

*AN EVALUATION OF THE RELATIVE EFFICACY OF AND CHILDREN'S PREFERENCES FOR TEACHING STRATEGIES THAT DIFFER IN AMOUNT OF TEACHER DIRECTEDNESS*

NICOLE A. HEAL, GREGORY P. HANLEY, AND STACY A. LAYER

UNIVERSITY OF KANSAS

The manner in which teachers mediate children's learning varies across early childhood classrooms. In this study, we used a multielement design to evaluate the efficacy of three commonly implemented strategies that varied in teacher directedness for teaching color- and object-name relations. Strategy 1 consisted of brief exposure to the target relations followed by an exclusively child-led play period in which correct responses were praised. Strategy 2 was similar except that teachers prompted the children to vocalize relations and corrected errors via model prompts. Strategy 3 incorporated the same procedures as Strategy 2 except that a brief period of teacher-initiated trials was arranged; these trials involved the use of prompt delay between questions and prompts, and correct responses resulted in tokens and back-up activity reinforcers. Children's preferences for the different teaching strategies were also directly assessed. Strategy 3 was most effective in promoting the acquisition and generalization of the color- and object-name relations and was also most preferred by the majority of children, Strategy 1 was the least effective, and Strategy 2 was typically the least preferred. Implications for the design of early educational environments based on evidence-based values are discussed.

DESCRIPTORS: child preference, direct instruction, discovery learning, embedded teaching, evidence-based teaching strategies

The practices of early childhood educators have been guided by the recommendations from both the National Association for the Education of Young Children (NAEYC; Bredekamp & Copple, 1997) and the Division of Early Childhood (DEC; Smith et al., 2002). A dominant belief that is consistent with these position statements is the importance of varied child–environment interactions to promote learning. Wolery and Wilbers (1994) outlined a continuum on which teaching strategies can be located, with exclusively child-initiated interactions at one endpoint and exclusively teacher-initiated interactions at the other endpoint. Strategies located at the child-initiated

end of the continuum generally result in high levels of child engagement, whereas strategies located at the teacher-initiated end generally produce specific teacher-selected behaviors (Wolery & Sainato, 1996). Discovery learning, embedded teaching, and direct instruction are three specific early childhood teaching strategies that occupy different points on this continuum.

On the child-initiated endpoint of the continuum lies discovery learning, a teaching method developed from the constructivist philosophy of learning (Piaget, 1970) in which the learner is expected to discover new ideas and relations through independent interactions with the environment with little or no guidance from a teacher (Bruner, 1961). The teacher's primary role is to arrange the environment to promote independent interactions with the materials and expose the child to the learning objectives through intermittent commenting and acknowledgment when a child is successful (Klahr & Nigam, 2004; Solter & Mayer, 1978). Active engagement and reinforcement that are not socially mediated (i.e., so-called intrinsic moti-

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Requests for reprints should be addressed to Gregory P. Hanley, Psychology Department, Western New England College, 1215 Wilbraham Road, Springfield, Massachusetts, 01119 (e-mail: ghanley@wnec.edu).

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vation) are presumed to be the critical variables underpinning the learning that occurs in this approach.

Embedded teaching (Bricker, Pretti-Frontczak, & McComas, 1998) is located in the middle of the continuum and is characterized by instructions and feedback regarding target skills being delivered within child-initiated activities during typical routines. Embedded teaching strategies were derived from the early work of Hart and Risley (1968, 1975) on incidental teaching. A typical example of incidental teaching involves the teacher placing preferred materials within sight but out of the child's reach, thereby increasing the likelihood that the child will request the materials. When the child engages in the desirable request, the materials are provided. According to Daugherty, Grisham-Brown, and Hemmeter (2001), multiple variations of the embedded teaching procedure have been described, with characteristics such as type of activity, prompts, programmed consequences, and learning materials distinguishing the variations. Nevertheless, learning opportunities are considered child initiated, and the reinforcing consequences for engaging in target responses are considered natural in that the child continues to play with materials following a trial of embedded teaching, or the child receives the requested item that is associated with the scheduled activity.

A third teaching strategy, which is located on the teacher-initiated end of the continuum, is direct instruction, in which the teacher plays a more prominent role in the teaching situation (Magliaro, Lockee, & Burton, 2005). Direct instruction is characterized by relatively simple and precise materials tailored to specific learning objectives, planned (and sometimes scripted) prompting procedures, provision of high-quality reinforcers for correct responding, and multiple trials conducted during brief teaching periods (Fredrick, Deitz, Bryceland, & Hummel, 2001). Wolery and Sainato (1996) outlined a variety of procedures that are often

adopted during direct instruction; these include constant or progressive prompt delays, error correction via modeling correct answers or brief time-out periods, and differential reinforcement of correct responding with high-quality or highly preferred items.

Each of these three teaching approaches varies primarily in the amount of teacher directedness during the teaching situation, and each has unique strengths and weaknesses. The discovery-oriented approaches require the careful selection of learning materials, but demands on the teacher are not high during the learning period. A second advantage of this approach is that the teacher respects the momentary preferences of children for simultaneously available activities and materials. However, because this approach is devoid of prompts and feedback from the teacher, specific learning objectives are difficult to target, and it is difficult to determine the specific skills acquired as a direct function of this teaching approach (Mayer, 2004). Despite the lack of empirical evidence supporting the efficacy of purely discovery-oriented teaching methods (Mayer), these methods are included as recommended practice by the NAEYC (Bredekamp & Copple, 1997).

Because teacher prompting and feedback are arranged during embedded teaching, specific skill acquisition occurs with this approach (Fox & Hanline, 1993; Horn, Lieber, Li, Sandall, & Schwartz, 2000; Woods, Kashinath, & Goldstein, 2004). When compared to direct instruction, embedded teaching produced similar skill acquisition; however, better skill generalization was observed by Losardo and Bricker (1994) and McGee, Krantz, and McClannahan (1985) with the embedded procedures. A primary disadvantage of embedded teaching is the difficulty inherent in routine and successful implementation. For example, Pretti-Frontczak and Bricker (2001) observed that following extensive training on implementing embedded teaching, early childhood and early childhood

special educators implemented these procedures on less than 10% of observation intervals.

Along with questionable generalization of skills acquired during direct instruction, a primary criticism is usually directed towards its reliance on contrived learning opportunities, materials (e.g., flash cards), and programmed consequences (e.g., tokens, traded in for backup material reinforcers; see Strain et al., 1992). Despite strong empirical evidence for the efficacy of direct instruction (Adams & Englemann, 1996; Stebbins, St. Pierre, Proper, Anderson, & Cerva, 1977), these procedures are not widely adopted by early childhood educators (Walsh & Petty, 2006).

A teaching strategy that has overwhelming empirical support but that is not considered to be socially acceptable by relevant consumers (parents, teachers, and interventionists) is not likely to be adopted in practice (Wolf, 1978). Schwartz (1999) observed the importance of the construct of social validity with the early childhood interventions of direct instruction and activity-based (embedded) instruction for teaching arithmetic. The strongest research support is in favor of direct instruction, but embedded teaching has greater social validity (i.e., parents and teachers find it more acceptable), and the latter is adopted more in preschool settings. Thus, determining the acceptability of early childhood practices, which is usually accomplished by administering questionnaires to teachers or other relevant stakeholders, is important when designing early childhood classroom practices. However, an additional measure of a practice's value may be obtained from the children who directly experience it, and these measures of children's acceptance may provide additional compelling evidence for the adoptability of a practice.

Determining the acceptability of instructional strategies with young children of limited verbal competence, limited history with the strategies in question, or both, complicates this process considerably. Nevertheless, a procedure

for directly determining preferences of children with disabilities for behavioral interventions was described by Hanley, Piazza, Fisher, Contrucci, and Maglieri (1997) and Hanley, Piazza, Fisher, and Maglieri (2005). These procedures were recently extended to determine children's preferences for instructional contexts that varied in the amount of child control (Tiger, Hanley, & Hernandez, 2006), amount of information regarding the availability of teacher attention (Tiger, Hanley, & Heal, 2006), and by the type of motivational system (Heal & Hanley, 2007). In these studies, different-colored poster boards were correlated with the different teaching strategies (or interventions), and children repeatedly experienced the strategies in the presence of the colored poster boards. Smaller colored cards or microswitches, one associated with each strategy, were then made available to the children outside the room in which teaching typically occurred, and the child was asked to select the one he or she liked best. When the child handed a card to the teacher (or pressed a microswitch), the teacher and child entered the room and briefly experienced the strategy associated with the selected color. This process of handing cards (or pressing switches) and experiencing correlated strategies was repeated until the child selected one option on a regular basis (or some other pattern emerged). Thus, preferences for contexts, which were difficult to describe to young children, were directly assessed by recording each child's selections of cues correlated with the important teaching or intervention strategies.

In the current study, the relative efficacy of and children's preferences for three teaching strategies that differed in the amount of teacher directedness (discovery oriented, embedded, and direct instruction) was determined using single-subject experimental designs. The procedures implemented in each teaching strategy were not mutually exclusive; instead, more elements were added to each successive strategy such that the mediating role of the teacher in

the learning situation was more extensive across the strategies. Thus, our analysis allows a description of the added value of embedding learning opportunities and providing brief periods of direct instruction. Relative efficacy of these strategies for teaching preschool children naming relations was assessed by examining skill acquisition data (i.e., number of learning opportunities, percentage of correct responses, and latency to mastery) and pre- and posttest data with respect to the relations taught in each strategy. In addition, children's preferences for the strategies were determined by directly measuring their selections of each strategy over time.

## METHOD

### PARTICIPANTS AND SETTING

Participants were 6 Caucasian English-speaking children, 4 girls and 2 boys aged from 48 to 61 months ( $M = 55$  months). The children attended a full-day inclusive preschool classroom that served children of typical and atypical development. None of the children had been diagnosed with a developmental disability; however, individualized curricula showed great variability in their progress. Children were selected for participation based on informed consent and consistent classroom attendance. All sessions were conducted in a small room (3 m by 3 m) near the children's classroom that contained a child-sized table and chairs (in addition to the session materials).

### MATERIALS

Two relations were taught to each child. The child was initially taught to vocally label colors in Spanish; then he or she was taught to vocally label animals in Spanish. There were 12 color and 12 animal names taught. Each strategy was associated with four color relations and then four animal relations (see Table 1 for the specific color and animal relations). Three sets of materials designed to evoke the target responses (color or animal names) during each

Table 1  
Target Responses for Each Teaching Strategy

Relation	Target responses			
	Strategy 1	Strategy 2	Strategy 3	
Color	Anaranjado	Morado	Amarillo	
	Orange	Purple	Yellow	
	Azul	Negro	Blanco	
	Blue	Black	White	
	Gris	Plata	Café	
	Gray	Silver	Brown	
	Rosa	Rojo	Verde	
	Pink	Red	Green	
	Animal	Caballo	Pato	Cochino
		Horse	Duck	Pig
Gallina		Perro	Pajaro	
Chicken		Dog	Bird	
Gato		Serpiente	Rana	
Cat		Snake	Frog	
Pez		Tortuga	Vaca	
Fish		Turtle	Cow	

assessment (i.e., color- and animal-name assessments) were rotated across sessions. Within each set of materials, each target stimulus was represented by three items. We included three distinct sets of materials for each relation because we aimed to keep the children's interest in the toy sets high throughout the study, we did not want the children to select one of the three teaching strategies to gain access to a particular toy set during the preference assessments, and we were explicitly programming for generalization of the name relations across stimuli. In addition to the multiple toy sets, 12 color and animal cards, plastic tokens, and a treasure box were arranged in the strategy involving some direct instruction. Each teaching strategy was associated with distinctly colored large (60 cm by 75 cm) and small (15 cm by 10 cm) laminated poster boards.

### RESPONSE MEASUREMENT AND INTEROBSERVER AGREEMENT

Data were collected using paper and pencil within 15-s intervals. A child-initiated learning opportunity was defined as the first occurrence within each 15-s interval of the child grasping a target item or pushing down on the target item for a minimum of 1 s. If a second target item

was touched within the same 15-s interval, this was not scored as a child-initiated learning opportunity. Teacher-initiated learning opportunities were scored when the teacher held up a color or animal card and in English said, "What color [animal] is this?" Learning opportunities are reported as a frequency count within each teaching strategy, and the numbers of child-initiated and teacher-initiated learning opportunities are combined in Strategy 3. Given an occurrence of a learning opportunity, a correct response was scored when the child independently and correctly said the Spanish word corresponding with the target stimulus within 5 s of the initiation of the learning opportunity, and a frequency count across intervals is reported. In addition, the mean percentage of correct responding was calculated by calculating the mean percentage correct scored within the final five sessions of each teaching strategy for the color- and animal-name assessments.

During the preference assessments, selections were scored and defined as the child removing one of the three cards from the door and handing it to the teacher. Card selections are reported as a preference rank in which 1 represents the first card selected and 3 represents the last card selected. Session duration was recorded and is reported as mean duration across children and assessments. Mean session duration was calculated by calculating mean session durations for each child; individual means were then averaged across all children and assessments.

A second observer recorded behavior simultaneously but independently in at least 27% of sessions across all children and assessments (range, 27% to 60%). The records of each observer were compared on an interval-by-interval basis. An agreement was scored when both observers scored the occurrence or nonoccurrence of a learning opportunity and occurrence or nonoccurrence of a correct response within each interval. Interobserver agreement was calculated by dividing the number of

agreements by the number of agreements plus the number of disagreements and then converting this ratio to a percentage. Agreement was 94% (session range, 50% to 100%) for learning opportunities and 98% (session range, 67% to 100%) for correct responses across all children and assessments. Interobserver agreement was collected and calculated in the same manner as described above for card selections in a minimum of 20% of all preference assessments across all children (range, 20% to 37%). An agreement, defined as both observers recording the same card selection for each session, was 100% across all children and assessments.

#### FIDELITY OF TEACHERS' PROMPTS AND CONSEQUENCES

Measures of procedural fidelity were collected on the teachers' delivery of the initial vocal prompt and consequences provided following the child's response in each teaching strategy. Given a learning opportunity, data were recorded on the nonoccurrence (Strategy 1) or occurrence (Strategies 2 and 3) of an initial vocal teacher prompt (e.g., "What color is that?") for each session. Because the teacher was not to deliver a vocal prompt following the initiation of a learning opportunity during Strategy 1 sessions, to calculate fidelity the number of learning opportunities in which the teacher did not deliver a vocal prompt was divided by the total number of learning opportunities, and this ratio was converted to a percentage. By contrast, the teacher was required to deliver a vocal prompt during Strategies 2 and 3; thus, to calculate fidelity, the number of learning opportunities in which the teacher delivered a vocal prompt was divided by the total number of learning opportunities, and this ratio was converted to a percentage.

Given a learning opportunity and child response, consequences also varied across the three teaching strategies. Following an incorrect or no response the teacher was required not to

deliver a model prompt during Strategy 1 sessions, but the teacher was required to deliver a model prompt following an incorrect or no response during Strategies 2 and 3. In addition, the teacher was always required to deliver praise following a correct response in all three strategies. To calculate fidelity measures on teacher consequences during Strategy 1 given a learning opportunity, the number of correct responses in which the teacher delivered praise plus the number of incorrect or no responses in which the teacher did not deliver a model prompt were divided by the total number of child responses and then converted to a percentage. For Strategies 2 and 3, given a learning opportunity, the number of correct responses that were followed by teacher praise plus the number of incorrect or no responses that were followed by a teacher model prompt were divided by the total number of child responses, and this ratio was converted to a percentage.

Across all children and assessments, the teacher did not deliver a vocal prompt following a learning opportunity for a mean of 99% of opportunities during Strategy 1. The teacher did deliver a vocal prompt following the initiation of a learning opportunity on a mean of 93% and 97% of opportunities during Strategies 2 and 3, respectively, across all children and assessments. Given a learning opportunity and child response, the teacher delivered the appropriate consequence on a mean of 99%, 96%, and 98% of opportunities across all children and assessments during Strategies 1, 2, and 3, respectively. Taken together, these data suggest that the procedures of each strategy were implemented with a high degree of fidelity.

#### EXPERIMENTAL DESIGN

A multielement single-subject experimental design (Sidman, 1960) was used to determine the relative efficacy of the three strategies for teaching color- and object-name relations to 6

preschoolers. The counterbalanced and rapid alternation of the three teaching conditions allowed performance in each of the three strategies to be influenced by outside factors (lack of sleep, illness) similarly and for each child to experience each strategy for the same amount of time. A concurrent-chains arrangement (Catania & Sagvolden, 1980; Hanley *et al.*, 1997) was used to determine children's preferences for the teaching strategies.

#### PROCEDURE

##### *Overview*

Three preassessments were conducted prior to evaluating the relative efficacy of and preference for the three teaching strategies. To identify the colors that would be associated with each strategy, a paired-item color preference assessment was conducted first. To ensure that each child had the necessary skills to echo a model prompt, an echoic assessment was conducted second. To assess each child's skill level with respect to the color- and animal-name relations, a pretest with all 12 target relations was conducted third. Following the simultaneous evaluation of efficacy and preference, post tests of the color- and animal-name relations were conducted and served as a measure of generalization for the acquired relations.

##### *Preassessments*

*Color preference assessment.* Ten colored cards were initially included in a paired-item assessment (Fisher *et al.*, 1992) with each child. Each colored card was paired with every other colored card once, the pairs were presented to the child one at a time, the child was prompted to touch the color he or she liked best, and the colored card selected was scored. The order of presented pairs was randomized. For every card selection, the teacher delivered a brief statement of praise (e.g., "thanks"); therefore, no differential consequences were provided for selecting a particular colored card. Selection percentages and a preference hierarchy were obtained by

dividing the number of times a card was selected by the total number of times it was presented, and this ratio was converted to a percentage. The three colors that were identified as moderately and similarly preferred (i.e., colors that were identified in the middle of the preference hierarchy) were selected to decrease the likelihood that the child's selections in the strategy preference assessments might be controlled by a preexisting color preference. The three cards were then randomly assigned to each of the strategies and were held constant throughout the efficacy and preference assessments for each child.

*Echoic assessment.* A nine-trial assessment to determine if each child could echo one- to five-syllable words in English was conducted next. The trial types were adjusted according to the responses. In the first trial, the teacher vocally modeled a one-syllable word (e.g., "cat" or "milk") and then prompted the child to repeat the word. If the child successfully echoed the word, a two-syllable word (e.g., "apple" or "crayon") was presented on the next trial. This process continued until five-syllable words were presented. If a response was incorrect or the child did not respond within 5 s of the model prompt, the next word presented contained one less syllable than the word that was not successfully echoed. If all responses were correct, the teacher vocally modeled five-syllable words for the final four trials. A short statement of praise was delivered following correct responses, and no corrective feedback was provided following incorrect or no responses. The next trial was initiated following a 2-s pause. All children correctly echoed at least one five-syllable word during this assessment.

*Pretest.* A novel teacher who was fluent in Spanish conducted all pretests with each child. The teacher instructed the child to answer all of the questions in Spanish prior to the start of each pretest. Sitting across from the child at a child-sized table, the teacher held up one laminated color or animal card and in English

asked, "What color [animal] is this?" No consequences were delivered following correct or incorrect responses. However, the teacher provided statements of descriptive praise (e.g., "nice sitting") after every other trial. Correct and incorrect responses were scored.

### *Efficacy Assessment*

After the three preassessments were conducted, the efficacy assessment began. Three distinct sessions made up a session block; one session block was conducted per day, such that each child experienced each teaching strategy once daily. The same teacher conducted all sessions and provided some form of attention (i.e., specific prompts, praise, comments) during each 15-s interval such that the amount of attention the child received was similar across the three strategies. The mediating role of the teacher varied across the three strategies, ranging from playing a very minimal role (Strategy 1) to playing a more prominent role (Strategy 3) in the teaching situation. In addition, the strategies were arranged such that new elements were added to the ones arranged in the previous strategy (e.g., Strategy 3 incorporated elements of Strategies 1 and 2 plus additional elements). Table 2 contains a summary of the elements in each teaching strategy.

*Strategy 1.* The role of the teacher in Strategy 1 was to describe the target relations to the child, arrange the environment to promote active engagement, and provide feedback when the child responded correctly. The child and teacher sat on the floor across from each other with the toys on a colored mat that corresponded to Strategy 1 between them. Because this was the only strategy in which the teacher never prompted responses or provided correct-answer models, pre-session exposure was arranged in which the teacher vocally labeled each target item once prior to the start of each session. Specifically, the teacher held up one target stimulus at a time and labeled it in Spanish until each name relation was labeled once. All interactions were child initiated; the teacher provided no prompts to play and did not directly or indirectly question the child about

Table 2  
Summary of the Elements of Each Teaching Strategy

Strategy 1	Strategy 2	Strategy 3
Pre-session exposure —	— —	— Teacher-initiated learning opportunities (prompt delay, conditioned and back-up reinforcers)
Child-initiated learning opportunities	Child-initiated learning opportunities followed by a teacher vocal prompt	Child-initiated learning opportunities followed by a teacher vocal prompt
Praise provided for a correct response —	Praise provided for a correct response Corrective feedback provided for an error	Praise provided for a correct response Corrective feedback provided for an error

*Note.* Dash indicates the absence of the element in each teaching strategy.

either color- or animal-name relations (i.e., when the child touched a target item, thereby initiating a learning opportunity, the teacher did not deliver prompts of any sort). If the child emitted the target response within 5 s of the initiation of the learning opportunity (e.g., the child said, “This is azul”), the teacher provided praise (e.g., “That’s right, that is azul”). In addition, the teacher never delivered a model prompt following an error (e.g., the child said, “This is rosa,” while holding a blue crayon).

*Strategy 2.* Two additions to the procedures outlined for Strategy 1 were included in Strategy 2. First, the teacher provided vocal prompts to name colors and animals when a learning opportunity was initiated (i.e., when the child touched a target item for the first time within a 15-s interval). Second, the teacher provided a model of the correct response following an error and provided an opportunity for the child to echo the model. When the child initiated a learning opportunity by touching a target item such as a red car, in English the teacher asked, “What color is that car?” If the child said, “rojo,” the teacher provided praise; if the child said anything else or did not respond, the teacher provided a model prompt, “It’s rojo.” There was no explicit instruction to imitate the teacher’s model prompt, but when the child did correctly imitate the model, the teacher provided praise. When the child did not correctly imitate the model, the teacher simply continued playing. If the child touched a second target item in the same 15-s interval, another

question was not issued; only the first target item touched in each 15-s interval occasioned teaching. Two changes from Strategy 1 were also relevant. First, the relations were not dictated to the child at the start of these sessions, and second, a different-colored mat was present during Strategy 2.

*Strategy 3.* The child and teacher sat on the floor across from each other with a colored mat correlated with Strategy 3 between them, and a box (25 cm by 40 cm by 50 cm) that contained relevant toys was next to them. This strategy involved two distinct components; the first was consistent with direct instruction (teacher-initiated trials, prompt-delay procedures, and differential reinforcement), and the second was consistent with the teaching procedures described for Strategy 2. Teacher-initiated learning opportunities were conducted in the first component. The teacher first implemented a 0-s prompt delay, such that a model of the correct response (e.g., “blanco”) immediately followed the initial prompt (i.e., “What color is this?”). The prompt-delay schedule then progressed by 1 s in each subsequent session (independent of responding) until a 5-s delay was reached. Three sessions were then conducted at the 5-s delay. If the child did not reach the mastery criterion during these sessions, the delay was reset to 0 s and progressed on a slower schedule (each delay was implemented for two sessions instead of one).

During each teacher-initiated learning opportunity, the teacher held up a color or animal card and in English asked, “What color is this?”



Following a correct response to the initial vocal prompt, the child received praise and two gold tokens. A model of the correct response and an opportunity to echo the model followed errors. Following a correct response to the model prompt, the child received praise and one gold token. Errors following the model prompt were ignored, and the next trial was initiated. Each relation was presented to the child twice; thus, eight teacher-initiated trials were conducted. When the child answered correctly after the initial vocal prompt of the first presentation of a relation, that color or animal card was not presented again, such that the total number of learning trials was reduced. Therefore, the number of teacher-initiated learning opportunities ranged from four to eight, depending on the child's responding. Once the child received eight gold tokens, he or she was allowed to exchange them for access to toys in the box (i.e., backup reinforcers) that was decorated and referred to as the treasure box. The toys in the treasure box included the target stimuli for the same color- and animal-name relations that were targeted in the first component. This second component of Strategy 3 was then conducted identically to Strategy 2 for a period of 4 min. The time required to complete the first component of Strategy 3 varied between 30 and 120 s depending on responding. To calculate the total time of Strategy 3 sessions, the time required to complete the first component was added to the 4 min required for the second component. To keep the session time consistent across strategies, the session times of Strategies 1 and 2 were yoked to the time required to conduct the previous Strategy 3 session. For example, if it took 1 min and 4 min to conduct the first and second components of a Strategy 3 session, the following sessions of Strategies 1 and 2 were both 5 min in duration. To establish the yoking procedure, each assessment started with a Strategy 3 session.

#### *Preference Assessment*

As noted above, three distinct sessions made up a session block, and one session block was

conducted per day. Session blocks alternated between forced choice and free choice. During forced-choice blocks, the experimenter randomly determined the order of the teaching strategies; during free-choice blocks, the child determined the order. The free-choice blocks yielded our measure of children's preference for the teaching strategies.

On the outside of the session room door, there were three colored cards, each of which corresponded to one of the teaching strategies. The cards were attached to the door in a row, and their placement was randomized each session. When the child removed one of the colored cards from the door and handed it to the teacher (initial link of the concurrent-chains arrangement), he or she entered the room to experience the correlated teaching strategy (terminal link of the chain). At session completion, the teacher informed the child that the session was over and instructed the child to stand up. The teacher and child left the room for approximately 30 to 60 s. During this time the teacher and child played in the hallway (e.g., passed a ball to each other, or the child may have told the teacher a story). These procedures were repeated until the child experienced each of the three teaching strategies, and the session block was complete. During the forced-choice blocks, the teacher stood behind or next to the child and said, "Hand me the [color] card." These session blocks were arranged to teach the children the association between selecting a particular card and experiencing the correlated teaching context and to provide evidence of the relative efficacy of the procedures. The main difference between the forced- and free-choice blocks was that the teacher said, "Hand me the card that you would like to do first [next]" during the free-choice blocks. All of the children followed the instruction to remove and hand a card to the teacher during all session blocks. The teacher delivered a short statement of praise following all card selections (i.e., no

differential consequences for selecting a particular card were provided other than access to the different teaching strategies). In both the forced- and free-choice blocks, the selected card was removed from the array such that fewer cards were present during subsequent selection opportunities in each session block.

Each assessment continued until the child reached a mastery criterion in one of the teaching strategies or 90 sessions occurred. The mastery criterion was reached when the child was 100% correct with respect to each target relation for two nonconsecutive sessions or 80% correct with respect to each target relation for three nonconsecutive sessions.

#### *Posttests*

Four posttests comprised of 48 trials were conducted with the color- and animal-name relations with all children following completion of each assessment. The teacher who conducted the efficacy and preference assessments also conducted two of the posttests. The teacher sat on the floor across from the child and held up individual target objects used previously (e.g., cars, crayons) and asked, "What color is this?" The teacher who conducted the pretests conducted the other two posttests. Sitting across from the child at a table, the teacher held up one laminated color or animal card at a time and said, "What color is this?" Both teachers instructed the children to answer in Spanish, and no consequences were delivered following correct or incorrect responses. The teachers provided descriptive praise (e.g., "I like your shirt today") following every other trial. Correct responses were tallied, and the results of all four posttests were added together and divided by four to obtain a mean posttest score.

## RESULTS

The patterns observed in Emma's (Figure 1), Jeff's (Figure 2), and Lisa's (Figure 3) session-by-session data are most representative of the patterns observed with the other children;

therefore, only these session-by-session data are depicted. The other children's data are summarized in Figure 4 and Table 3.

#### *Efficacy*

Figures 1 to 3 depict individual performance during the color-name assessments in the first columns and the animal-name assessments in the second columns. Emma's responding (Figure 1) was consistent across both taught relations, with the highest number of learning opportunities and correct responses observed in Strategy 3. She did not reach the mastery criterion in either assessment; therefore, both assessments were terminated following the completion of 90 sessions. Jeff (Figure 2) experienced more learning opportunities and emitted the highest number of correct responses in Strategy 3 during both name-relation assessments. He emitted more correct responses in Strategy 2 sessions during the animal-name relation assessment than in Strategy 2 sessions in the color-name relation assessment. The asterisks above the data points denote the sessions in which he met mastery criterion in Strategy 3 during both assessments. For Lisa (Figure 3), consistent with the other children's data, the highest number of learning opportunities was observed in Strategy 3 during both assessments. In addition, she emitted more correct responses in Strategy 3 than in Strategies 1 and 2 across both name-relation assessments. The mastery criterion was met in Strategy 3 during the color-name relation assessment; however, the mastery criterion was not met during the animal-name relation assessment.

Group means (and standard deviations) of the efficacy measures are shown in Figure 4. The mean number of learning opportunities was roughly equivalent between Strategies 1 and 2 ( $M_s = 8.3$  and  $8.6$  learning opportunities per session, respectively). By contrast, a higher mean number of learning opportunities was observed in Strategy 3 ( $M = 13.4$ ). Children rarely emitted correct responses in the absence

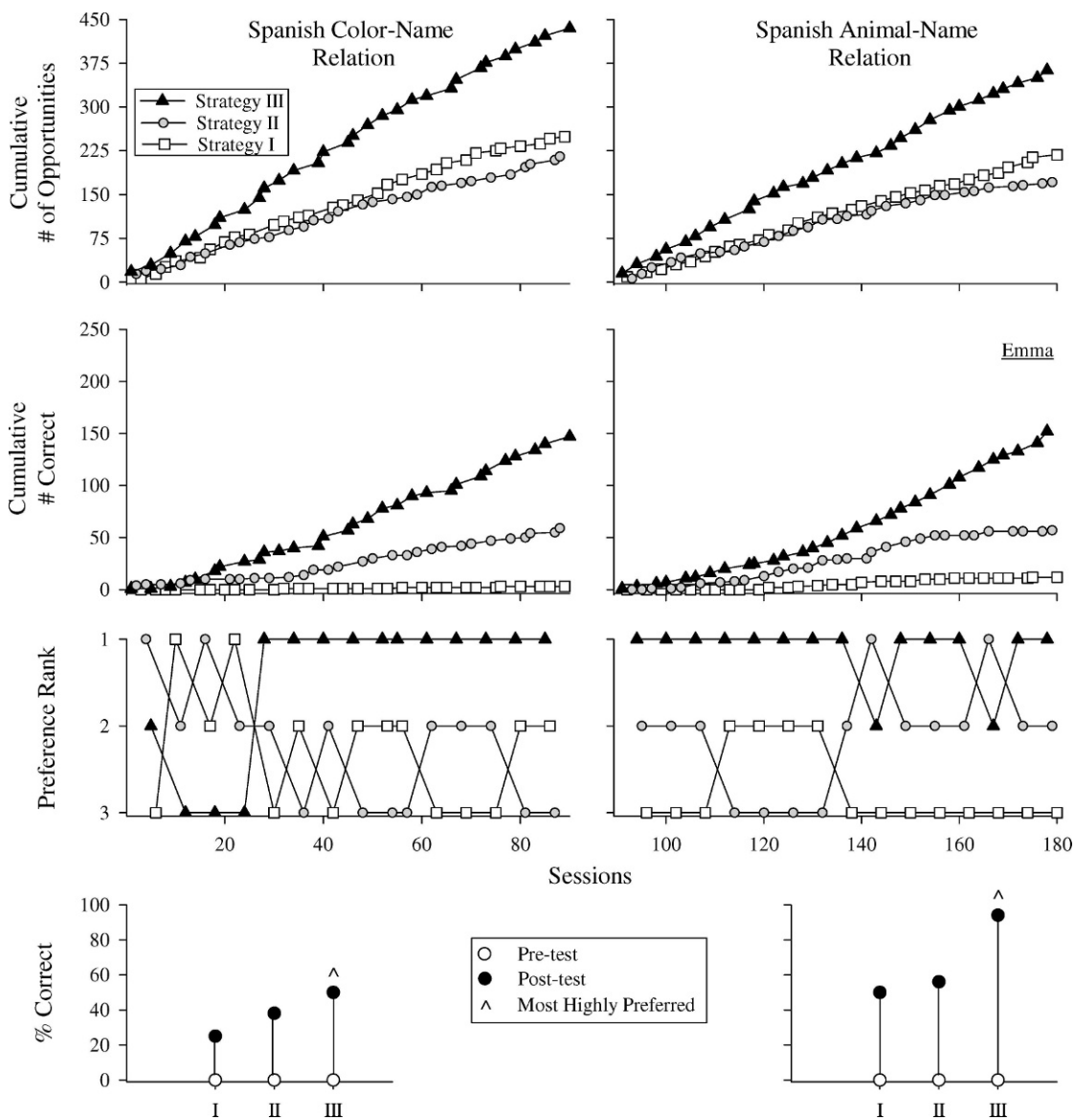


Figure 1. The cumulative number of learning opportunities (top panels), cumulative number of correct responses (second panels), preference rank (third panels), and pre- and posttest scores (bottom panels) during the efficacy and preference evaluations for Emma.

of teacher vocal prompts, as evident by the low mean number correct in Strategy 1 ( $M = 0.3$ ). Although the mean number correct was higher in Strategy 2 ( $M = 3.1$ ) than in Strategy 1, the mean number correct observed in Strategy 2 was less than half that of Strategy 3 ( $M = 6.8$ ). Table 3 shows that the highest percentage of correct responding was observed in Strategy 3

for all children. In addition, the mastery criterion was met in 7 of the 12 name-relation assessments exclusively in Strategy 3.

In addition to analyzing acquisition data, we also inspected pre- and posttest scores as additional indicators of the relative efficacy of the teaching strategies. A small, statistically insignificant difference in the mean percentage

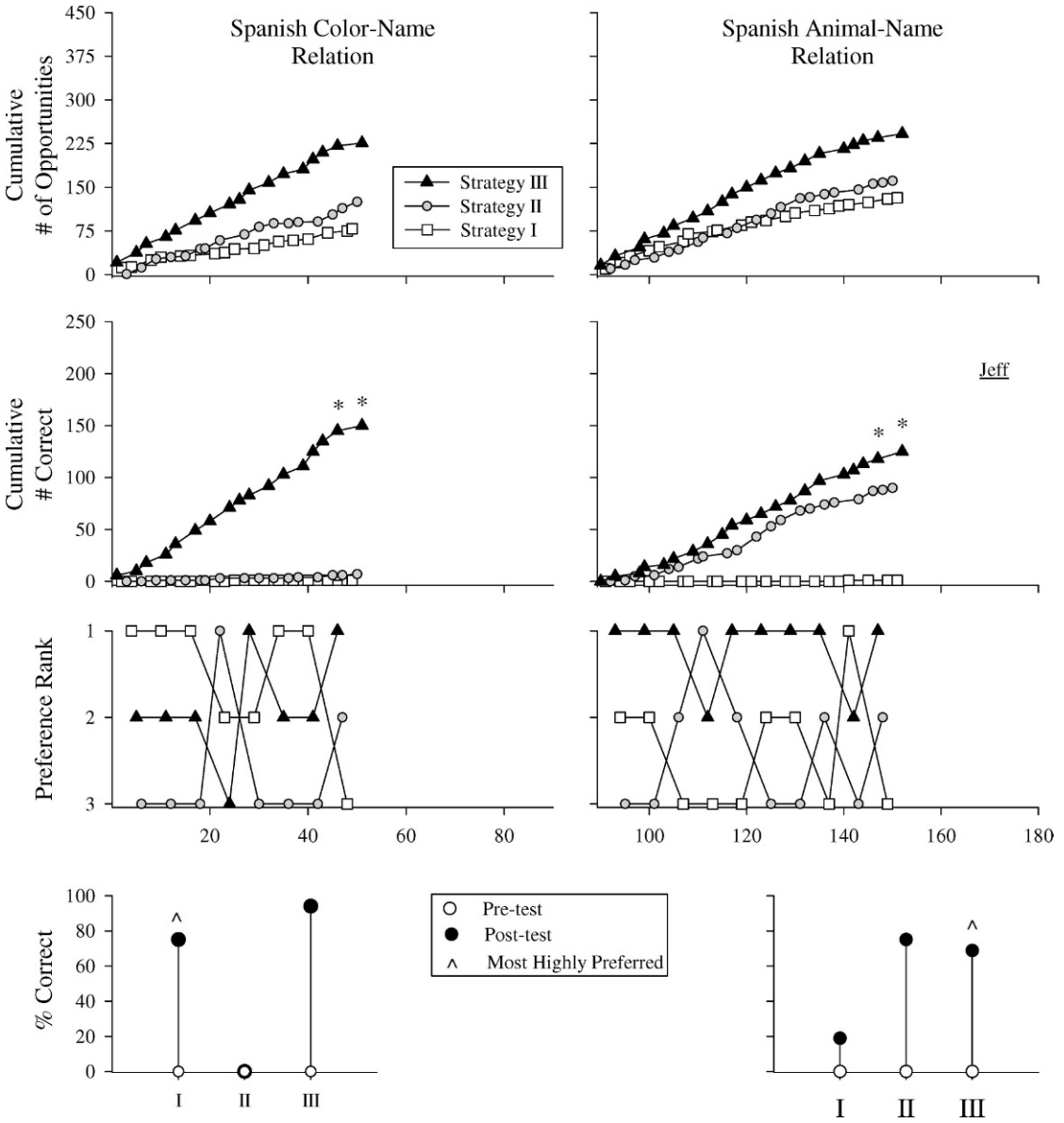


Figure 2. The cumulative number of learning opportunities (top panels), cumulative number of correct responses (second panels), preference rank (third panels), and pre- and posttest scores (bottom panels) during the efficacy and preference evaluations for Jeff.

correct was found across the two different teachers who conducted the posttests; thus the scores from the four posttests were combined and reported as a mean. Figure 1 (bottom) shows Emma's mean pre- and posttest scores. She scored 0% correct on pretests with respect to all relations. Posttest scores increased with

respect to all relations, but the highest posttest scores observed were for relations taught in Strategy 3. Jeff's mean pre- and posttest scores are presented in Figure 2 (bottom). He also scored 0% correct with respect to both sets of relations. His mean posttest scores for the color-name relations show an increase in percentage

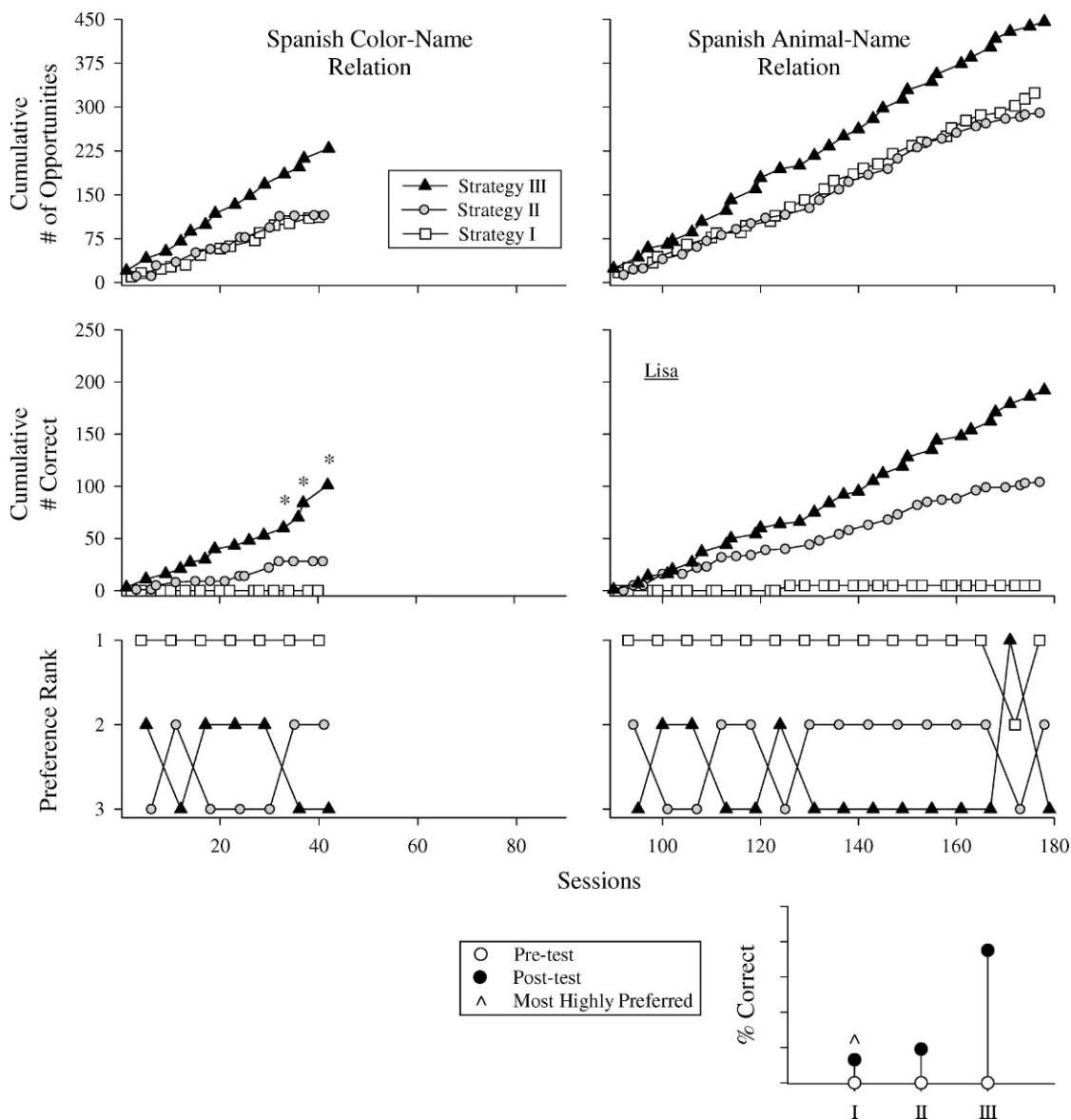


Figure 3. The cumulative number of learning opportunities (top panels), cumulative number of correct responses (second panels), preference rank (third panels), and pre- and posttest scores (bottom panels) during the efficacy and preference evaluations for Lisa.

correct with respect to Strategy 1 and 3 relations. His mean posttest scores for the animal names increased with respect to all relations. Although he met the mastery criterion in Strategy 3 during the efficacy assessment, the highest posttest scores were observed for the relations taught in Strategy 2. Lisa's posttests for the color-name relations were not conducted in the same manner

in which the other children's posttests were conducted due to teacher error; thus, they are not included in the current analysis. However, Lisa's mean pre- and posttest scores for the animal-name relations are shown in Figure 3 (bottom). She scored 0% correct with respect to all taught relations, and her mean posttest scores increased from pretest, with the highest percentage correct

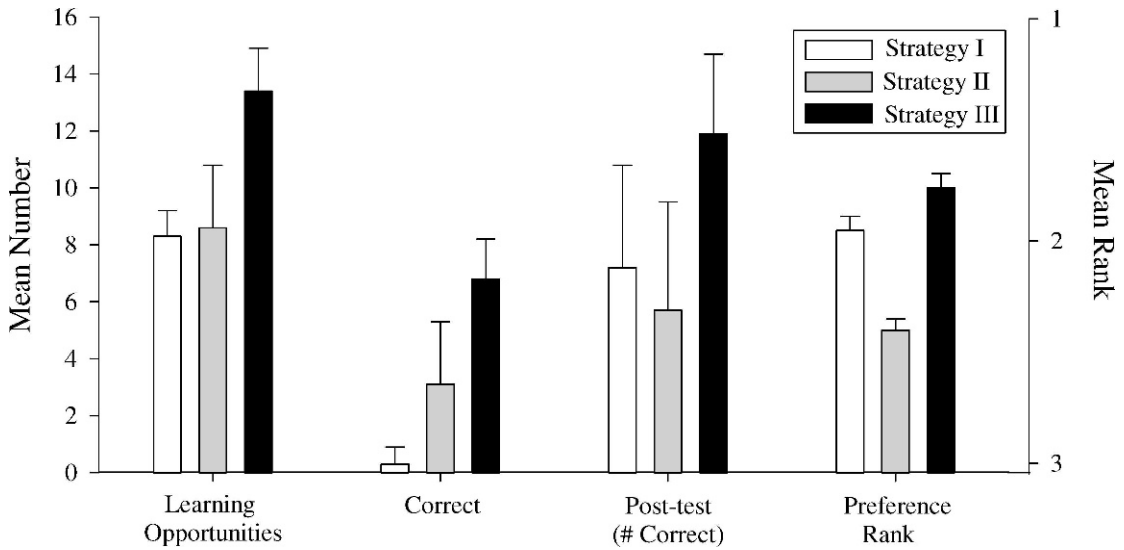


Figure 4. Mean number of learning opportunities, correct responses during acquisition, correct responses on posttests, and mean preference rank across all teaching strategies. The lines above each bar represent the standard deviations.

observed with respect to the relations taught in Strategy 3.

Figure 4 shows the mean posttest scores across all children. (All children’s pretest scores were zero; thus all posttest scores represent both an absolute score as well as a percentage change score.) The overall mean number correct during the posttests was higher with respect to Strategy 1 relations than Strategy 2 relations ( $M_s = 7.2$

and 5.7, respectively); however, the highest mean number correct was observed with respect to Strategy 3 relations ( $M = 11.9$ ).

The mean number of errors, which were defined as learning opportunities without correct responses, occurred more often in Strategy 3 ( $M = 6.6, SD = 1.7$ ) than in Strategy 2 ( $M = 5.1, SD = 1.2$ ). It is important to point out that in addition to more errors,

Table 3  
Efficacy and Preference Assessment Results Summary

Child	Relation	Highest percentage correct	Highest posttest score	Most preferred	Least preferred
Emma	Color	3	3	3	1
	Animal	3	3	3	1
Mary	Color	3	1	3	2
	Animal <sup>a</sup>	3	2/3	3	2
Quinn	Color	3	3	2	3
	Animal <sup>a</sup>	3	3	3	2
Jeff	Color <sup>a</sup>	3	3	1	2
	Animal <sup>a</sup>	3	3	3	2
Rena	Color <sup>a</sup>	3	3	1	3
	Animal <sup>a</sup>	3	3	3	2
Lisa	Color <sup>a</sup>	3	N/A <sup>b</sup>	1	2
	Animal	3	3	1	3
Mode outcomes		3	3	3	2

<sup>a</sup> Indicates the assessment in which the child reached the mastery criterion within 30 instructional sessions.

<sup>b</sup> Indicates the exclusion of the posttest results due to procedural inconsistencies.

there were more learning opportunities in Strategy 3; thus, the mean proportion of errors, derived by dividing the number of errors by the number of learning opportunities, was actually higher in Strategy 2 ( $M = .66$ ) than in Strategy 3 ( $M = .46$ ).

The mean amount of time each child experienced each strategy was 112 min per set of relations (range, 37 min to 155 min). In Strategy 3, the mean amount of time in the first component was only 22 min (range, 9 min to 35 min), and the mean duration of the second component was 90 min (range, 28 min to 120 min).

### *Preference*

Emma's preference rank of the teaching strategies across free-choice opportunities is displayed in the third pair of panels in Figure 1. A rank of 1 represents the teaching strategy that was selected first, whereas a rank of 3 represents the strategy that was selected last during each free-choice block. Selections during the color-name relation assessment were initially variable; however, she consistently selected Strategy 3 first during the last 11 free-choice blocks. She selected Strategy 3 first on 13 of 15 opportunities, although some variability in selections was evident during the animal-name relation assessment. Jeff's preference assessment data are depicted in the third pair of panels in Figure 2. He selected Strategy 1 first during five of the eight free-choice blocks during the color-name relation assessment. However, during the animal-name relation assessment, he selected Strategy 3 first during 8 of the 10 free-choice blocks. Figure 3 shows Lisa's preference assessment results in the third pair of panels. During both assessments, she selected Strategy 1 first almost exclusively during all free-choice blocks.

Table 3 shows that 2 of the 6 children (Emma and Mary) showed a relative preference for Strategy 3 during both color- and animal-name assessments. Three of the 6 children (Quinn, Jeff, and Rena) initially showed a relative preference for either Strategy 1 or 2

during the first assessment (color); however, all 3 children showed a relative preference for Strategy 3 during the second assessment (animal). Lisa showed a relative preference for Strategy 1 during both assessments. In sum, following experiences with each teaching strategy during the color-name relation assessment, 5 of the 6 children showed a preference for Strategy 3 during the animal-name relation assessment, and Strategy 2 was least preferred for 4 of the 6 children following this same experience.

## DISCUSSION

We determined that the mixed approach (Strategy 3) involving discovery, embedded, and direct instruction was the most efficacious for teaching preschool children name relations. By arranging teacher-initiated learning opportunities, a mean of 115 more learning opportunities were experienced per relation during Strategy 3 than in Strategies 1 and 2. As a result, Strategy 3 produced the highest number of correct responses, the least amount of time to reach the mastery criterion, and the highest posttest scores.

In the absence of explicit teacher prompts, the children rarely emitted correct responses in Strategy 1 sessions. Nevertheless, children scored a mean of 41% correct with respect to Strategy 1 relations on our posttest measures. Furthermore, the results of 5 of the 11 posttests indicated that children scored higher with respect to Strategy 1 relations than Strategy 2 relations. These results suggest that simply exposing children of typical development to target relations in the absence of requirements for responding was sufficient for some learning to occur.

Mastery was, however, met only in Strategy 3. This occurred in 7 of 12 of the applications. Thus, after a mean of only 22 min of direct instruction was provided in addition to discovery-oriented and embedded teaching strategies, there was more than a 50% chance that a

concept class would be mastered. By contrast, the probability of mastering a concept class when only discovery-oriented or embedded teaching strategies were implemented for a similar amount of time was zero. By arranging for some intermittent and brief teacher-initiated learning opportunities, measurable gains in learning were achieved.

The procedures implemented in Strategy 3 were perhaps more effective in promoting skill acquisition due to the interaction between the prompt-delay procedures and the motivational system implemented during the teacher-initiated component. Implementation of the prompt-delay procedure most likely allowed transfer of stimulus control from the model prompt to the actual stimuli (Wolery & Gast, 1984). The contingent delivery of tokens exchangeable for toys (which occasioned child-initiated learning opportunities) probably provided sufficient motivating conditions for learning to occur as well. It is also possible that the relative efficacy of Strategy 3, especially with regard to the posttest outcomes that could be construed as generalization measures, was predicated on the interaction between the multiple teaching strategies implemented during Strategy 3.

Both teacher-initiated and child-initiated learning opportunities were included in Strategy 3 to facilitate both the acquisition and generalization of target relations. Some early childhood researchers have expressed a concern that embedded teaching procedures may not in isolation provide sufficient learning opportunities for skill acquisition (e.g., Daugherty *et al.*, 2001; Van Der Heyden, Snyder, Smith, Sevin, & Longwell, 2005). Our results provide support for those concerns. Presumably due to children's limited interaction with specific toys or in specific contexts (e.g., Cammilleri & Hanley, 2005), only some target relations may be taught during discovery-oriented and embedded teaching strategies. By analyzing the percentage of sessions in which all four target relations were occasioned at least once within each teaching strategy, we found

that all four relations were occasioned an average of 47% (range, 10% to 81%), 26% (range, 0% to 47%), and 100% of Strategy 1, 2, and 3 sessions, respectively. Thus, by arranging for short periods of direct instruction, all of the target relations were represented in all teaching sessions, thereby ensuring that learning opportunities for all target relations would be experienced.

Perhaps more surprising than the efficacy outcomes were the outcomes with respect to children's preferences for the different teaching contexts. When approximately 20% of teaching time was usurped by teacher-directed instruction in Strategy 3, children did not avoid this strategy. Instead, 5 of 6 children showed a preference for this strategy when the second relation was taught. (Note that although we measured children's preference for the strategies while teaching both relations, we find the preference data with respect to the second relation taught more compelling, given that the children had more experience with each strategy at these points in time.) It is also important to point out that our data showed that embedded teaching (Strategy 2), which is recommended as best practice for teaching young children (Bredekamp & Copple, 1997; Bricker *et al.*, 1998), was the least preferred for 4 of the 6 of the children during the second assessment.

Lisa preferred Strategy 1 during both the first and second assessments. Her data are unique in that she selected Strategy 1 first in her initial free-choice block, and her selections never varied. By contrast, preferences emerged over time for the other 5 children. Lisa's data suggest that either she did indeed have a strong preference for discovery-oriented teaching following a single experience with that strategy, or some other variable controlled her selections above and beyond the programmed consequences for card selections (e.g., color bias, self-generated rule).

It was our goal to arrange ecologically valid teaching conditions that varied in teacher directedness; because of this, the three options



differed in multiple ways. Understanding the controlling variables for the observed preferences is complicated by this fact. Furthermore, any individual child's preference may have been a dynamic interaction between, for example, the potentially reinforcing elements of Strategy 3 and the potentially aversive elements of Strategy 2. The reinforcing elements of Strategy 3 may have been the inclusion of conditioned and backup reinforcers, the relatively high number of descriptive praise statements that were a function of the higher amount of correct responding, the varied nature of the teaching (i.e., all three strategies were experienced), or the fact that children were simply more effective under these conditions. The identified elements may have been operating independently or in combination to influence children's preference for Strategy 3.

Although there were more total errors in Strategy 3 than in Strategy 2, there were also many more learning opportunities and more correct responses in Strategy 3. Thus, there were a higher proportion of errors in Strategy 2, and it is possible that the high proportion of errors experienced in Strategy 2 may have led children to avoid this teaching context. Our data are consistent with other learning research that has demonstrated the aversive properties of conditions associated with high levels of errors. For instance, while examining the effects of task difficulty on the aberrant behavior of 2 children with severe developmental disabilities, Weeks and Gaylord-Ross (1981) found that tasks that resulted in more errors were also associated with higher levels of aberrant behavior to escape the task. Because of the possible impact of this variable on children's preferences for instructional strategies, future research should examine the effect the number and proportion of errors has on children's preferences for teaching conditions in a more controlled manner.

Another potentially aversive element of Strategy 2 may have been the delivery of instructions while children interacted with

preferred activities. It is possible, and we think likely, that the teacher prompts in Strategy 2 represented a brief time-out from preferred activities in that we were repeatedly interrupting children's play to deliver instructions during our embedded teaching. We did indeed observe that 1 child (Quinn), who selected Strategy 2 the least during his second preference assessment, touched the target toys less across time during Strategy 2 sessions. Because no teacher questions were provided for touching toys in Strategy 1 and touching the target toys persisted during Strategy 1 sessions, preliminary evidence that the embedded prompting in Strategy 2 was aversive is apparent.

The somewhat speculative nature of our assertions regarding controlling variables for preference, especially as they relate to embedded teaching, has occasioned a number of research questions. We think it is critical to first evaluate different embedded teaching strategies that vary in the rate and proportion of prompts and descriptive comments regarding play. In addition, it is likely that the preference value of the toys and the initial skill difficulty are influential. For example, attempting to teach a highly difficult skill to a child while she is playing with her most preferred toys is likely to create a nonpreferred teaching context. Therefore, the influence of these factors on efficacy and preference should be evaluated.

The children in the current investigation were all of typical development; however, we believe that our results have implications for children at risk or with developmental disabilities. Although individual studies have demonstrated the efficacy of direct instruction (e.g., Risley & Wolf, 1967), more recent studies have isolated relative advantages of normalized approaches such as incidental teaching (e.g., McGee et al., 1985), natural language teaching paradigm (e.g., Koegel, Koegel, & Surratt, 1992), or pivotal response training (e.g., Schreibman, Kaneko, & Koegel, 1991) for teaching language to young children with

autism or related disabilities. Our results suggest that direct teaching clearly adds value to the normalized approaches, and that language goals may be difficult or impossible to achieve without some direct teaching. Therefore, our results support the general assertion that combining the two language intervention procedures will yield optimal results for language learners (e.g., Lennox & Brune, 1993; Schepis *et al.*, 1982).

We identified children's preferences for teaching contexts using procedures similar to those used to identify children's preferences for behavioral interventions (e.g., Hanley *et al.*, 1997, 2005). Our methods differed from previous applications of concurrent-chains arrangements in multiple ways. In previous studies, experiences within each relevant context for which preference was to be assessed were conducted prior to preference assessments to ensure that discriminated selections would emerge when the opportunity to choose was arranged (Hanley *et al.*, 1997, 2005). By contrast, experience with the contexts and assessment of preference occurred simultaneously and from the beginning of each evaluation in the current study. Thus, we were able to assess preferences early and as they emerged as a function of experiencing the teaching strategies. Our study also differed by the manner in which the terminal links were made available following selections. That is, following a selection of a particular strategy, that strategy was restricted from the subsequent choice opportunity (by contrast, the stimulus array in the initial links remained constant in Hanley *et al.*, 1997, 2005). Although a child's motivation to select his or her most preferred context could be affected by the fact that he or she will always experience each context for the same amount of time, this restriction procedure allowed a preference hierarchy to develop in addition to identifying the most preferred teaching strategy, and it also ensured that children were exposed

to each teaching strategy for the same amount of time. These procedural modifications resulted in a more comprehensive description of preferences and ensured the experimental integrity of the comparative efficacy analysis. Thus, our assessment allowed us to determine directly the acceptability of classroom practices with the children who experience the practices. It is our hope that early childhood researchers who conduct comparative analyses of practices or interventions will consider determining children's preferences in a similar manner in addition to determining relative efficacy in their evaluations.

The selection of teaching strategies for young children has been, and to some extent continues to be, based on developmentally appropriate practice (Bredenkamp, 1987), with the prominent strategies being of child-initiated orientation almost to the exclusion of more teacher-initiated direct-instruction strategies (Carta, Atwater, Schwartz, & McConnell, 1993; Carta, Schwartz, Atwater, & McConnell, 1991; Johnson & Johnson, 1992). More recent efforts have been made to identify a range of evidence-based teaching strategies (Smith *et al.*, 2002). A primary contribution of the current study is to point out that the efficacy of each strategy is only one important measure; child preference for strategies under consideration should also be taken into account. Although recommendations to assess the social validity of interventions have been made (Schwartz, 1999; Schwartz & Baer, 1991; Wolf, 1978), Odom and Strain (2002) reported that of the 184 single-subject studies identified in the child-focused recommended practices strand of the DEC task force, only 15% and 27% of studies assessed the social validity of the procedures and outcomes, respectively, and to our knowledge none assessed social validity directly (i.e., all relied on verbal reports) or with the children themselves. Thus, we are calling for more and better assessments of social validity to be considered during the evolution of early childhood recommended practices.

Because we evaluated general strategies as opposed to specific tactics (e.g., a brief time-out vs. a correct model following incorrect responses), the manner in which we designed the three teaching strategies may certainly differ to some degree from the manner in which these strategies are implemented in many preschool classrooms. A good direction for future research would be to incorporate different types of these teaching strategies into comparative analyses such that the conditions under which each strategy may confer advantages can be articulated. For instance, various forms of discovery-oriented teaching often occur in preschool classrooms out of necessity, given that teacher-to-child ratios vary from 1:3 to 1:10, depending on the age of the children. The efficacy of this type of teaching undoubtedly varies as a function of the likelihood of the materials selected to evoke developmentally important behavior and provide automatic reinforcement for those behaviors (for good examples, see materials originally described by Maria Montessori; Martin, 1993). Furthermore, our Strategy 2 involved a specific amount and timing of teacher questions and model prompts in the context of a particular play context. All of these parameters should be varied and evaluated in future research.

It is also important to note that we evaluated the relative efficacy of Strategy 2 in the context of a one-on-one teaching situation as opposed to the context of ongoing classroom activities with other children and teachers present, which is typically the context in which embedded teaching occurs. However, Pretti-Frontczak and Bricker (2001) found that when teachers embedded learning opportunities (which was not often), they did so during one-on-one activities with the child. Thus, we do not believe that our controlled arrangement greatly detracts from the generality of our results, and we contend that variations of these teaching strategies should be evaluated under similarly controlled, and thus technologically describable, conditions in future research.

Our research goal was to identify empirically a set of teaching procedures that was most effective and preferred by the children who experienced the strategies. Our results, although preliminary, support the use of varied teaching practices that incorporate discovery-oriented, embedded, and direct-instruction approaches. Thus, we recommend that early childhood and early childhood special education teachers arrange some teacher-initiated learning opportunities throughout the day, in addition to exclusively or partially child-initiated learning opportunities, to promote skill acquisition and to provide learning environments that are preferred by children.

## REFERENCES

- Adams, G. L., & Englemann, S. (1996). *Research on direct instruction: Twenty-five years beyond Distar*. Seattle: Educational Achievement Systems.
- Bredenkamp, S. (1987). *Developmentally appropriate practice in early childhood programs serving children from birth through age 8*. Washington, DC: National Association for the Education of Young Children.
- Bredenkamp, S., & Copple, C. (1997). *Developmentally appropriate practices in programs for children 3 to 8*. Washington, DC: National Association for the Education of Young Children.
- Bricker, D., Pretti-Frontczak, K., & McComas, N. R. (1998). *An activity-based approach to early intervention* (2nd ed.). Baltimore: Brookes.
- Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*, 31, 21–32.
- Cammilleri, A. P., & Hanley, G. P. (2005). Use of a lag-differential reinforcement contingency to increase varied selections of classroom activities. *Journal of Applied Behavior Analysis*, 38, 111–115.
- Carta, J. J., Atwater, J. B., Schwartz, I. S., & McConnell, S. R. (1993). Developmentally appropriate practice: A reaction to Johnson and McChesney Johnson. *Topics in Early Childhood Special Education*, 13, 243–254.
- Carta, J. J., Schwartz, I. S., Atwater, J. B., & McConnell, S. R. (1991). Developmentally appropriate practice: Appraising its usefulness for young children with disabilities. *Topics in Early Childhood Special Education*, 11, 1–20.
- Catania, C. A., & Sagvolden, T. (1980). Preference for free choice over forced choice in pigeons. *Journal of the Experimental Analysis of Behavior*, 34, 77–86.
- Daugherty, S., Grisham-Brown, J., & Hemmeter, M. L. (2001). The effects of embedded skill instruction on the acquisition of target and nontarget skills in preschoolers with developmental delays. *Topics in Early Childhood Special Education*, 21, 213–221.

- Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25*, 491–498.
- Fox, L., & Hanline, M. F. (1993). A preliminary evaluation of learning within developmentally appropriate early childhood settings. *Topics in Early Childhood Special Education, 13*, 308–327.
- Fredrick, L. D., Deitz, S. M., Bryceland, J. A., & Hummel, J. H. (2001). *Behavior analysis, education, and effective schooling*. Reno, NV: Context Press.
- Hanley, G. P., Piazza, C. C., Fisher, W. W., Contrucci, S. A., & Maglieri, K. A. (1997). Evaluation of client preference for function-based treatment packages. *Journal of Applied Behavior Analysis, 30*, 459–473.
- Hanley, G. P., Piazza, C. C., Fisher, W. W., & Maglieri, K. A. (2005). On the effectiveness of and preference for punishment and extinction components of function-based interventions. *Journal of Applied Behavior Analysis, 38*, 51–65.
- Hart, B. M., & Risley, T. R. (1968). Establishing use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. *Journal of Applied Behavior Analysis, 1*, 109–120.
- Hart, B. M., & Risley, T. R. (1975). Incidental teaching of language in the preschool. *Journal of Applied Behavior Analysis, 8*, 411–420.
- Heal, N. A., & Hanley, G. P. (2007). Evaluating preschool children's preferences for motivational systems during instruction. *Journal of Applied Behavior Analysis, 40*, 249–262.
- Horn, E., Lieber, J., Li, S., Sandall, S., & Schwartz, I. S. (2000). Supporting young children's IEP goals in inclusive settings through embedded learning opportunities. *Topics in Early Childhood Special Education, 20*, 208–223.
- Johnson, J. E., & Johnson, K. M. (1992). Clarifying the developmental perspective in response to Carta, Schwartz, Atwater, and McConnell. *Topics in Early Childhood Special Education, 12*, 438–457.
- Klahr, D., & Nigam, M. (2004). The equivalence of learning paths in early science instruction: Effects of direct instruction and discovery learning. *Psychological Science, 15*, 661–667.
- Koegel, R. L., Koegel, L. K., & Surratt, A. (1992). Language intervention and disruptive behavior in preschool children with autism. *Journal of Autism and Developmental Disorders, 22*, 141–153.
- Lennox, D. B., & Brune, P. (1993). Incidental teaching for training communication in individuals with traumatic brain injury. *Brain Injury, 7*, 449–454.
- Losardo, A., & Bricker, D. (1994). Activity-based intervention and direct instruction: A comparison study. *American Journal on Mental Retardation, 98*, 744–765.
- Magliaro, S. G., Lockee, B. B., & Burton, J. K. (2005). Direct instruction revisited: A key model for instructional technology. *Educational Technology Research and Development, 53*, 41–55.
- Martin, K. (1993). Preparing for life: Montessori's philosophy of sensory education. *Montessori Life, 5*, 24–27.
- Mayer, R. E. (2004). Should there be a three-strikes rule against pure discovery learning? *American Psychologist, 59*, 14–19.
- McGee, G. G., Krantz, P. J., & McClannahan, L. E. (1985). The facilitative effects of incidental teaching on preposition use by autistic children. *Journal of Applied Behavior Analysis, 18*, 17–31.
- Odom, S. L., & Strain, P. S. (2002). Evidence-based practice in early intervention/early childhood special education: Single-subject design research. *Journal of Early Intervention, 25*, 151–160.
- Piaget, J. (1970). *Science of education and psychology of the child*. New York: Oxford University Press.
- Pretti-Frontczak, K., & Bricker, D. (2001). Use of the embedding strategy during daily activities by early childhood education and early childhood special education teachers. *Infant Toddler Intervention, 11*, 111–128.
- Risley, T. R., & Wolf, M. M. (1967). Establishing functional speech in echolalic children. *Behaviour Research and Therapy, 5*, 73–88.
- Schepis, M. M., Reid, D. H., Fitzgerald, J. R., Faw, G. D., Van Den Pol, R. A., & Welty, P. A. (1982). A program for increasing manual signing by autistic and profoundly retarded youth within the daily environment. *Journal of Applied Behavior Analysis, 15*, 363–379.
- Schreibman, L., Kaneko, W. M., & Koegel, R. L. (1991). Positive affect of parents of autistic children: A comparison across two teaching techniques. *Behavior Therapy, 22*, 479–490.
- Schwartz, I. S. (1999). Controversy or lack of consensus? Another way to examine treatment alternatives. *Topics in Early Childhood Special Education, 19*, 189–198.
- Schwartz, I. S., & Baer, D. M. (1991). Social validity assessment: Is current practice state of the art? *Journal of Applied Behavior Analysis, 24*, 189–204.
- Sidman, M. (1960). *Tactics of scientific research*. Oxford, UK: Basic Books.
- Smith, B. J., Strain, P. S., Snyder, P., Sandall, S. R., McLean, M. E., Ramsey, A. B., et al. (2002). *DEC recommended practices: A review of 9 years of EI/ECSE research literature*. Longmont, CO: Sopris West.
- Solter, A., & Mayer, R. E. (1978). Broader transfer produced by guided discovery of number concepts with preschool children. *Journal of Educational Psychology, 70*, 363–371.
- Stebbins, L. B., St. Pierre, R. G., Proper, E. C., Anderson, R. B., & Cerva, H. (1977). *Education as experimentation: A planned variation model. An evaluation of Project Follow Through*. Cambridge, MA: Abt.
- Strain, P. S., McConnell, S. R., Carta, J., Fowler, S. A., Neisworth, J. T., & Wolery, M. (1992). Behaviorism in early intervention. *Topics in Early Childhood Special Education, 12*, 121–141.

- Tiger, J. H., Hanley, G. P., & Heal, N. A. (2006). The effectiveness of and preschoolers' preference for variations of multiple-schedule arrangements. *Journal of Applied Behavior Analysis, 39*, 475-488.
- Tiger, J. H., Hanley, G. P., & Hernandez, E. (2006). An evaluation of the value of choice with preschool children. *Journal of Applied Behavior Analysis, 39*, 1-16.
- Van Der Heyden, A. M., Snyder, P., Smith, A., Sevin, B., & Longwell, J. (2005). Effects of complete learning trials on child engagement. *Topics in Early Childhood Special Education, 25*, 81-94.
- Walsh, B. A., & Petty, K. (2006). Frequency of six early childhood education approaches: A 10-year content analysis of early childhood education journals. *Early Childhood Education Journal, 34*, 301-305.
- Weeks, M., & Gaylord-Ross, R. (1981). Task difficulty and aberrant behavior in severely handicapped students. *Journal of Applied Behavior Analysis, 14*, 449-463.
- Wolery, M., & Gast, D. L. (1984). Effective and efficient procedures for the transfer of stimulus control. *Topics in Early Childhood Special Education, 4*, 55-77.
- Wolery, M., & Sainato, D. M. (1996). General curriculum and intervention strategies. In S. L. Odom & M. E. McLean (Eds.), *Early intervention recommended practices* (pp. 125-158). Austin, TX: Pro-Ed.
- Wolery, M., & Wilbers, J. (Eds.). (1994). *Including children with special needs in early childhood programs*. Washington, DC: National Association for the Education of Young Children.
- Wolf, M. M. (1978). Social validity: The case for subjective measurement, or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis, 11*, 203-214.
- Woods, J., Kashinath, S., & Goldstein, H. (2004). Effects of embedding caregiver implemented teaching strategies in daily routines on children's communication outcomes. *Journal of Early Intervention, 26*, 175-193.

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