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Small Group Instruction for Students With Autism

General Case Training and Observational Learning

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A multiple-probe design across response chains and students was used to evaluate the combined instructional effects of progressive time delay, general case training, and observational learning on the food and drink preparation skills of three children with autism. All instruction was delivered in a group learning arrangement. The data suggested that these students acquired and maintained the targeted skills through the use of these instructional techniques. In addition, students were able to acquire response chains by observing the other student in the group and appeared to generalize the acquired skills to similar response chains. The implications for future research are discussed.

Keywords: *small group teaching; autism; general case training; observational learning; progressive time delay; food and drink preparation skills*

Food and drink preparation skills are important in the domain of daily living for children with autism because they enhance their independence at home, facilitate employment opportunities in the community, and increase group-home living options. Teaching food and drink preparation skills is especially important for children with autism who are making the transition to youth and adulthood (Carothers & Taylor, 2004; Lancioni & O'Reilly, 2002, National Research Council, 2001).

An effective instructional procedure for teaching children with developmental disabilities is progressive time delay (PTD; Farmer, Gast, Wolery, & Winterling, 1991; Wolery, Ault, & Doyle, 1992). Evidence-based research studies investigating PTD show that PTD is an effective instructional procedure for teaching discrete as well as chained behaviors to individuals with various disabilities and of different ages. Many discrete behaviors have been taught by PTD, including identifying objects (Barbara & Sulzer-Azaroff, 1983; Godby, Gast, & Wolery, 1987), reading words (Ault, Gast, & Wolery, 1988; Browder, Hines, McCarthy, & Fees, 1984; Collins & Stinson, 1995; McCurdy, Cundari, & Lentz, 1990; Stinson, Gast, Wolery, & Collins, 1991), identifying pictures (Barbara & Sulzer-Azaroff, 1983), establishing a receptive repertoire of communicative

gestures (Duker, Van Deursen, de Wit, & Almen, 1997), and naming photographs of foods (Doyle, Schuster, & Meyer, 1996). Moreover, chained tasks, such as making a bed (Snell, 1982), using a vending machine (Browder, Snell, & Wildonger, 1988), and purchasing skills using a calculator (Frederick-Dugan, Test, & Varn, 1991), have been taught through PTD. The majority of the studies have taught discrete skills, but chained tasks have also been taught using PTD procedures.

The aforementioned research establishes the effectiveness of PTD, but efficiency should also be considered when deciding which instructional procedure to choose (Tekin-Iftar, Acar, & Kurt, 2003). Wolery and Gast (1990) defined efficiency as producing rapid learning, more generalized performance, and broader learning and also providing for the emergence of relationships that were not directly taught but positively

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influence later learning. Under this conceptualization, acquiring response chains by observation and promoting the generalization of the acquired skills to similar response chains meet some criteria of efficiency (i.e., facilitating broader learning and generalization). Therefore, educators should continue to search for alternative instructional procedures that promote learning and generalization during acquisition training (Tekin-Iftar et al., 2003).

The literature shows that individuals with disabilities often have difficulty in generalizing the acquired skills across situations (Alberto & Troutman, 1995; Cooper, Heron, & Heward, 1987; Steere, Pancsofar, Powell, & Butterworth, 1989; Wolery, Bailey, & Sugai, 1988). Therefore, generalization of the acquired skills to novel situations should be planned when designing instruction for individuals with disabilities. General case approach has been used to systematically promote generalization during the acquisition stage. The effective use of general case programming requires defining the range of responses and stimuli that need to be acquired, and using this information to select the most logical items to teach examples that will enable students to transfer their learning to other items not directly taught (Browder & Snell, 2000; O'Neill, Faulkner, & Horner, 2000; Sprauge & Horner, 1984). Browder and Snell (2000) describe the features of the general case approach as follows: (a) Define the instructional universe, (b) define the stimulus and response variation, (c) select the exemplars that sample the range of variation, (d) vary the irrelevant features, and (e) teach one set of exemplars and test the others. The general case approach has been used successfully to obtain or at least facilitate generalization of discrete and chained skills. This approach was used to teach money skills (Gardill & Browder, 1995), communication skills (McDonnell, 1996), and purchasing skills using a calculator (Frederick-Dugan et al., 1991).

Research has shown that students of various ages and ability levels can learn response chains during group instruction through observational learning (Farmer et al., 1991; Fickel, Schuster, & Collins, 1998; Griffen, Wolery, & Schuster, 1992; Hall, Schuster, Wolery, & Gast, 1992; McCurdy et al., 1990; Parker & Schuster, 2002; Stinson et al., 1991; Wolery, Ault, Gast, Doyle, & Griffen, 1991). Three of the above-mentioned studies were conducted with PTD (Farmer et al., 1991; McCurdy et al., 1990; Stinson et al., 1991). However, there are no studies investigating the combined effects of PTD with general case

training and observational learning on teaching chained skills to children with autism. There are several reasons to investigate the effectiveness of PTD combined with general case training and observational learning. First, as noted above, there is little research about the effectiveness of PTD on teaching chained behaviors. Second, there is a need to replicate the effects of the general case approach for the purpose of promoting generalization because obtaining generalization is an important outcome of effective teaching. Third, there is still a need to investigate ways of increasing instructional efficacy through the acquisition of response chains via observational learning. Therefore, the present study should contribute to the existing research literature on PTD by investigating the combined effects of PTD with general case training and observational learning.

The present study was planned to answer the following specific research questions: Does the use of PTD combined with general case training and observational learning in a small group (teaching one child and having two observers) result in (a) the acquisition of the instructed response chains, (b) generalization to similar response chains, (c) maintenance in a 1-week follow-up assessment, and (d) observational learning of the instructed chains?

Method

Participants

Students. Three Turkish boys with autism participated in the study. They were diagnosed at the psychiatry department of a university hospital, and their ages ranged from 3 years 5 months to 4 years 5 months during the diagnostic period. All students attended primary school on a full-time basis during the study. Ulas and Ali were twin brothers (The names are pseudonyms). No adaptive scores were available for the students.

Ogulcan (8 years 11 months old during the study) was a third-grade student with autism in a regular school and was mainstreamed at a normal class during the study. He was enrolled at an early intervention program known as Small Steps Early Intervention Program for Children with Developmental Delays when he was 3 to 5 years old. Ogulcan received one-to-one instruction as a support service for 3 years, could read and write, and could do subtraction, multiplication, addition, and division. He was able to perform most self-care skills. His areas of weaknesses

include social interaction and initiating and maintaining communication with others. Besides the aforementioned weaknesses, he had difficulty performing daily living skills, such as food and drink preparation, transportation, and so on.

Ulas (8 years 7 months old during the study) was a second-grade mainstreamed student with autism. He was enrolled at Small Steps Early Intervention Program for Children with Developmental Delays when he was 4 to 5 years old. Ulas could read and write and do subtraction, multiplication, addition, and division. He was able to perform most self-care skills. However, he had difficulty in some of the daily living skills, such as food and drink preparation, bed making, cleaning up the table, bus riding, and so on. His areas of weakness also included social interaction and initiating and maintaining communication with others.

Ali, Ulas's twin brother, was a second-grade mainstreamed student with autism in a regular school. He was also enrolled at Small Steps Early Intervention Program for Children with Developmental Delays when he was 3 to 5 years old. Ulas could read and write and do subtraction, multiplication, addition, and division. He was able to perform most self-care skills, like his brother Ulas. However, he had difficulty in some of the daily living skills. His areas of weaknesses were same as his brother Ulas. Ali had also difficulty in social interaction and initiating and maintaining communication with others.

The students had to have the following prerequisite skills: (a) attending to audio and visual stimuli for at least 10 min, (b) turn-taking skills, (c) following verbal directions, and (d) motor skills that were needed to learn the target skills. Audiovisual acuity skill was assessed through observation as well as interviewing the parents and teachers. Turn-taking skill was assessed by delivering specific directions to a particular member in the group; the rest of the group members' responses were assessed in terms of whether they awaited their turn in the group. The ability to follow verbal instructions was assessed by delivering a simple instruction, such as asking them to bring an object near to them. Motor skills were observed during several activities that required those skills. Also, the second author had already conducted several studies with the students who participated in the study. Therefore, the researcher's previous observations and experiences with them were taken into consideration. All students had the prerequisite skills for this study based on the results of these assessment processes and the researcher's observation.

Staff. All experimental sessions were conducted by the second author of the study, who had 15 years of experience working with students with autism and mental retardation. A research assistant from the same institute collected the reliability data. She was a graduate student in special education and familiar with the instructional procedures used in the study.

Settings

All sessions were conducted at the cafeteria of the Research Institute for the Handicapped at Anadolu University. There was a kitchen counter with wash-basin, a tea machine, a toaster, a small refrigerator, cupboards, and four circle tables each with four chairs in the cafeteria. Other than the teacher and the students, no one was available in the cafeteria during the experimental sessions. The instructed child and the teacher were standing face to face, in front of the kitchen counter. The other two students were placed at one of the circle tables in the cafeteria across the instructed child and the teacher, enabling them to observe the instruction.

Materials

The following materials were used during training: pitchers, scissors, spoons, glasses, robo-presses on different brands, citrus squeezer on different brands, toasters on different brands, knives, cutting board, blender, mixer, hot plate, pot, countertop, refrigerator, kettle, bowls, apple, carrot, tomato, drinking water, sandwich breads in different forms, feta cheese, salami, sausage, powdered drink mix, concentrated juice, yogurt, milk, hot chocolate, and a trash can. Also, data collection forms and a Handycam camera were used for recording. The general case approach was used for facilitating generalization of the target skills. Therefore, training sets were formed for each target behavior and for each student. Besides training sets, two generalization sets were formed from the above-mentioned materials for each target behavior for each student to test for generalization. In sum, there were three sets for each target behavior of each student. One set was used during training, and the other two sets were used to test the generalization. The materials were selected as follows: First, an instructional universe was defined. For the small kitchen tools, the common three brands in Turkey were selected as the instructional universe. For the food and drink items, the instructional universe was defined by the items that were available in the convenient

grocery markets in the town (one in the university campus). Among the alternatives in the instructional universe, the best example (the common one) was selected. After defining the instructional universe, generic task analyses were developed for each of the target behaviors for each student. After that, the stimulus and response variations were determined. For example, the power buttons of the blenders were quite different: One of the blenders required pushing a button, and the other required rotating a button. A description of these variations can be obtained from the corresponding author. The target behaviors, the number of steps in the task analyses of target behaviors, training sets, generalization behaviors, the number of steps in the task analyses of generalization behaviors, and generalization sets for each student are presented at Table 1. The students consumed the foods and drinks that they prepared as tangible reinforcers.

Task Analyses

The target behaviors were food and drink preparation skills. Generalization was attempted through the general case approach. There was one training set for performing each target behavior during acquisition and two sets for assessing generalization. The task analyses developed for performing the target behaviors (generic task analysis) with training sets and generalization sets can be obtained from the corresponding author. The numbers of the steps of the task analyses range from 15 to 27 (see Table 1).

Experimental Design and Assessment Conditions

Experimental design. A multiple-probe design across food and drink preparation skills that was replicated across students was used to evaluate the effects of PTD combined with general case training and observational learning to teach response chains in a small group. We were specifically interested in assessing (a) the acquisition of the instructed response chains, (b) generalization to similar response chains, (c) maintenance in a 1-week follow-up assessment, and (d) observational learning of the instructed and generalization chains. The dependent variable was the percentage of correct responses in performing the steps of the target skill. The independent variable was PTD combined with general case training and observational learning. One chained food and drink preparation skill was introduced at a time. The effectiveness of PTD was demonstrated when the student

was responding at or near baseline levels during full probe conditions before the intervention and the criterion was reached only after the intervention was introduced (Tekin-Iftar & Kircaali-Iftar, 2004; Wolery et al., 1988).

Generalization and observational learning pretest and posttest conditions. Generalization to similar response chains and acquisition of the observationally learned response chains were tested during pretest and posttest trials. Pretest occurred just after baseline session (first probe session). All generalization and observational learning response chains were tested individually. As soon as the criterion was met for each target behavior, a posttest condition was conducted immediately after the full probe conditions. There was one trial in these conditions.

Generalization pretest and posttest trials were conducted with each generalization set. The teacher had the materials ready, introduced them to the student, secured the participants' attention, and presented the task direction, "Ogulcan, please prepare juice from the powdered mix." The student was given 4 s to initiate the task and could respond correctly, respond incorrectly, or produce no response. Correct responses were defined as the student's initiating the correct step of the task analysis and completing it correctly within 15 s. Incorrect responses were defined as the student's initiating an incorrect step of the task analysis or completing it incorrectly. No responses were defined as not initiating the step of the task analysis in 4 s. Incorrect response and no response were both counted as errors. Correct responses resulted in verbal descriptive praise, and incorrect responses and no responses were ignored. Students were verbally reinforced for their attending and cooperation behaviors during the sessions. Students were tested only for their own generalization sets. In other words, generalization assessment was not conducted to test the observationally learned response chains. For example, Ogulcan was tested on his own generalization sets, which were not used during training.

Observational learning of the response chains taught to others in the group was probed by testing all students about the response chains of each student in the group. Ulas and Ali were required to perform Ogulcan's response chains, Ali and Ogulcan were required to perform Ulas's response chains, and Ulas and Ogulcan were required to perform Ali's response chains in these probe sessions. The observational

Table 1
The Target and Generalization Behaviors for Each Student, Training Sets, and Generalization Sets

Student	Target Behavior (No. of Steps in the Task Analysis)	Training Set	Generalization Behavior (No. of Steps in the Task Analysis)	Generalization Set 1	Generalization Behavior (No. of Steps in the Task Analysis)	Generalization Set 2
Ogulcan	1. Preparing juice from powdered mix (15)	Pitcher, scissors, fork, glass, drinking water, powdered mix	1. Preparing cold orange tea from mix (15)	Pitcher, scissors, fork, glass, drinking water, orange tea mix	1. Preparing juice from concentrate (15)	Pitcher, scissors, fork, glass, drinking water, concentrate
	2. Preparing apple juice (21)	Robo-press in Arcelik brand, glass, knife, cutting board, apple	2. Preparing carrot juice (21)	Robo-press in Beko brand, glass, knife, cutting board, carrot	2. Preparing tomato juice (21)	Robo-press in Kenwood brand, glass, knife, cutting board, tomato
	3. Preparing feta cheese sandwich (19)	Sandwich bread, feta cheese, tomato, knife, cutting board	3. Preparing sandwich with salami (19)	Sandwich bread, salami, tomato, knife, cutting board	3. Preparing mixed sandwich (19)	Sandwich bread, salami, feta cheese, tomato, knife, cutting board
Ulas	1. Preparing yogurt drink with spoon (16)	Yogurt, bowl, spoon, glass, drinking water, refrigerator	1. Preparing yogurt drink with hand mixer (16)	Yogurt, bowl, spoon, hand mixer, drinking water, refrigerator	1. Preparing yogurt drink in blender (16)	Yogurt, bowl, spoon, blender, drinking water, refrigerator
	2. Preparing hot chocolate on hot plate (26)	Mug, milk, hot chocolate mix, hot plate, teaspoon, pot	2. Preparing hot chocolate on countertop (26)	Mug, milk, hot chocolate mix, counter plate, teaspoon, pot	2. Preparing hot chocolate with kettle (26)	Mug, milk, hot chocolate mix, kettle, teaspoon
	3. Preparing toasted jelly sandwich (25)	Toaster in Arcelik brand, sliced bread, butter, jelly, knife, plate	3. Preparing toasted jelly sandwich (25)	Toaster in Beko brand, sliced bread, butter, jelly, knife, plate	3. Preparing toasted jelly sandwich (25)	Toaster in Arzum brand, sliced bread, butter, jelly, knife, plate
Ali	1. Preparing toasted sandwich with cheese (26)	Toaster, sliced bread, cheese, knife, cutting board, refrigerator	1. Preparing toasted sandwich with sausage (26)	Toaster, sliced bread, sausage, knife, cutting board, refrigerator	1. Preparing toasted mixed sandwich (26)	Toaster, sliced bread, cheese, sausage, knife, cutting board, refrigerator
	2. Preparing orange juice with Arcelik citrus squeezer (24)	Citrus squeezer, orange, knife, cutting board, glass, trash can, refrigerator	2. Preparing orange juice with Beko brand citrus squeezer (24)	Citrus squeezer, orange, knife, cutting board, glass, trash can, refrigerator	2. Preparing orange juice with Kenwood brand squeezer (24)	Citrus squeezer, orange, knife, cutting board, glass, trash can, refrigerator
	3. Preparing soup on hot plate (27)	Hot plate, soup mix, saucepan, pitcher, glass, bowl, scissors, scoop	3. Preparing soup on countertop (27)	Countertop, soup mix, saucepan, pitcher, glass, bowl, scissors, scoop	3. Preparing soup on stove (25)	Stove, soup mix, saucepan, pitcher, glass, bowl, scissors, scoop

learning probe sessions were conducted in the same fashion as the generalization probe session.

Baseline and probe conditions. Baseline conditions were conducted prior to teaching food and drink preparation skills to each student, whereas full probe conditions were conducted after the criterion was met for the response chain and when stable data were obtained for at least three consecutive sessions. There was a trial in both baseline and full probe sessions. A single-opportunity method was used in these conditions. Task directions were provided to the student and a 4-s response interval was applied. Baseline and full probe sessions were conducted in the same manner except that at the beginning of the baseline conditions, the materials and the places they were located were introduced to the students. For instance, a teacher would open a drawer and introduce the utensils that they would use during the session by saying, "These are knives, forks, and spoons. We will be using them in a minute. Their places are right here." This introduction was occurred for all materials used in the study.

Baseline and full probe conditions were conducted as follows. The teacher delivered an attentional cue to the group: "Folks, let's work." After receiving verbal or gestural affirmative response from the group, the teacher praised the group for their attention by saying, "You are just great!" The teacher then provided an individual task direction to one of the students in the group, "Ogulcan, please prepare juice from powdered mix," and waited 4 s for the student to respond. The possible student responses were the same as in the generalization and observational learning pretest-posttest sessions. Correct responses resulted in receiving verbal and tangible reinforcers, and incorrect responses were ignored. Correct responses were reinforced during probe sessions to ensure that behavior changes occurring during instruction were the result of the PTD combined with general case training and observational learning.

Maintenance probe conditions. Maintenance probe conditions were conducted 1 week after the instruction. These conditions were conducted in the same fashion as the full probe conditions with the exception that reinforcers were faded during maintenance. A fixed ratio reinforcement schedule (based on the completion of the steps of task analysis) was used in these conditions.

Instructional Procedures

Group arrangements and general procedures. Three food and drink preparation skills that were selected by the teacher for each student on the basis of Individualized Education Program objectives and parents' opinions were targeted for instruction. Each target behavior was taught in a small-group teaching arrangement by delivering instruction with PTD. The group consisted of three students. While working with one of the students in the group, the teacher encouraged other students to observe the instruction by reinforcing their observing behaviors (i.e., "Very good. You observe us while we are working."). Two trials were conducted during instruction. During the instructional sessions, all students received instruction on his chain and observed his peers being instructed on their chains. In other words, each instruction session involved direct instruction and observational learning. Two training sessions with two trials were conducted in a week during the study. Instruction continued until all students in the group reached the criterion of 100% correct responding without prompts for at least two consecutive instructional sessions. Continuous schedule of reinforcement was used until the criterion was met, and then variable ratio schedule (approximately every third correct response) and fixed ratio schedule (correct completion of the steps of the task analysis) were used. The student who fixed the food served it to the group, and they consumed it together as an edible reinforcer at the end of each instructional trial. After the first trial, the students were allowed to consume the drink and food they prepared, after which the second trial was conducted.

PTD. A PTD with verbal and physical prompt was used within the total task format to teach food and drink preparation skills to three students with autism in a group-teaching arrangement. The initial instructional session was conducted using a 0-s delay interval. After the initial instructional session, the duration between the task direction and the prompt was progressively increased. A 2-s time increment between the task direction and the controlling prompt was used in each instructional session, and the maximum delay interval was 8 s.

There were five types of student responses in the instructional sessions: two types of correct responses, unprompted corrects and prompted corrects; and

three types of incorrect responses, unprompted incorrect, prompted incorrect, and no response. *Unprompted correct responses* were defined as initiating a step of the task analysis before the prompt and completing the response correctly within 15 s. *Prompted correct responses* were defined as initiating a step of the task analysis after the prompt and completing it correctly within 15 s. *Unprompted incorrect responses* were defined as initiating a step of task analysis before the prompt but performing it incorrectly, or not completing it in 15 s, or performing a different step of the task analysis. *Prompted incorrect responses* were defined as completing a step of the task analysis after the prompt incorrectly. *No responses* were defined as not initiating any response within 4 s. Unprompted correct responses were counted toward the criterion. Both types of the correct responses resulted in verbal reinforcement. All incorrect responses resulted in error correction and reproviding the controlling prompts. Nonwait errors were corrected before going to the next step. As long as the student performed the step correctly, the order of the steps of task analysis was not important. For example, if the task analysis called for Ali to put in the soup mix first and then pour the water but he put in the water before the soup mix, the response was scored as correct.

Instructional sessions were conducted as follows. The teacher had the materials ready and secured the students' attention by saying, "Folks, are you ready?" and reinforced the students' affirmative responses with the group attentional cue, "Very good. You all are ready." The teacher then selected a student and explained the rules to the group, "I'm going to work with Ogulcan today. He is going to learn to prepare juice from a powdered mix. Please watch us carefully." The teacher then delivered the task direction, "Ogulcan, please prepare juice from a powdered mix." Controlling prompts (verbal and physical prompt) were immediately provided in the 0-s delay interval. During the subsequent instructional sessions, the PTD interval trials were implemented in the same manner as the 0-s delay trials, except the 2-s time increments were used between the task direction and the controlling prompt.

Reliability

Dependent variable reliability. Reliability data for the dependent variable were collected during at least

20% of all experimental sessions. The point-by-point method was used to compute the number of agreements divided by the number of agreements plus disagreements, multiplied by 100% (Tawney & Gast, 1984; Tekin-Iftar & Kircaali-Iftar, 2004). Interrater agreement for Ogulcan and Ulas was 99% (range = 98%–100%) across behaviors during intervention and 100% agreement during full probe, maintenance, and generalization (with Set 1 and Set 2) probe sessions. Interrater agreement for Ali was 97% (range = 90%–100%) across behaviors during intervention and 100% agreement during full probe, maintenance, and generalization (similar response chains) probe sessions.

Independent variable reliability. Independent variable reliability data were collected to determine whether the teacher delivered intervention and other experimental sessions (e.g., full probe sessions, generalization probe sessions, etc.) as they were planned. Independent variable reliability was calculated by dividing the number of observed teacher behaviors by the number of planned teacher behaviors and multiplying by 100% (Billingsley, White, & Munson, 1980; Tekin-Iftar & Kircaali-Iftar, 2004). The teacher delivered the intervention with 98% compliance with the planned steps of the PTD sessions for Ogulcan and 99% compliance with the planned steps of the PTD sessions for Ulas and Ali. Also, the teacher delivered full, maintenance, and generalization probe sessions with 100% accuracy across the three students.

Results

Effectiveness

Figures 1 through 3 display the percentage of unprompted correct responding during baseline and full probe, intervention, and maintenance probe sessions for Ogulcan, Ulas, and Ali, respectively. As seen in these figures, PTD combined with general case training and observational learning delivered in the group-teaching arrangement was effective on teaching food and drink preparation skills to children with autism. Procedural modifications were not needed during training. Prior to instruction, the percentage of correct responding during baseline and full probe sessions was almost zero for all students except Ali (i.e., his third full probe session was slightly higher than 0%). The introduction of PTD in each instructional session resulted in criterion-level

responding for the target behaviors of each student. In the final probe sessions, criterion-level responding was maintained for each student. Furthermore, all students maintained the criterion-level responding during the maintenance probe sessions.

Efficiency

Efficiency data for the PTD are summarized in Table 2. Measures of efficiency are the number of training sessions and trials, the number and percentage of training errors, and the number and percentage of full probe errors through criterion. Ogulcan and Ulas needed four instructional sessions and 8 trials through criterion for the first target behavior and three instructional sessions and 6 trials through criterion for the second and third target behaviors. Ogulcan had 3 training errors through criterion for the first and second target behaviors and had no errors for the third target behavior. He had 3% and 2% training errors through criterion for the first two target behaviors, respectively. Ulas had 12 training errors through criterion for the first target behavior and no errors for the second and third target behaviors. He had 6% training errors through criterion for the first target behavior. Ali needed five instructional sessions and 10 trials through criterion for the first target behavior and three instructional sessions and 6 trials through criterion for the second and third target behaviors. Ogulcan had 16 training errors through criterion for the first target behavior and 3 errors for the third target behavior and had no errors for the second target behavior. He had 10% and 2% training errors through criterion for the first and third target behaviors. None of the students committed any errors during full probe sessions.

Generalization

Prior to instruction, the percentage of correct responding for the first and second generalization response chains was zero across all students. After criterion-level responding was obtained by delivering instruction with PTD, the percentage of correct responding for the first and second generalization response chains was 100% accuracy across students (except for one student with one response chain). Furthermore, students maintained 100% response accuracy during maintenance probe sessions.

Observational Learning

Prior to instruction, the percentage of correct responding for the skills taught to others in the group

was zero for all students. In other words, none of the students performed any of the target behaviors of the other students in the group. After criterion-level responding was obtained, the percentage of correct responding for the target behaviors of the students by other group members was 100% accuracy.

Discussion

The purpose of this study was to determine the effects of PTD combined with general case training and observational learning on the acquisition, maintenance, and generalization of response chains taught to students with autism. The data showed that all three students with autism acquired and maintained the targeted food and drink preparation skills through PTD combined with general case training and observational learning. In addition, students were able to acquire response chains taught to another student in the group through observation, and they generalized the acquired skills to similar response chains. These findings are similar to those in the previous studies that have examined the effects of the PTD on teaching chained tasks to students with disabilities (e.g., Browder et al., 1988; Frederick-Dugan et al., 1991; Snell, 1982). Therefore, the present study is consistent with the current literature regarding the effectiveness of PTD.

The data indicate that PTD delivered in the small-group teaching arrangement promoted the acquisition of the targeted food and drink preparation skills. Ogulcan and Ulas required 10 training sessions and 20 training trials through criterion, and Ali required 11 training sessions and 22 training trials across the three target behaviors. The total number of training errors that Ogulcan, Ulas, and Ali committed was 6, 12, and 19, respectively, across the target behaviors. The percentages of training errors across behaviors were between 0% and 3% for Ogulcan, between 0% and 6% for Ulas, and between 0% and 10% for Ali. None of the students committed an error during full probe sessions. Training time was not considered in the present study because the preparation time for some of the skills was quite high (e.g., preparing soup). Therefore, it would be unrealistic to take into account the training time as one of the indicators of efficiency. Nevertheless, it can be argued that all students learned the skills quickly with few errors, especially because each of the skills taught in the study had many steps.

Figure 1
Percentage of Correct Responses Without Prompt for Food and Drink Preparation Skills for Ogulcan
During Probe, Time Delay, and Maintenance Probe Sessions

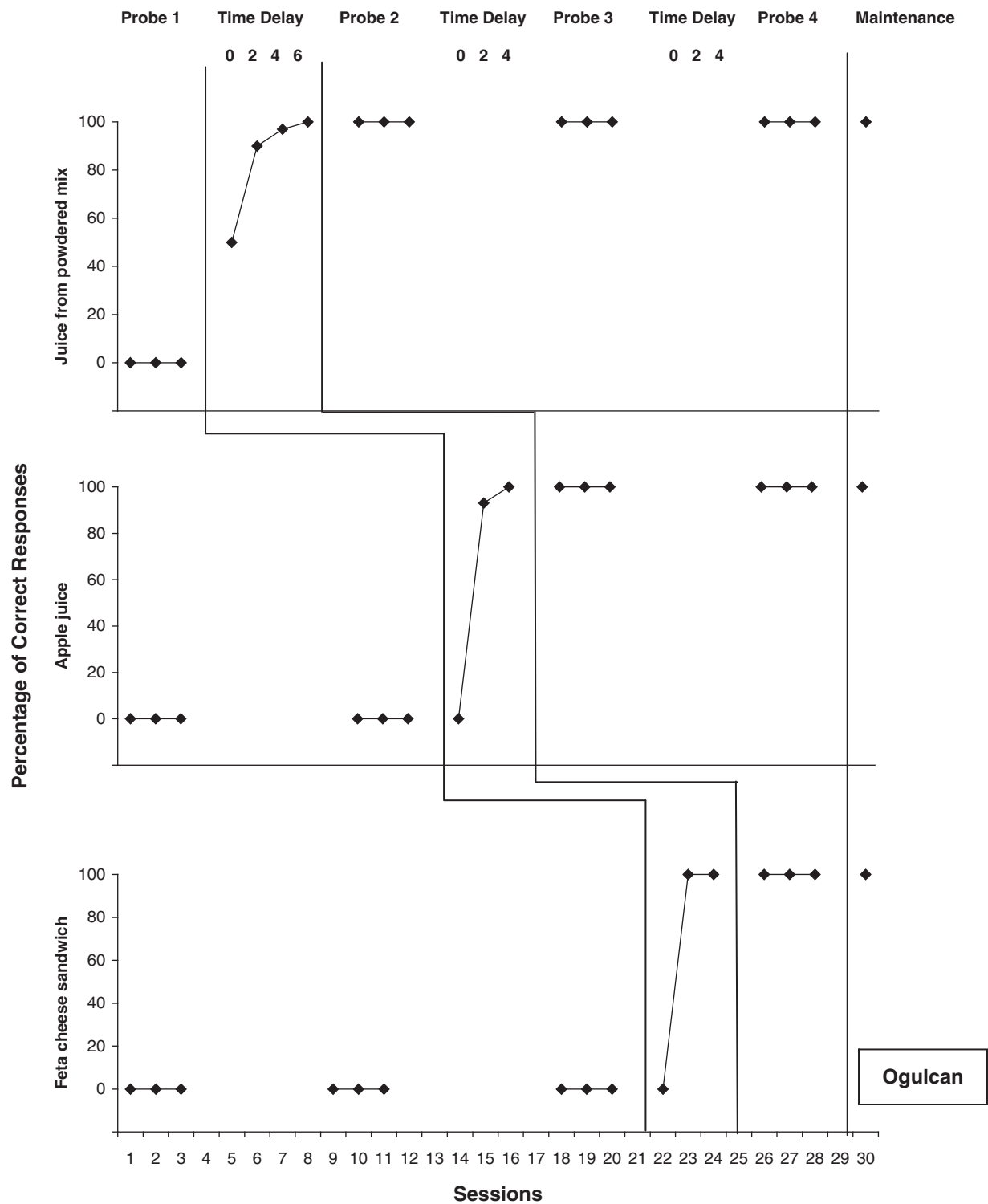


Figure 2
Percentage of Correct Responses Without Prompt for Food and Drink Preparation Skills for Ulas
During Probe, Time Delay, and Maintenance Probe Sessions

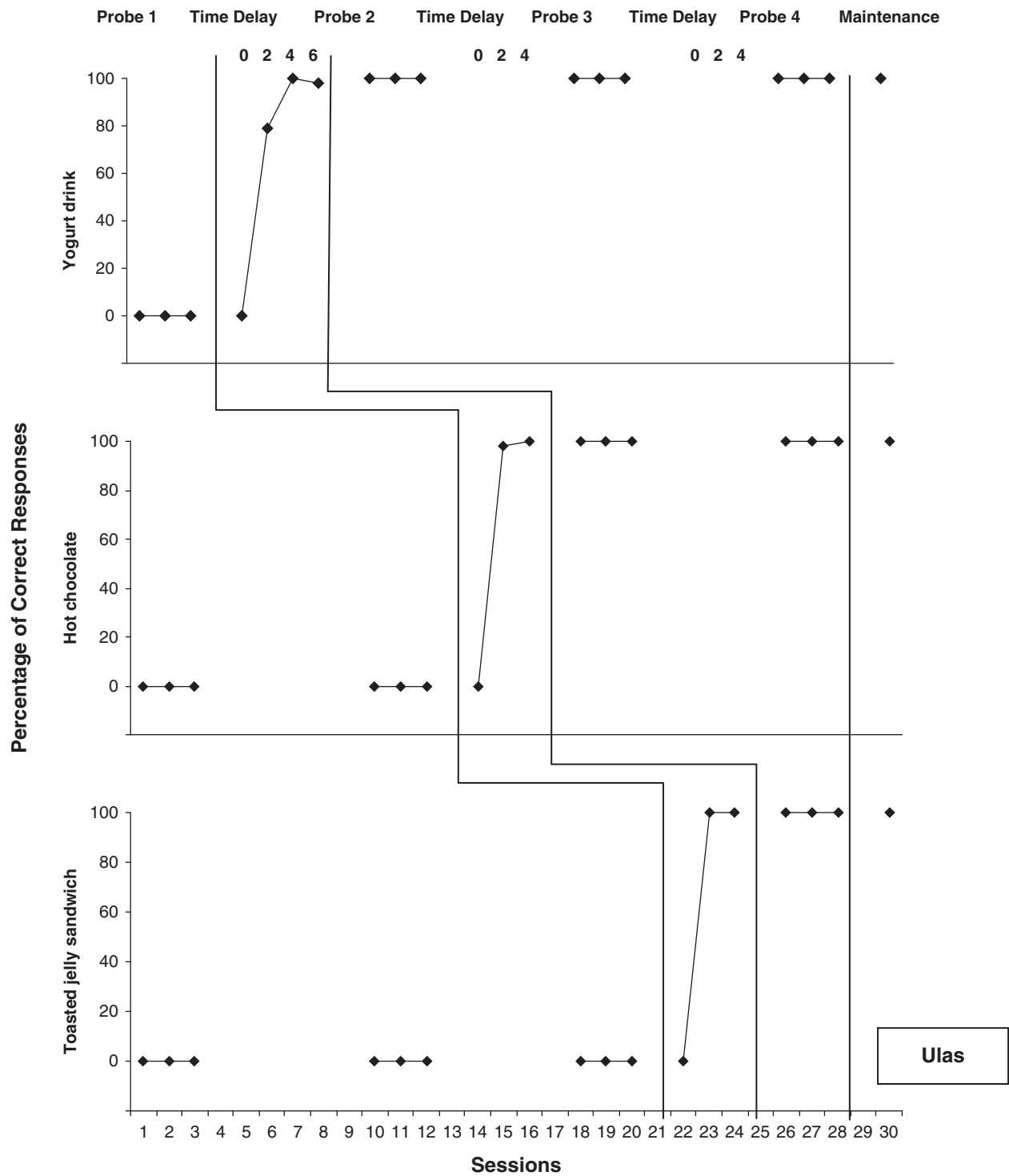


Figure 3
Percentage of Correct Responses Without Prompt for Food and Drink Preparation Skills for Ali During Probe, Time Delay, and Maintenance Probe Sessions

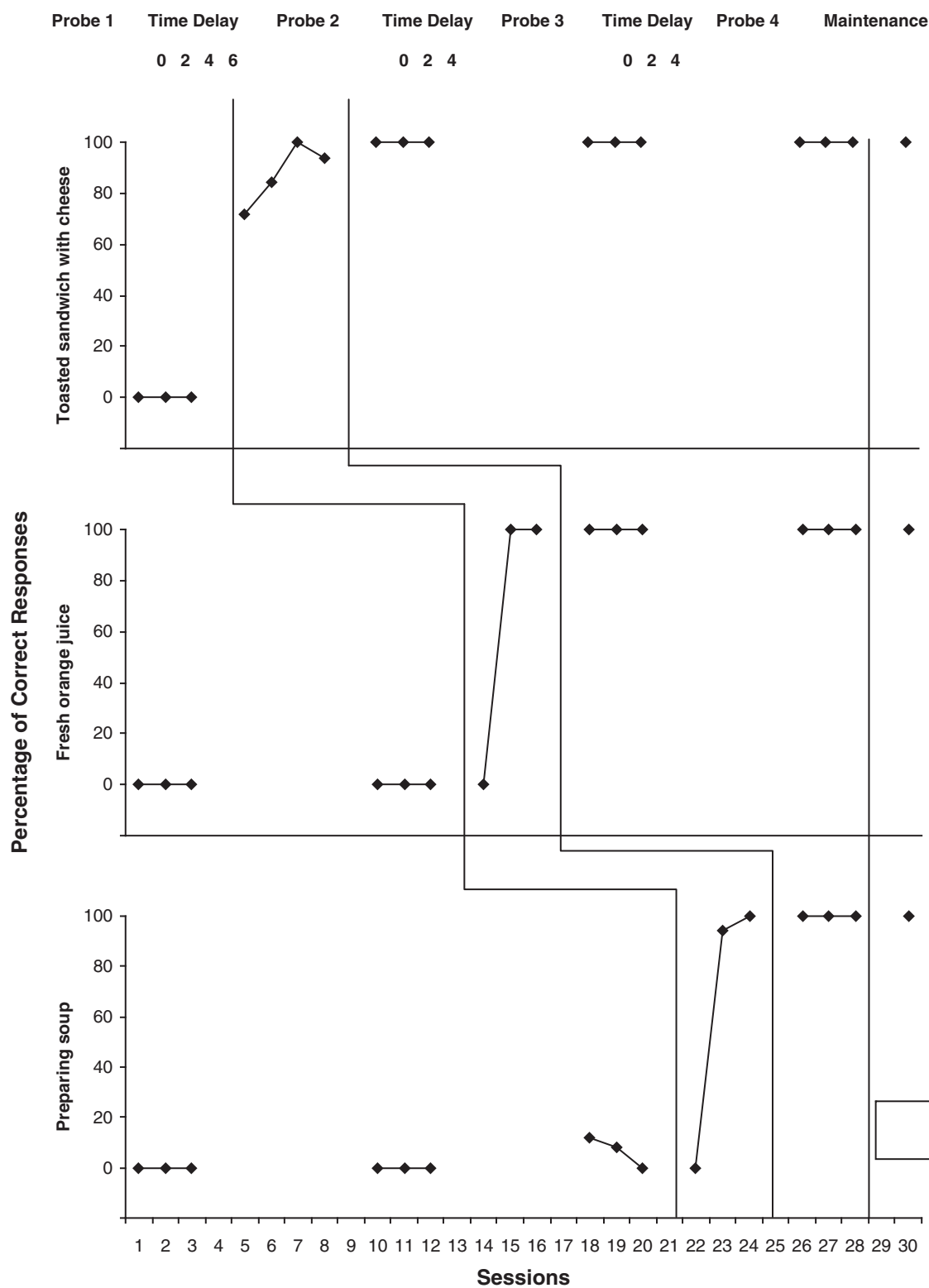


Table 2
Measures of Efficiency Through Criterion Across Target Behaviors and Students

Participant	Target Behavior	No. of Training Sessions / No. of Trials	No. / % of training errors	No. / % of full probe errors
Ogulcan	1	4 / 8	3 / 3%	0 / 0%
	2	3 / 6	3 / 2%	0 / 0%
	3	3 / 6	0 / 0%	0 / 0%
Ali	1	5 / 10	16 / 10%	0 / 0%
	2	3 / 6	0 / 0%	0 / 0%
	3	3 / 6	3 / 2%	0 / 0%
Ulas	1	4 / 8	12 / 6%	0 / 0%
	2	3 / 6	0 / 0%	0 / 0%
	3	3 / 6	0 / 0%	0 / 0%

The effectiveness data indicate the absence of any gain during the baseline and probe sessions for the second and third response chains of all students (except Ali, with a slight rising during the third probe condition). This might be explained by the nature of the data collection method used in the study. The single-opportunity method was used in the study, and the first steps of the task analyses of each response chain were different. Our data showed that most often, students committed an incorrect response at the very first step of the task analyses. There would be sequence and carryover effects on other steps of the task analyses. Because the single-opportunity method did not allow the teacher to tolerate the incorrect response, we were unable to observe the rest of the steps in the analyses of second and third response chains.

The data reveal that students were able to maintain the acquired skills at criterion level 1 week after the training. This finding supports the findings of the previous studies (e.g., Browder et al., 1988; Frederick-Dugan et al., 1991; Snell, 1982), although the maintenance probe session was conducted only a week after training because of summer break. One week might be considered to be a very short time period to assess maintenance effects. On the other hand, it can be thought that Probes 2 through 4 functioned as maintenance probes for the first response chains, Probes 3 and 4 functioned as the maintenance probes for the second response chains, and so forth. This perspective strengthens the claim for the maintenance of the instructional effect. Furthermore, even though formal long-term maintenance data were not collected, telephone interviews were conducted with the parents regarding the sustainability and durability of the acquired skills 20 months after the study. All the parents reported that their children were able to use the food and drink preparation skills they learned during the study.

Even though a functional relationship between instruction and generalization of the acquired skills cannot be claimed because of the design of the study, the difference between pre- and postinstruction responding suggests that students (except one student with one behavior) were able to generalize the acquired skills to similar response chains. Only Ali needed general case training to generalize one of his target behaviors to the first generalization response chain (preparing soup on the countertop with 88% accuracy). Therefore, general case training was used only for Ali in the present study. The criterion was met at the second training session—two training sessions with four training trials—with the first generalization set. This finding is especially important because the generalization to similar response chains is a well-documented problem for students with disabilities (Browder & Snell, 2000; Steere et al., 1989; Wolery et al., 1988). However, it should be kept in mind that a functional relationship cannot be claimed because the pre- and posttest assessment was used. Therefore, the reader should cautiously interpret these results.

Even though a functional relationship was not established, the data suggest that students were able to acquire the nontarget food and drink preparation skills through observational learning. In other words, each student acquired the skills that were taught to other students in the group at criterion level. There were no correct responses during pretest sessions. However, observing the skills taught to other students in the group resulted in 100% accuracy for all students at the posttest. These findings are consistent with previous research that investigated the acquisition of skills through observational learning (Farmer et al., 1991; Fickel et al., 1998; McCurdy et al., 1990; Parker & Schuster, 2002; Stinson et al., 1991). However, the absence of appropriate experimental

controls with respect to the effects of observational learning require that the results be interpreted with caution.

Several limitations of the study should be noted. First, the small number of participants with autism limits the generalization of the findings to other students with disabilities. Second, a functional relationship regarding the generalization and observational learning findings could not be unequivocally established because of the study's design limitations. Even though the same findings were replicated across three students, these results should be interpreted cautiously. Third, analysis for the error types was not conducted in the study. Therefore, it is not possible to explain the types of errors that students committed and the possible reasons for the incorrect responses. Fourth, the authors observed that students were inactive while waiting for boiling and cooking during the study. This time could have been used to provide instruction about topics related to the goals of the study. Fifth, the maintenance effect of PTD was examined only a week after training because of summer vacation. Therefore, a compelling conclusion about the long-term effects of PTD cannot be drawn in the study. Sixth, a cost analysis regarding obtaining foods and kitchen appliances for each student was not conducted because the majority of the kitchen appliances used during study belonged to the researchers. Therefore, we are unable to give an idea about the cost of the instruction to the teachers and researchers. However, as stated by Schuster (1998), food preparation instruction can be expensive because of the cost of the foods and items and their reusability, and the financial cost of this instruction may be an obstacle for many teachers and researchers for targeting this skill. Other instructional costs are negligible, as all the schools have the necessary assets. The cost analysis of this instruction should have been analyzed to give a perspective for teachers and researchers who need to deliver food preparation instruction.

Based on the findings and observations, the following suggestions can be made for future research. First, a larger number of students with different learning and behavioral characteristics should be included in future studies to strengthen the generalization of these findings. Second, future studies should include experimental conditions that would provide conclusive evidence about the possibility of a functional relationship between the outcomes and observational learning and general case training. Third, error analysis should be conducted when replicating the findings. Fourth, future studies should investigate and compare

the effects of other response-prompting strategies for teaching food and drink preparation skills to children with disabilities. Fifth, individual responding and criterion were used in the present study. The effectiveness of choral responding versus individual responding in the group and individual criterion versus group criterion can be investigated in future research studies. In the present study, an independent group contingency was used. Studies that aim to investigate the effects of either interdependent or dependent group contingencies, or to compare the types of group dependencies, can be designed when teaching food and drink preparation skills. Sixth, conducting training with PTD by peers, siblings, or parents either in a one-to-one teaching arrangement or group-teaching arrangement can be investigated in future studies as well. Furthermore, the effects of peer-, sibling-, or parent-delivered training with PTD can be compared with teacher-delivered training with PTD on the acquisition of food and drink preparation skills. Social validation checks can be applied in future studies to examine consumer satisfaction and cost analysis. Finally, this study should be replicated in a natural context.

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