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AN EXTENSION OF INCIDENTAL TEACHING PROCEDURES TO READING INSTRUCTION FOR AUTISTIC CHILDREN

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In an extension of incidental teaching procedures to reading instruction, two autistic children acquired functional sight-word reading skills in the context of a play activity. Children gained access to preferred toys by selecting the label of the toy in tasks requiring increasingly complex visual discriminations. In addition to demonstrating rapid acquisition of 5-choice discriminations, they showed comprehension on probes requiring reading skills to locate toys stored in labeled boxes. Also examined was postteaching transfer across stimulus materials and response modalities. Implications are that extensions of incidental teaching to new response classes may produce the same benefits documented in communication training, in terms of producing generalization concurrent with skill acquisition in the course of child-preferred activities.

DESCRIPTORS: incidental teaching, reading, generalization, autism

Hart and Risley (1968, 1974, 1975) initially demonstrated positive effects of contextual language training with disadvantaged preschool children. More recently, similar "incidental teaching" strategies have been used with developmentally disabled children to facilitate language use (Campbell & Stremel-Campbell, 1982; Halle, Baer, & Spradlin, 1981; Rogers-Warren & Warren, 1980) and to teach new communication skills (Carr & Kologinsky, 1983; McGee, Krantz, Mason, & McClannahan, 1983; McGee, Krantz, & McClannahan, 1985; Neef, Walters, & Egel, 1984).

Functional language interactions have typically been the targeted response class in reports on incidental teaching. Because the process of teaching in the context of naturally occurring stimuli has produced generalization benefits for receptive and expressive speech, it seemed important to inquire whether similarly promising results might be obtained by incidental teaching of other skills. Therefore, we examined the effects of reading instruction provided to autistic children (i.e., visual discriminations of printed stimuli in response to auditory cues) within the context of a play activity. Multidimensional measures permitted assessment of maintenance of sight-word reading skills, generalization of visual discriminations to a reading comprehension task, and postteaching transfer across stimulus materials and response modalities.

METHOD

Subjects

Two children enrolled in the Princeton Child Development Institute participated in the study. Both were diagnosed autistic in accordance with criteria established by the National Society for Autistic Children (Ritvo & Freeman, 1977). Child 1 was also diagnosed as neurologically impaired, and Child 2 had additional diagnoses of Childhood Schizophrenia and Moderate Mental Retardation.

Child 1 was a 5-year-old female. On a recent evaluation, she achieved a Vineland Age Equivalent Score of 2.8, and she did not achieve a basal score on the Peabody Picture Vocabulary Test (PPVT). Child 2 was a 13-year-old male; he obtained a Vineland Age Equivalent of 3.2, and scored 2.11 on the PPVT.

Since program entry, both of the participants

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Detailed scoring instructions, teaching and assessment procedures, and interobserver agreement data are available on request from the first author.

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had acquired functional, but severely delayed, language. They followed simple directions and had basic toy-play skills. The children participated in unstructured "incidental teaching" free-play sessions prior to the onset of this study, and they had recently learned to initiate toy play via gestures or verbal requests.

Criterion for selection was slow acquisition in the Edmark Reading Program (1975), a carefully programmed curriculum provided in traditional operant training sessions. When this study began, Child 1 had met criterion on three word-recognition lessons after 65 sessions, and Child 2 had been working on prereading step 5 (match-to-sample task) for 33 sessions.

Setting and Stimuli

Sessions were in a classroom that contained a play area. Prior to baseline, each subject selected nine toys that would fit in a shoebox (32 cm × 18 cm × 10 cm). The toy selection procedure, similar to the toy preference assessment described by Shafer, Egel, and Neef (1984), consisted of three free-play sessions with a large number of toys displayed. Preference values were assigned according to the order of toy selections and were used to designate three sets of three toys of approximately equal value for each child.

Teaching stimuli consisted of words that corresponded to the labels of each child's nine preferred toys plus six distractors. Child 1's target words were as follows: (a) game, ruler, and beads in Set 1; (b) paper, copter, and music in Set 2; and (c) rabbit, bugs, and kitty in Set 3. For Child 2, target words were: (a) copter, egg, and seal in Set 1; (b) pen, ruler, and bugs in Set 2; and (c) owl, candle, and book in Set 3. For both children the same distractor words were randomly selected from the pool of nonsense distractors used in the Edmark Reading Program (1975). Stimulus words were printed in black, lowercase, 24-point Simplex Bold letters. Words were centered on white index cards (7.6 cm × 7.6 cm), and word cards were enclosed in plastic recipe holders to prevent tearing or other identifying marks.

Generalization materials included identical cardboard shoeboxes that were held shut by wide rubber bands. Word cards, prepared like the teaching stimuli, were attached to the end of each box. Additional stimuli were word cards with 18-point Simplex Bold letters, word cards with standard pica typewritten print, as well as a book in which typewritten words were centered on blank pages (14 cm × 9 cm), one word per page.

Experimental Design

A multiple baseline (Baer, Wolf, & Risley, 1968) across three sets of words was used to assess reading skills during baseline, teaching, and follow-up conditions, with replication across a second child. Generalization to a task requiring functional use of reading skills was assessed throughout baseline and teaching. Acquisition and generalization were evaluated using two probe procedures that remained standard throughout conditions (the sequence of assessment probes and teaching phases is outlined in Figure 1).

Acquisition Probes

On acquisition probes, observers scored reading responses correct when the child responded to the teacher's request to "Give me the word ____" by selecting from a display of five words and handing the requested word to the teacher. Only reading responses that occurred within 5 s of the teacher's request were correct; merely touching or pointing to a word, or self-correcting by handing a second word to the teacher, was incorrect.

Data were collected daily during baseline, immediately prior to each teaching session, and during follow-up 15 days and 25 days after the final teaching session. During acquisition probes, the child sat adjacent to the teacher, who presented five word cards in each set (three target words and two distractor words) in randomized arrangements. The teacher extended her hand and looked at the child during and following each request to "Give me the word ____." The order of requests for words varied across three randomized blocks of three words in each set, yielding a total of 27 trials per probe. Participants earned brief playtime periods or small bits of food (e.g., a piece of potato

chip) on a VR-3 schedule for visual attending and direction following. There was no feedback or reinforcement for correct/incorrect responding.

The data sheet indicated the order of requests for words as well as the order in which target and distractor stimuli should be displayed. Additional randomization of stimulus presentation resulted from rotation of three versions of the data sheet across sessions. Independent observers recorded the stimulus card selected by the child and scored each selection as correct or incorrect.

Incidental Teaching Procedures

Each child received daily 1:1 instruction in the context of a 25-min play activity. The child and teacher sat on the floor facing each other, and the teacher displayed two toys (initially). One of the displayed toys was a target item and the other a nontarget item; when the child gestured toward or requested a nontarget item, the teacher provided it immediately. In response to the child's initiation (verbal or gestural) for a target item, an incidental teaching episode began. A 3-level prompt system combined with a stimulus-fading strategy (as illustrated in Figure 1) maximized correct responding.

Prompts. Following an initiation for a target item, the teacher presented the word card(s) between the child and the item and prompted an elaborated response, "Give me the word ____" (1st-order prompt). If the child responded incorrectly, the teacher pointed to the correct word, quickly mixed and rearranged the word cards, and again requested "Give me the word ____" (2nd-order prompt). The teacher followed an incorrect response to this second opportunity by providing gentle physical assistance in selecting the correct card and handing it to the teacher (3rd-order prompt). The teacher provided 60 s access to the desired item contingent on the child's correct responding to any of the prompts.

When incorrect responses were errors of commission (the wrong card was selected), the teacher interrupted the response by immediately moving to the next prompt level. Following errors of omission (no response), additional prompts occurred 5 s from the teacher's direction to "Give me the word ____."

Stimulus fading. In each session, the child's first initiation for a target item resulted in teacher presentation of the word card for that item. On episodes following correct responses to the 1st-order prompts, the teacher presented an additional word card from the same set when the child initiated for a target item (i.e., errorless episodes increased from a 1- to 5-choice discrimination task). Incorrect responses to 1st-order prompts led to a 1-step reduction in the number of stimulus cards presented, both in the 2nd-order prompt and in the subsequent episode for that item.

Format of teaching sessions. Teaching sessions began with at least one maintenance incidental teaching episode for all previously acquired words, with a 5-choice discrimination task presented. If an incorrect response occurred in the 1st-order prompt, the teacher reinstated stimulus-fading conditions until the child was able to respond accurately to the 5-choice discrimination task.

After correct responses to all maintenance words, the teacher introduced the new target word. When the child worked up to three consecutive 5-choice discriminations for the target word, the remainder of the session consisted of incidental teaching for previously acquired words in the same set, interspersed with episodes of incidental teaching for the target word. During interspersal teaching, and during maintenance teaching of previously acquired sets, the teacher displayed three toys prior to each episode.

Each word was targeted sequentially until the child achieved a criterion of at least 80% accuracy on two consecutive acquisition probes. During two final maintenance sessions, one-third of each session was devoted to each set of words.

Measurement of Incidental Teaching Episodes

The measurement system permitted assessment of dependent and independent variables during incidental teaching episodes. It was also designed for use across response classes and to be convenient for use by teachers wishing to assess children's progress

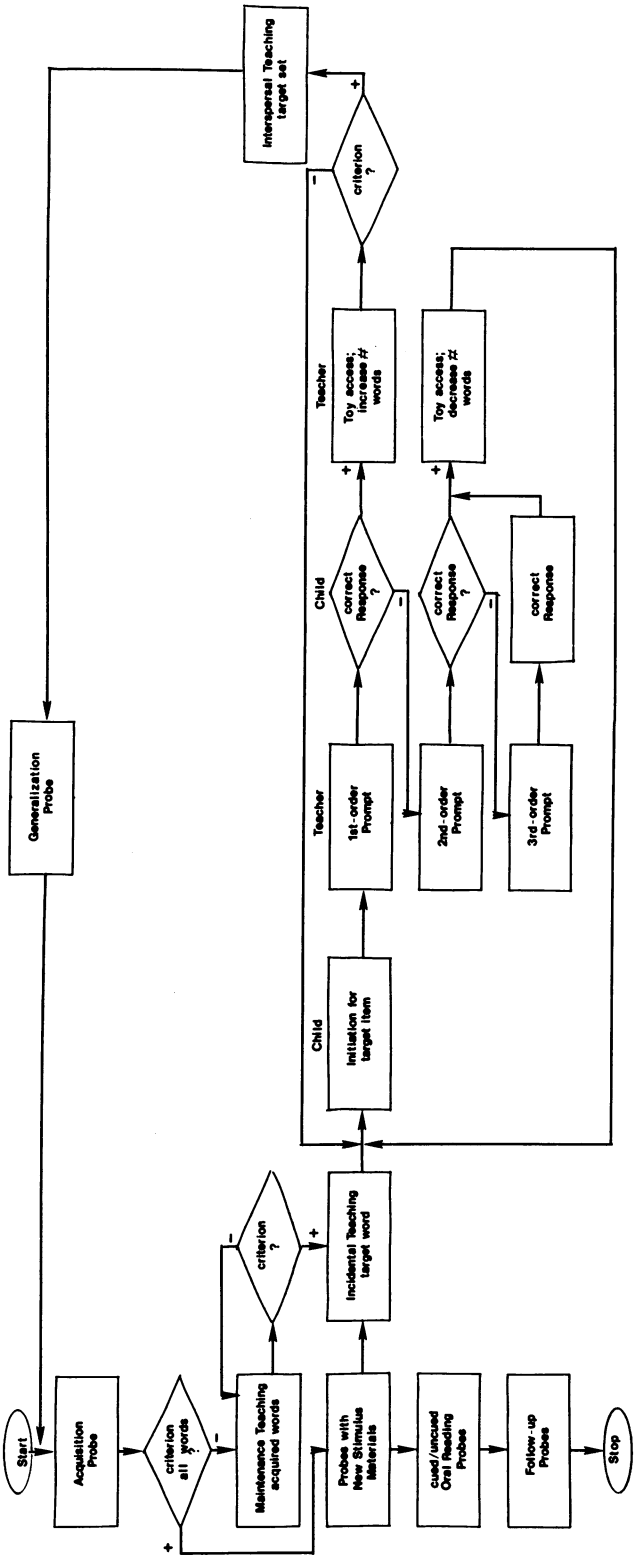

Figure 1. Sequence of assessment probes, teaching phases, and components of incidental teaching episodes, including the 3-level prompt system and the stimulus-fading strategy.

in incidental teaching sessions. Operational definitions of the components of an incidental teaching episode (Hart & Risley, 1982) were: (a) *child initiation* (verbal requests or gestures) for an available item, (b) *teacher prompts* for an elaborated (slightly more complex) response about the item within 5 s of initiation, (c) correct *child response* within 5 s of one of three prompts, and (d) *access to item* provided by the teacher to child within 5 s of correctly elaborated response.

A coded data sheet provided consecutive lines for recording up to 48 teaching opportunities. Observers recorded in a blank box the label of any item the child initiated for, and then circled yes or no regarding the presence or absence of subsequent components. All four components had to be present to constitute an incidental teaching episode, so that if one category was scored no, additional categories were not rated.

Observers also recorded data on the stimulus-fading strategy and the level of prompt to which the child responded. Recording the number of stimulus cards initially presented with the teacher's prompt, and the level of prompt (1st-, 2nd-, or 3rd-order) required for correct child responding, permitted assessment of within-session acquisition as well as assessment of the accuracy and effectiveness of the prompting and fading procedures.

Generalization Measures

Ongoing reading comprehension probes. Assessing generalization of reading responses to functional skills in locating desired items provided a measure of reading comprehension. Generalization probes were conducted daily throughout baseline and following every fifth teaching session. At least 1 hour of intervening classes separated generalization probes from teaching sessions, with intervening activities held in different classrooms with other teachers.

Generalization was assessed in a different activity area in the reading classroom; the child stood in front of a large bookcase on which five identical shoeboxes were displayed in randomized arrangements. Word cards similar to those used in teaching were attached to the end of each box, including the three target words and two distractor words for each set. The preferred toys were concealed in boxes with corresponding labels, and distractor boxes concealed other toys that weighed and sounded similarly to preferred toys; wide rubber bands prevented visual access to the boxes' contents.

On probe trials, the teacher maintained eye contact with the child and instructed, "Find the ____." Throughout baseline and teaching conditions, the teacher followed correct selections by assisting the child in opening the box and saying "You found the ____, so you can play with it now." The child received approximately 60 s playtime with each correctly located toy, then the teacher replaced the boxes on the bookcase in a new randomized arrangement. No prompts or feedback followed incorrect selections; unopened boxes were simply returned to the shelves in a new randomized arrangement, and the teacher presented the next trial. The teacher delivered small pieces of edibles contingent on attending, but the delivery of edibles was unrelated to correct responding.

On each trial, independent observers recorded the label of the box selected, and scored each selection as correct or incorrect. Observers scored reading responses correct when the child responded to the teacher's direction (to "Find the ____") by selecting from the five labeled boxes and removing the correct box from the shelf. Only first selections that completely cleared the bookcase within 10 s of the teacher's instruction were correct.

As on acquisition probes, the order of trials varied across three randomized blocks of the three words in each set, yielding a total of 27 trials per probe. The data sheet indicated the order of trials as well as the order of stimuli arrangements on the shelves. Three versions of the data sheet were again rotated across sessions, and additional control for unidentified marking of boxes was achieved by rotating toys and word cards to different boxes across probe sessions.

Probes with new stimulus materials. Because autistic children often "overselect" irrelevant characteristics of teaching stimuli (Lovaas, Schreibman,

Koegel, & Rehm, 1971), an important measure of the effectiveness of reading instruction may involve transfer to different typestyles. Thus, postteaching probes assessed reading of words composed of smaller letters (18-point) and different style letters (typewritten). Assessment procedures were identical to those used to conduct standard generalization probes, with the exception that two new sets of stimulus cards were prepared. The teacher presented a complete probe of 27 trials for 18-point Simplex Bold letters in the session following the final maintenance teaching session; the next session consisted of a complete probe with box labels printed in pica typewritten letters.

Oral reading probes. The focus of reading instruction during teaching conditions was on visual discriminations, with no direct teaching of oral reading responses. A final pair of probes concurrently assessed postteaching transfer across (a) response modalities (to oral reading responses), (b) activities (to reading words in a book), and (c) different formats of stimulus presentation (typewritten words presented one at a time). This markedly different task assessed both cued (i.e., "Read") and uncued reading responses.

Specifically, the nine target words were presented in typewritten letters centered on a white page in a book, one word per page. The order of word presentation was randomized, with each word presented three times (for a total of 27 trials). On the first cued probe, the teacher presented each word with the instruction "Read"; responses were scored correct when the child accurately read the word aloud, within 5 s of the teacher's instruction.

Immediately following the cued probe, the teacher gave the book to the child and, where needed, provided assistance in turning the pages one at a time. Again, each word was presented three times in randomized order, but no cue or direction was given by the teacher. Observers scored responses correct if the child accurately read the word aloud within 5 s of turning to the page on which the word was presented. The child received no prompts, differential feedback, or reinforcement for reading responses on either cued on uncued probes; the teacher delivered edibles on a VR-3 schedule for attending.

Because transfer from visual to oral reading responses did not occur with Child 2 on the first cued probe administered, he received two special teaching sessions. Word cards were on display between the child and the three toys for each set. When the child initiated for an item, the teacher extended her hand to receive the word card but omitted the verbal instruction to "Give me the word ____." On receipt of the correct word card, the teacher prompted "Read," and accurate oral reading resulted in teacher praise and immediate access to the desired toy. After two of these sessions, the cued probe was readministered, followed by the uncued reading probe.

Interobserver Agreement

Six rotating pairs of observers, trained in data collection procedures prior to the study, independently collected data on 40% of acquisition probes, 35% of teaching sessions, and 54% of generalization probes. Interobserver agreement was assessed for each child in each condition, and was calculated using the formula: total number of agreements divided by total number of agreements plus disagreements.

During teaching sessions, line-by-line agreement was computed separately for occurrence of each component of the independent variable (incidental teaching), for the dependent variable (child response), and for the overall number of incidental teaching episodes (counted only for episodes scored the same across components of the independent and dependent variables). Table 1 shows percent means and ranges of interobserver agreement.

RESULTS

Acquisition Probes

Acquisition probe data displayed in Figure 2 show the effects of incidental teaching on short- and long-term retention of reading discriminations. The means of the last three data points in baseline for Child 1 were 11% for Set 1 and 15% for Sets

2 and 3. The means of the last three data points in teaching conditions for Child 1 were 85%, 100%, and 93% for Sets 1–3, respectively. Child 1 met criterion on each of the three sets following six to nine sessions.

These results were replicated with a second child, although more sessions (14, 21, and 11) were required for acquisition across the three sets. Changes in mean percent correct from (the last three data points) baseline to teaching conditions for Child 2 were 22% to 96% for Set 1, 7% to 100% for Set 2, and 33% to 89% for Set 3.

Data on follow-up acquisition probes indicate that performances were maintained after 15 and 25 days. Across the three sets, Child 1's scores were 89%, 78%, and 100% correct at 15 days postteaching, maintaining at 89%, 89%, and 100% correct at the 25 days follow-up. Child 2's scores were 100%, 90%, and 78% at 15 days after teaching; his follow-up performances were 100%, 90%, and 89% correct (across Sets 1–3) at 25 days after teaching ended.

Table 1
Percent Means (and Ranges) of Interobserver Agreement

Assessment	Child 1	Child 2
	Probes	
Acquisition		
Set 1	95 (89–100)	99 (89–100)
Set 2	94 (89–100)	99 (89–100)
Set 3	100 (100)	100 (89–100)
Generalization		
Set 1	100 (100)	100 (100)
Set 2	100 (100)	98 (89–100)
Set 3	99 (89–100)	98 (89–100)
	Teaching sessions	
Incidental teaching components		
Initiations	98 (93–100)	98 (90–100)
Prompts	99 (94–100)	98 (90–100)
Responses	99 (96–100)	99 (96–100)
Access	99 (95–100)	99 (96–100)
Episodes	98 (96–100)	99 (94–100)

Teaching Sessions

The teaching procedures were largely "errorless" for both children, regardless of the number of stimuli presented. Thus, the combined stimulus-fading and graduated-prompt strategies yielded correct responses to the 1st-order prompt ("Give me") on 86% of all teaching episodes. The 2nd-order prompt (teacher pointing to correct response and providing a new opportunity to respond) corrected most of the errors that occurred.

Data on the independent variable indicate a high degree of teacher compliance with the protocol. Teacher errors (i.e., display of incorrect number of stimulus cards) occurred on only 1% of teaching episodes (0.46 per session) and did not appear to influence child performance.

Teaching episodes (controlled by child initiations) occurred at a relatively quick pace. Child 1 initiated a mean of 25 times per session (1 per min), and Child 2 averaged 35 initiations (1.4 per min). The majority of both children's selections were for target items that led to complete incidental teaching episodes (88% for Child 1 and 69% for Child 2).

Generalization Probes

Figure 3 shows generalization of reading responses acquired through incidental teaching to a task requiring functional use of reading skills to locate toys stored in labeled boxes. Although the potential for inadvertent teaching was present during both baseline and treatment (i.e., access to correctly labeled toys was provided in both conditions), baseline stability indicates that this probe procedure was insufficient to produce visual discriminations. For Child 1, baseline mean percent correct was 15%, 13%, and 25%, across the three sets. Following acquisition in teaching sessions, Child 1 scored a mean percent correct of 85% for Set 1, 84% correct for Set 2, and 89% correct for Set 3. On postteaching probes, Child 1 scored 100% correct on all three sets for words written in smaller letters (18-point) and different typestyles (pica typewritten print). Child 1 also scored 100% correct for all three sets on a task requiring oral reading of words in a book, in both cued and uncued conditions.

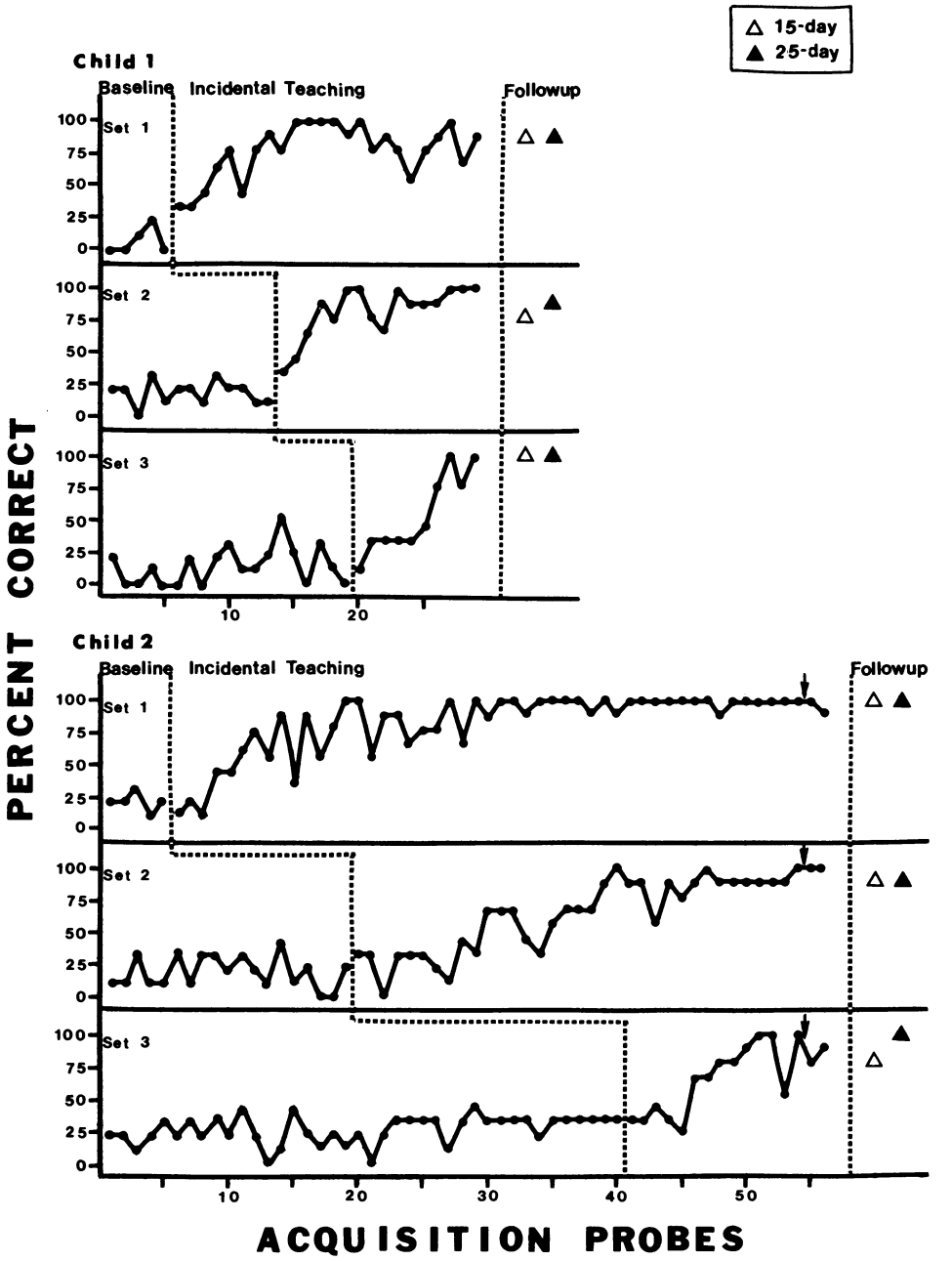

Figure 2. Percent correct responses on acquisition probes during baseline, incidental teaching, and at 15- and 25-day follow-ups. Arrows indicate the point at which Child 2 began special oral reading sessions.

Child 2's functional use of reading skills on baseline generalization probes was 18% for Set 1, 14% for Set 2, and 45% for Set 3. The higher level of correct responding on Set 3 resulted from his perseverative selection of the box labeled "owl" (which was correct 33% of the time); however, teaching session data showed that Child 2 was unable to correctly discriminate the word owl when

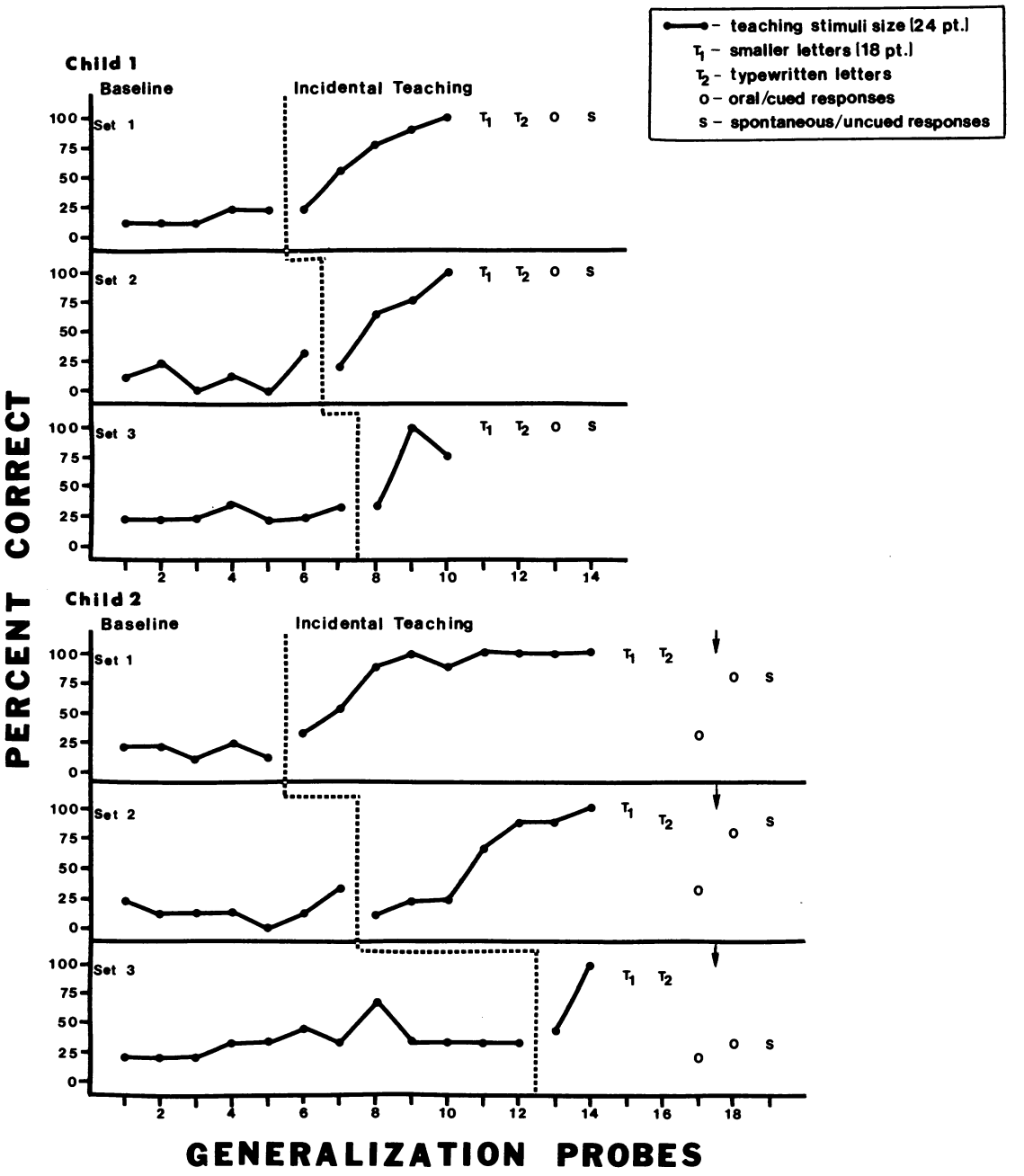

Figure 3. Percent correct responses on generalization probes involving novel stimulus materials and response modalities. Arrows indicate the point at which Child 2 received special oral reading sessions.

teaching began. Following acquisition in teaching sessions, mean percent correct across the three sets was 97%, 95%, and 100%. Postteaching assessment of words printed in smaller letters was 100%, 100%, and 89% for Sets 1–3, respectively, and percent correct responding to words printed in standard pica typewritten letters was 100% for Set 1, 89% for Set 2, and 89% for Set 3.

The first cued probe for Child 2's oral reading of words written in a book showed accuracy decreased to 33% for Set 1, 33% for Set 2, and 22% for Set 3. Following remedial training, his probe performances increased on Sets 1 and 2 under cued and uncued conditions. However, correct responding on Set 3 remained at baseline levels, possibly due to a fewer number of teaching episodes provided prior to his reaching criterion on this set.

DISCUSSION

Results show that incidental teaching promoted acquisition and retention of sight-word reading responses. Of importance are replicated demonstrations that incidental teaching of visual discriminations yielded generalization to functional reading skills, or word comprehension. Relevant to reading are data on postteaching performance on probes using stimulus words printed in different size letters and different style print, which suggest transfer to novel stimulus materials. Additional findings demonstrate that oral reading responses may be acquired by incidental teaching of visual discriminations, although special programming will be needed for some children. The major significance of this study is in illustrating that extension of incidental teaching procedures to a new response class (reading) produces results similar to applications of incidental teaching to communication skills.

These results indicate that incidental teaching procedures provide a viable instructional alternative for children having difficulty in a traditional curriculum, and available comparison data lend further support to these findings. The children concurrently continued their participation in the standard Edmark Reading Program (1975), and reliable performance data indicated that both children's acquisition was faster and retention greater in incidental teaching conditions. Marked performance differences also favored incidental teaching on postteaching probes of words written in smaller and typewritten print, as well as on probes assessing cued and uncued reading of words in a book. Although generally congruent with the results of more tightly controlled studies of the relative effects of traditional versus incidental teaching (McGee et al., 1985), this comparison lacked control for several significant variables (e.g., word difficulty, reinforcement schedules and values). Further, we should highlight that many autistic children at the Institute have made excellent progress in the well-programmed Edmark curriculum. Thus, the issue is not which curriculum is "best" but, rather, one of refining teaching processes that maximize skill development in difficult-to-teach children.

The measurement system facilitates component analysis of the incidental teaching process. The following teaching session data suggest that children "enjoyed" the *process* of incidental teaching: (a) high percentages of initiations for incidental teaching items; (b) increased selection of toys following introduction to incidental teaching (cf. Hart & Risley, 1974, 1975); and (c) quick pacing of episodes (not making full use of playtime, with immediate reinitiations for the same toys). The fact that incidental teaching did not decrease children's preferences for target items is noteworthy given that autistic children might be expected to choose items that can be obtained with the least effort or a minimum of interpersonal interaction. Systematic study of these effects might include an examination of whether responsiveness to social attention is a prerequisite or byproduct of incidental teaching, perhaps by analyzing the stimulus conditions controlling individual performances (Carr & Durand, 1985).

In conclusion, this research illustrates that incidental teaching procedures are applicable to skills other than vocal communications. Extension across response classes provides the advantage of concurrent programming for acquisition and generalization. By broadening the array of responses that may be taught in the course of pleasant, child-preferred activities, we should substantially advance our efforts to provide severely delayed children with skills that will be useful in their everyday environments.

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