EFFECTS OF AN ORAL-SENSORY/ORAL-MOTOR STIMULATION/POSITIVE REINFORCEMENT PROGRAM ON THE ACCEPTANCE OF NONPREFERRED FOODS BY YOUTH WITH PHYSICAL AND MULTIPLE DISABILITIES

RITA L. BAILEY AND MAUREEN E. ANGELL
Illinois State University

ABSTRACT

This study employed a multiple probe design to evaluate the effectiveness of a school-based lunchtime oral-sensory/oral-motor/positive reinforcement program on food acceptance behaviors of three youth with multiple disabilities. Overall dramatic gains in food acceptance behaviors of all participants indicated that trained school personnel were effective in implementing the combined program package after observing trained speech-language pathology graduate students.

Children and youth with severe physical and/or multiple disabilities often have difficulty maintaining adequate nutrition (Gangil, Patwari, Aneja, Ahuja, & Anand, 2001; Sullivan et al., 2001). Sometimes nutritional problems result from physical difficulties with eating and swallowing, an impairment known as dysphagia. Other times, problematic mealtime behaviors can limit the intake of a full array of nutritious foods and liquids. Extreme food selectivity and food refusals are commonly noted problematic mealtime behaviors exhibited by children and youth with disabilities (Anderson & McMillan, 2001; Arvedson, 1997; O'Brien, Repp, Williams, & Christophersen, 1991; Shore, Babbitt, Williams, Coe, & Snyder, 1998). In fact, feeding difficulties and dietary inadequacies have been reported to occur

in as many as 80% of children with severe or multiple disabilities (Palmer, Thompson, & Linscheid, 1975).

Reasons for these problematic behaviors are often multifaceted. It is known that a child's nutrition reflects the sum processes involved in the acceptance and use of foods (Kovar, 1997). Early experience and repeated exposure to new foods appears to contribute to the development of food acceptance patterns and the control of food intake. In fact, most children are likely to reject new foods initially, but they learn to like them with time and repeated neutral exposure (Birch, Johnson, & Fisher, 1995; Birch & Marlin, 1982). Even the age at which new textures are introduced appears to make a difference in the development of food acceptance patterns. Northstone, Emmett, and Nethersole (2001) found that infants who were introduced to foods with textures at earlier ages consumed a greater variety of foods at later ages, while those who were introduced to textures past the age of 10 months were more difficult to feed and had more definite likes and dislikes.

Unfortunately, early experiences with oral feeding and oral sensory stimuli are often limited for children with neurological and/or physical impairments, especially for those who experience extensive episodes of hospitalization. Medically fragile children are often subjected to medically necessary but intrusive and aversive oral/facial sensory inputs. Suctioning, oral and nasal gastric tube placement, and the use of facial tape to secure tubes may lead to tactile defensiveness and oral hypersensitivity (Comrie & Helm, 1997). These children often receive non-oral feedings for the first few months of their lives, and miss out on early oral feeding experiences all together. A combination of oral hypersensitivities, limited oral experiences, and negative associations with the act of eating may result in the development of marked food selectivity and food refusal behaviors.

While the exact underlying etiologies of extreme food preferences and refusal to try new foods may be difficult to determine, several treatment options have been identified. Newman (2000) recommended a variety of oral-stimulation procedures to decrease oral hypersensitivities in young children who are tube fed. The strategies included tooth brushing with a soft toothbrush, pacifiers dipped in juice or formula, sucking on a pacifier during tube feeding, popsicles and candy rubbed on the lips, touching the face, lips, and gradually moving posteriorly in the oral cavity. Elliot, Clawson, and Bishop (2003) recommended an external and external facial stimulation program and oral-motor exercises. Gaebler and Hanzlik (1996) reported a decreased number of gavage feedings, greater weight gain, and fewer days of hospitalization with the use of a 5-minute oral-motor stimulation program for medically fragile children in a hospital nursery. Gisel (1996) reported signif-

icantly increased growth rates children and youth with the diagnosis of cerebral palsy ranging in age from 4 to 13 years following an oral-sensory/oral-motor stimulation program intervention. The oral-sensory/oral-motor stimulation program intervention included activities to improve tongue lateralization, lip control, and vigor of chewing. Development and use of appropriate oral-stimulation programs has been reported in the literature of several disciplines including speech-language pathology, nursing, and occupational therapy (Alper & Manno, 1997; Fuclie, Gisel, & Lau, 2002; Gaebler & Hanzlik, 1996; Gisel, 1996). Bailey and Angell (2005) also reported successful generalization of oral-stimulation programs in educational settings with implementation of these programs by trained school staff members.

Other researchers have reported success with the use of behavior management interventions to treat extreme food selectivity and food refusals. These include the use of extinction and reinforcement (Coe et al., 1997); access to highly preferred tangible items and differential reinforcement (Kahng, Tarbox, & Wilke, 2001); stimulus fading, reinforcement, and extinction (Freeman & Piazza, 1998); texture fading, extinction, and reinforcement (Shore et al., 1998); and multifaceted behavior management programs such as one described by Luiselli, Evans, and Boyce (1985), consisting of establishing temporal limits during meals, withholding social reinforcement for problem behaviors, and contingently reinforcing consumption of non-preferred foods. Recently, Kahng, Boscoe, and Byrne (2003) used escape contingency and token-based reinforcement of alternative behavior to increase food acceptance in a 4-year old girl with pervasive developmental disorder and speech impairment. Najdowski, Wallace, Doney, and Ghezzi (2003) were also successful in helping the mother of a 5-year old boy with autism spectrum disorder increase his food acceptance behaviors at home and in a restaurant by implementing a program consisting of differential reinforcement of alternative behavior, escape extinction, and demand fading.

The two treatment approaches (oral-sensory/oral-motor stimulation and behavior management) that have been used in the prevention and treatment of marked food selectivity and food refusals both appear to have yielded successful results in multiple experiments. However, the effect of an oral-sensory/oral-motor stimulation program (to decrease oral hypersensitivities) combined with a positive reinforcement behavior management program (to increase positive food acceptance behaviors) on the acceptance of non-preferred foods has not been evaluated. Thus, the purpose of the current study was to demonstrate the effectiveness of a feeding intervention package that included an oral-sensory/oral-motor treatment program with a positive rein-

forcement behavior management component in increasing food acceptance behaviors of youth with multiple disabilities.

METHOD

SETTING

The study was conducted at an elementary and a junior high school within a public school district, located within a town of approximately 45,000 people, with 10,416 students making up the district's population. Of these students, 1470 received special education and related services. Two of the participants were fed in the same junior high school classroom and another was supervised in self-feeding in an elementary school classroom. The participants were fed and/or supervised as they ate by school personnel in their classrooms, due to safety concerns, the need for proximity to healthcare personnel, and/or the perceived negative effects of the distracting lunchroom environment.

PARTICIPANTS

Participants in the study were 3 youth between the ages of 11 and 15 with moderate to severe developmental disabilities. All participants received special education services and had been previously identified with feeding impairments to the extent to which they were fed, assisted in feeding, or supervised during self-feeding in the school environment and all had been identified by parents/guardians and teachers as having consistent and extreme food preferences and food refusals. Categories of cognitive and physical disability were established in compliance with the criteria stated in the Individuals with Disabilities Education Act (P.L. 101-476). Licensed psychologists and students' eligibility teams had determined the participants' classification through the use of appropriate measures of general intellectual functioning and adaptive behavior. See Table 1 for participant demographic characteristics and target goals.

DARREN

Darren (Participant 1) was an 11-year old male diagnosed with severe cognitive deficits and multiple disabilities following a severe seizure at birth, as a result of encephalitis. He was also identified as having a behavior disorder. Darren was able to independently eat a regular diet, with consistent verbal prompting to take bites and to attend to the feeding task. Observations and

TABLE 1.
Participant Demographic Information and Target Goals

Participant Number and "Name"	Diagnosis	Age	Gender	Level of Cognitive Function and Disabilities	Feeding Supports	Target Feeding Goal
Participant 1 "Darren"	Seizure at birth; effects of Encephalitis	11	M	Severely Impaired	Staff supervision of self-feeding	Eat a non-preferred food. (any fruit)
Participant 2 "Alice"	Unknown	13	F	Severely and Multiply Disabled	Staff feeds; pureed diet; thick liquids; adaptive cup, spoon	Eat a non-preferred food. (any flavorful food item listed on her parent/staff-generated list of non-preferred foods)
Participant 3 "Jared"	Unknown; Seizure Disorder	15	M	Severely and Multiply Disabled	Supervision; food cut to bite size pieces; Adaptive plate; Adaptive utensils	Eat a non-preferred food. (any food identified as non-salty and non-crunchy)

interviews revealed marked food preferences and food refusals including a nearly categorical refusal of fruit. If Darren accepted a bite of fruit, he often expelled it immediately. Darren also exhibited resistance to touch, usually responding by hitting, attempting to bite, or pinching the person who touched him.

ALICE

Alice (Participant 2) was a 13-year old female with severe cognitive and physical impairment of unknown origin. Observations and interviews revealed marked food preferences and food refusals with expulsion of non-preferred foods. While Alice did not consistently avoid specific food groups, it was noted that the foods she preferred were bland and that foods she typically expelled were of a more flavorful variety. Alice also exhibited resistance to touch, as evidenced by turning rapidly away from her feeder when she was touched by a napkin, cloth, or gloved hands.

JARED

Jared (Participant 3) was a 15-year old male with severe physical and cognitive disabilities of unknown origin and a secondary diagnosis of seizure disorder. Jared's teacher reported that Jared's seizure activity had increased dramatically in the year before the study and that he had shown regression in all academic areas. Jared's seizures were evident throughout the investigation. Seizure activity lasted from brief moments to approximately 45 minutes on several occasions. Jared's seizure activity resulted in several falls that had occurred outside of school. During one of these falls, Jared's chin was split open and required stitches. Approximately 2 weeks later, he fell again. This second fall opened up the original chin injury and the injury was reportedly bandaged instead of attempting stitches a second time. This series of falls made it impossible to implement the external oral-sensory/oral-motor stimulation program for several weeks, as Jared would not allow anyone to touch his face during this time. Additionally, Jared often refused all intraoral facets of the oral-sensory/oral-motor stimulation program for days at a time. The research team judged this to be related to Jared's prior injuries and resultant pain. Therefore, these programs were implemented on an "as tolerated" basis for Jared. Jared's participation in the oral-motor exercise group therapy programs were also affected by his chin injury. Therefore, the researchers avoided activities involving Jared's external face or chin. Jared participated in approximately 50% of the group oral exercise programs during the B and C conditions.

Observations and interviews revealed that Jared had marked food preferences (salty, crunchy foods) and refusal of all other types of foods. Jared exhibited resistance to touch, as evidenced by his turning rapidly away from his feeder when he was touched by a napkin, cloth, or gloved hands. This observable resistance increased following his chin injury.

Experimental Design

An A-B-C multiple probe design across three participants (Murphey & Bryan, 1980) was used to evaluate the effectiveness of the independent variable (i.e., oral-sensory/oral-motor treatment program with a positive reinforcement behavior management component) on the dependent variable (i.e., acceptance and swallowing of identified non-preferred foods by individuals with severe and/or multiple disabilities). Within this design, the identified dependent variable was measured under baseline conditions and the intervention was introduced sequentially to the three participants. Individual performance data were recorded during each session.

Each participant was exposed to three conditions:

1 (A) baseline condition which included parent/guardian, special education teacher, related services personnel, and classroom assistant interviews and documentation of pre-intervention performance on the target behavior
2 (B) the oral-motor/oral-sensory stimulation program (See Appendix A) combined with a positive reinforcement behavior management program for acceptance and swallowing of nonpreferred food items; during this condition trained graduate students in speech-language pathology implemented the treatment package while school personnel observed
3 (C) the oral-motor/oral-sensory stimulation program combined with the positive reinforcement behavior management program implemented in Condition B but implemented by school staff members who were trained by the researchers via systematic instructional procedures

General Procedures

Parents/guardians, special education teachers, support service personnel, and classroom assistants of potential participants were approached to obtain information regarding the participants' food preferences and refusal behaviors. A list of non-preferred food items or food categories was generated by parents/guardians, special education teachers, support services personnel, and classroom assistants. Lists were compiled from separate interviews and compared to determine those food items that all or most considered non-preferred by each participant. Baseline (A) probe sessions were conducted at

each participant's home school, with the same feeders and within the setting where they were currently being fed and/or supervised during lunchtime meals. For three lunch sessions, multiple trials of an assortment of the types of foods or specifically identified non-preferred food items were introduced in the same environment and by the same supervising teacher or classroom assistant with whom the students were normally fed or supervised while eating. The first author conducted these baseline evaluations. A graduate student in speech-language pathology independently documented performance data for purposes of interobserver reliability calculations. All evaluations were videotaped to allow for further analysis and for purposes of calculating interobserver reliability percentages by an additional member of the research team. To select the nonpreferred foods to be presented to each participant and to determine food acceptance responses, the researchers used Baseline (A) probe findings and compared transcripts of the lists of non-preferred food items generated by parents/guardians and school staff. Members of the research team were in 100% agreement regarding the non-preferred food items and categories for each participant prior to initiation of the investigation.

Baseline Probes

The first author and graduate students in speech-language pathology charted baseline percentages of accurate responses for each participant. The graduate student observers were trained in the use of individualized data collection sheets that utilized a plus (+) and minus (–) system to chart participants' performance on target food acceptance behaviors. The graduate students verbally demonstrated a functional understanding of the + and – system prior to the initiation of the first baseline session. Using this recording system, each observer marked a plus (+) sign if the participant accepted the non-preferred food and swallowed it and a (–) sign if the participant did not accept and swallow a non-preferred food for each bite or opportunity. If the food was initially accepted and then expelled, a (–) was assigned for that trial. Each new presentation of the food was assigned a + or – sign. So, the same bite of food may have been rejected for two presentations, (–) and (–), and then accepted on a third presentation (+), yielding an acceptance rate of 33% for 3 trials. Once a food was rejected 10 times in succession, no further presentations of that food were given during that session. Three observations of lunchtime meals were used to collect baseline data recorded for each participant prior to the introduction of the sequential treatment conditions.

Intervention Conditions

Intervention sessions were conducted during school lunchtime mealtimes 4 days per week until all participants reached performance criterion. Prior to the introduction of the interventions, the graduate student clinicians received specific training in the research protocol (i.e., conducting reinforcer preference assessments and interpreting results, implementing the positive reinforcement behavior management program, implementing the oral-motor/oral-stimulation program, and collecting performance data). The authors conducted these training sessions during two 3-hour class periods in a university setting prior to the initiation of the investigation. The first author (a licensed certified speech-language pathologist) supervised the administration of all interventions for 100% of the study. All school personnel involved in the participants' mealtimes attended both training sessions to standardize the training information and methods across graduate students and school personnel.

Prior to each treatment session, a pre-session assessment of reinforcer preference protocol (Gast et al., 2000) was conducted to determine the current reinforcement preferences of each participant. The protocol for each preference assessment included a 2-minute pre-session presentation of stimuli during a 5-minute experimental session prior to the feeding session. During the reinforcer preference assessment, two neutral stimuli and two preferred stimuli were presented to the child. The duration of attention to the stimulus and indications of attraction to the stimulus (smiling or laughing behavior) were recorded. The stimulus that elicited the longest duration of attention, smiling, or laughing behavior was selected as the current preferred stimulus and was used during that session as positive reinforcement of the target behavior (acceptance of non-preferred foods). Preference assessment data collection forms were created and sensory reinforcers for each sensory category were placed in each intervention setting. The positive reinforcement behavior management program used for each participant included verbal praise for the behavior (e.g., "good bite" or "good eating") immediately followed by a brief introduction of the identified sensory reinforcer (O'Brien et al., 1991).

The positive reinforcement behavior management component of the treatment program consisted of positive social and sensory reinforcement for performance of target food acceptance behaviors. The reinforcers were selected using the 5-min preference assessment protocol prior to each meal (Gast et al., 2000). Contingent positive reinforcement was provided directly following a participant's performance of the target behavior. For example, if a participant exhibited preference for the talking baby doll during the rein-

forcer preference assessment, the talking doll was presented immediately after each performance of a target behavior (i.e., accepting a bite of a non-preferred food).

The oral-motor/oral-sensory stimulation component of the program consisted of a 5-min oral and perioral stimulation program as described by Gaebler and Hanzlik (1996) and modified by the first author for use with older children (see Appendix A). The 5-min oral and perioral stimulation program was implemented just prior to each Condition B and C mealtime in order to prepare each student's oral mechanism for the eating process. Oral-motor exercises and activities were completed after each meal as a group therapy activity (see Appendix B), with graduate student clinicians providing instruction and modeling activities and exercises for individual participants as needed. These group exercises/activities were completed within a 10–15 min time period after the meal, so as not to fatigue the participants' oral-motor systems prior to eating.

During Condition B, graduate student clinicians implemented the intervention package. During Condition C, the previously trained school personnel who had observed the graduate student clinicians during Condition B implemented the intervention package. The graduate student clinicians and supervising speech-language pathologist (the first author) stayed with the classroom personnel during meals throughout Condition C while the school personnel provided the interventions. Guidance and instruction were systematically faded as the classroom personnel exhibited skill in the administration of the interventions. After the third session of Condition C for each participant, the graduate students served as observers, only recording data and providing no guidance or instruction to the staff so that 100% of the interventions were provided by the trained school staff.

Performance and Procedural Reliability

To measure progress toward target behaviors, the first author and graduate students in a university speech-language pathology program collected data during every intervention session. To measure reliability during intervention sessions, both participant performance data and feeding helper procedural reliability data (Billingsley, White, & Munson, 1980) were collected. Independent analysis of participants' performance data was conducted by a review of videotapes of individual therapy sessions by graduate speech-language pathology students who were not providing intervention during the study. The first author individually trained these students in the data recording system and evaluation of the videotapes. Before the observers served as independent raters of participant progress toward target goals, they were

required to demonstrate competence (in verbal and written form) in the data collection procedures by accurately recording and analyzing data using a sample training videotape.

In addition, independent interobserver reliability observations were conducted when study participants were absent from school on an intervention day. In this case, the graduate student clinician assigned to the absent student functioned as an independent reliability rater for another participant and graduate student peer in the research setting. A procedural reliability checklist was created for this purpose. Procedural reliability variables included the following steps: (a) recording situational information, (b) administering the pre-session preference assessment per recorded protocol (during Conditions B and C), (c) administering the pre-session oral-motor/oral-sensory stimulation program (during Conditions B and C), (d) delivering appropriate consequences for target behaviors (during Conditions B and C), (e) recording the participant's performance data on the data sheet, and (f) assisting the participant in engaging in additional oral-motor group activities following the meal (during Conditions B and C). The independent rater listed the observed participant's target goal on the procedural reliability checklist, recorded the participant's performance on the target behavior, and recorded the graduate student peer's implementation of the intervention procedures.

To determine reliability during instructional sessions, both participant performance data and data on graduate students' procedural reliability (Billingsley et al., 1980) were collected and analyzed. Performance reliability coefficients were calculated by dividing the number of agreements plus disagreements by the number of agreements between the graduate student and the reliability observer and multiplying by 100. Procedural reliability percentages were calculated by dividing the number of clinician behaviors performed by the number of clinician behaviors that should have been performed and multiplying by 100. Performance and procedural reliability rates of 90% were considered acceptable for this investigation.

RESULTS AND DISCUSSION

Darren's Performance

The top graphic display in Figure 1 shows Darren's performance data. Baseline (A) data for accepting and swallowing non-preferred food (fruit) were measured at a mean correct response rate of 9%. In the B condition, Darren's mean response rate increased by 29%, resulting in a mean rate of 38%. In Condition C, Darren's mean rate improved 33% to a mean 71%.

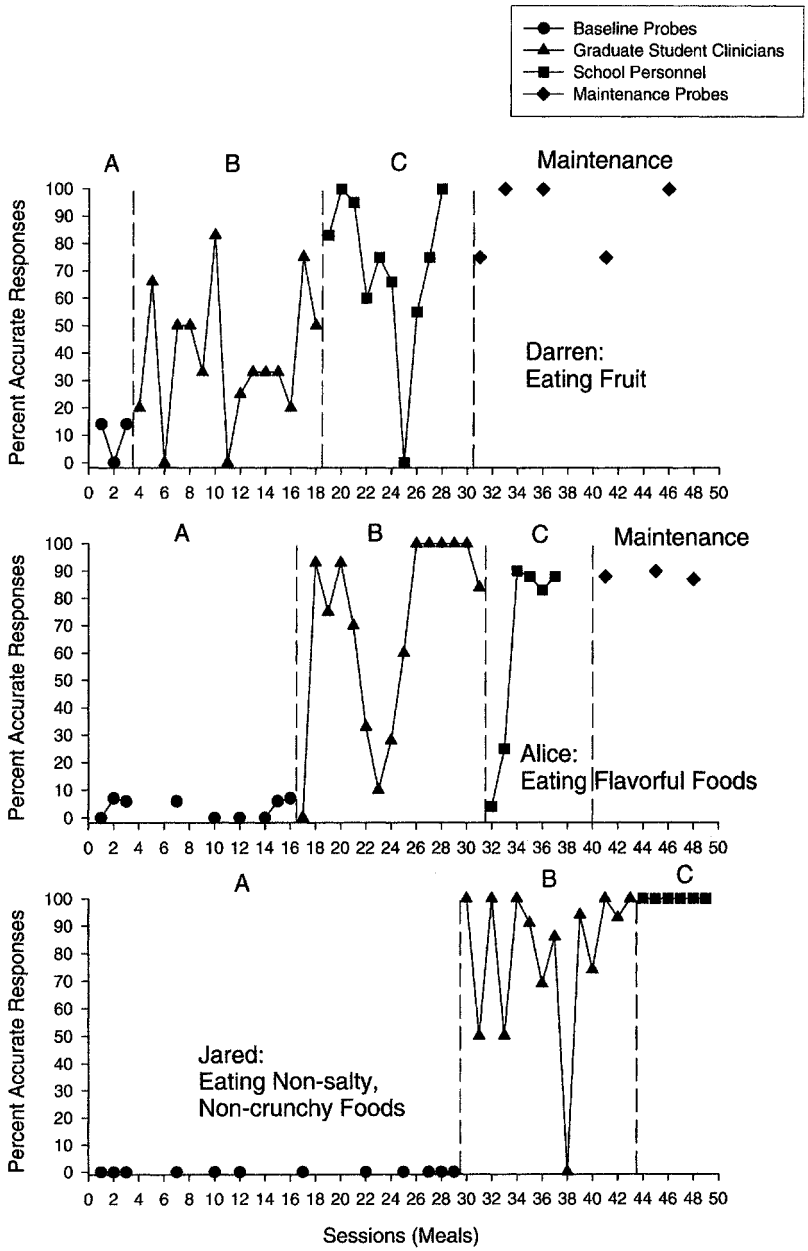

Figure 1.

Graphic display indicating percentage of accurate responses (food acceptance behaviors) across participants and conditions.

Darren's total gain in mean rate of correct responding from the Condition A to Condition C was 62%.

A functional relationship was established between the intervention package and Darren's food acceptance behaviors. Table 2 shows performance data with mean percent change across conditions per participant. Darren gained a mean 29% in the acceptance of fruit in the B condition. While Darren made progress throughout the (B) condition, he made more marked progress (33% gain) in the Condition C when the school personnel were providing the interventions. The research team did not find this result surprising, because the severity of Darren's behavior disorder appeared to negatively affect almost all interactions with graduate students who provided interventions during Condition B. Darren exhibited more frequent maladaptive behaviors when he interacted with graduate students than when he interacted with school personnel. In fact, a notable decrease in maladaptive behaviors occurred in interactions with school staff, likely due to the strength of previous relationships that had been established between Darren and school staff. Maintenance probes were conducted approximately once per week following the investigation. Darren's mean rate of correct responding during maintenance probes was measured at 90%, reflecting a continued gain of 19% following the final intervention condition (C).

Alice's Performance

Alice's performance data are shown in the middle graphic display of Figure 1. Baseline data for accepting and swallowing non-preferred (flavorful) foods revealed a mean rate of correct responding of 4%. A functional relationship was found between the intervention package implemented by the graduate student clinicians and by the school staff and Alice's food acceptance behaviors during Conditions B and C. In Condition B, Alice's mean correct response rate rose 66% to a mean 70%. In Condition C, her mean rate of correct responses decreased 7%, ending with a mean rate of 63%. Alice's total gain from the baseline condition (A) through the second intervention condition (C) was 59%. Maintenance probes were conducted once per week following the investigation. Alice's mean rate of correct responding during maintenance probes was measured at 88%, reflecting a gain of 25% following the final intervention condition (C).

Jared's Performance

Jared's performance data are shown in the bottom graphic display found in Figure 1. Baseline data (A) for accepting and swallowing non-salty and non-crunchy foods were measured at 0%. A functional relationship was found

TABLE 2.
Individual Data - Mean Percent Change Across Conditions

Participants	Condition A	Condition B	Condition C	Maintenance Probes	Total Mean Gain (A–C)
Darren (Accept fruit)	9%	+29%	+33%	+19%	+62%
Alice (Accept Selected Non-Preferred Flavorful Foods)	4%	+66%	–7%	+25%	+76%
Jared (Accept Non-Salty, Non-Crunchy Foods	0%	+79%	+21%	None conducted	+100%

between the feeding improvement program and Jared's food acceptance behavior in both Conditions B and C. In the B condition, Jared increased his mean percent correct responding by 79%. During Condition C, this rate improved an additional 21% to a mean of 100% acceptance of non-salty and non-crunchy food bites offered by the classroom personnel. Jared's total gain from the baseline condition (A) to the second intervention condition (C) was 100%. Maintenance probes for Jared were not conducted as the school year ended.

Variability in Jared's performance data during Condition B may be attributed to the increase in seizure activity that he experienced periodically throughout this intervention condition. During this time period, Jared's seizure activity was documented as lasting up to 45 minutes of the lunch period. Following a lengthy seizure, Jared appeared fatigued, and often did not eat well. This increase in seizure activity may have contributed to Jared's inconsistency in food acceptance behaviors during Condition B (see Figure 1). Jared's mean rate of correct responding during school staff-implemented Condition C was measured at 100%, reflecting improved and stable maintenance of behaviors gained in the Condition B.

Reliability Data

Data relating to interobserver agreement on participant performance and interventionists' procedural fidelity were collected simultaneously during at least 20% of all sessions and across all conditions (Billingsley et al., 1980; Tawney & Gast, 1984). Both on-site interraters and videotaped intervention sessions were rated by graduate students trained in the (+) and (–) recording system. Mean interrater agreement on participant performance was deemed acceptable at rates of 96% (Jared), 97% (Alice), and 98% (Darren). Additionally, procedural reliability across intervention providers was evaluated using a (+) and (–) system similar to the one used to evaluate participant performance that contained the procedural checklist created for this purpose. Procedural reliability was measured at a rate of 98% for graduate students administering interventions in the B condition and at 90% for school staff administering interventions in the C condition. Both were considered acceptable at or above a rate of 90%.

Demonstration of Experimental Control

Several factors demonstrated experimental control in this investigation per guidelines provided by Tawney and Gast (1984). First, the replication of the intervention across three participants increased experimental control. In this study, the dependent variables were repeatedly measured across three partic-

ipants, two school settings, and two intervention conditions. This was achieved by recording each participant's performance data during every session within each condition (A, B, and C).

Secondly, attempts were made to control for extraneous and potentially confounding variables. To ensure consistent training in the research protocol and intervention methodology, graduate student feeding helpers and school staff members received training in the intervention methods at the same time, using the same instructors, methods, and materials. School staff members were present during most intervention sessions, and were well aware of the intervention protocol conditions. Graduate student feeding helpers provided additional training and support to classroom staff feeding helpers during Condition C, fading the amount and levels of assistance until the school staff members provided 100% of the interventions.

LIMITATIONS

The interventions were provided in a systematic, sequential fashion, but they were not counterbalanced across participants. It is possible that the sequence in which the interventions were provided affected the outcomes that were observed. In this study, the researchers purposely sequenced the conditions in this order so that school personnel would observe implementation of the interventions as part of their training protocol. Future investigations should counterbalance the sequence of interventions across participants to counteract cumulative treatment effects and to assist in the measurement of treatment effectiveness under different conditions. Results of this study are also limited to three students with multiple disabilities, thus limiting the study's external validity. Similar studies should be conducted with more participants under various environmental conditions.

IMPLICATIONS

This study provides a significant contribution to the literature related to food acceptance and refusal by individuals with physical and multiple disabilities. Previous investigations have not focused on the effects of combined oral-motor/oral-sensory stimulation programs and positive reinforcement behavior management programs on food acceptance behaviors for students with disabilities. Furthermore, the efficacy of school-based intervention programs has not been evaluated. Gains made by participants in this study help to establish a framework for management of marked food preferences and

refusals in the school-aged population. Further study in this area will more clearly define "best practice" applications in school settings.

The dramatic progress made by each participant in this study appears to confirm the results of other investigations that included positive reinforcement methods in improving food acceptance behaviors (e.g., Freeman & Piazza, 1998; Kahng et al., 2001; Shore et al., 1998). The addition of the oral-stimulation treatment program may prove to be a critical tool in the management of marked food preferences and food refusals. While further research is warranted, the positive results that were documented in response to this intervention package are promising.

Finally, all participants maintained or continued to progress toward food acceptance goals in maintenance probes conducted by research team members approximately once per week following the final intervention condition. This appears to be a positive prognosticator for generalization and carryover of progress resulting from these combined interventions. It is especially promising that the school staff members effectively provided the interventions during the final condition. Rates of food acceptance behaviors with interventions provided by school staff in the school environment were markedly higher than during the Baseline (A) condition. This may indicate that carryover and generalization of the effects of the intervention programs are likely to occur when interventions are provided by school staff. The overall positive effects of combined positive reinforcement and oral-sensory/oral-motor stimulation programs indicate that this novel school-based intervention approach may be a viable means of increasing food acceptance behaviors of youth with multiple disabilities in educational environments. Administrators and school-based teams should be encouraged by these results, as they indicate that the strategies investigated in this study fit nicely into person-centered program approaches and can lead to both maintenance and generalization of skills and behaviors in natural settings under normalized conditions.

APPENDIX A
ORAL-SENSORY/ORAL-MOTOR STIMULATION PROGRAM

1. (a) Five small firm rubs on each side of the mouth-from the ear to the corner of the mouth.
   (b) Gentle pressure under the base of the tongue, under the chin.
   (c) Repeat (a) and (b) two more times.

2. (a) Five small, firm rubs around the lips (from center to side)
   (b) Gentle pressure under the base of the tongue, under the chin.
   (c) Repeat (a) and (b) two more times.

3. Rub three times around upper gums, front to back on each side, gentle pressure under chin after each side is stimulated
   (b) Repeat (a) on lower gums
   (c) Repeat (a) on inside of upper gums
   (d) Rub three times back to front along upper palate
   (e) Hold finger (or Nuk Brush) against upper palate for 2–3 seconds

4. Rub three times from front to back on center of tongue.
   (b) Repeat (a) from center to sides.
   (c) Tap three times from front to back on center of tongue
   (d) Gentle pressure under the base of the tongue, under the chin

APPENDIX B
SAMPLE ORAL-MOTOR EXERCISE LESSON PLAN

GOAL # 1
The participant will improve lateral tongue movement.

EQUIPMENT/TOOLS: NUK™ BRUSH, FLAVORED JUICE

PROCEDURE
The feeding helper will use a Nuk™ brush dipped in flavored juice to stroke the sides of the tongue from front to back to stimulate lateral tongue movements.

GOAL # 2
The participant will improve mandibular movements for chewing.
Equipment/tools: Non-latex "chewy" tubes

PROCEDURE
The feeding helper will place the chewy tubes on the molars of one side of the mouth and provide tactile assistance to the participant's jaw to begin chewing movements. Next, move to the other side of the mouth and repeat.

GOAL # 3

The participant will improve lip-rounding movements.

Equipment/tools: Pinwheels

PROCEDURE:

The feeding helper will hold the pinwheel up and demonstrate blowing while instructing the participant to blow. If the participant doesn't blow, line the pinwheel up by the participant's face and blow on the participant's cheeks while also blowing the pinwheel. It may also be necessary to use a mirror to demonstrate and practice the lip rounding movements prior to adding the blowing.

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Address correspondence to Dr. Rita L. Bailey, Department of Speech Pathology and Audiology, Illinois State University, Campus Box 4710, Normal, IL 61790-4710. rlbaile@ilstu.edu