem behavior averaged 48% (range, 20% to 75%) prior to FCT and was 5% (range, 0% to 30%) following FCT. The problem behavior of all 5 students declined following FCT.

### *Consequences*

In general, the teachers provided few consequences for the students' problem behaviors in either baseline or intervention. There were no instances of teachers providing tangible items or escape as a consequence for any of the students' behaviors. The percent-

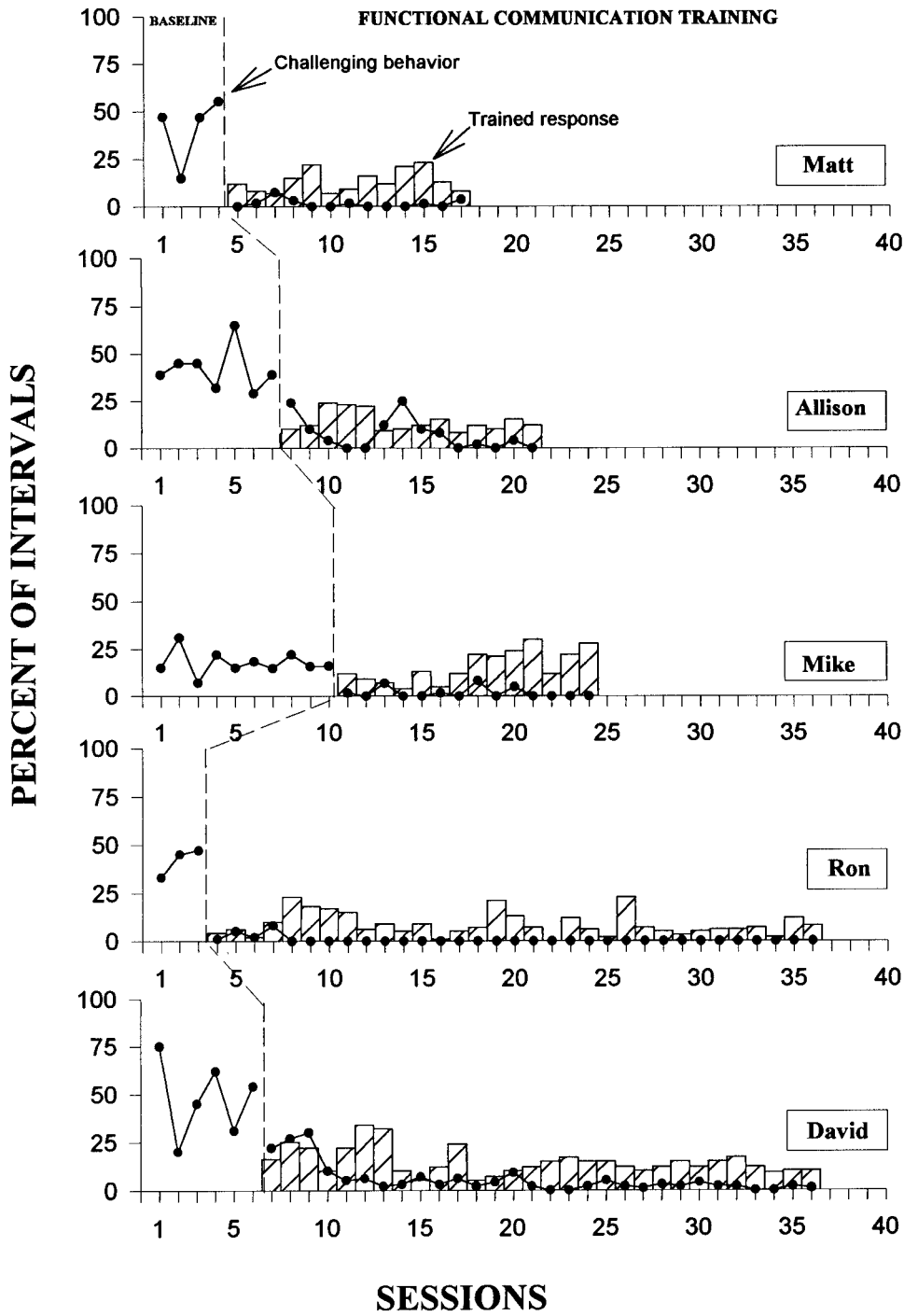


Figure 2. The percentage of intervals of challenging behavior are displayed (filled circles) for each of the 5 participants in baseline and FCT in the classroom. The hatched bar graphs show the percentage of intervals of unprompted communication for each student.

age of instances of Matt's behavior problems followed by social attention was 9% during baseline and 0% during intervention. The percentage of instances of David's behaviors followed by social attention was 0% during baseline and 7% during intervention. The percentage of instances of Allison's behavior problems followed by social attention was 7% during baseline and 9% during intervention. No instances of social attention were recorded following Mike's or Ron's behavior problems.

These results replicate previous successful efforts to reduce problem behavior using FCT. The teaching of alternative communicative behaviors that were functionally equivalent to problem behavior served to reduce the frequency of these problem behaviors. Specific consequences (e.g., social attention, tangible items, or escape) did not differ across baseline and intervention and, therefore, do not appear to account for the changes in the students' behavior problems. The training was successful for each student, despite their lack of prior formal communication skills, using vocal output communication devices.

### STUDY 3: COMMUNITY INTERVENTION

This study occurred concurrently with Study 2 and was designed to assess the effects of the in-school training of the use of the assistive devices on the communicative and problem behaviors of the students outside of the classroom.

#### METHOD

The 5 students who participated in Study 1 and Study 2 were included in Study 3.

#### *Design and Procedure*

Prior to the introduction of FCT in Study 2, the teachers were asked to take all 5 students to places in the community that their

teachers felt would be helpful in furthering their community skill goals and that the students might enjoy. They made the vocal output devices (which were programmed with each student's communicative requests) available during each of these community visits. Matt's teacher decided to take him to a local candy store (because he liked candy), Allison was taken to a local shopping mall (because she liked watching other people and shopping), Mike was taken to the movie theater (because he liked movies and movie snacks), Ron was taken to a book and magazine shop (because he liked magazines), and David was taken to the library (because he liked picture books).

Teachers introduced a series of short sessions (3 to 5 min each, with a mean of approximately 3.5 min for each student) in each setting that resembled the baseline sessions in the classroom. The sessions were introduced in a staggered fashion so as to conform to a multiple baseline across students design (see Figure 3). Because of scheduling differences in the baseline sessions between Study 2 and Study 3, there are different numbers of these sessions across the two studies. The students were placed in situations in these settings that were often problematic for them. For example, Matt had to be helped to purchase things at the store. If he had trouble taking out his money he would often become agitated when he could not just take what he wanted and leave. His teachers would prompt him to make a purchase, but would not help him immediately. To address their tangibly influenced behavior problems, Allison (at the food court in the mall) and Mike (at the snack bar at the movies) were put in situations in which they had some access to favorite foods, but needed to request more if they wanted additional snacks. Ron was taken to a local magazine store, and his teacher stood to the side in order to see how he would obtain attention from others. Any attempts at aggression to-

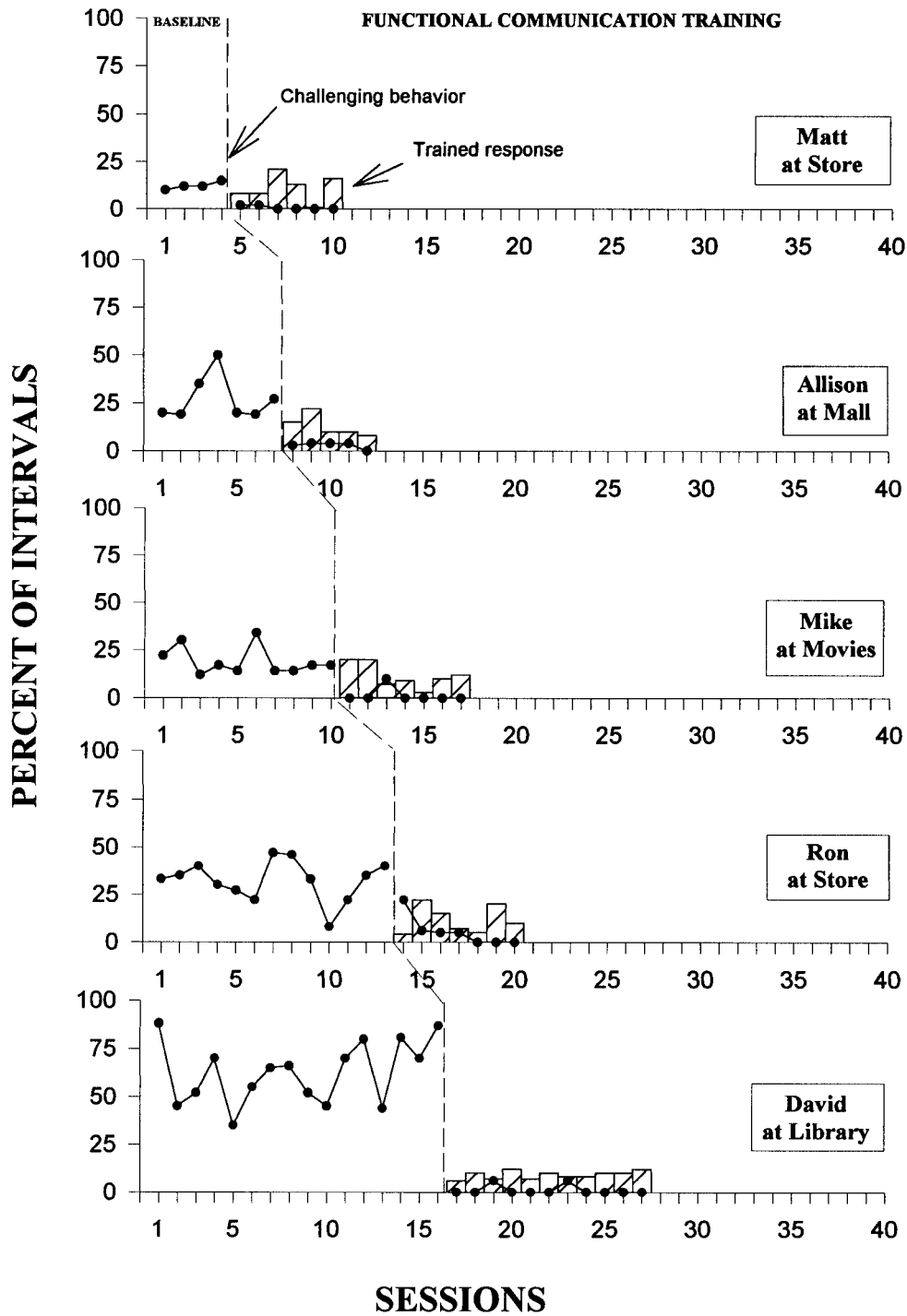


Figure 3. The percentage of intervals of challenging behavior are displayed (filled circles) for each of the 5 participants in baseline and FCT in the community. The hatched bar graphs show the percentage of intervals of unprompted communication for each student.

ward others were blocked. David became disruptive if there was a delay in taking out a favorite book from the library, and therefore he was prompted to use his library card to charge out books. The teachers placed the vocal output devices within reach of the students at all times.

Following FCT in the classrooms, the teachers continued to introduce the sessions in the community as above. No additional prompts were given, and the devices continued to be available. Recall that Matt's and David's behaviors were recorded more frequently during difficult tasks, and they were taught to use their devices to request assistance with their work ("I need help"). This phrase was also seen as appropriate to ask store clerks for help with change (Matt) and library staff for help with charging out books (David). Again, Allison's and Mike's behavior problems were believed to be maintained by their tangible consequences, and their devices were programmed to request additional food (e.g., "I want more please"). This was viewed as relevant for purchasing more snacks at the stores in the food court (Allison) and at the snack bar in the movie theater (Mike). Finally, Ron's behaviors were presumed to be maintained by attention from others, so his device was programmed to make a request that would result in attention (i.e., "Would you help me with this?"). It was hoped that this would result in attention from the clerk at the magazine store.

Although the employees at these various community settings were familiar with the students (they also visited these settings prior to our study), they were not instructed in how to respond to verbal and nonverbal attempts to communicate. Their responses to the students were recorded prior to and after classroom FCT was implemented.

*Interobserver agreement.* The mean occurrence and nonoccurrence agreement scores across students were 92% (range, 80% to

100%) and 97% (range, 90% to 100%), respectively, for problem behavior, 100% each for unprompted communication, and 100% each for adult response. The mean occurrence and nonoccurrence agreements for the independent variable checks across students were both 100% for praise, easy task, difficult task, and tangible. The mean occurrence and nonoccurrence agreements for the problem behavior-consequence sequence across students were 96% (range, 92% to 100%) and 98% (range, 92% to 100%), respectively, for social attention. There were no instances of tangible or escape, and the mean nonoccurrence coefficient was 100% for each.

## RESULTS AND DISCUSSION

### *Independent Variable Manipulation*

For Matt, the mean percentages of intervals including praise were 21% (range, 11% to 33%) for baseline and 18% (range, 12.5% to 27.8%) for intervention. The mean percentage of easy task and tangible was 0% across baseline and intervention, and the mean percentage of difficult task was 100% across baseline and intervention. For Allison, the mean percentages of praise were 25% (range, 8.3% to 37.5%) for baseline and 22% (range, 3.3% to 33%) for intervention. The mean percentage of tangible was 30% (range, 25% to 33%), easy task was 100%, and difficult task was 0% across baseline and intervention. For Mike, the mean percentages of praise were 32% (range, 6.7% to 38.9%) for baseline and 35% (range, 11.1% to 33%) for intervention. The mean percentages of tangible were 27% (range, 17% to 33%) for baseline and 23% (range, 12.5% to 37.5%) for intervention. The mean percentage of easy task was 100%, and difficult task was 0% across baseline and intervention. For Ron, the mean percentages of intervals including praise were 35% (range, 16.7% to 41.7%) for baseline

and 37% (range, 13.3% to 45.8%) for intervention. The mean percentages of difficult task and tangible were 0% across baseline and intervention, and the mean percentage of easy task was 100% across baseline and intervention. Finally, for David, the mean percentages of intervals including praise were 42% (range, 29.2% to 67%) for baseline and 35% (range, 25% to 44%) for intervention. The mean percentage of easy task and tangible was 0% across baseline and intervention, and the mean percentage of difficult task was 100% across baseline and intervention. These data were consistent with our efforts to present Ron with lower rates of praise, Allison and Mike with reduced access to tangible items, and Matt and David with a more difficult task during both baseline and intervention.

#### *Unprompted Communication*

Data on unprompted communication were similar for each student. Prior to the intervention, none of the students used their devices in the community without prompts. Following FCT in the classroom, each student engaged in some level of unprompted device use outside of the classroom. The mean percentages of intervals of unprompted communication after intervention were 11% (range, 1% to 21%) for Matt, 13% (range, 8% to 22%) for Allison, 12% (range, 3% to 20%) for Mike, 12% (range, 4% to 22%) for Ron, and 9% (range, 6% to 12%) for David. Figure 3 illustrates these data during all sessions. The students appeared to learn to use their communication devices successfully as a function of the training.

#### *Problem Behavior*

Figure 3 also shows the individual data on problem behavior for each student. The mean percentages of intervals of Matt's problem behaviors were 12% (range, 10% to 15%) prior to intervention and 0.5% (range, 0% to 2%) following FCT. Allison's mean

level of problem behavior was 27% (range, 19% to 50%) prior to FCT and was 3% (range, 0% to 4%) following FCT. Mike's mean level of problem behavior was 19% (range, 12% to 34%) prior to FCT and was 1% (range, 0% to 10%) following FCT. Ron's mean level of problem behavior was 32% (range, 8% to 47%) prior to FCT and was 5% (range, 0% to 22%) following FCT. Finally, David's mean level of problem behavior was 63% (range, 35% to 88%) prior to FCT and was 1% (range, 0% to 6%) following FCT. The problem behavior of all 5 students declined in the community settings following FCT in their classrooms.

#### *Appropriate Adult Response*

Data on appropriate adult responses were similar for each student. Prior to the intervention, the adults in the community did not have the opportunity to respond to appropriate communicative attempts. Following functional communication training in the classroom, and when the students used their devices to make requests of them, the adults engaged in some level of appropriate response to each student. The mean percentages of appropriate adult response (per student request) after intervention were 88% (range, 60% to 100%) for Matt, 71% (range, 50% to 96%) for Allison, 93% (range, 75% to 100%) for Mike, 100% for Ron, and 79% (range, 61% to 100%) for David. These data suggest that there was a high level of response to the students as a function of their requests.

#### *Consequences*

There were no instances of community members providing tangible items or escape as a consequence for any of the students' behaviors. The percentages of instances of Matt's behavior problems followed by social attention were 7% during baseline and 0% during intervention. The percentages of instances of David's behaviors followed by social attention were 13% during baseline and



0% during intervention. The percentages of instances of Allison's behavior problems followed by social attention were 7% during baseline and 0% during intervention. No instances of social attention were recorded following Mike's or Ron's behavior problems.

Overall, the results of Study 3 point out that the students used their devices without prompting in a new situation (but one that functionally resembled the training situation), and that adults without an awareness of the program could respond appropriately to the students. These responses, in turn, appeared to have resulted in decreased levels of problem behavior.

#### GENERAL DISCUSSION

Initial intervention data from these students replicate previous efforts with functional communication training. By assessing the presumed function of the students' problem behavior and teaching them an alternative behavior that served the same function, their problem behaviors were reduced. This study expands on previous research by demonstrating that students with severe communication deficits could be taught to use assistive devices as the alternative behavior, and that they were successful in recruiting maintaining stimuli from untrained members of their communities.

The true test of an intervention strategy lies not only in its ability to reduce behavior problems in controlled situations but also in its potential to be integrated into everyday environments, that is, with people who are not trained and in unpredictable settings. Along this line, we demonstrated previously that the positive effects of FCT could extend to teachers who were unaware of the intervention in effect (Durand & Carr, 1991). By contrast, when we employed time-out from positive reinforcement to reduce behavior problems, these problem behaviors returned in the presence of teachers who were un-

aware of the intervention plan. The results of this and previous studies suggest that, at least in some cases, students with disabilities may be able to recruit their reinforcers from untrained individuals, which can result in reduced levels of problem behavior (Durand & Carr, 1991, 1992).

These findings take on added importance because an increasing number of individuals who engage in severe behavior problems are living and working in community settings. It is obvious that people including bus drivers, fast food restaurant workers, or store clerks will not be trained to implement sophisticated behavioral programs such as time-out from positive reinforcement as a consequence for problem behavior or non-contingent reinforcement to decrease these behaviors. Yet, these same individuals may be able to understand simple requests for attention or assistance, and therefore will be able to respond in a limited way to the communication of people with intellectual disabilities. The challenge becomes one of teaching people with behavior problems ways of communicating that will be understood even by people who do not have training in the area of communication difficulties or intellectual disabilities.

The data on the unprompted use of the devices by the students in the present study parallel results in previous studies that used verbal and sign language (e.g., Bird et al., 1989; Durand & Carr, 1991). Specifically, the data indicate that the students did not use their devices excessively (e.g., requesting help with tasks or more food continuously). Instead, their teachers reported that they communicated for things that they wanted at an acceptable level, and problem behavior remained low. It has been hypothesized that factors such as stimulus satiation or choice may account for this rate of responding by many individuals in these studies (Durand, 1990). Other research suggests that choice, under certain circumstances, may in itself

have a reinforcing effect (Fisher, Thompson, Piazza, Crosland, & Gotjen, 1997; Hanley et al., 1997). Future work with FCT should further investigate the relationship between rate of reinforcement for problem behavior and functionally equivalent replacement behaviors.

With respect to FCT, if significant others cannot understand efforts at verbal or gestural communication, they may not be able to respond appropriately, which will result in no reductions in problem behavior. One alternative communication strategy employed in the present study is augmentative communication systems (Baumgart, Johnson, & Helmstetter, 1990; Reichle, York, & Sigafoos, 1991). These strategies have included using communication boards that require students to point to pictures (Miranda, 1985; Rotholz, Berkowitz, & Burberry, 1989), vocal output devices (Dattilo & Camarata, 1991; Miranda & Beukelman, 1987), and a variety of other adaptations (Mathy-Laikko et al., 1989). Vocal output systems have several advantages over other augmentative systems. Others may be more likely to respond to vocal output devices over communication boards. Calculator and Dollaghan (1982), for example, have noted that less than two thirds of the initiations made by students with communication boards (i.e., picture books) are responded to by adults. If individuals do not respond to this type of communication, the applicability of such an intervention approach for community settings is limited. In the present study, adults appeared to understand and respond appropriately to most of the requests students made with their devices. These successful interactions served as the basis for significant reductions in problem behaviors.

Despite the students' success in communicating to members of the community, not all of their communicative efforts were successful. There are several reasons for this result. In some of the settings (e.g., at the food

court in the mall), the level of ambient noise was such that it was sometimes difficult to hear the voice output from the devices. In several other situations it appeared as if the adult understood the request, but was not sure if he or she should respond. The teachers did not intervene in these situations but, instead, waited for either the adult to respond or for the student to repeat the request. Such potential difficulties with successful communication should be anticipated by individuals who want to intervene in this manner, and appropriate adjunct training (e.g., teaching a student to repeat a request after a period of delay) should be used to prevent the student from relapsing.

The success of this intervention with students who had previously been unsuccessful in communication training efforts can be credited to several factors. First, the assistive devices required minimal skills to operate. Four of the students could press the pads with limited training, and an adaptation for the 5th student (i.e., Allison's head pointer) provided her with the means to successfully communicate. An additional consideration seemed to be the immediate feedback provided by the vocal output. Although the teachers and community members did not respond instantaneously to the students' requests, the vocal output from the devices appeared to serve as a conditioned stimulus that bridged the delay.

A final factor contributing to the success of these students may have been the responses being taught and their consequences. Previous research has demonstrated that the variables that maintain problem behavior can be used as reinforcers (Durand, Crimmins, Caulfield, & Taylor, 1989). This suggests that teaching students to request the stimuli presumably maintaining their problem behavior may provide them with highly reinforcing consequences (e.g., escape, social attention, food). The specific requests being targeted for training may have been more

likely to be successful because we individually assessed them for each student.

Future work in this area should evaluate the parameters involved in having untrained persons understand and respond to the requests made by individuals with problem behavior. Evaluating the effectiveness of such an approach to intervention appears to hold significant promise in helping many individuals better integrate into community settings.

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*STUDY QUESTIONS*

1. What is meant by the term “natural community of reinforcement,” and how might functional communication training (FCT) facilitate the process of recruiting such reinforcement?
2. Describe the method used for scoring the consequences for problem behavior.
3. Briefly describe the antecedent and consequent events that were manipulated during the functional analysis.
4. How were the results of the functional analysis related to the selection of consequences for each participant’s communicative response?
5. How was the multiple baseline design used in Study 2 constructed?
6. Results obtained in Study 2 showed reductions in problem behavior and increases in communication for all students. The author noted that, “Specific consequences . . . did not differ across baseline and intervention and, therefore, do not appear to account for changes in the students’ behavior problems.” If so, to what processes can one attribute behavior changes such as those observed?
7. How did the antecedent conditions in Study 3 differ from those in Study 2?
8. One goal of the study was to demonstrate facilitation of maintenance through the use of vocal output devices. How might one evaluate the superiority of the devices?

Questions prepared by Eileen Roscoe and Michele Wallace, The University of Florida