AN EVALUATION OF THE RELATIVE EFFICACY OF AND CHILD PREFERENCE FOR TEACHING STRATEGIES THAT DIFFER IN AMOUNT OF TEACHER DIRECTEDNESS

By

Nicole A. Heal

M.A., University of Kansas, 2005

Submitted to the Department of
Applied Behavioral Science and the
Faculty of the Graduate School of the
University of Kansas in Partial
Fulfillment of Requirements for the
Degree of Doctor of Philosophy

_____
Gregory P. Hanley, Chairperson

_____
Edward K. Morris, Committee Member

_____
Jan B. Sheldon, Committee Member

_____
Holly L. Storkel, Committee Member

_____
Rachel H. Thompson, Committee Member

Date defended: _____

The Dissertation Committee for Nicole A. Heal certifies that
This is the approved version of the following dissertation:

AN EVALUATION OF THE RELATVIE EFFICACY OF AND

CHILD PREFERENCE FOR TEACHING STRATEGIES THAT DIFFER

IN AMOUNT OF TEACHER DIRECTEDNESS

Committee:

_____
Gregory P. Hanley, Chairperson

_____
Edward K. Morris, Committee Member

_____
Jan B. Sheldon, Committee Member

_____
Holly L. Storkel, Committee Member

_____
Rachel H. Thompson, Committee Member

Date approved: _____

Abstract

AN EVALUATION OF THE RELATVIE EFFICACY OF AND

CHILD PREFERENCE FOR TEACHING STRATEGIES THAT DIFFER

IN AMOUNT OF TEACHER DIRECTEDNESS

HEAL, NICOLE A. Ph.D., Department of Applied Behavioral Science, University of Kansas, 2007. Dissertation directed by Professor Gregory P. Hanley

Although it is generally agreed that learning occurs through children's interactions with their environments, the manner in which the teacher mediates this 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 simple color- and object-name relations. Strategy I consisted of brief exposure to the target relations, followed by an exclusively child-led play period in which praise was provided for correct responses. Strategy II was similar except that teacher prompts to vocalize relations and error correction (model prompts) were provided when the child interacted with the relevant objects. Strategy III incorporated the same procedures as Strategy II except that a brief period of teacher-initiated trials was arranged; these trials involved the use of time delay between questions and prompts, tokens for correct responding, and back-up activity reinforcers. Children's preferences for the different teaching strategies were also assessed within a concurrent-chains arrangement in which selections of strategy-correlated cues resulted in access to the correlated strategy. Our results indicated that Strategy III was most efficacious in promoting the acquisition of the color- and object-name relations and was also most preferred by the majority of children; Strategy I was the least efficacious, and Strategy II

was typically the least preferred. Implications for the design of early educational environments based on evidence-based values are discussed.

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 the NAEYC and DEC 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 acknowledgement when a child is successful (Klahr & Nigam, 2004; Solter & Mayer, 1978). Active engagement and intrinsic (i.e., non-socially

mediated) motivation are presumed to be the critical variables underpinning the learning that occurs within this approach.

Embedded teaching (Bricker, Pretti-Fontczak, & 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 the direct instruction approach 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 time 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. Although discovery-oriented approaches require the careful selection of learning materials, demands by 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). These methods are included as recommended practice by the NAEYC (Bredekamp & Copple, 1997) despite the lack of empirical evidence supporting the efficacy of purely discovery-oriented teaching methods (Mayer, 2004).

Because teacher prompting and feedback are arranged during embedded teaching, skill acquisition occurs within this approach (Fox & Hanline, 1993; Horn, Lieber, Li, Sandall, & Schwartz, 2000; Woods, Kashinath, & Goldstein, 2004). When compared to direct teaching, embedded teaching produced similar skill acquisition; however, better

skill generalization was observed with the embedded procedures (Losardo & Bricker, 1994; McGee, Krantz, & McClannahan, 1985). 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 back-up material reinforcers; see Strain, McConnell, Carta, Fowler, Neisworth, & Wolery, 1992). Despite the strong empirical evidence of the efficacy of direct instruction strategies (Adams & Englemann, 1996; Stebbins, St. Pierre, Proper, Anderson, & Cerva, 1977), these procedures are not widely adopted by general educators.

A teaching strategy that has overwhelming empirical support, but is *not* considered 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 an important factor to consider 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 an instructional strategy 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 has been 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 micro-switches, one associated with each strategy, were then made available to the children outside of the room in which teaching typically occurred, and the child was asked to select the one she liked best. When the child handed a card to the teacher (or pressed a micro-switch), 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 that may have been indescribable to young children were directly assessed by recording each child's selections of cues correlated with important teaching or intervention strategies.

In the current study, the relative efficacy of three teaching strategies that differed in the amount of teacher directedness (discovery-oriented, embedded, and direct instruction) was determined using single-subject experimental designs, and children's preferences for the teaching strategies also were identified. Relative efficacy of 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 via post-tests 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. Although none of the 6 children were diagnosed with an explicit developmental disability, their individualized curriculum showed great variability in their respective 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 naming relations were taught to each child. The child was initially taught to vocally label colors in Spanish; then the child was taught to vocally label animals in Spanish. There were 12 color and 12 animal names taught. First, each strategy was associated with 4 color, then 4 animal relations (see Table 1 for the specific color and animal relations taught). Three sets of materials that designed to evoke the target responses (color or animal names) during each 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 wanted 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 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 x 75 cm) and small (15 cm x 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; teacher-initiated learning opportunities were scored when the teacher held up a color or animal card and in English said, “What color is this?” Learning opportunities are reported as a frequency count within each teaching strategy and the number of child-initiated and teacher-initiated learning opportunities is combined in Strategy III. Given an occurrence of a learning opportunity, a correct response was scored if 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 averaging the percentage correct scored within the final five sessions of each teaching strategy for the color- and animal-name assessments.

During the preference assessments, child 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 where “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 averaging session durations for each child, individual child 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 (IOA) was calculated by dividing the number of agreements by the number of agreements plus the number of disagreements and then multiplying by 100. Interobserver agreement was 94% (session range, 50% to 100%) for learning opportunities and 98% (session range, 67% to 100%) for corrects across all children and assessments. IOA was collected and calculated in the same manner as described above for card selections in a minimum of 20% of all preference assessment sessions 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

Procedural fidelity measures were collected on the teachers' delivery of the initial vocal prompt and consequences provided following a child response in each teaching strategy. Given a learning opportunity, data were recorded on the nonoccurrence (Strategy I) or occurrence (Strategy II and III) of an initial vocal teacher prompt (e.g., "What color is that?") for each session. In that the teacher was not to deliver a vocal prompt following the initiation of a learning opportunity, to calculate procedural 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 then multiplied by 100. In contrast, the teacher was required to deliver a vocal prompt during Strategy II and III sessions, thus to calculate procedural fidelity, the number of learning opportunities in

which the teacher delivered a vocal prompt was divided by the total number of learning opportunities and the resulting number was multiplied by 100. Given a learning opportunity and child response, teacher consequences also varied across the three teaching strategies such that following an incorrect or no response the teacher was required to not deliver a model prompt during Strategy I sessions, but the teacher was required to deliver a model prompt following an incorrect or no response by the child during Strategy II and III sessions. In addition, the teacher was always required to deliver praise following a correct response in all three teaching strategies. To calculate fidelity measures on teacher consequence during Strategy I sessions, 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 multiplied by 100. For Strategy II and III sessions, 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 the resulting number was multiplied by 100.

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 I sessions. The teacher did deliver a vocal prompt following the initiation of a learning opportunity a mean of 93% and 97% of opportunities during Strategy II and III sessions, respectively, across all children and assessments. Regarding teacher consequence, 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 Strategy I, II, and III sessions, respectively. Taken together, these data suggests that the procedures of each teaching 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 for 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 teaching 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.

Procedures

Overview of Study

Three pre-assessments 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 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 pre-test with all 12-target stimuli was conducted

third. Following the simultaneous evaluation of efficacy and preference, post-tests of the color- and animal-name relations were conducted.

Pre-assessments

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 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 colored card was selected by the total number of times it was presented and then multiplying by 100. The three colors that were identified as moderately and similarly (i.e., colors that were identified in the middle of the preference hierarchy) preferred were selected because we did not want the child's selections in the teaching strategy preference assessments to be controlled by a pre-existing color preference, but rather by the teaching strategies associated with the colored cards. The three colored cards were then randomly assigned to each of the teaching strategies and held constant throughout the efficacy and preference assessments for each child.

Echoic assessment. A nine-trial assessment to determine if each child could echo single to five-syllable words in English was conducted next. The trial types were adjusted according to child 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 (i.e., correctly articulated each syllable), a two-syllable word (e.g., “apple,” or “crayon”) was presented in a similar manner 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 child 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 in the current study correctly echoed at least one five-syllable word within this assessment.

Pre-test. A novel teacher who was fluent in speaking Spanish conducted all pre-tests with each child. The teacher instructed the child to answer all of the questions in Spanish prior to the start of each pre-test. 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 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

During the efficacy assessments, 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) within 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 I) to playing a more prominent role (Strategy III) in the teaching situation. In addition, the teaching strategies were arranged such that new elements were added to the ones arranged in the lower strategy (e.g., Strategy III incorporated elements of Strategy I and II plus additional elements). Table 2 contains a summary of the elements in each teaching strategy.

Strategy I. The role of the teacher in Strategy I was to describe the target relations to the child initially, arrange the environment to promote active engagement, and provide feedback when the child responded correctly with regard to the target relations. The child and teacher sat on the floor across from each other with the toys on a colored mat that corresponded to Strategy I in between them. Because this was the only strategy in which the teacher never prompted responses or provided correct-answer models, a pre-session exposure period 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 teachers provided no prompts to play and did not directly or indirectly question the child about either color- or animal-name relations (i.e., when the child touched a target item, such as a blue crayon, 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 saying, "This is rosa." while holding a blue crayon).

Strategy II. Two additions to the procedures outlined for Strategy I were included in Strategy II. 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. If the child touched a second target item within the same 15-s interval, another question was not issued; only the first target item touched within each 15-s interval occasioned teaching. Two changes from Strategy I 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 II.

Strategy III. The child and teacher sat on the floor across from each other with a colored mat correlated with Strategy III in between them and a box (25 x 40 x 50 cm) that contained relevant toys next to them. This strategy involved two distinct components; the first was consistent with direct instruction (teacher-initiated trials, time delay procedures,

and differential reinforcement), and the second was consistent with the teaching procedures described for Strategy II. Teacher-initiated learning opportunities were conducted in the first component. A 0-s time delay was implemented initially such that a model of the correct response ("Blanco") immediately followed the initial prompt ("What color is this?"). The time delay schedule then progressed by 1 s in each subsequent session (independent of child 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 time delay was reset to 0 s and progressed on a slower schedule (each time delay was implemented for 2 sessions instead of 1).

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. When the child answered correctly after the initial vocal prompt, that color or animal card was removed such that the total number of learning trials was reduced. Therefore, the number of teacher-initiated learning opportunities ranged between four and eight depending on the child's responding. Once the child received eight gold tokens, the child was allowed to exchange them for access to toys in 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 III was then

conducted identically to Strategy II for a period of 4 min.The time required to complete the first component of Strategy III varied between 30 and 120 s depending on child responding. To calculate the total time of Strategy III 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 Strategy I and Strategy II were yoked to the time required to conduct the previous Strategy III session. For example, if it took 1 min and 4 min to conduct the first and second components of a Strategy III session, the following Strategy I and II sessions were both 5 min in duration.

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- 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. 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), they 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 60s. During this time the teacher and child either 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*" during the free-choice blocks. The free-choice blocks served to directly measure children's preferences among the teaching strategies. 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.

Post Tests

Four post-tests 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 post-tests. 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 pre-tests conducted the other two post-tests. 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 post-tests were added together and divided by four to obtain a mean post-test score.

Results

Session-by-session data highlight the single-subject experimental designs, repeated measurement of performances, and allow the reader access to characteristics of the efficacy and preference data, such as level, trend, and variability that are lost when data are summarized in tables or presented in bar charts. Nevertheless, 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 1-3 depict individual child performance during the color-name assessments in the first columns; performance during the animal-name assessments is shown in the second columns. Cumulative number of learning opportunities is shown on the top panels and cumulative number of corrects on the second set of panels. Emma's data are shown in Figure 1; Emma's responding was consistent across both taught relations, with the highest number of learning opportunities (top panels) and correct responses (second set of panels) observed in Strategy III. Emma did not reach the mastery criterion in either assessment; therefore, both assessments were terminated following the completion of 90 sessions. As evident in Figure 2, Jeff experienced more learning opportunities (top panels) and emitted the highest number of correct responses (second set of panels) in Strategy III during both name-relation assessments. Jeff emitted more correct responses in Strategy II sessions during the animal-name relation assessment as compared to Strategy II sessions in the color-name relation assessment. The asterisks above the data points denote the sessions in which Jeff met mastery criterion in Strategy III during both assessments. Lisa's responding is shown in Figure 3. Consistent with the other children's data, the highest number of learning opportunities (top panels) was observed in Strategy III during both assessments. In addition, Lisa emitted more correct responses (second set of panels) in Strategy III relative to Strategies I and II across both name-relation assessments. The mastery criterion was met in Strategy III during the color-name relation assessment, however the mastery criterion was not met during the animal-name relation assessment thus the assessment was ended following the completion of 90 sessions.

Group means (and standard deviations) of the efficacy measures are shown on Figure 4. The mean number of learning opportunities was roughly equivalent between Strategies I and II (*Ms* = 8.3 and 8.6 learning opportunities per session, respectively). In contrast, a higher mean number of learning opportunities was observed in Strategy III (*M* = 13.4). Children rarely emitted correct responses in the absence of teacher vocal prompts as evident by the low mean number correct in Strategy I (*M* = 0.3). Although the mean number correct was higher in Strategy II (*M* = 3.1) compared to Strategy I, the mean number correct observed in Strategy II was less than half that of Strategy III (*M* = 6.8). Finally, Table 3 shows that the highest percentage of correct responding was observed in Strategy III for all children. In addition, the mastery criterion was met in 7 of the 12 name-relation assessments exclusively in Strategy III.

In addition to analyzing acquisition data, we also inspected pre- and post-test scores as additional indicators of the relative efficacy of the teaching strategies. Figure 1 shows Emma's mean pre- and post-test scores on the bottom panels. Emma scored 0% correct on pre-tests with respect to all relations. Post-test scores increased with respect to all relations, but the highest post-test scores observed were for relations taught in Strategy III. Jeff's mean pre- and post-test scores can be seen on the bottom panels of Figure 2. Jeff also scored 0% correct with respect to both sets of relations. Jeff's mean post-test scores for the color-name relations show an increase in percent correct with respect to Strategy I and III relations. Jeff's mean post-test scores for the animal-names increased with respect to all relations. Although Jeff met the mastery criterion in Strategy III during the efficacy assessment, the highest post-test scores were observed for the relations taught in Strategy II. Lisa's post-tests for the color-name relations were not conducted in

the same manner in which the other children's post-tests were conducted due to teacher error, thus they are not included in the current analysis. However, Lisa's mean pre- and post-test scores for the animal-name relations can be seen on the bottom panel of Figure 3. Lisa score 0% correct with respect to all taught relations and her mean post-test scores increased from pre-test with the highest percent correct observed with respect to the relations taught in Strategy III. Figure 4 shows the mean post-test scores across all children. (All children's pre-test scores were zero; thus all post-test scores represent both an absolute score as well as a percentage change score.) The overall mean number correct during the post-tests was higher with respect to Strategy I relations in comparison to Strategy II relations (7.2 and 5.7, respectively); however, the highest mean number correct was observed with respect to Strategy III relations (11.9).

The mean number of errors, which were defined as learning opportunities without correct responses, occurred more in Strategy III (M = 6.6, SD = 1.7) relative to Strategy II (M = 5.1, SD = 1.2). It is important to point out that in addition to more errors, there were more learning opportunities in Strategy III, thus, the mean proportion of errors, derived by dividing the number of errors by the number of learning opportunities, was actually higher in Strategy II (M = 0.66) relative to Strategy III (M = 0.46).

The average amount of time each child experienced each strategy was 112 min per set of relations (range, 37 min to 155 min). In Strategy III, the average amount of time in the first component was only 22 min (range, 9 min to 35 min), while 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 set of panels on Figure 1. A rank of one represents the teaching strategy that was selected first, whereas a rank of three represents the strategy that was selected last during each free-choice block. Selections during the color-name relation assessment were initially variable; however, Emma consistently selected Strategy III first during the last 11 free-choice blocks. Some variability in selections was evident during the animal-name relation assessment; however, Emma selected Strategy III first on 13 of 15 opportunities. Jeff's preference assessment data are depicted on the third set of panels on Figure 2. Jeff selected Strategy I first during 5 out of 8 free-choice session blocks during the color-name relation assessment. However, during the animal-name relation assessment Jeff selected Strategy III first during 8 out of 10 free-choice session blocks. Figure 3 shows Lisa's preference assessment results on the third set of panels. During both assessments, Lisa selected Strategy I first almost exclusively during all free-choice session blocks. Table 3 shows that 2 of the 6 children (Emma and Mary), showed a relative preference for Strategy III during both color- and animal-name assessments. Three of the 6 children (Quinn, Jeff, and Rena) initially showed a relative preference for either Strategy I or II during the first assessment (color); however, all three children showed a relative preference for Strategy III during the second assessment (animal). Lisa showed a relative preference for Strategy I during both assessments. In sum, following experiences with each teaching strategy during the initial relation taught, 5 of the 6 children showed a preference for Strategy III while the second relation was

being taught (Strategy II was least preferred for 4 of the 6 children following this same experience).

Discussion

We determined that the eclectic approach (Strategy III) involving discovery, embedded, and direct instruction was the most efficacious for teaching preschool children name relations. By arranging teacher-initiated learning opportunities, an average of 115 more learning opportunities were experienced per relation by the children during Strategy III relative to Strategies I and II. Furthermore, the procedures implemented in Strategy III consistently resulted in the highest number of correct responses, the least amount of time to reach the mastery criterion, and the highest post-test scores. It is important to note that during the efficacy assessments, the children rarely emitted correct responses in Strategy I sessions but scored on average 41% correct on the post-tests with respect to Strategy I relations. These results suggest that simply exposing the child to the target responses in the absence of the child actively emitting the target responses was sufficient for some learning to occur.

Nevertheless, the mastery criterion was reached only in Strategy III sessions. This occurred in 7 of 12 the applications. Thus, the session duration data imply that after an average 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 III were perhaps more efficacious in promoting skill acquisition due to the interaction between the time delay procedures and the motivational system implemented during the teacher-initiated component. Implementation of the time delay procedure most likely provided for transfer of stimulus control from the model prompt to the actual stimuli (Wolery & Gast, 1984). The tokens exchangeable for toys that occasioned child-initiated learning opportunities appeared effective in promoting acquisition of the relations. It is also possible that the relative efficacy of Strategy III, especially with regard to the post-test outcomes, was predicated on the interaction between the different teaching strategies implemented during Strategy III. We designed our Strategy III to include teacher-initiated learning opportunities in addition to child-initiated learning opportunities as has been suggested in the literature (e.g., Losardo & Bricker, 1994; Schepis, Reid, Fitzgerald, Faw, Van Den Pol, & Welty, 1982; Wolery & Sainato, 1996). The concern that embedded teaching procedures may not provide sufficient learning opportunities for skill acquisition has appeared in previous literature (e.g., Daugherty et al., 2001; VanDerHeyden, Snyder, Smith, Sevin, & Longwell, 2005), and our results support those concerns.

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 teaching strategy at these points in time. The preference data during the second assessment showed that 5 out

of 6 children showed a relative preference for Strategy III, which consisted of all teaching strategies including direct instruction. Lisa preferred Strategy I during both the first and second assessment. Her data are unique in that she selected Strategy I first in her initial free-choice block and her selections did not vary at all. In contrast, preferences emerged over time for the other five 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 is also important to note that our data showed that embedded teaching (Strategy II), which is recommended as best practice (Bredekamp & Copple, 1997; Bricker et al., 1998), was the least preferred for 4 out of 6 of the children during the second assessment.

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 III and the potentially aversive elements of Strategy II. The reinforcing elements of Strategy III may have been the inclusion of conditioned and back up reinforcers, the relatively high amount 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 III.

Although there were more total errors in Strategy III than in Strategy II, there were also many more learning opportunities and more correct responses in Strategy III. Thus, there was a higher proportion of errors in Strategy II, and it is possible that the high proportion of errors experienced in Strategy II may have led to children avoiding 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 two 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 II may be the delivery of instructions while children were interacting with preferred activities. It is possible that the teacher prompts in Strategy II 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 one of the children in the current study (Quinn), who avoided Strategy II during the second preference assessment, touched the target toys less across time during Strategy II sessions. Because touching the target toys during Strategy I sessions persisted at similar levels across the evaluation (no teacher

prompts were provided for touching toys in Strategy I), preliminary evidence that the embedded prompting was aversive is apparent.

The 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 is 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 non-preferred teaching context. Therefore, the influence of these factors on efficacy and preference should also be evaluated.

Research efforts have been dedicated to evaluating the efficacy of the teaching strategies evaluated in the current investigation primarily with young children with developmental disabilities or identifiable risk factors for early school failure (Chiara, Schuster, Bell, & Wolery, 1995; Cole, Dale, Mills, & Jenkins, 1993; Losardo & Bricker, 1994; Solter & Mayer, 1978; VanDerHeyden et al., 2005). Although the children in the current investigation were all of typical development, we believe that our results have additional implications for children at risk or with developmental disabilities. In addition, the methods used to identify preferences in the current investigation have been implemented with individuals with severe developmental disabilities and clear preferences did emerge (Hanley et al., 1997; Hanley et al., 2005). Our preference assessment procedures allowed us to directly determine the acceptability of classroom

practices with the children who experience these practices. Our preference assessment procedures required relatively little time in that we evaluated the efficacy of and preference for the teaching strategies simultaneously (previous studies have determined the efficacy of a practice or intervention and then conducted evaluations of child preference). It is our hope that early childhood researchers who conduct comparative analyses of practices or interventions will consider determining children's preferences 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 (Bredekamp, 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). The 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 treatment acceptability and social importance, respectively, and to our knowledge none assessed social acceptability 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 versus 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. This may be particularly relevant to Strategies I & II. Evidence that practitioners and teachers implement Strategy I-like procedures can however be found in the early childhood/special education literature. Warren (1998) noted that, whereas teachers have been observed to arrange the environment to promote learning (as in Strategy I), effective naturalistic instruction was observed infrequently. He stated, "I rarely saw them [practitioners or teachers] use prompts (e.g., questions, models) intended to push their children ahead" (p. 297). Additional studies have shown that prior to training, teachers do not implement embedded teaching strategies often (e.g., Horn et al., 2000; Schepis, Reid, Ownbey, & Parsons, 2001; Tate, Thompson, & McKerchar, 2005) suggesting that teachers are using discovery-oriented approaches.

Strategy II was designed to isolate the effects of child-initiated learning opportunities, embedded instructions, and differential consequences for child responses; all of which are inherent procedures of embedded teaching. In order to ensure a high degree of experimental control, we evaluated the relative efficacy of our Strategy II procedures in the context of a one-on-one teaching situation as opposed to in the context of ongoing classroom activities with other children and teachers present, which is

typically the context in which embedded teaching occurs. We do not believe that our controlled arrangement greatly detracts from the generality of our results because Pretti-Frontczak and Bricker (2001) found that teachers were most likely to embed learning opportunities during one-on-one activities with the child.

Our research goal was to empirically identify a set of teaching procedures that was most efficacious and preferred by the children experiencing the strategies. Our results, although preliminary, support the use of varied teaching practices that incorporate discovery-oriented, embedded, *and* direct teaching 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 exclusive or partial 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.

Bredekamp, 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.

Bredekamp, 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.

Carta, J. J., Atwater, J. B., Schwartz, I. S., & McConnell, S. R. (1993). Developmentally appropriate practice: A reaction to Johnson and McChesney Johnson. *Topic 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. *Topic 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.

Chiara, L., Schuster, J. W., Bell, J. K., & Wolery, M. (1995). Small-group massed-trial and individually-distributed-trial instruction with preschoolers. *Journal of Early*

Intervention, 19, 203-217.

Cole, K. N., Dale, P. S., Mills, P. E., & Jenkins, J. R. (1993). Interaction between early intervention curricula and student characteristics. *Exceptional Children, 60,* 17-28.

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. 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: 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.*

Horn, E., Lieber, J., Li, S., Sandall, S., & Schwartz, I. (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.

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.

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.

Sidman, M. (1960). *Tactics of scientific research.* Oxford: Basic Books.

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.

Schepis, M. M., Reid, D. H., Ownbey, J., & Parsons, M. B. (2001). Training support staff to embed teaching within natural routines of young children with disabilities in an

inclusive preschool. *Journal of Applied Behavior Analysis, 34,* 313-327.

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.

Smith, B. J., Strain, P. S., Snyder, P., Sandall, S. R., McLean, M. E., Broudy Ramsey, A., 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.

Tate, T. L., Thompson, R. H., & McKerchar, P. M. (2005). Training teachers in an infant classroom to use embedded teaching strategies. *Education and Treatment of Children, 28,* 206-221.

Tiger, J. H., Hanley, G. P., & Heal, N. A. (2006). The effectiveness of and preschooler's 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.

VanDerHeyden, 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.

Warren, S. F. (1998). Back to the future? *Journal of Early Intervention, 21,* 297-298.

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.* Austin: 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. *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.

Table 1. Target Responses for each Teaching Strategy

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

Table 2. Summary of the Elements of each Teaching Strategy

Teaching strategies		
Strategy I	Strategy II	Strategy III
Pre-session exposure	--	--
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	Praise provided for a correct response
--	Corrective feedback provided for an error	Corrective feedback provided for an error
--	--	Teacher-initiated learning opportunities (Time delay, conditioned and back-up reinforcers)

Note: -- indicates the absence of the element in each teaching strategy.

Table 3. Efficacy and Preference Assessment Results Summary

Child	Relation	Highest percentage correct	Highest post-test score	Most preferred	Least preferred
Emma	Color	III	III	III	I
	Animal	III	III	III	I
Mary	Color	III	I	III	II
	Animal [a]	III	II/III	III	II
Quinn	Color	III	III	II	III
	Animal [a]	III	III	III	II
Jeff	Color [a]	III	III	I	II
	Animal [a]	III	III	III	II
Rena	Color [a]	III	III	I	III
	Animal [a]	III	III	III	II
Lisa	Color [a]	III	N/A	I	II
	Animal	III	III	I	III
Mode outcomes		III	III	III	II

Note: [a] indicates the assessment in which the child reached the mastery criterion within 30 instructional sessions. N/A indicates that the exclusion of the post-test results due to procedural inconsistencies.

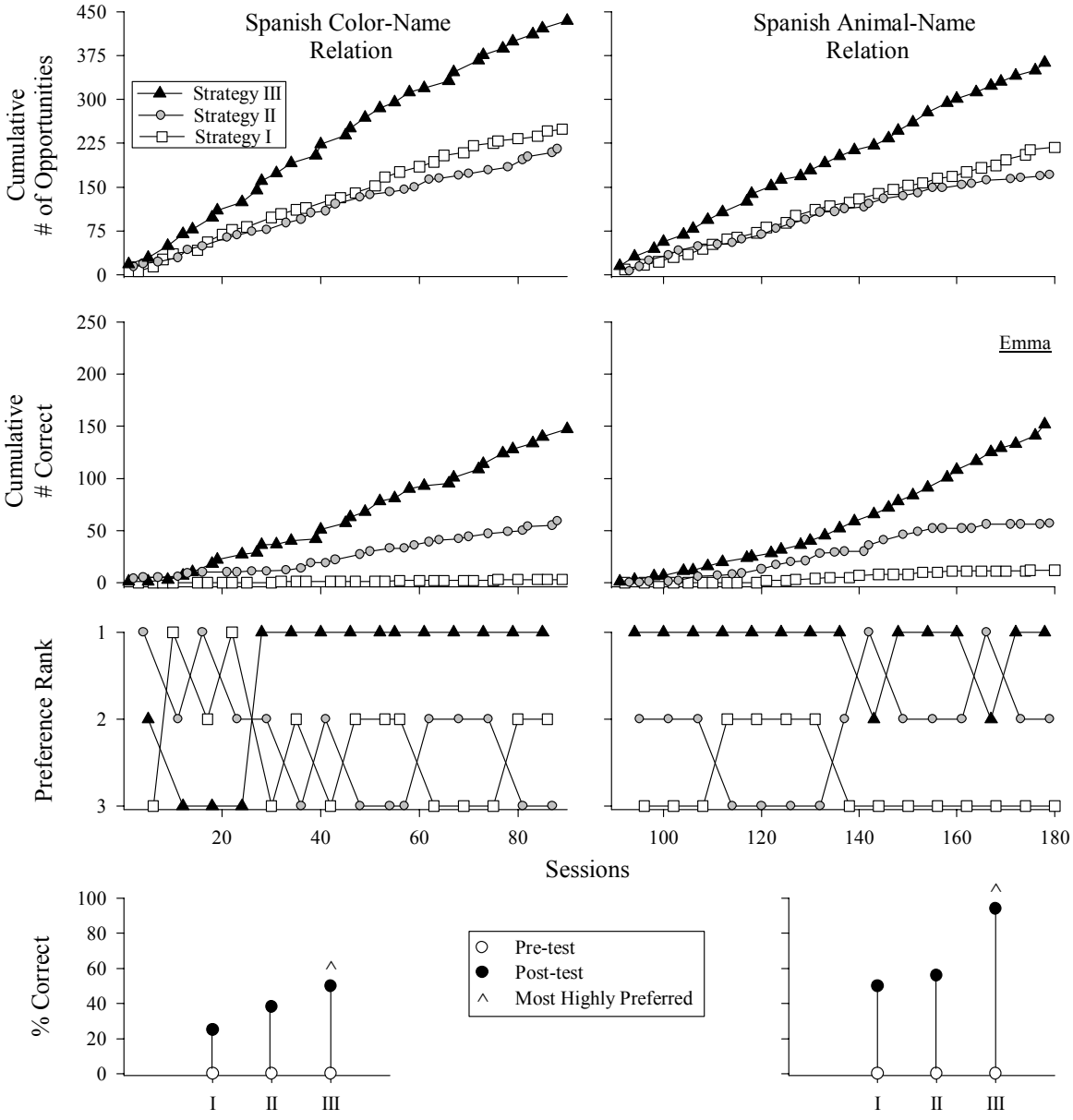
Figure Captions

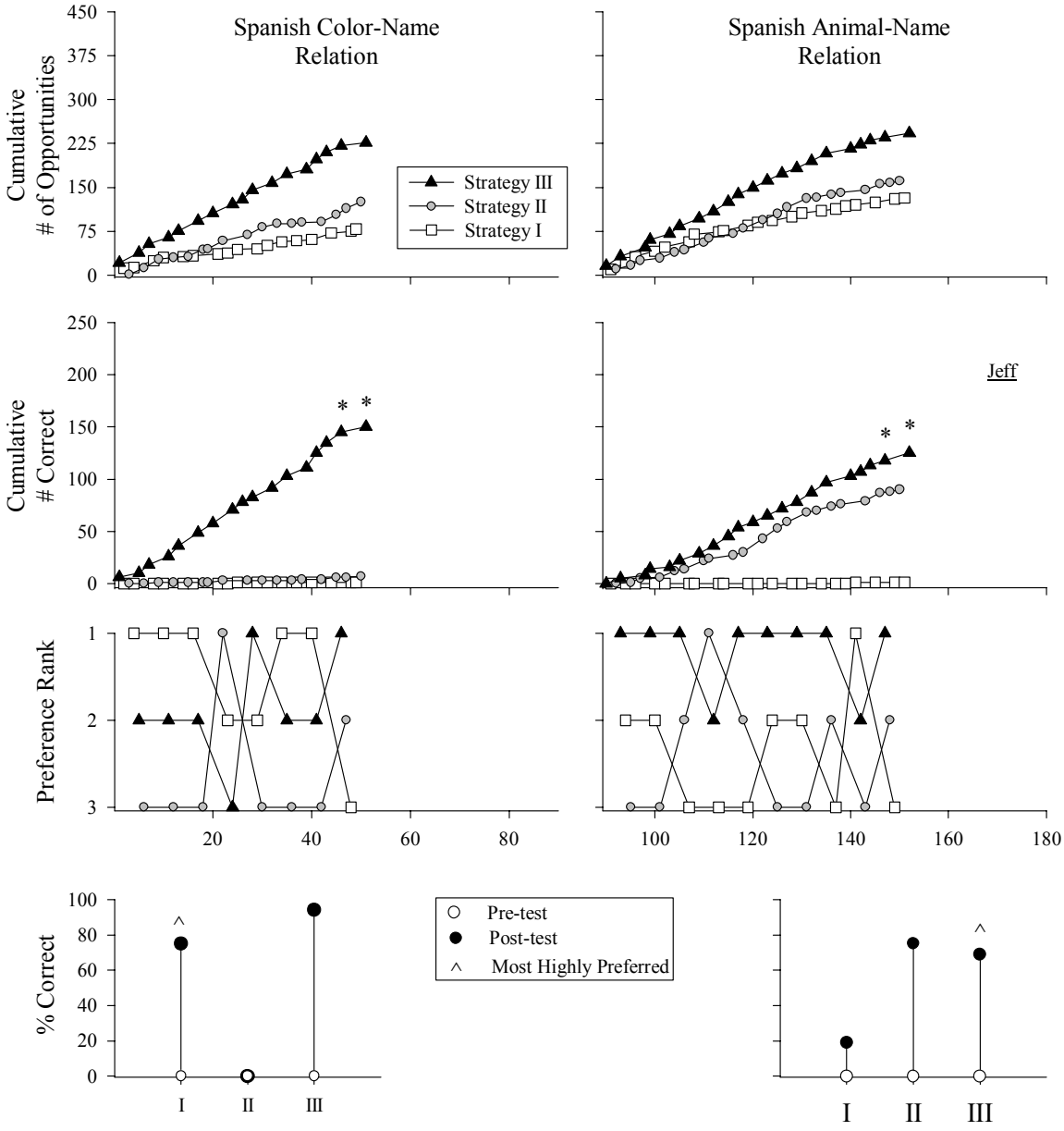
Figure 1. The cumulative number of learning opportunities (top panel set), cumulative number of correct responses (second panel set), preference rank (third panel set), and pre and post-test scores (bottom panel set) during the efficacy and preference evaluations for Emma.

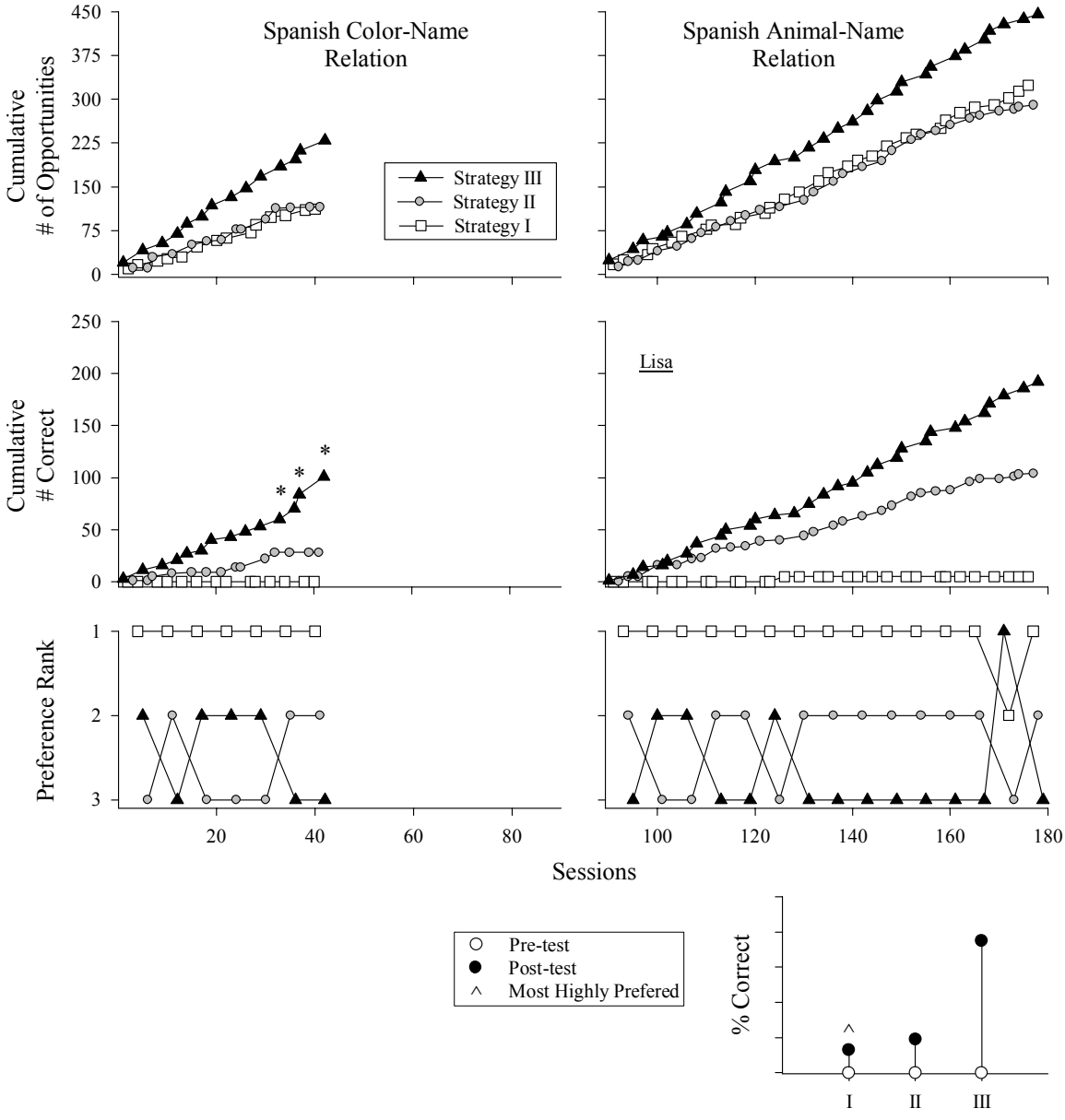
Figure 2. The cumulative number of learning opportunities (top panel set), cumulative number of correct responses (second panel set), preference rank (third panel set), and pre and post-test scores (bottom panel set) during the efficacy and preference evaluations for Jeff.

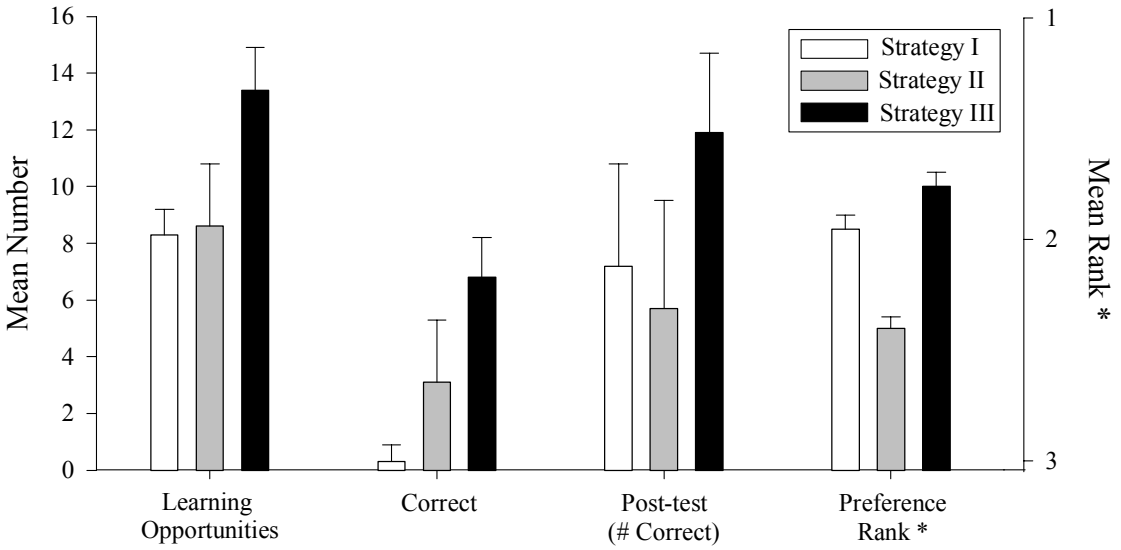
Figure 3. The cumulative number of learning opportunities (top panel set), cumulative number of correct responses (second panel set), preference rank (third panel set), and pre and post-test scores (bottom panel) during the efficacy and preference evaluations for Lisa.

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


Spanish Color-Name Relation
Spanish Animal-Name Relation
Strategy III
Strategy II
Strategy I
Cumulative # of Opportunities
Cumulative # Correct
Preference Rank
Emma
Sessions
% Correct
Pre-test
Post-test
Most Highly Preferred
I
II
III


Spanish Color-Name Relation
Spanish Animal-Name Relation
Cumulative # of Opportunities
Strategy III
Strategy II
Strategy I
Cumulative # Correct
Jeff
Preference Rank
% Correct
Pre-test
Post-test
Most Highly Preferred
I
II
III


Spanish Color-Name Relation
Spanish Animal-Name Relation
Cumulative # of Opportunities
Strategy III
Strategy II
Strategy I
Cumulative # Correct
Lisa
Preference Rank
Sessions
Pre-test
Post-test
Most Highly Prefered
% Correct
I
II
III


Mean Number
16
14
12
10
8
6
4
2
0
Mean Rank *
1
2
3
Strategy I
Strategy II
Strategy III
Learning Opportunities
Correct
Post-test (# Correct)
Preference Rank *