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GROSS-MOTOR SKILL ACQUISITION BY PRESCHOOL DANCE STUDENTS UNDER SELF-INSTRUCTION PROCEDURES

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The effects of two training procedures—(a) modeling and praise and (b) self-instruction, modeling, and praise—on complex gross-motor chain acquisition for preschool dance class students were evaluated. Six girls participated in the study. A multiple baseline design across six gross-motor chains with a secondary group comparison for treatment order effects was used. Both procedures were effective in teaching the gross-motor chains. Nevertheless, for 4 of the 6 participants, the self-instruction procedure produced a faster acquisition rate in at least two of the three comparable pairs of gross-motor chains. Furthermore, very early in gross-motor chain acquisition, for five of the six gross-motor chains, the self-instruction condition was associated with faster response acquisition.

DESCRIPTORS: acquisition, dance, gross-motor chains, modeling, self-instruction, training procedures

A number of experimental studies have examined the functional relation between verbal and nonverbal behavior in preschool-age children (Duarte & Baer, 1994; Fjellstrom, Born, & Baer, 1988; Grote, Rosales, & Baer, 1996; Meacham, 1978; Miller, Shelton, & Flavell, 1970; Mithaug & Mithaug, 2003; Risley & Hart, 1968; Rogers-Warren & Baer, 1976). One of the verbal responses examined in conjunction with nonverbal tasks is self-instruction. Based on previous research, the concept of self-instruction can be defined as a verbal response that directs other responses of the speaker, such as (a) object sorting (Duarte & Baer; Fjellstrom et al.; Grote et al.), (b) on-task behavior (Friedling & O'Leary, 1979), and (c) other motor behavior (Higa, Tharp, & Calkins, 1978; Miller et al.). Previous authors have argued that self-instruction can be beneficial for preschool-age children in some difficult learning situations (Duarte & Baer; Fjellstrom et al.; Grote et al.). One of these beneficial effects is increased performance accuracy (Grote et al.; Guevremont, Osnes, & Stokes, 1988; Keller & Schoenfeld, 1950/1995). These findings have been demonstrated with complex tasks, such as object sorting (Duarte & Baer; Grote et al.), matching (Fjellstrom et al.), and academic tasks (Guevremont et al.).

Although research has addressed effects of self-instruction, most studies have been limited to fine-motor behavior (Calkins & Tharp, 1984; Miller et al., 1970; Risley & Hart, 1968), and only a few have examined gross-motor behavior (Kirby & Holborn, 1986; Meacham, 1978; Merriman, Barnett, & Isenberg, 1995). In addition, researchers in various fields have addressed motor-skills

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development and training, but previous research has not systematically examined the effects of self-instruction on the acquisition of gross-motor chains in preschool children (Cech & Martin, 1995; Drowatzky, 1981; Fitts, 1964; Schmidt, 1975, 1982; Singer, 1968).

When analyzing response acquisition with and without self-instruction, another comparison might include response effort, which can be measured as duration of responding (Keller & Schoenfeld, 1950/1995). This measure can be thought of as the duration of a gross-motor chain from its start to its completion. Motor-control researchers call this measure *movement time* and typically use it to detect the planning strategies used in acquired complex gross-motor movements that exceed 500 ms in duration (Rose, 1997). The phenomenon of speed–accuracy trade-off is demonstrated using this measure. Guevremont et al. (1988) described a similar concept in the applied behavior-analytic literature. They showed that, for some preschoolers, the use of self-instruction was associated with "a slower pace" and the "most consistent improvements in correct responding" on academic tasks. Nevertheless, the possible differential effect of response time as a function of self-instruction during the acquisition of new gross-motor chains in preschool-age children has not been examined.

The present study addressed the relation between self-instruction and acquisition of complex gross-motor chains in preschool-age children under two modes of training: (a) self-instruction, modeling, and praise and (b) modeling and praise alone. The purposes of the present study were (a) to examine the relative effectiveness of the two procedures and (b) to examine the duration of gross-motor chains in both procedures during the acquisition of complex gross-motor chains by preschool-age children in a ballet class setting.

METHOD

Participants

The participants were 8 students enrolled in preballet classes at a private school for music and dance. The participants were selected because they were preschool age and because they did not display the selected gross-motor chains. They attended a preballet class once a week. Six of the participants completed the study, and 2 experienced only modeling and praise for three gross-motor chains. Thus, only the data on the 6 participants who completed the study are presented. At the beginning of the study Tamara was 5 years 2 months old; Lena was 4 years 10 months; Dana was 4 years 7 months; Ana was 4 years 2 months; Amanda was 3 years 9 months; and Tina was 3 years 7 months. All participants had been attending preballet classes for at least 3 months and were able to execute basic dance steps.

General Procedure and Setting

The participants were brought to class by their parents or caregivers. Each participant attended one 45-min class each week with 8 to 12 students attending each class. All classes were conducted in a dance studio (10 m by 7 m) containing one wall of mirrors, ballet barres, a piano, a table, a few chairs, one portable audiocassette player, and audiotapes with prerecorded music of various rhythms. Experimental sessions were conducted during each student's regularly scheduled class; two classes were used, one meeting on Thursday and one meeting on Sunday each week. The experimenter was the students' regular dance teacher and she conducted all sessions. A Sony® TRV62 videocamera mounted on a tripod was placed in a corner of the classroom and recorded the behavior of the participants and the teacher for later data collection.

A session was defined as five trials. Each trial consisted of the teacher providing the initial instruction (naming the step) followed by the execution of the gross-motor chain by the participant.

Dependent Measures

Data obtained from the videotapes included the following: (a) the number of trials with a correct gross-motor chain in a session; (b) the number of such chains that were accompanied by self-instruction responses in a session; (c) the duration in seconds of the first correct gross-motor chain in a trial.

A gross-motor chain was defined as a general body activity involving large skeletal muscle groups that produces such movements as balancing, walking, jumping, and kicking. The six gross-motor chains were tarantella, polka, cupcake dance, little ballerina dance, butterfly dance, and play-time dance. These chains are defined in Table 1. In performing these gross-motor chains, it did not matter whether the child stepped on the right or the left foot first; the alternating gait was the necessary condition. A gross-motor chain was scored as being correct if all the steps were performed in the defined order; it was scored as being incorrect if the number of steps or their order was not correct or if no response was made within 7 s of the teacher's instruction.

The teacher's instruction was a request for the student to engage in a named dance step or a dance. The teacher directed the instruction to the participant or the whole class during the dance class.

Self-instruction was defined as the participant voicing aloud the self-instruction (described below) modeled by the teacher for each gross-motor chain while performing it so that an observer could hear the words being said or could see her lips moving. Table 2 summarizes the self-instructions for the six gross-motor chains. Self-instruction was scored as being correct if the participant voiced either an exact self-instruction or a closely similar one (e.g., instead of "opposite arm up" a participant might say "opposite hand up"); it was scored as incorrect if self-instruction was absent or dissimilar to the instructions provided by the teacher.

The duration in seconds of the first correct gross-motor chain in a trial was defined as the time elapsed from the start of the first correct gross-motor response to the end of the last gross-motor response of each gross-motor chain.

Experimenter Responses

Four experimenter responses—(a) the initial instruction, (b) modeling the gross-motor chain, (c) modeling the self-instruction response, and (d) praise—were recorded as being present or absent. The initial instruction was scored as being present whenever the experimenter gave the instruction to participants (e.g., "Show me please the polka step" or "Show me please the butterfly dance"). Modeling the gross-motor chain was scored as being present whenever the experimenter demonstrated the gross-motor chain. Modeling the self-instruction response was scored as being present whenever the experimenter demonstrated the appropriate self-instruction (see Table 2). Praise statements (e.g., "That was a very nice tarantella step!" or "Very good!") were scored as being present when they occurred.

Evaluation of Gross-Motor Chains

Because the dimensions of response chains can affect the speed and accuracy of the behavior that is being learned (Sulzer-Azaroff & Mayer, 1991), a task analysis of the six gross-motor chains was conducted on three dimensions of each chain: length, complexity, and familiarity. The length of a chain was defined as the number of steps composing a complete gross-motor chain (Table 1). The complexity of a chain was defined as the degree of homogeneity: The more homogeneous (physically similar) the separate

Table 1
Operational Definitions of Gross-Motor Chains

Gross-motor chain	Definition
Tarantella	The alternating gait of 8 steps Step 1: a forward step is made on the right foot Step 2: a hop is made with the left leg in front with the knee bent while the right arm moves up over the head Step 3: a forward step is made on the left foot Step 4: a hop is made with the right leg in front with the knee bent while the left arm moves up over the head Steps 5–8: Steps 1–4 are repeated
Polka	The alternating gait of 8 steps Step 1: with a small hop, a forward step is made on the right foot and the left foot is pulled behind the right foot Step 2: repeat Step 1 Step 3: with a small hop, a forward step is made on the left foot and the right foot is pulled behind the left foot Step 4: repeat Step 3 Steps 5–8: Steps 1–4 are repeated
Cupcake dance	The alternating gait of following 18 steps Step 1: a forward step is made on the either left or right foot Step 2: repeat Step 1 with the other foot Step 3: jump landing on both feet Steps 4–6: with small hops alternating heels are placed on the floor Steps 7–18: Steps 1–6 are repeated twice
Little ballerina dance	The alternating gait of 12 steps Step 1: a forward step on the right foot while the other left leg is lifted up in the back (could be started from the left foot) Step 2: a forward step on the left foot while the right leg is lifted up in the back (could be started from the right foot) Step 3: turn around making small steps on the balls of the feet (tiptoe) while bringing the arms up over the head Step 4: repeat Step 3 Step 5–12: Steps 1–4 are repeated twice
Butterfly dance	The alternating gait of 18 steps Step 1: a sliding step forward is made on the right foot Step 2: a jump is made on the right foot while bringing the left leg up in the back Step 3: a sliding step forward is made on the left foot Step 4: a jump is made on the left foot while bringing the right leg up in the back Step 5: run forward on the balls of the feet (tiptoe) Step 6: stop Steps 7–18: Steps 1–6 are repeated twice
Play-time dance	The alternating gait of 12 steps Step 1: a forward step and a hop is made on the right foot while bending the left knee and bringing it up Step 2: a forward step and a hop is made on the left foot while bending the right knee and bringing it up Step 3: a sideways step is made on the right foot jumping and pulling the feet together and landing on the left foot Step 4: repeat Step 3 Steps 5–12: Steps 1–4 are repeated twice

Table 2
Self-Instruction for Gross-Motor Chains

Gross-motor chains	Self-instruction
Tarantella	"Opposite arm up, opposite arm up."
Polka	"One, two, one, two."
Cupcake dance	"Step, step, jump, one, two, three."
Little ballerina dance	"One leg, the other leg, turn, an turn."
Butterfly dance	"Slide, jump, slide, jump, run, and stop."
Play-time dance	"One, two, gallop, gallop."

components of the chain, the less complex the task; the more heterogeneous the separate components of the chain, the more complex the task. A three-point scale was used to measure complexity. One point was given to a low-complexity chain consisting of two elements, each element being performed only once. Two points were given to a medium-complexity chain consisting of two elements, each element being repeated twice. Three points were given to a high-complexity chain of three elements with varied repetitions. Familiarity of the chain was defined as mastery of the individual elements of a chain based on the repertoire of skills thus far introduced in the preballet class. A two-point scale was used to measure familiarity. One point was given to a chain consisting of well-learned responses. Two points were given to a chain consisting of new responses. Finally, based on the analysis (see Table 3), comparable gross-motor chains were paired into two sets (Set 1 and Set 2) so they could be assigned to two different training procedures, with and without self-instruction: polka (Set 1, Response A or S1A), tarantella (Set 2, Response A or S2A), little ballerina dance (Set 1, Response B or S1B), play-time dance (Set 2, Response B or S2B), butterfly dance (Set 1, Response C or S1C), and cupcake dance (Set 2, Response C or S2C).

Design and Procedure

A multiple baseline design across gross-motor chains was used. Three of the chains were taught with self-instruction, modeling, and praise (self-instruction procedure), and three other chains were taught with the modeling and praise procedure (no-self-instruction procedure). A secondary group-comparison design was used to evaluate effects of treatment order. Of the 6 participants, 4 (Tamara, Dana, Amanda, and Ana) received the self-instruction procedure first for three gross-motor chains and the no-self-instruction procedure second for the other three gross-motor chains. Two participants (Tina and Lena) received the no-self-instruction procedure first and the self-instruction procedure second. Two gross-motor chain orders were used: S1C, S1A, S1B, S2C, S2A, and S2B, later referred to as Chain Order 1, and S2C, S2A, S2B, S1B, S1A, and S1C, later referred to as Chain Order 2 (Table 3).

The data-recording procedure used was event recording (occurrence or nonoccurrence) of the behavior during the trial for each gross-motor chain and self-instruction.

Table 3
Pairing of the Gross-Motor-Chain Sets Based on the Content Analysis

Set 1		Set 2				
Code	Name	Code	Name	Length	Complexity	Familiarity
S1A	Polka	S2A	Tarantella	8	1	2
S1B	Little ballerina dance	S2B	Play-time dance	12	2	1
S1C	Butterfly dance	S2C	Cupcake dance	18	3	1

One data point represented one session consisting of five trials. The observers collected data on the responses of the experimenter and the participants.

During the baseline condition, the participants were asked to demonstrate various gross-motor chains. The experimenter provided the initial instruction for a previously taught chain (e.g., "Show me please the bear walk" or "Show me please the skipping") and for a new gross-motor chain ("Show me please the butterfly dance" or "Show me please the tarantella") and waited for approximately 7 s. The instruction for a previously taught chain was given to ascertain that the participants were compliant with instructions. The participants were able to demonstrate the chains that they had previously been taught but not the experimental chains that had not been previously taught. If a correct gross-motor chain was not demonstrated within 7 s, a new instruction was presented.

During the no-self-instruction condition, the experimenter continued to deliver instructions for previously taught gross-motor chains. For experimental chains, the experimenter delivered the initial instruction (e.g.,"Let's do the butterfly dance!") for the first of the three gross-motor chains and demonstrated it herself. Then, the participants were asked to perform the chain (e.g., "Show me please the butterfly dance"). A praise statement was made (e.g., "That was a very nice butterfly dance!" or "Very good!") for the correctly performed chain with all elements of the chain being correct. Once the participants demonstrated correct responding, the experimenter discontinued modeling this chain on the following trials. If the chain was incorrectly performed, the same chain was modeled again two more times and then a new instruction was presented. When the participant reached correct responding on three consecutive trials in one session, a new chain was introduced, except when the third trial was the last trial of the given day, in which case, four consecutive trials in one session were required before a new chain was introduced. Training on a chain continued until the mastery criterion (two consecutive sessions with 9 of 10 trials with correct gross-motor chains) was reached for each chain.

The self-instruction procedures were the same as in the no-self-instruction condition except that the experimenter simultaneously modeled the chain and the accompanying self-instruction response. Two self-instruction practice trials (saying out loud the specific self-instruction) preceded a performance of the gross-motor chain on the initial treatment trial only. A praise statement was contingent on a correctly performed gross-motor chain regardless of the presence or absence of the self-instruction response. Once the participant demonstrated correct responding, the experimenter discontinued the demonstration of this chain on the following trials. If the chain was incorrectly performed, the same chain was modeled again two more times and then a new instruction was presented.

Interobserver Agreement

Two observers viewed the videotapes of the sessions. One observer was the experimenter. The other observer was a person who was not familiar with the children or the preballet class curriculum. Prior to data scoring, practice sessions were conducted until interobserver agreement scores were 95% or better. Observers viewed the videotapes together and independently scored the responses. The scores were compared after scoring was completed for two ballet class sessions. On occasions when there was a disagreement on the correctness of the gross-motor chain or self-instruction responses, response definitions were reviewed and the two sessions were scored again, with a maximum of three scorings of the same session by the two observers. Interobserver agreement was calculated by dividing the total number of agreements by the sum of agreements and disagreements and then multiplying by 100%. The data presented are for the 6 participants who completed the study.

Interobserver agreement for the six gross-motor chains and self-instruction responses was obtained during 85% of all sessions. For individual participants it was obtained during 83% of all sessions. Overall agreement for the gross-motor chains and self-instruction responses across experimental conditions was 100%. Procedural integrity of the experimenter's responding (instruction, modeling the gross-motor chains, modeling the self-instruction, and praise) was also 100%.

Interobserver agreement for the duration of the gross-motor chains was obtained by comparing time in seconds for the first correct gross-motor chain, rounded to the nearest second, using a point-by-point method. For example, if one observer scored 3 s and another 4 s, those scores were in disagreement. Agreement was calculated as the total number of agreements divided by the sum of agreements and disagreements and then multiplied by 100%. Agreement was obtained on 76% of all trials for the duration of the first correct gross-motor chain for the six gross-motor chains. For each of the 6 participants, interobserver agreement was obtained on 73% of all trials for the duration of the first correct gross-motor chain. For all participants as a group and for each individual participant, the mean score for the duration of the first correct response across experimental conditions and six chains was 88% (range, 73% to 100%).

RESULTS

Figures 1 through 6 show the number of trials with correct responding on the six gross-motor chains and accompanying self-instruction responses during baseline and treatment for Tamara, Dana, Amanda, Ana, Tina, and Lena, respectively. Overall, none of the participants performed any of the gross-motor chains correctly during baseline, and all of the participants reached the mastery criterion for each gross-motor chain in both the self-instruction and no-self-instruction conditions. Over time, most of the participants showed decreased use of the self-instruction response after mastery performance was achieved in the self-instruction condition.

The primary difference between the self-instruction and no-self-instruction conditions was in the rapidity with which mastery performance was acquired. To evaluate differences in the rate of acquisition between the self-instruction and no-self-instruction conditions, we evaluated the number of sessions participants required to display mastery performance across the pairs of gross-motor chains that were matched on response effort and familiarity. In Pair A, 4 participants (Tamara, Dana, Amanda, and Ana) required fewer sessions to reach the mastery criterion with the self-instruction procedure than with no self-instruction; for 1 participant (Tina) the reverse relation was found, and for 1 participant (Lena) there was no difference in the rate of acquisition. In Pair B, 4 participants (Tamara, Dana, Tina, and Lena) required fewer sessions to reach the mastery criterion with self-instruction than with no self-instruction; for 1 participant (Ana) the reverse relation was found, and for 1 participant (Amanda) there was no difference in the rate of acquisition. In Pair C, 3 participants (Tamara, Tina, and Lena) required fewer sessions to reach the mastery criterion with the self-instruction procedure than with no self-instruction; for 1 participant (Ana) the reverse relation was found, and for 2 participants (Dana and Amanda) there was no difference in the rate of acquisition.

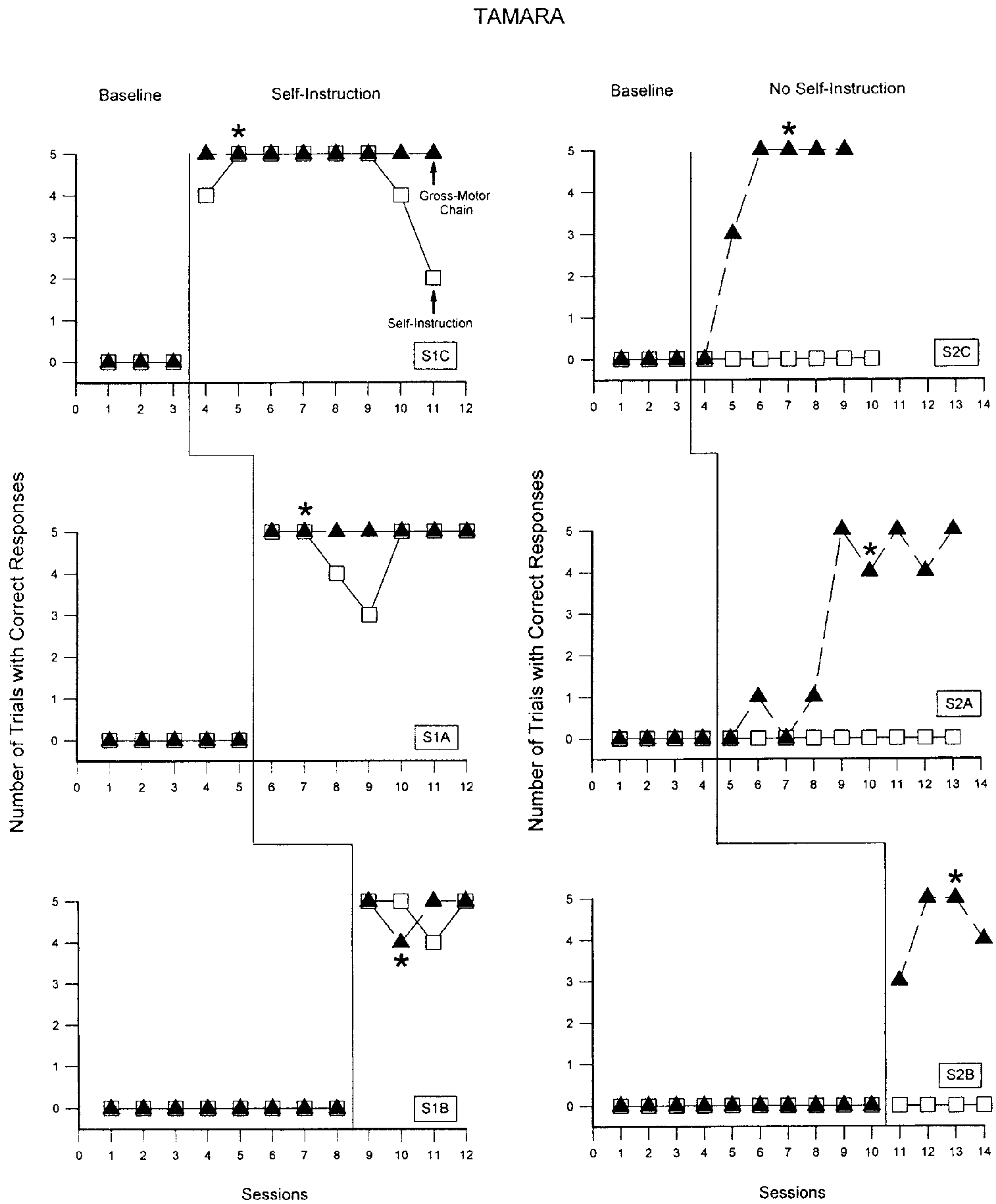

Figure 1. Number of trials for Tamara with correct gross-motor chains (filled triangles) and self-instruction responses (open squares) per session across S1C (butterfly dance), S1A (polka), S1B (little ballerina dance), S2C (cupcake dance), S2A (tarantella), and S2B (play-time dance). Asterisks indicate the sessions when the mastery criterion was reached.

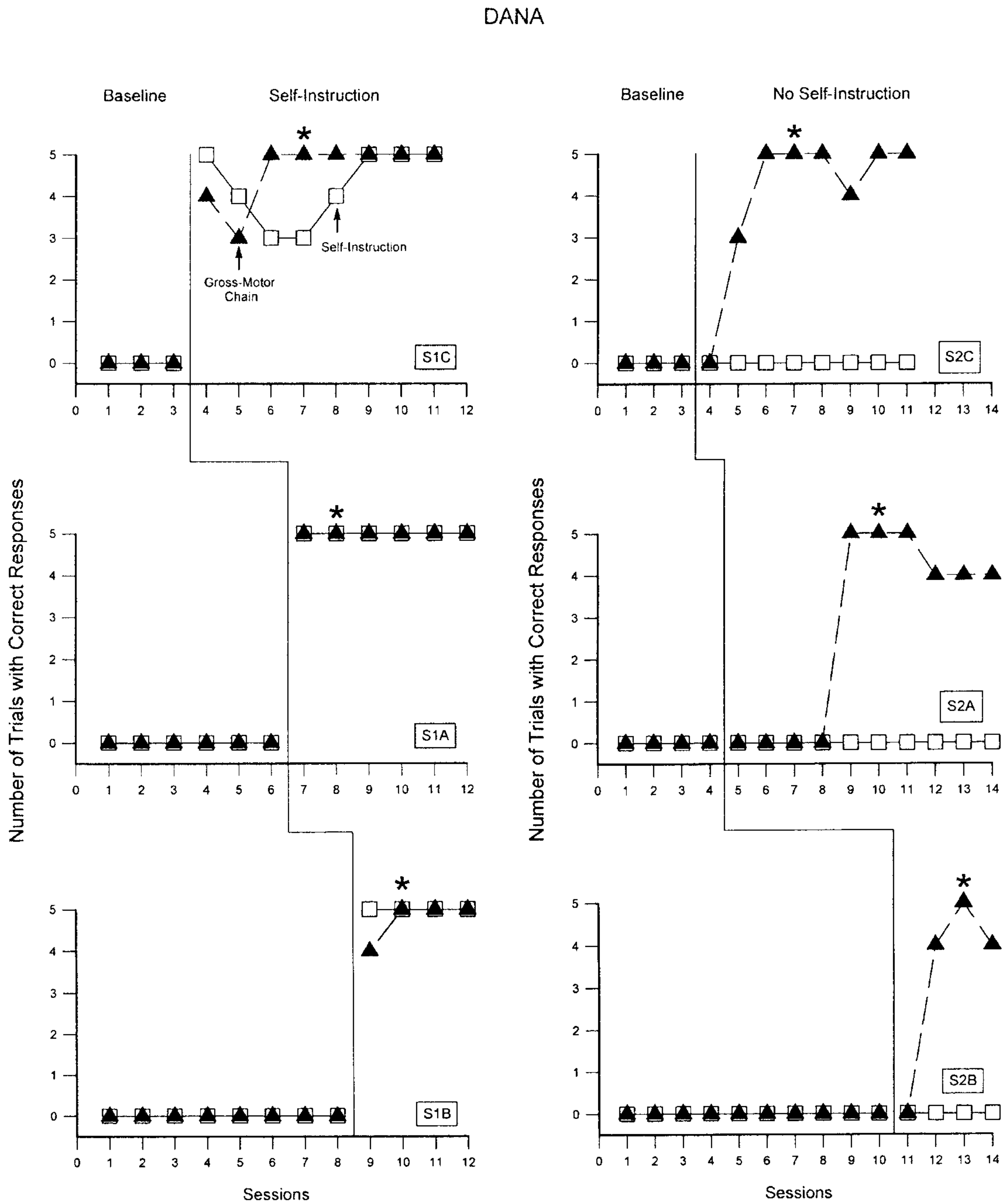

Figure 2. Number of trials for Dana with correct gross-motor chains (filled triangles) and self-instruction responses (open squares) per session across S1C (butterfly dance), S1A (polka), S1B (little ballerina dance), S2C (cupcake dance), S2A (tarantella), and S2B (play-time dance). Asterisks indicate the sessions when the mastery criterion was reached.

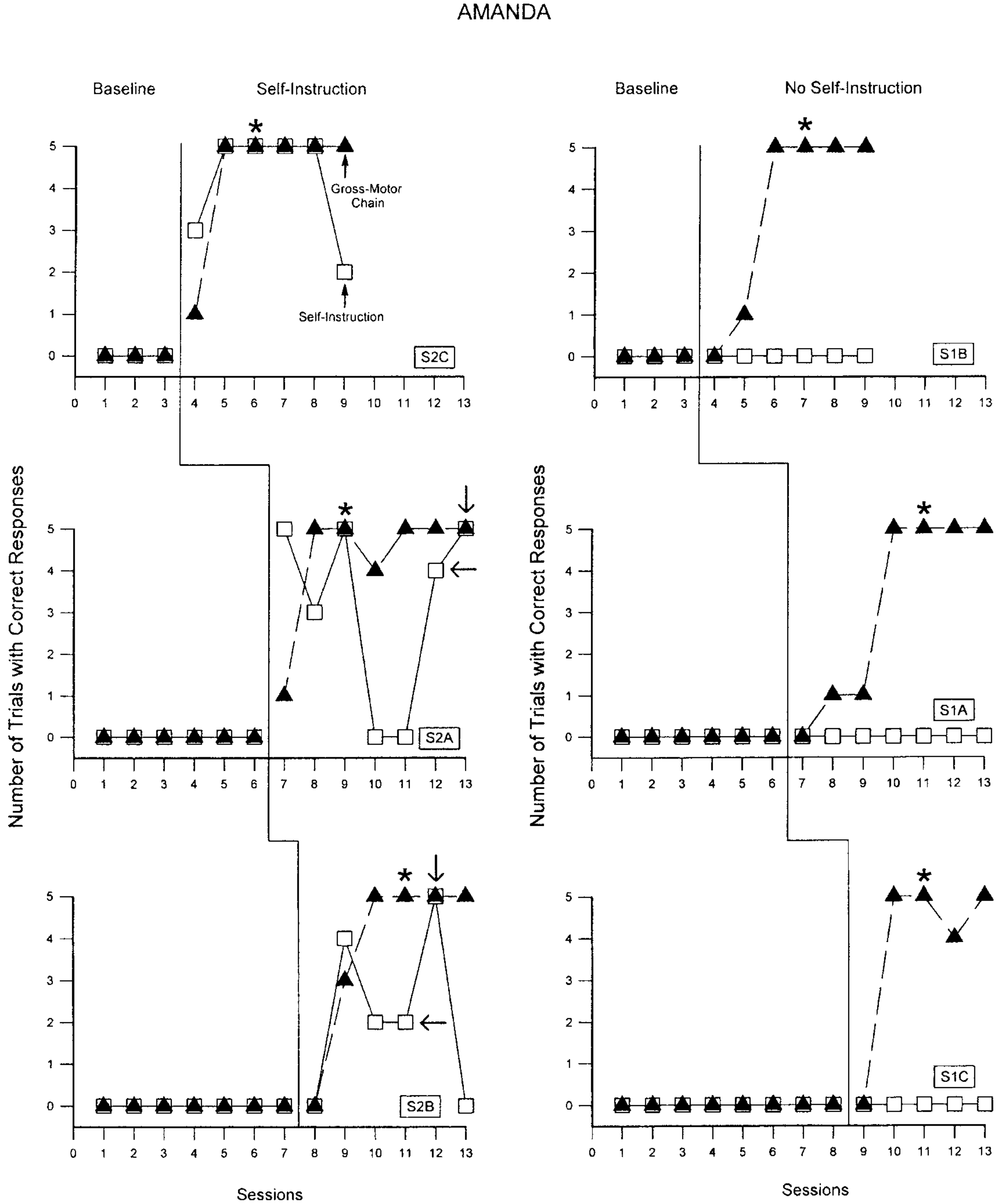

Figure 3. Number of trials for Amanda with correct gross-motor chains (filled triangles) and self-instruction responses (open squares) per session across S2C (cupcake dance), S2A (tarantella), S2B (play-time dance), S1B (little ballerina dance), S1A (polka), and S1C (butterfly dance). Asterisks indicate the sessions when the mastery criterion was reached. Arrows indicates the delivery of a prompt.

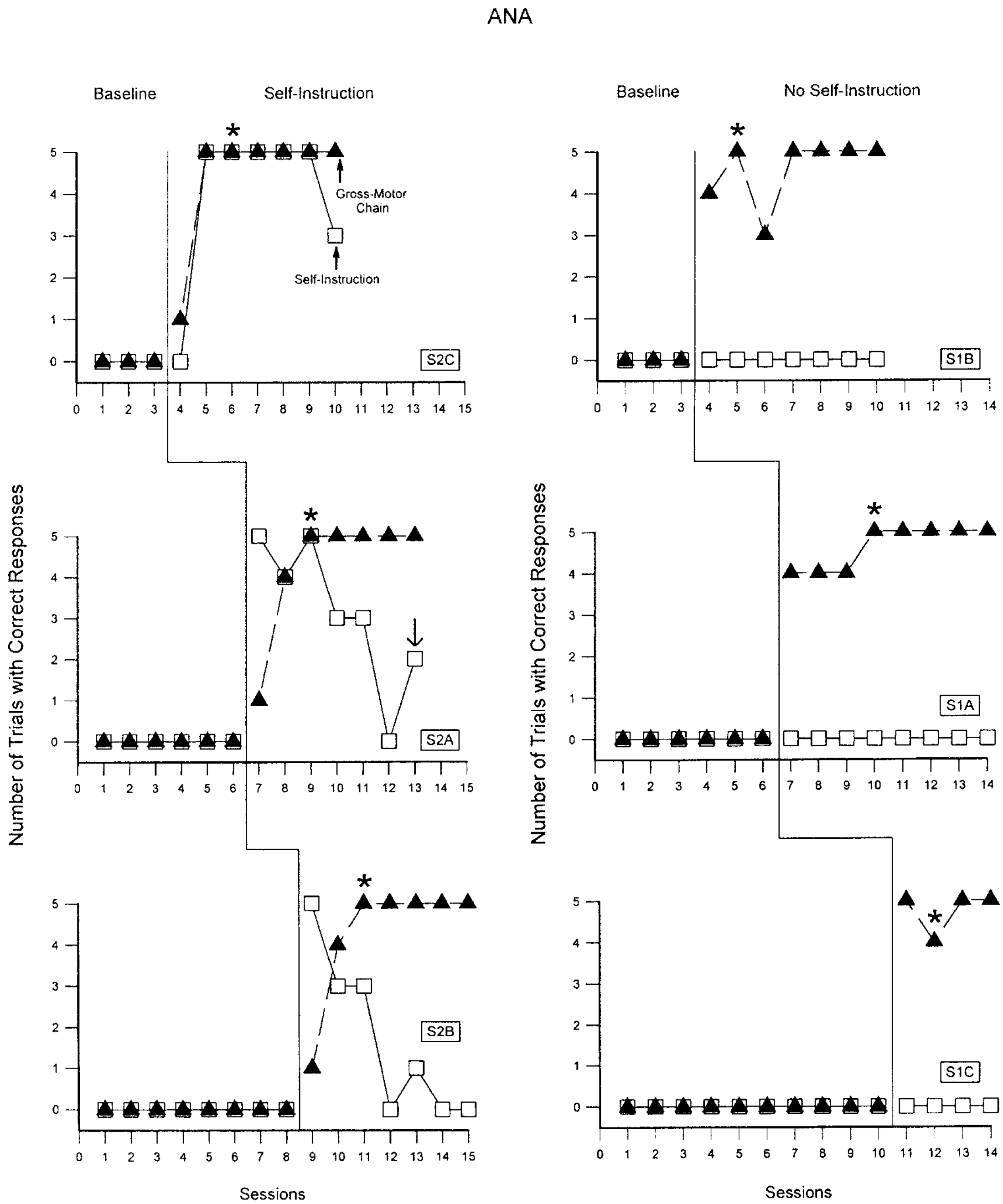

Figure 4. Number of trials for Ana with correct gross-motor chains (filled triangles) and self-instruction responses (open squares) per session across S2C (cupcake dance), S2A (tarantella), S2B (play-time dance), S1B (little ballerina dance), S1A (polka), and S1C (butterfly dance). Asterisks indicate the sessions when the mastery criterion was reached. The arrow indicates the delivery of a prompt.

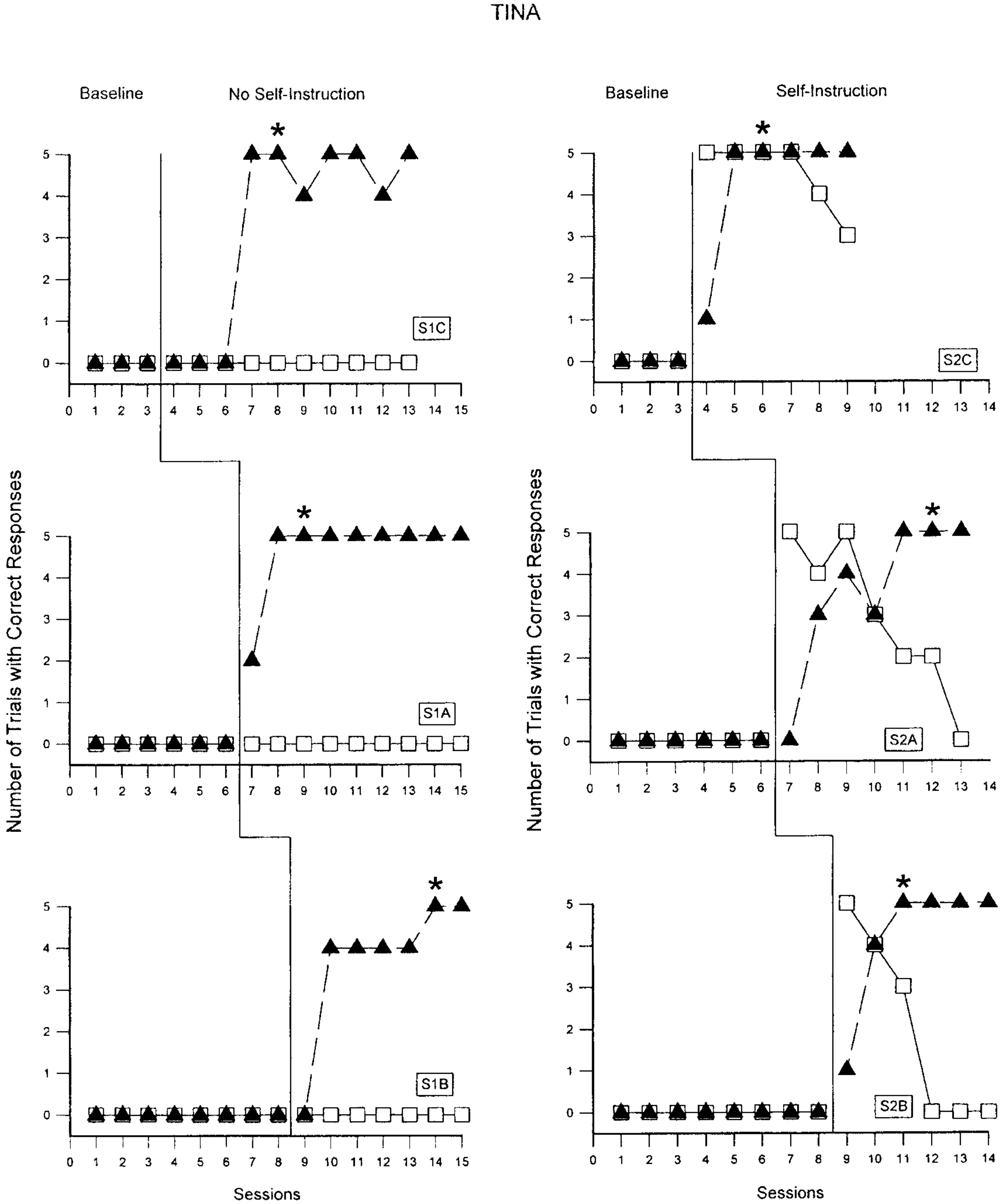

Figure 5. Number of trials for Tina with correct gross-motor chains (filled triangles) and self-instruction responses (open squares) per session across S1C (butterfly dance), S1A (polka), S1B (little ballerina dance), S2C (cupcake dance), S2A (tarantella), and S2B (play-time dance). Asterisks indicate the sessions when the mastery criterion was reached.

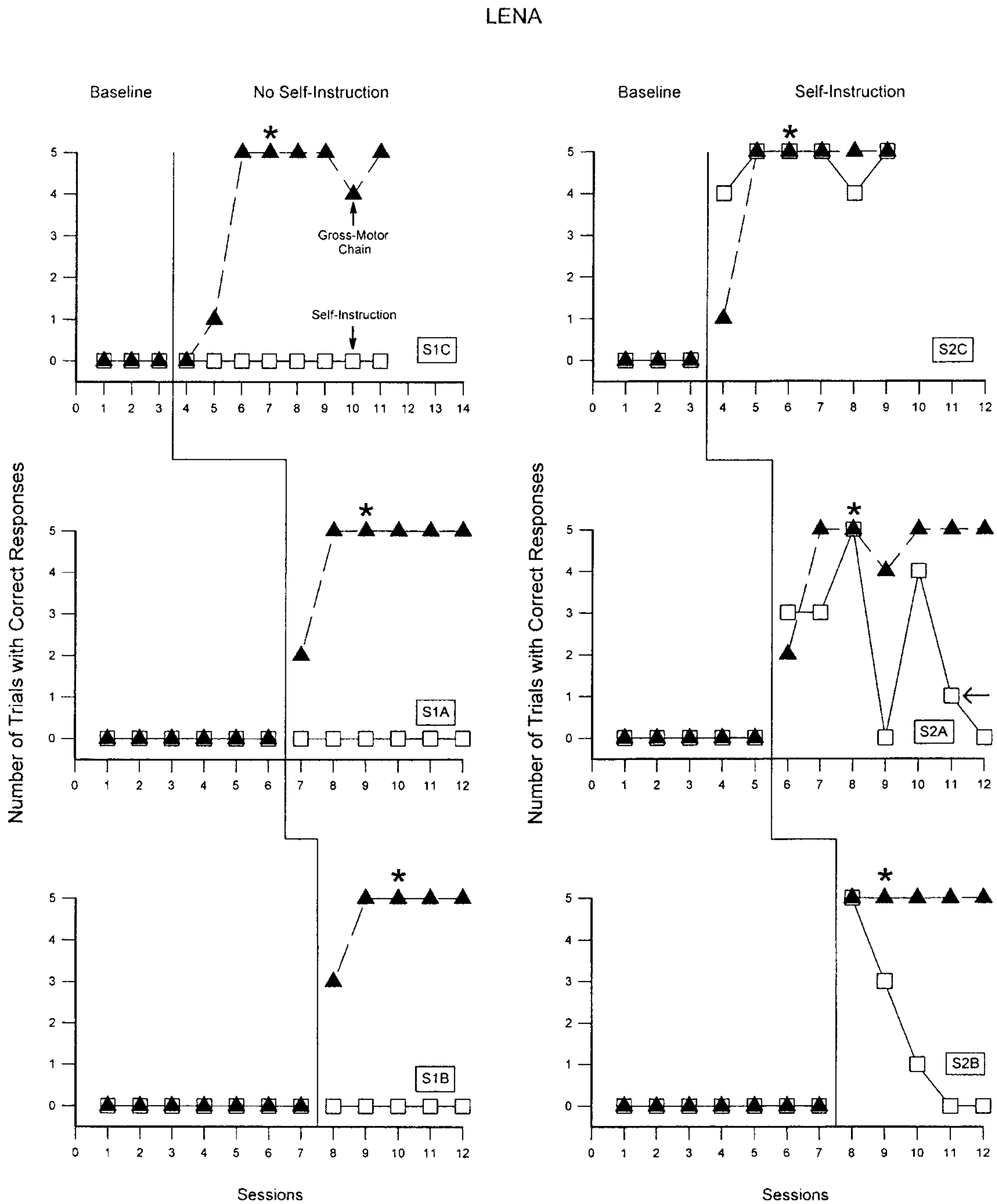

Figure 6. Number of trials for Lena with correct gross-motor chains (filled triangles) and self-instruction responses (open squares) per session across S1C (butterfly dance), S1A (polka), S1B (little ballerina dance), S2C (cupcake dance), S2A (tarantella), and S2B (play-time dance). Asterisks indicate the sessions when the mastery criterion was reached. The arrow indicates the delivery of a prompt.

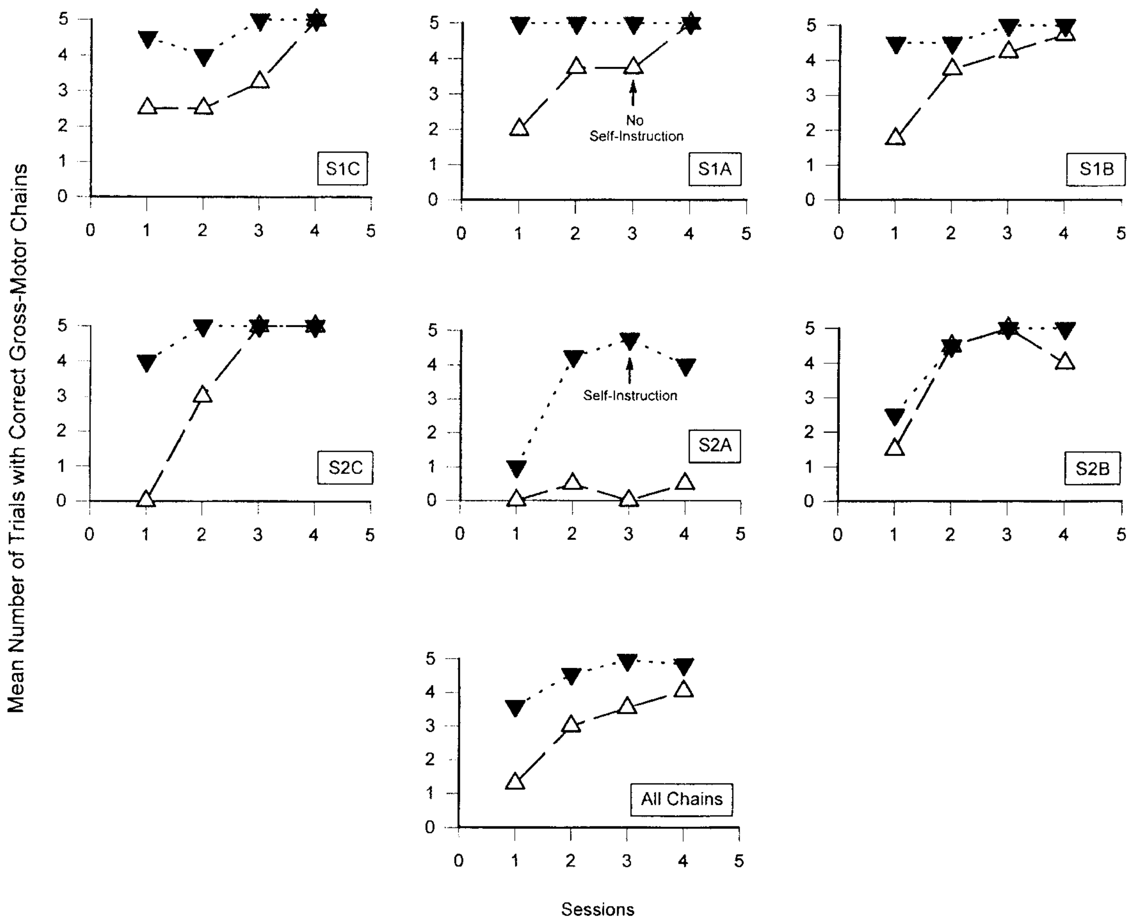

Figure 7. Acquisition curves for individual gross-motor chains when correct responses were averaged across the 6 participants and two experimental conditions.

The differences between the self-instruction and no-self-instruction conditions did not appear to be influenced significantly by order effects. Self-instruction preceded no self-instruction for 4 participants (Tamara, Dana, Amanda, and Ana) and 12 gross-motor-chain pairs and the reverse order (no self-instruction first) occurred for 2 participants and six gross-motor-chain pairs. Self-instruction was associated with more rapid acquisition in 7 of the 12 (58%) gross-motor-chain pairs when it came first and with four of the six (67%) pairs when it came second. By contrast, the no-self-instruction condition was associated with more rapid acquisition in one of the six (17%) gross-motor-chain pairs when it came first and with 2 of the 12 (17%) pairs when it came second.

Figure 7 shows acquisition curves for the first four sessions for each of the six gross-motor chains, and for all chains pooled, for the two experimental conditions. The data used in this display were averaged across the 6 participants for the first four sessions. For five of the six chains (S1C, S1A, S1B, S2C, and S2A), the mean number of trials with correct gross-motor chains was higher during the first two or three sessions for the self-instruction condition than for the no-self-instruction condition. This difference is most pronounced for the S2A chain. For the S2B chain, there is almost no difference between the acquisition curves of the two procedures. The pooled data show a faster acquisition curve for the procedure containing self-instruction compared to one that did not. Thus, very early in the gross-motor-chain process, self-instruction was associated with greater performance accuracy than the no-self-instruction condition.

The differential effect of self-instruction on the duration of the first correct gross-motor chain in a trial was observed in five of the six gross-motor chains (tarantella, polka, butterfly dance, cupcake dance, and play-time dance) during the first five trials. The greatest difference was in the tarantella, with average response time of 6 s in self-instruction and 3 s in no-self-instruction conditions. The smallest difference was in the play-time dance, with average response time of 6.7 s in self-instruction and 7.1 s in no-self-instruction conditions. There was no difference between the two conditions in the duration of the first correct gross-motor chain in a trial for the little ballerina dance.

DISCUSSION

Results demonstrated systematic increases in correct responding with the introduction of both training procedures: (a) modeling and praise with self-instruction and (b) modeling and praise without self-instruction. Therefore, one may conclude that both procedures were effective in teaching gross-motor chains to the preschoolers. Furthermore, for 4 of 6 participants, it took fewer sessions to reach mastery criterion with the self-instruction procedure than without it. Previous studies have demonstrated that self-instruction can improve performance of various complex tasks (Duarte & Baer, 1994; Fjellstrom et al., 1988; Grote et al., 1996; Kirby & Holborn, 1986; Risley & Hart, 1968; Rogers-Warren & Baer, 1976). The present study demonstrated that self-instruction could increase the acquisition rate (mean number of sessions to the mastery criterion) of new complex gross-motor chains. When the order of gross-motor chains was controlled, the acquisition rate was faster with the procedure that included self-instruction.

The present study is unusual in having measured the self-instruction response throughout the course of experimentation for each participant. Previous studies have not routinely presented a direct measure of this response (Duarte & Baer, 1994; Fjellstrom et al., 1988; Freidling & O'Leary, 1979; Grote et al., 1996; Guevremont et al., 1988; Higa et al., 1978; Kirby & Holborn, 1986). Of those studies that measured the self-instruction response, several presented group measures (Higa et al.; Risley & Hart, 1968; Rogers-Warren & Baer, 1976), and only one measured individual responding (Grote et al.). One limitation of group measures is that they do not provide information about the extent to which each individual responds differentially in the presence or absence of self-instruction. By continuing to measure this response throughout the experiment, the present study revealed that during most of the final sessions the children decreased or discontinued their use of self-instruction.

Several factors may account for the fact that the children decreased or discontinued their use of self-instruction over time. One of the factors could be response effort, if one assumes that self-instruction is more effortful. Support for that assumption was found in the present study, to the extent that initial trials with self-instruction had a longer duration than initial trials without self-instruction. According to Keller and Schoenfeld (1950/1995), a response that requires more effort is maintained if it is the only response that is reinforced. In the present study, a praise statement was contingent on a correctly performed gross-motor chain regardless of the presence or absence of the self-instruction response. In other words, when the children discontinued self-instruction but continued correct gross-motor performance, they still received reinforcement. Thus, the gross-motor response without the self-instruction may have demanded less effort; therefore, the probability of the response without self-instruction occurring again would be greater.

Another possible reason for decreasing or discontinuing self-instruction could involve the information that self-instruction contains. It could contain information on rhythm, critical features, or the order of the steps. Although the present study did not systematically manipulate the kind of information conveyed by the self-instruction, it appears that for some gross-motor chains self-instruction drops out quickly. An example of that is the tarantella. For other chains, self-instruction was maintained throughout (e.g., the polka). For the tarantella, self-instruction provides information on a critical feature of the chain ("opposite arm up"). Once the gross-motor chain is acquired, self-instruction does not facilitate its performance; thus, it ceases to be functional. For the polka, self-instruction provides rhythm ("one, two, one, two"). In this case, even when the chain is acquired, self-instruction may remain useful. Future research could look at a systematic manipulation of information included in self-instruction and what effect it has on gross-motor chains.

In the present study, a differential effect of the self-instruction and no-self-instruction procedures was revealed in the acquisition curves for five of the six gross-motor chains (see Figure 7). It appears that the tarantella was the most difficult step to learn with the modeling and praise procedure. The play-time dance did not show a differential effect between the two interventions. These results suggest that the gross-motor-chain set containing the tarantella might have been more difficult to learn with the modeling and praise procedure, and the set containing the play-time dance might minimize the differences between the two procedures. Set 2 contained both the tarantella and the play-time dance. Thus, the earlier observed differential effect of the two procedures in the two chain orders could be a result, not of the order, but of differences in the chains themselves. These differences appear to be a result of dimensions other than those included in the initial analysis of the chains (Table 3).

Similarly, self-instruction could serve other discriminative stimulus functions. The discriminative stimulus properties of self-instruction might have differentially affected chain acquisition and generalization. Some of the properties of these discriminative stimuli might include the rhythm, sequence, direction, and length of the utterance. For example, in the tarantella chain, self-instruction provided information about which response to emit ("opposite arm up"), and, in the play-time dance, self-instruction provided a rhythm and named one of the steps ("one, two, gallop, gallop"). Self-instruction containing information about which response to emit might have generalized to other chains and thus facilitated acquisition, whereas self-instruction containing information on rhythm and the name of the step might not have.

Several studies have experimentally tested the function of speech for nonverbal behavior of children and have produced mixed results (Calkins & Tharp, 1984; Higa et al., 1978; Meacham, 1978; Miller et al., 1970). A question raised by these studies was the extent to which verbal behavior served as a discriminative stimulus (Calkins & Tharp; Kirby & Holborn, 1986) or as a reinforcing stimulus (Meacham). Alternatively, verbal behavior could be an irrelevant response (Miller et al.). Keller and Schoenfeld (1950/1995, pp. 60–61) suggested that language might have a discriminative informational function in a learning task for the to-be-learned response, thereby reducing the acquisition time and error rate. Because in the present study the procedure containing self-instruction produced significantly faster acquisition of gross-motor chains than the modeling and praise procedure, it could be argued that the verbal behavior was functional for the chains. Nevertheless, the acquisition curves suggest that this effect might be transitory. Because of these observations, it could be argued that, during response-chain formation, self-instruction serves as a discriminative stimulus during the acquisition of the gross-motor chain, but this relation changes once the chain has been learned. Future research could address the conditions under which it is helpful for the verbal stimulus to occur throughout the duration of the chain, at the beginning of the chain, or at the end of the chain.

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STUDY QUESTIONS

1. According to the authors, what is self-instruction and what are some potential benefits and limitations of its use?

2. Describe the two participant dependent variables and how they were measured.

3. How were the gross-motor chains analyzed, and how was the analysis used as the basis for grouping chains into the two sets?

4. Describe the rationale for including the previously taught chains in each trial session.

5. Briefly describe each of the experimental conditions.

6. Summarize the results of the experimental comparison on correct performance of gross-motor chains.

7. What main difference in effects from the two interventions is reflected in the data in Figure 7?

8. What two reasons did the authors provide to explain why participants' self-instruction eventually decreased or ceased? Which is more plausible, and why?

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