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Effects of Daily Probing on Acquisition of Instructive Feedback Responses

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This study evaluated the effects of daily probes of instructive feedback stimuli on students' acquisition of two types of instructive feedback responses. Four students, two with disabilities, participated and were taught four sets of behaviors, two sets received daily probes and two sets did not. A modification of the multiple probe design across behaviors was used. The findings indicate that students acquired their target behaviors rapidly and maintained correct responding during subsequent probe conditions. Students also acquired both types of instructive feedback and maintained it across subsequent probe conditions. The daily probes of the instructive feedback stimuli did not appear to enhance acquisition or maintenance of the instructive feedback responses, but students appeared to acquire the instructive feedback responses while learning their target behaviors. The implications of this study for understanding how students learn instructive feedback responses and for practice are discussed.

KEY WORDS: instructive feedback; daily probing; constant time delay.

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In an effort to promote instructional efficiency, extra stimuli have been added to the consequent events of instructional trials (i.e., in praise statements or with other reinforcers). Students are not asked to respond to these additional stimuli during instruction and are not reinforced if they do (Gast, Doyle, Wolery, Ault, & Baklarz, 1991; Wolery, Holcombe, Werts, & Cipollone, 1993). This procedure is called instructive feedback, and the additional stimuli are called instructive feedback stimuli. Instructive feedback has been used in more than 20 studies involving a broad age range of students (preschoolers to adolescents) and students with a variety of different disabilities (Werts, Wolery, Holcombe, & Gast, 1995). The results of these studies indicate that students acquire a majority, but not necessarily all, of the responses to the instructive feedback stimuli, despite the fact that during instruction students are not prompted to respond to those stimuli, do not respond to those stimuli on a regular basis, and no programmed contingencies are provided if such behaviors occur.

In some studies (e.g., Gast, Doyle, Wolery, Ault, & Kolenda, 1994; Wolery, Werts, Holcombe, Billings, & Vassilaros, 1993), two instructive feedback stimuli have been provided for each target stimulus/response. When those stimuli are similar to one another, students appear to acquire responses for both stimuli, but when they are quite different from one another, students acquire responses to only one type (Gast et al., 1994). In all of the instructive feedback research, students' responses to the instructive feedback stimuli were measured before instruction was initiated on target behaviors and after students achieved criterion level responding on their target behaviors. In all of these studies, criterion level performance on target behaviors involved multiple sessions at 100% correct responding. As a result, the timing of when students acquire the instructive feedback stimuli is not known; specifically, do students acquire the responses while learning the responses to their target stimuli or after learning the target responses (i.e., during sessions required to demonstrate criterion level responding)? In a recent study (Werts, Caldwell, & Wolery, 1996), students' responses to instructive feedback stimuli were assessed immediately after students' first session of 100% correct responding on target behaviors but before criterion was met. The results indicated that in most cases students learned the responses to the instructive feedback stimuli by the first session of 100% on target stimuli.

Both incidental and observational learning have been suggested as the mechanisms by which students learn the correct responses to the instructive feedback stimuli (Wolery, Werts, & Holcombe, 1993). An additional explanation is demand characteristics; that is, students respond to instructional interactions with teachers using a rule that could be described as, "learn what the teacher presents." Increasing the demand characteristics may pro-

duce concomitant increases in learning; however, to date, no test of this possibility has occurred.

This study had three purposes. First, earlier research indicated that when two similar instructive feedback stimuli are presented for each target stimulus, students acquired responses to both instructive feedback stimuli. We attempted to replicate this finding in this study. Second, earlier research does not indicate when instructive feedback stimuli are acquired; thus, we used daily probe sessions (brief assessments) of the instructive feedback stimuli being presented during instructional sessions to monitor acquisition of those responses. Third, an explanation for students' acquisition of instructive feedback responses is demand characteristics; thus, we sought to increase the demand characteristics in some conditions by using daily probes of the instructive feedback stimuli being presented.

METHOD

Participants and Setting

Four male, caucasian students from two suburban school districts participated. They had no previous history of instruction with constant time delay or with instructive feedback. Three students, Steve, Gregory, and Todd, were from the same fifth grade classroom and were taught in a small group format. The fourth student, Liam, was taught in a one-to-one format in his special education classroom. Steve and Liam were diagnosed as having disabilities; Gregory and Todd were selected as typically developing peers in Steve's general education classroom. Todd had previously been diagnosed as having a learning disability but was not receiving special education services during the study.

Steve (11 yr, 3 mo) was diagnosed as having an emotional disability. At 7 yr, 11 mo, he was assessed with the *Wechsler Intelligence Scale for Children-III (WISC-III)* (Wechsler, 1991) resulting in a full scale IQ of 85 (VIQ = 87, PIQ = 86) and with the *Peabody Picture Vocabulary Test-Revised* (Dunn & Dunn, 1981) which produced a mental age equivalent of 4-10. On the *California Achievement Test* (CAT) (California Testing Bureau, 1992) administered during the study, his total battery percentile was 48. He was included full time in a general education classroom, and a special education teacher assisted him with tests and ongoing classroom routines approximately 1 hr per day. Gregory (10 yr, 5 mo) and Todd (11 yr, 2 mo) received total battery percentile scores on the *CAT* of 85 and 45, respectively. Liam (10 yr, 7 mo) was diagnosed as having a learning disability which included significant academic delays, visual-motor deficits, and short term memory

and attention weaknesses. On the *WISC-III* given 2 mo before the study, he obtained a full scale IQ of 86 (VIQ = 88, PIQ = 87). On the *Wide Range Achievement Test* (Jastak & Wilkinson, 1984) given at the end of the study, his grade equivalents were third grade in reading and math and second grade in spelling. His time was split about evenly between a special education class and a general fourth grade classroom; he received weekly speech therapy.

All probe and instructional sessions were conducted by the investigators. For Liam, experimental sessions occurred in his special education classroom at his desk or a table located in the back of the room. Probe sessions were conducted individually with Steve, Gregory, and Todd at each student's desk or at a table in the back of the general education classroom. Instructional sessions for these three students occurred in a small group format at a table in the back of the classroom. The students were seated opposite the investigator.

Target and Instructive Feedback Behaviors

Behaviors were selected from consultation with teachers about students' educational plans and the information to be addressed during the school year. The target behavior was naming the state when the corresponding capital city was presented. The instructive feedback stimuli were outlines of the corresponding state and photocopied sketches or photographs of a landmark located within each state. Thus, each instructive feedback stimulus was conceptually related to the target stimulus, but each required a different response. Target and instructive feedback behaviors are shown in Table 1. Before selecting specific stimuli, the students were screened and had 0% correct on the following: naming (a) the states when the capital was named, (b) the state outlines, (c) the landmarks, (d) the state in which the landmarks were located, and (e) the capital when the state was named. In an identity match-to-sample format, students were 100% correct when matching landmarks, state outlines, and words of capital cities.

Materials

Five sets of materials were used. For probe and instructional conditions, the names of cities of state capitals were printed in CG Times bold font (50 point) on index cards (10 cm × 15 cm); these served as target stimuli. For the instructive feedback stimuli, four sets of cards were used, three for probe conditions and one for instructional conditions. The first probing set was state outlines generated by Charisma software (Micrografx,

Table 1. Target and Instructive Feedback Stimuli

		Instructive Feedback Stimuli	
Subject Set[a]	Target Stimuli	States	Landmarks
Liam			
Set 1	Pierre	South Dakota	Crazy Horse Monument
	Tallahassee	Florida	Cape Canaveral
Set 2	Austin	Texas	Alamo
	Jefferson City	Missouri	Gateway Arch
Set 3	Richmond	Virginia	Monticello
	Carson City	Nevada	Hoover Dam
Set 4	Cheyenne	Wyoming	Old Faithful
	Frankfort	Kentucky	Churchill Downs
Group			
Set 1	Lincoln	Nebraska	Chimney Rock
	Annapolis	Maryland	U.S. Constellation
	Baton Rouge	Louisiana	French Quarter
Set 2	Richmond	Virginia	Monticello
	Jackson	Mississippi	Vicksburg Historic Park
	Des Moines	Iowa	Elk Horn Windmill
Set 3	Helena	Montana	Bighorn Canyon
	Dover	Delaware	Grand Opera House
	Montgomery	Alabama	Space & Rocket Center
	Springfield	Illinois	Sears Tower
Set 4	Pierre	South Dakota	Crazy Horse Monument
	Lansing	Michigan	Mackinac Straight
	Salt Lake City	Utah	Delicate Arch
	Columbia	South Carolina	Winsboro Town Clock

[a]Sets 1 and 3 taught without daily probes of instructive feedback stimuli, and Sets 2 and 4 taught with daily probes of instructive feedback stimuli.

1990) printed to approximately 8 cm × 6 cm and placed individually on index cards (10 cm × 15 cm). The second probing set was sketches or photographs of state landmarks which corresponded to each state. The sketches and photos were gathered from a variety of books and photocopied (enlarged or reduced) to approximately 6 cm × 6 cm and placed on index cards (10 cm × 15 cm). The third probing set was used in a matching probe (i.e., state outline to state landmark, and vice versa) and consisted of an 8 cell display (2 × 4) of the outlines or landmarks identical in size to the stimuli noted above. These were placed on legal-sized sheets and inserted in a notebook. For instruction, the instructive feedback material set consisted of both the state outline and the state landmark on the same card (10 cm × 15 cm), with the outline on the left and the landmark on the right in the sizes note above.

Response Definitions and Data Collection

Data were collected using direct observation and trial-by-trial recording. Three responses were recorded for probe sessions: *Correct*—student performed the correct behavior within 3s of the task direction, *incorrect*—student performed an incorrect behavior within 3s of the task direction, and *no response*—student did not respond within 3s of the task direction. Four responses were recorded for instructional sessions: *Unprompted correct*—student responded correctly within 3s of the task direction, *prompted correct*—student responded correctly within 3s of the instructor's verbal model, *unprompted error*—student responded incorrectly within 3s of the task direction, *prompted error*—student responded incorrectly within 3s of the instructor's verbal model.

Experimental Design

A variation of the multiple probe design across behaviors (Tawney & Gast, 1984) was used to evaluate the effects of instruction with and without daily probes of the instructive feedback stimuli. The target and corresponding instructive feedback stimuli were divided into 4 behavior sets. All target behavior sets were taught using constant time delay with presentation of the corresponding instructive feedback stimuli. Daily probes occurred of the instructive feedback stimuli that were being presented during instruction for Behavior Sets 2 and 4 but not for Behaviors Sets 1 and 3. For Sets 1 and 3, an individual intermediate probe session of the instructive feedback occurred following the first session in which a student had 100% correct on his target behaviors. A full probe condition occurred before any behavior set was taught and after criterion was achieved on each set. The full probe condition involved multiple individual probe sessions of all target and instructive feedback stimuli. The criterion for moving to a full probe condition was 3 of 4 days of 100% unprompted correct responses to target stimuli.

Probe Procedures

All probe sessions were conducted individually and the trial sequence was: present stimulus, secure student's attention, deliver task direction, provide a 3-s response interval, deliver consequences, and wait a 2- to 5-s intertrial interval while recording the response. During the probe conditions for target and instructive feedback behaviors and during the intermediate instructive feedback probe sessions, correct responses were praised and error responses and no responses were ignored. During daily probes and

matching instructive feedback probes, all responses were ignored or responded to with a noncommittal statement.

Full Probe Condition Procedures

The full probe condition consisted of at least three sessions on target stimuli and three sessions on each type of instructive feedback (naming outlines of states and naming landmarks). Three trials per stimulus occurred in each session, and stimuli across sets were intermixed. If 4 or more days occurred after a probe session but before instruction, additional probe sessions were conducted.

Intermediate Instructive Feedback Probes

When a student had 100% unprompted correct responses on target stimuli during instruction for Sets 1 and 3, a probe session of the instructive feedback being presented during that set occurred immediately after the instructional session. The two types of instructive feedback (states and landmarks) were assessed in intermixed fashion with 5 trials per stimulus.

Daily Instructive Feedback Probes

During the instructional conditions for Sets 2 and 4, daily probe sessions of the instructive feedback stimuli occurred before the daily instructional session. The daily probes included both types of instructive feedback stimuli (states and landmarks) being presented for that set. The stimuli were presented in intermixed fashion with 2 trials per stimulus.

Matching Instructive Feedback Probes

To assess students' ability to identify relationships between state outlines and the respective landmarks, two matching probe sessions occurred before the first probe condition and following the last probe condition. One session assessed students' ability to match the landmark to the respective state outline; the second session assessed their ability to match each state outline to the respective landmark; 3 trials per stimulus occurred. A stimulus card was presented, and students were asked to point to the respective state or landmark in an 8-choice task; and a 4-s response interval was used.

Instructional Procedures

A constant time delay procedure was used to teach each set of target behaviors; the first 2 sessions of each set used 0-s trials and all subsequent sessions used 3-s delay trials. The trial sequence was: ensure the student's attention, present the target stimuli, provide the task direction, wait the correct response interval, provide a verbal model of the target response (if needed), deliver the consequences (i.e., praise for correct responses, ignoring for incorrect responses), present the instructive feedback stimuli following correct responses—withholding praise if the student responded to the instructive feedback stimulus, and wait a 2- to 5-s intertrial interval while recording the response. The task direction was, "*City name* is a capital of a state; what state?" When showing the card with the instructive feedback stimuli, the instructor said, "And this is *state name* and this is *name of landmark.*" Before the first instructional set, the students were taught to wait for assistance when an unknown stimulus was presented using procedures described by Wolery, Ault, and Doyle (1992).

During instructional sessions, the stimuli were presented in intermixed fashion using a random order. For Liam, 5 trials were presented per stimulus. Two review trials for stimuli taught in Set 1 (i.e., 1 trial per stimuli) were intermixed in instructional trials for Set 2 for Liam; no review trials were provided during instruction on Sets 3 and 4.

For Steve, Gregory, and Todd (taught in a small group arrangement), 2 trials were presented for each stimulus for each student. The order of trials for each student was determined randomly; no review trials occurred. Because Steve, Gregory, and Todd were taught the same behaviors in a small group, a target probe session occurred on target behaviors when a student met criterion for a behavior set. This was done to ensure that the student could respond correctly to the target stimuli outside of the small group context. This session consisted of 5 trials per stimulus being taught, presented in intermixed fashion. If the student responded correctly at 100%, he was removed from group instruction and was placed into the full probe condition; if he did not, he was returned to group instruction.

Reliability

Interobserver agreement and procedural fidelity data were collected simultaneously during each experimental condition. These assessments occurred in at least 40% of the full probe sessions, 50% of the intermediate probe sessions, 35% of the daily probe sessions, 50% of the matching probe sessions, and 42% of the instructional sessions. Interobserver agreement

percentages were calculated by using the point-by-point method (the number of exact agreements were divided by the number of agreements plus disagreements and the quotient was multiplied by 100). Interobserver agreement data on student responses across full probe conditions were 98.9% for Liam, 98.7% for Steve, 99.6% for Gregory, and 96.9% for Todd. Interobserver agreement data during criterion probe conditions were 100% for Liam and Gregory, and 97.4% for Todd. During daily probes, interobserver agreement data were 100% for Liam, Gregory, and Todd; and 92.4% for Steve. During target probes, interobserver agreement data were 100% for Steve, Gregory, and Todd. Interobserver agreement data during matching probes were 100% for Liam and Steve, 97.7% for Gregory, and 98.7% for Todd. For instructional conditions, the percentage of interobserver agreement was always 100 with the exception of Set 4 for Steve, Gregory, and Todd (95.8%).

For procedural fidelity, the percentage of compliance was calculated by dividing the number of actual behaviors in each category by the number of planned behaviors and multiplying by 100 (Billingsley, White, & Munson, 1980). For each investigator behavior, for each student, by each type of probe condition, the percentage of correct implementation always exceeded 97%. For instructional conditions, correct implementation for all investigator behaviors was 100% with the following exceptions: for Liam, 99.7% for waiting the correct delay interval, 99.3% for delivering the correct consequence, and 99.7% for waiting the intertrial interval; and for group instruction, 99.7% for waiting the correct delay interval, and 99.4% for withholding praise for instructive feedback.

RESULTS

Below data are presented from a number of analyses. Initially, students' acquisition and maintenance of target responses are described. Subsequently, students' acquisition and maintenance of the instructive feedback responses are described. Also, the daily probe data and the intermediate probe data are used to identify when during instruction students acquired responses to the instructive feedback stimuli. Finally, the extent to which relationships were formed between the two types of instructive feedback is described.

Target Behaviors

The percentage of correct responses on target stimuli for probe and instructional conditions are shown for Liam, Steve, Gregory, and Todd in

Fig. 1. The percentage of correct responses by Liam on four sets of target behaviors during probe and instructional conditions; slashes indicate breaks of 4 or more days between sessions. Sets 1 and 3 taught without daily probes of the instructive feedback stimuli, and Sets 2 and 4 taught with daily probes of the instructive feedback stimuli.

Fig. 2. The percentage of correct responses by Steve on four sets of target behaviors during probe and instructional conditions; slashes indicate breaks of 4 or more days between sessions. Sets 1 and 3 taught without daily probes of the instructive feedback stimuli, and Sets 2 and 4 taught with daily probes of the instructive feedback stimuli

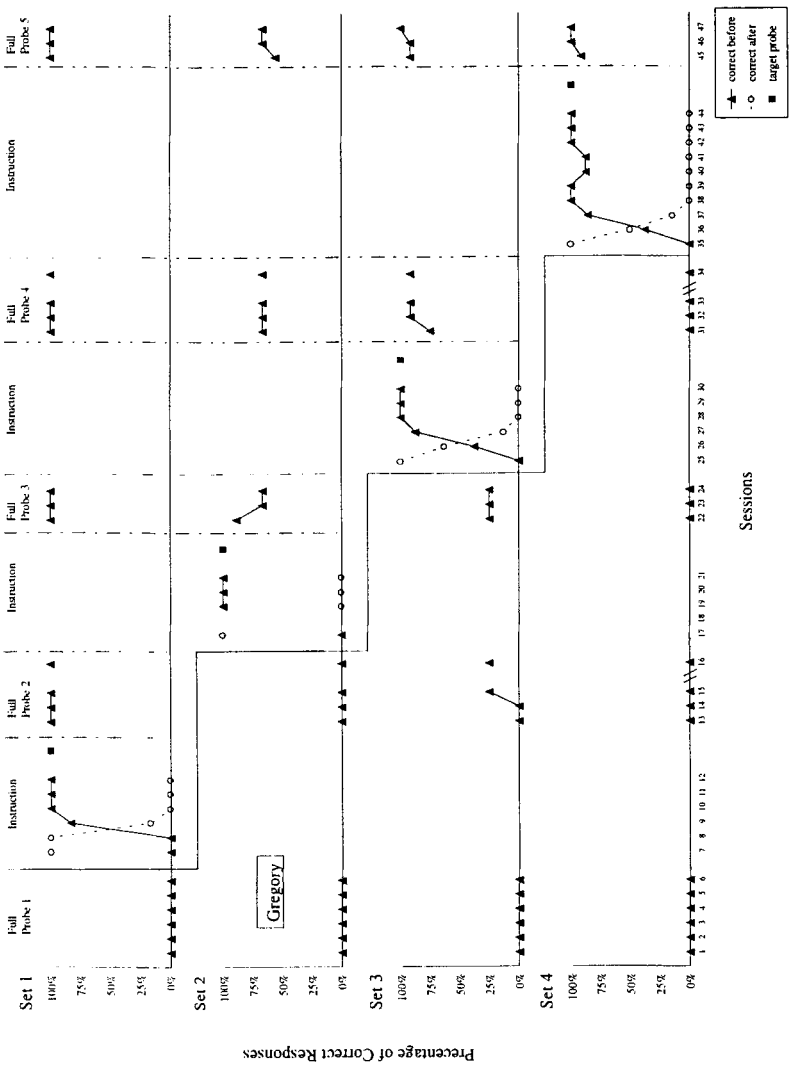

Fig. 3. The percentage of correct responses by Gregory on four sets of target behaviors during probe and instructional conditions; slashes indicate breaks of 4 or more days between sessions. Sets 1 and 3 taught without daily probes of the instructive feedback stimuli, and Sets 2 and 4 taught with daily probes of the instructive feedback stimuli.

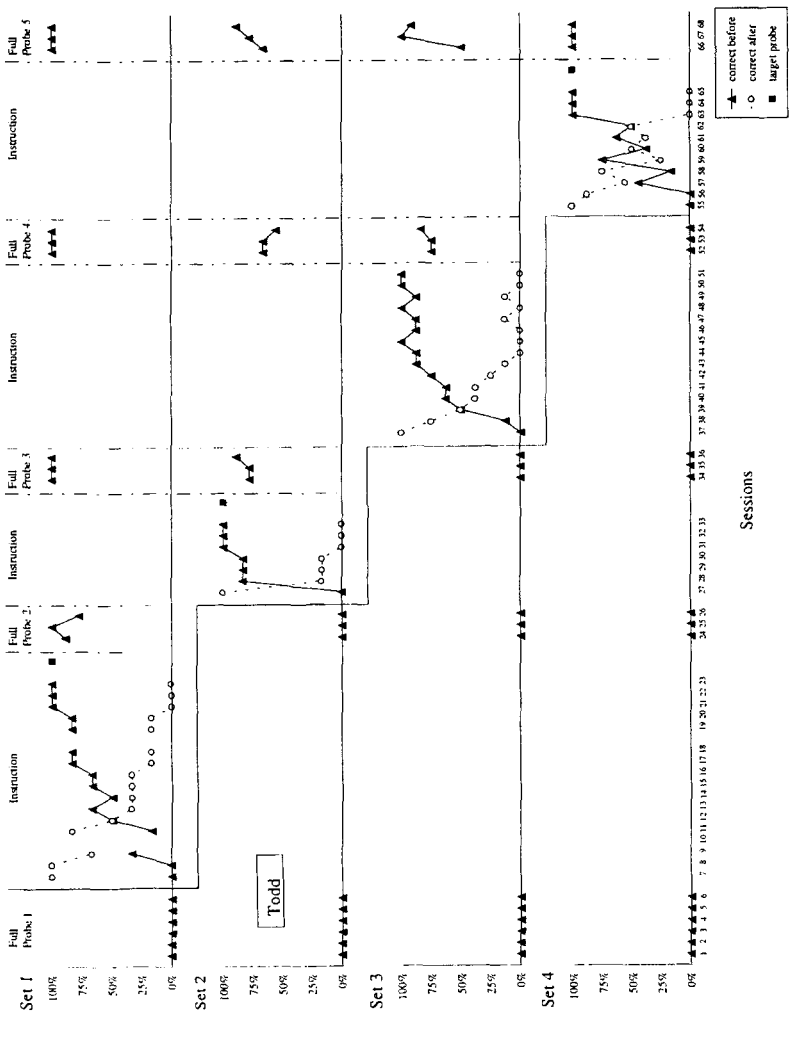

Fig. 4. The percentage of correct responses by Todd on four sets of target behaviors during probe and instructional conditions; slashes indicate breaks of 4 or more days between sessions. Sets 1 and 3 taught without daily probes of the instructive feedback stimuli, and Sets 2 and 4 taught with daily probes of the instructive feedback stimuli.

Table 2. Number of Sessions, Number of Minutes/Seconds, and Percentage of Errors Through Criterion

Student	Behavior Set[a]	# Sessions	# Min/Sec	% of Errors
Liam				
	Set 1	6	8:09	5.0
	Set 2	6	10:08	0.0
	Set 3	12	12:36	2.5
	Set 4	6	6:8	1.7
Steve				
	Set 1	4	13:11	0.0
	Set 2	4	9:01	0.0
	Set 3	5	16:00	0.0
	Set 4	7	22:16	5.4
Gregory				
	Set 1	7	19:27	0.0.
	Set 2	4	9:14	0.0
	Set 3	6	15:57	0.0
	Set 4	10	28:08	3.8
Todd				
	Set 1	16	24:12	1.0
	Set 2	7	12:13	0.0
	Set 3	15	25:22	2.5
	Set 4	11	27:04	3.4

[a]Sets 1 and 3 taught without daily probes of the instructive feedback stimuli, and Sets 2 and 4 taught with daily probes of instructive feedback stimuli.

Figures 1 through 4, respectively. Prior to instruction on each behavior set, Liam and Todd had 0% correct responses on all target stimuli. Gregory responded correctly to one stimulus for Set 3 prior to instruction in Probe Conditions 2 and 3, and Steve responded correctly prior to instruction on one target stimulus from Set 3 and two from Set 4. During instructional sessions, all students acquired unknown target behaviors rapidly with few errors; and they maintained correct performance at or near criterion level responding across subsequent probe conditions. The number of sessions, number of minutes/seconds of instruction, and percentage of errors during instruction are shown in Table 2. As shown, no consistent differences were replicated across participants in terms of the number of sessions or percentage of errors that occurred for behavior sets taught with and without daily probes of the instructive feedback.

Instructive Feedback Behaviors

The percentages of correct responses by students across instructive feedback probes are shown in Table 3. Prior to instruction, instructive feed-

back stimuli (states and landmarks) were at 0% correct for all students except for Steve who identified some states during Probe Conditions 2-4, and Gregory who identified one landmark during Probe Conditions 3 and 4. Following instruction, the percentage of correct performance on instructive feedback probes increased over previous probe conditions. This was true for each student, each type of instructive feedback, and each set of behavior with the exception of Liam on states for Sets 3 and 4. In general, performance across the two types of instructive feedback (states and landmark) was similar; no consistent pattern of differential performance for one type as compared to another emerged across students.

The effects of the daily probing of instructive feedback were analyzed by examining performance in the probe condition immediately after instruction on each behavior set. If daily probing enhances acquisition of the responses, then the percentage of correct responses in probe conditions immediately after instruction should be greater for sets taught with daily probes than without daily probes. However, no student's performance was greater in the two probe conditions following Sets 2 and 4 (with daily probes) than in the two probe conditions following Sets 1 and 3 (without daily probe). No consistent pattern was evident across either type of instructive feedback or with the two types summed together. Thus, daily probing does not appear to enhance students' acquisition of instructive feedback responses.

One purpose of the study was to determine when in relation to acquiring target behaviors students acquired the instructive feedback behaviors. Two sources of data were analyzed: (a) students' performance on the intermediate probe sessions for Sets 1 and 3 compared to their performance during Probe Condition 2 and 4, respectively (see Table 3); and (b) students' performance on the daily probe sessions for Sets 2 and 4 (see Figure 5). Students' percentages of correct responses was always higher in the intermediate probe sessions than during previous pre-instruction assessments. On five occasions, students' performance in the intermediate probe sessions was 100% correct; and on 11 occasions it was less than 100% correct. In terms of changes from the intermediate probe session to the subsequent probe condition, students' performance was equal on three occasions, increased on 7 occasions, and decreased on 6 occasions. As shown in Figure 5, a variety of patterns of correct performance during daily probes for Sets 2 and 4 occurred. In general, however, the percent of correct responses increased during instruction and it was usually lower than students' performance on target behaviors. Thus, it appears that the students acquired the instructive feedback responses while acquiring responses to target stimuli.

Table 3. Percentage of Correct Responses for the Two Types of Instructive Feedback Stimuli During Full Probe Conditions and Intermediate Probe Sessions

Student	Behavior Set	Type of Inst. Fdbk.[a]	Probe 1	Interm. Probe	Probe 2	Probe 3	Interm. Probe	Probe 4	Probe 5
Liam									
	Set 1:	States	0.0	80.0	91.7	100.0	—	100.0	100.0
		Landmarks	0.0	90.0	83.3	100.0	—	77.8	83.3
	Set 2:	States	0.0	—	0.0	66.7	—	50.0	50.0
		Landmarks	0.0	—	0.0	77.8	—	38.9	38.9
	Set 3:	States	0.0	—	0.0	0.0	70.0	0.0	0.0
		Landmarks	0.0	—	0.0	0.0	70.0	100.0	77.8
	Set 4:	States	0.0	—	0.0	0.0	—	0.0	0.0
		Landmarks	0.0	—	0.0	0.0	—	0.0	11.1
Steve									
	Set 1:	States	0.0	100.0	100.0	100.0	—	100.0	100.0
		Landmarks	0.0		100.0	100.0	—	100.0	100.0
	Set 2:	States	0.0	—	0.0	85.2	—	100.0	100.0
		Landmarks	0.0	—	0.0	100.0	—	94.4	100.0
	Set 3:	States	8.3	—	37.5	50.0	75.0	85.4	100.0
		Landmarks	0.0	—	0.0	0.0	75.0	93.4	100.0
	Set 4:	States	0.0	—	41.7	72.2	—	70.9	100.0
		Landmarks	0.0	—	0.0	0.0	—	0.0	44.5

Gregory									
	Set 1:	States	0.0	100.0	80.5	100.0	—	100.0	100.0
		Landmarks	0.0	100.0	100.0	88.9	—	94.5	96.3
	Set 2:	States	0.0	—	0.0	85.2	—	83.3	81.5
		Landmarks	0.0	—	0.0	96.3	—	100.0	100.0
	Set 3:	States	0.0	—	0.0	0.0	75.0	85.4	86.1
		Landmarks	0.0	—	0.0	0.0	100.0	100.0	100.0
	Set 4:	States	0.0	—	0.0	0.0	—	0.0	94.5
		Landmarks	0.0	—	0.0	7.4	—	25.0	100.0
Todd									
	Set 1:	States	0.0	86.7	77.8	77.8	—	92.6	100.0
		Landmarks	0.0	100.0	92.6	100.0	—	100.0	100.0
	Set 2:	States	0.0	—	0.0	59.3	—	55.6	48.2
		Landmarks	0.0	—	0.0	88.9	—	92.6	100.0
	Set 3:	States	0.0	—	0.0	0.0	55.5	36.1	30.6
		Landmarks	0.0	—	0.0	0.0	50.0	94.5	100.0
	Set 4:	States	0.0	—	0.0	0.0	—	0.0	47.2
		Landmarks	0.0	—	0.0	0.0	—	0.0	100.0

[a]Sets 2 and 4 taught with daily probes of the instructive feedback stimuli and Sets 1 and 3 taught without daily probes.
[b]Lines indicate when training occurred.

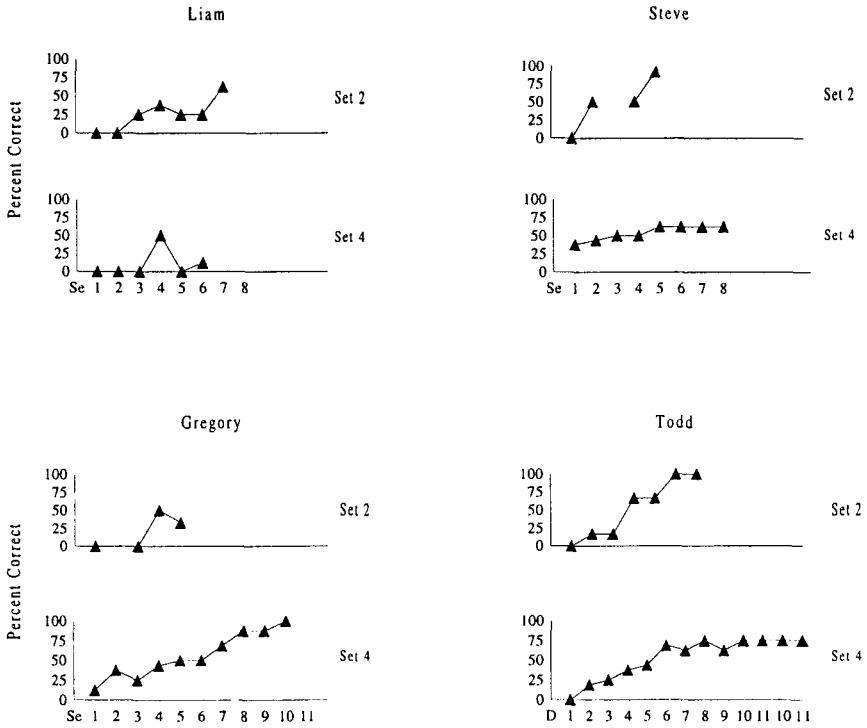

Fig. 5. The percentage of correct responses by the four students on the daily probes of the instructive feedback stimuli being presented during Sets 2 and 4.

Because of the multiple probe design, opportunities existed to assess maintenance of the instructive feedback for Sets 1, 2, and 3 from the probe condition immediately after instruction to the final probe condition (Probe 5). Thus, a total of 24 opportunities (4 students × 3 behavior sets × 2 types of instructive feedback [states and landmarks]) existed to analyze maintenance. Students' performance in the final probe condition was equal to or greater than performance in the probe condition immediately following instruction on 17 of the 24 opportunities. Students' combined final probe performance indicates a substantial amount of learning separate from direct instruction; specifically, their percentages of correct responses on both types of instructive feedback for all sets were 45.1%, 93.1%, 94.8%, and 78.3% for Liam, Steve, Gregory, and Todd, respectively.

As noted, two types of instructive feedback stimuli (states and landmarks) were presented simultaneously after each correct response on target behaviors. To determine whether a relationship emerged between the two

Table 4. Percentage of Correct Responses For Instructive Feedback Matching Probes

Student	Behavior Set[a]		Matching States to Landmarks		Matching Landmarks to States	
			Pretest	Posttest	Pretest	Posttest
Liam						
	Set 1		0.0	66.7	0.0	50.0
	Set 2		16.7	50.0	16.7	33.3
	Set 3		0.0	33.3	16.7	0.0
	Set 4		33.3	33.3	0.0	33.3
		Mean	12.5	45.8	8.4	29.2
Steve						
	Set 1		0.0	100.0	11.1	66.7
	Set 2		33.3	55.9	0.0	33.3
	Set 3		25.0	16.7	33.3	8.3
	Set 4		33.3	8.3	11.1	16.7
		Mean	22.9	45.2	13.9	31.4
Gregory						
	Set 1		22.2	77.6	22.2	66.7
	Set 2		0.0	22.2	11.1	22.2
	Set 3		16.7	8.3	16.7	33.3
	Set 4		0.0	33.3	8.3	50.0
		Mean	9.7	35.4	14.6	43.1
Todd						
	Set 1		0.0	33.3	11.1	66.7
	Set 2		11.1	11.1	22.2	55.6
	Set 3		8.3	0.0	8.3	16.7
	Set 4		8.3	25.0	25.0	16.7
		Mean	6.9	17.4	16.7	38.9

[a]Sets 1 and 3 taught without daily probes of the instructive feedback stimuli, and Sets 2 and 4 taught with daily probes of instructive feedback stimuli.

types of instructive feedback stimuli, students were asked to match states to landmarks and landmarks to states in an 8-choice format. These assessments occurred prior to Probe 1 and following Probe 5; the results are shown in Table 4. From the data in Table 4, it is clear that students' performance on posttests was greater than their performance on the pretest. Pretest means were less than twice chance (chance = 12.5%), and all posttest means were greater than twice chance except for Todd on matching states to landmarks. However, posttest performance indicates that strong relationships were not established between the two types of stimuli. Further, the percentages of correct responses on Sets 2 and 4 (daily probes) were not consistently greater than the percentages on Sets 1 and 3 (no daily probes). The combined percentage correct on the posttests were lower than students' percentage correct on naming the same stimuli during the final

probe condition (the condition most contiguous in time to the posttest). Liam's combined performance on the posttests was 37.5% and in Probe 5 was 45.1%; Steve's posttest percentage was 38.2% and his Probe 5 percentage was 93.1%; Gregory's posttest percentage was 39.2% and his Probe 5 percentage was 94.8%; and Todd's posttest percentage was 28.1% and his Probe 5 percentage was 78.3%.

DISCUSSION

Students in this study were taught four sets of behaviors, Sets 1 and 3 without daily probes of instructive feedback stimuli and Sets 2 and 4 with daily probes of the instructive feedback stimuli being presented during instruction of those sets. Two types of instructive feedback (states and landmarks) were presented for each target stimulus. This study was designed to determine when during the acquisition of target behaviors students learn responses to the instructive feedback stimuli and to determine the effects of daily probes on students' acquisition of the instructive feedback behaviors.

The students in this study acquired their target behaviors relatively rapidly and with low error percentages. This finding replicates a large body of literature indicating that students with and without disabilities can learn discrete skills when the constant time delay procedure is used (Wolery, Holcombe, et al., 1992) and when instructive feedback is presented (Werts et al., 1995). The students also acquired responses for two similar types of instructive feedback for each target stimulus/behavior. This replicates earlier research indicating that two similar instructive feedback stimuli can be presented for each target stimulus with the expectation that students will learn both types (Gast et al., 1994). Students' maintenance of the instructive feedback responses also was similar to earlier research (Werts et al., 1995).

The current study extends the instructive feedback research in at least two ways. First, this study indicates when students' learn the responses to the instructive feedback stimuli. All previous research on instructive feedback measured students' acquisition of instructive feedback responses only after clear demonstrations that the target responses were learned; in this study, daily probes of students' performance on the instructive feedback stimuli occurred for two sets of behaviors. This arrangement indicates that students learn to respond correctly to the instructive feedback stimuli while learning their target responses, including after initial mastery of the target behaviors. One previous study (Werts et al., 1996) indicated that little change occurred in students' performance on instructive feedback stimuli after the first session in which students had 100% correct on their target

stimuli. The current study suggests this occurs in some situations, but these students continued to acquire responses during instructional sessions used to demonstrate criterion level performance on target behaviors. Thus, teachers should present the instructive feedback from the beginning of instruction on target behaviors until criterion level responding on target behaviors is demonstrated.

Second, the findings of this study suggest that daily probes are not necessary nor warranted. Previous research on instructive feedback had not used daily probes, but the possibility existed that their use may enhance students' learning of the instructive feedback responses. This study suggests this is not the case. This finding holds two implications, one for teaching and one for understanding how students acquire instructive feedback responses. In terms of practice, we do not recommend using daily probes. From the data in this study, the daily probes of instructive feedback did not enhance students' acquisition or maintenance of the instructive feedback responses. Thus, when using instructive feedback, teachers should assess students' performance on those stimuli prior to teaching the target behaviors and after the target behaviors have been acquired.

As noted, some suggestion had existed that students acquired the instructive feedback responses from the demand characteristics present in the instructional context (Wolery, Werts, & Holcombe, 1993). In this study, daily probes were included for Sets 2 and 4 to enhance demand characteristics; that is, to communicate to students that they would be "tested" on the stimuli that were being presented. This arrangement, however, failed to produce differential effects. As a result, the finding diminishes but does not eliminate demand characteristics as an explanation of why students acquire the instructive feedback responses. It is possible, however, that other factors such as the probe condition assessments of the instructive feedback stimuli and the regular presentation of the instructive feedback stimuli produced sufficient demand characteristics that using daily probes did not produce additional demand characteristics.

As shown in Table 3, students did not acquire all of the responses for the instructive feedback stimuli. Future research should attempt to identify the factors that control this variability in responding. Also, future research should focus on the relationships that are established between instructive feedback stimuli when more than one are presented for each target behavior. Wolery, Werts, et al. (1993) compared two methods of presenting two instructive feedback stimuli for each target stimulus: Both instructive feedback stimuli were presented simultaneously on all trials of the target behavior as in the current study; and in the second condition, each instructive feedback stimulus was presented alone on alternating trials of the target behavior. Students in the Wolery, Werts, et al. (1993) study correctly

matched the two instructive feedback stimuli presented on alternating trials. However, in the current study, only weak relationships occurred between the two types of instructive feedback stimuli (see Table 4). In the earlier study (Wolery, Werts, et al., 1993), the two instructive feedback stimuli required the same response (e.g., the numeral "5" and the written word "five"); however, in the current study the two stimuli required different responses. This difference in the nature of the instructive feedback stimuli may account for the differences in the results. Additional research should address procedures for increasing the probability that the two instructive feedback stimuli will be viewed as related to one another.

This study clearly is limited by the stimuli that were taught and by the characteristics of the participants. The stimuli were selected because of their experimental expedience rather than their functional value. Their teachers were not planning to teach these responses and students had few opportunities to acquire the responses outside of the experimental sessions. The students in this study did not have major learning problems, although two of them currently were receiving special education services. Students in the previous instructive feedback research have primarily been students with disabilities (Werts et al, 1995). The effects of daily probes on students with more substantial disabilities warrants additional research.

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