

# An Examination of Skill Learning Using Direct Instruction

*Suzan F. Ayers, Lynn D. Housner, Rachel Gurvitch, Tony Pritchard, Matthew Dell'Orso, Scott Dietrich, Ha Young Kim, and Mary Pearson*

## **Abstract**

*The standing long jump was taught to 47 elementary children in one of three conditions; C1) practice only, C2) demonstration, cueing, and practice, and C3) direct instruction, which included all elements of the first two conditions + checks for understanding (CFU), corrective feedback, and closure. All children performed four jumping tasks 10 times each. Students were pre- and post-tested on their ability to demonstrate five critical elements of the long jump. Significant condition and gender main effects were found for process change scores. Gains for C3 (24.7%) were significantly higher than those for C1 (3.1%), but only slightly better than C2 (15.0%). Girls achieved greater gains (19.6%) than boys (7.7%). Students were also post-tested on the recall of four of five cues used to convey the critical elements and C3 produced the highest scores (91.7%) followed by C2 (65.6%) and C1 (7.8%).*

Research on teaching effectiveness has advanced dramatically over the last several decades. In the early 1970s little was known about the teacher and student behaviors associated with student learning (Dunkin & Biddle, 1974) and programs of teacher education were based primarily on the commitments or beliefs of teacher educators rather than empirical research findings. Prompted by the Coleman report (Coleman et al., 1966), educational researchers in the 1970s began examining factors that influenced student achievement in an attempt to reveal teachers' role in the educational process.

As the findings from process-product research emerged, it became apparent across a number of independently conducted studies that certain teacher and student behaviors were consistently

related to student achievement. These findings were eventually synthesized and presented as models of direct instruction (Anderson, Evertson, & Brophy, 1979; Good, Grouws, & Ebmeier, 1983; Rosenshine & Stevens, 1986). Though models of direct instruction vary somewhat, at the core of these models are similar principles of effective teaching. The key elements of models of direct instruction include: a) reviews to check student understanding of past learning, b) an anticipatory set to obtain student attention, state the objective and purpose of the lesson, and relate prior knowledge of the topic to new knowledge, c) the clear presentation of new material including examples, cues, illustrations, demonstrations, and strategies such as questioning to check student understanding, d) practice of the new material in such a way that students are accountable, engaged, and successful with the teacher able to supervise and provide feedback, and e) a closure in which the key elements of the lesson are reviewed and final checks for understanding are provided (Housner, 1990).

The development of direct instruction in classroom research prompted physical educators to adopt similar approaches to examining teaching effectiveness. Studies in physical education have deconstructed direct instruction and examined many of the elements independently. For example, early studies focused on student behavior and found that to facilitate student learning it is best to have students practice a simple to complex progression of tasks (French et al., 1991) that enable high levels of engagement in successful practice trials (Buck, Harrison, & Bryce, 1991; Silverman, 1991).

Later investigations focused on the teacher behaviors associated with direct instruction.

Teacher clarity has been investigated, in both general education and physical education, as a critical component of direct instruction (Rink, 1996; Rosenshine & Stevens, 1986). In the area of physical education, Rink and Werner (1989) studied the process of communicating tasks to learners. The components of clear communication include: a) providing a clear idea of lesson objectives and how to accomplish the objectives, b) demonstrating the skill, and c) providing two or three instructional cues that are accurate and of good quality. These elements of communication have been found to relate to student learning (Gusthart, Kelly, & Rink, 1997; Rink & Werner).

Providing verbal or visual instructional cues also has been widely advocated as a critical component of quality instruction (Landin, 1994). Masser (1993) examined the effectiveness of verbal cues in teaching gymnastics skills to children and found that verbal cues resulted in significantly better performance than when students practiced skill without the benefit of instructional cues. With respect to visual cues, teachers typically use demonstrations to provide a visual model of the skill, although pictures, videotapes or other visual models could be used. The number, accuracy, timing, and quality of demonstrations have been identified as critical components of demonstrations. As summarized by Rink (1996):

The use of demonstration is part of a larger issue related to presenting information clearly to learners and is better understood as part of a process of communication . . . the combination of verbal and visual information and the use of verbal rehearsal is most effective when the objective is to give the learner a clear idea of how to perform a motor task (p. 185).

Checking students' understanding (CFU) is another element of clearly communicating tasks to students. After lesson material has been clearly presented, having students demonstrate skills, answer questions, or chorally respond by showing a thumbs-up if they understand are ways of

checking to make sure that students understand the presented material. Unfortunately, studies have not been conducted to examine the contribution that checking for understanding makes to student achievement. Whether performed during the introduction of a lesson or as part of the teacher's interaction with students during practice, specific investigations on the effectiveness of various CFU strategies need to be conducted.

An element of direct instruction that occurs during interactive teaching is feedback. Like CFU strategies, support for the efficacy of feedback as a component of quality instruction has been elusive (Rink, 1996). Graber (2001) suggests this may be due, in part, to the unique environmental and instructional factors related to teaching gross motor skills. Part of the complexity in this area of research can be contributed to inconsistent focal points across research studies, such as to whom feedback is addressed, the quality of feedback, how equitably feedback is provided, and researchers' ability to control for student attention. Findings on the role of feedback in student learning make this instructional component an anomaly requiring additional examination. As Graber noted, regardless of the conflicting findings in the area of feedback, a few findings remain secure: a) teachers possessing more subject matter knowledge provide more content-related feedback, b) coaching specialists are better diagnosticians and provide better feedback than teachers, and c) pre-service teachers can be trained to provide more and higher quality feedback.

The present study extends previous research and investigates whether the presence or absence of specific components of direct instruction are responsible for increased student learning of a basic motor skill. Although there is a body of research examining the benefits of direct instruction, a complete understanding of exactly which component(s) of the model is still missing. For this reason, the present study was designed to examine the often-observed chunks of the direct instruction model associated with teachers of different levels of experience. Novice teachers

can tend to provide students with only verbal instructions (represented in this study by C1). More experienced teachers typically provide demonstrations, critical cues for correct performance and have students practice (represented in this study by C2). Highly experienced teachers, however, provide instruction that includes all of the components in addition to CFU, skill feedback and lesson closure (represented in this study by C3). The authors acknowledge that these conditions are not strictly based on empirical evidence, yet do represent common themes represented in practice.

### Methods

#### *Participants*

Elementary school children ( $N=47$ ) enrolled in kindergarten (male = 7, female = 7), first (male = 8, female = 7) and second (male = 7, female = 11) grade at an elementary lab school affiliated with a large Mid-Atlantic university were selected for participation in the study. One class from each grade was used.

#### *Procedures*

*Motor Skill Assessment.* All children were tested on the standing broad jump prior to and following participation in one of three experimental conditions. Participants performed two trials on a flat mat when prompted to “jump as far as you can.” The longest jump was measured to the nearest one-half inch to represent the product scores. Process scores were collected/measured by two independent observers who analyzed the performances to determine the presence and absence of five critical elements: a) knees deeply bent, b) arms straight back, c) two-foot take-off, d) arms extended forward and above head, and e) two-foot landing. A percentage was calculated based on how many of the five critical elements were exhibited/met during the two trials (i.e., 10 elements total). For example, if a participant exhibited three critical elements of the standing broad jump during both trials, his/her score was

60%. Inter-rater reliability was over 90% for both the pre- and post-tests.

Cognitive scores were measured after instruction to assess knowledge gained from the three experimental conditions. Percentage scores were produced by asking the participants four questions related to the cues given during instruction. Thus, if a participant recalled three cues, his/her score was 75% and a score of 100% represented recall of all four cues. The questions (answers are in parentheses) were;

- 1) When you squat down to jump, you crouch like a \_\_\_\_\_ (frog),
- 2) When you are crouching like a frog, your arms are \_\_\_\_\_ (back),
- 3) When you take off, you take off like \_\_\_\_\_ (a rocket or superman)
- 4) When you land, it is like your feet are \_\_\_\_\_ (stuck in mud).

*Experimental Conditions.* Students participated in one lesson on the standing broad jump during regularly scheduled physical education classes. Students were randomly assigned to each condition based on a stratified randomization procedure. Male and female students from each grade were ranked on pre-test process scores. Once ranked, students from the top, middle, and bottom third were randomly assigned to each of the three conditions so that pre-test scores were similar across conditions, gender, and grade.

The three experimental conditions were: C1) practice-only, C2) demonstration, cueing, and practice, and C3) direct instruction, which included all elements of the first two conditions plus CFU, corrective feedback, and closure. Three different teachers were used to implement the three conditions employed in the present study. Two graduate students with previous teaching experience implemented the practice-only and the demonstration, cueing, and practice conditions. A physical education teacher education (PETE) professor with extensive direct instruction experience implemented the direct instruction condition.

The authors acknowledge the limitation of using different instructors for each condition; however, this was done to ensure that children in the direct instruction condition were taught similarly. Also, due to end-of-year scheduling it was only possible to provide one lesson.

*Instructional Tasks.* Due to the direct relationship between opportunities to respond and actual student learning outcomes (Sweeting & Rink, 1999), the instructional tasks were designed to provide a consistent type and number of jumping opportunities. In each of the three conditions four different jumping tasks derived from Sweeting and Rink were used. Participants performed each task 10 times using the standing broad jump. The tasks were: a) single hurdle jump, b) double hurdle jump, c) number jump, and d) “swamp” jump. The single hurdle was a plastic stick attached to a 6-in. cone placed 18 in. from the starting line. Two plastic sticks, each attached to a 6 in. cone, served as the double hurdle. One hurdle was placed 18 in. from the starting line and the other 12 in. from the first hurdle. The number jump task was comprised of five 9 in. poly-spots numbered 1 through 5 and placed contiguously in a line from the starting line. Together, the numbers were approximately 45 inches in length. The “swamp” jump consisted of laminated swamp animal pictures attached to the floor in a rectangular shape (36 in x 24 in). Task measurements/distances were selected primarily based on the tasks used by Sweeting and Rink, however, slight adjustments were made according to pre-test scores so all students were able to perform all tasks. The gymnasium was divided into three sections with hanging sheets to minimize treatment overlap among conditions.

*Experimental Protocols.* Experimental protocols and scripts for each condition were designed prior to instruction and were monitored by observers who collected descriptive narratives on all activities. This was done to ensure that no deviations from the prescribed protocol occurred. Descriptive narratives and a computer-based observation system were used to collect data on teacher

behavior. Observers noted no deviations from the predesigned treatment protocols. The observational instrument utilized in the study was the West Virginia University Teaching Evaluation System (WVUTES). The instrument was developed to provide a rich, empirical source of information that could inform evaluative judgments made by physical education professionals regarding their subject matter lessons and programs (Hawkins & Wiegand, 1989). The WVUTES system was selected for data collection based on its utility and validity across a wide variety of subject matter activities. For a detailed description of WVUTES see Hawkins and Wiegand (1989).

WVUTES allows an accurate measurement of teaching behaviors during lessons by recording the frequency and duration of teachers’ performances of specific behaviors. This element was included in the study to verify teachers’ adherence to the a priori script. The observers were trained and assessed by one of the instrument’s designers to verify their instrument use proficiency. All observers were trained against a gold standard to achieve inter-rater reliability levels of  $\geq 80\%$ .

The teacher’s role in each condition was unique. As in all three conditions, the C1 teacher followed a scripted presentation to introduce the tasks to students. Demonstrations were not provided and the teacher gave students no feedback or additional instruction during practice opportunities. The teacher simply observed and made sure that the students complete 10 trials for each of the four jumping tasks. Descriptive narratives collected on the teacher implementing this condition confirmed that no instruction took place during student practice.

The C2 teacher demonstrated the standing long jump then provided a scripted verbal explanation of the performance cues (i.e. “crouch like a frog” and “take off like a rocket ship”) followed by a pictorial representation of the preparation, flight and landing phases of the jump. Students were given no feedback or additional instruction during

practice. The C3 teacher provided the same initial scripted presentation as the C2 teacher, but also provided CFU, and feedback during practice opportunities as well as a lesson closure. During student practice, the C3 teacher observed and provided students with individual and group feedback of a general and corrective type.

### *Data Analysis*

Institutional Review Board guidelines were adhered to in the selection of participants, imple-

mentation of conditions, and the collection and analysis of data. The Behavioral Evaluation Strategies and Taxonomies software (Sharpe & Koperwas, 1999) was used in collecting and analyzing the WVUTES data. Process and cognitive measures were analyzed using SPSS (version 11.0).

### **Results**

Data analysis was performed on process and cognitive scores. Means and standard deviations for these data are presented in Table 1.

Table 1

#### *Scores by Condition and Gender*

	Pre	Process Post	Change	Cognitive Post
Total	59.57 (19.33)	73.62 (20.26)	14.04 (20.82)	54.26 (41.48)
C1	61.88 (16.82)	65.00 (19.66)	3.13 (13.02)	7.81 (11.97)
C2	58.13 (20.07)	73.13 (19.57)	15.00 (21.29)	65.63 (34.00)
C3	58.67 (22.00)	83.33 (18.39)	24.67 (22.32)	91.67 (12.20)
Females	57.20 (15.68)	76.80 (19.90)	19.60 (20.51)	52.00 (38.81)
C1	60.00 (10.00)	70.00 (15.00)	10.00 (13.23)	8.33 (12.50)
C2	60.00 (13.09)	77.50 (19.09)	17.50 (22.52)	65.63 (26.52)
C3	51.25 (22.32)	83.75 (22.64)	32.50 (20.53)	87.50 (13.36)
Males	62.27 (22.87)	70.00 (21.38)	7.73 (19.74)	56.82 (45.11)
C1	64.29 (23.70)	58.57 (24.10)	-5.71 (5.34)	7.14 (12.20)
C2	56.25 (26.15)	68.75 (20.31)	12.50 (21.21)	65.63 (42.13)
C3	67.14 (19.76)	82.86 (13.80)	15.71 (22.25)	96.43 (9.45)

Note: Mean (SD). Participants (N=47) were grouped into the following three conditions: C1=practice only (n=16), C2=practice with demonstration and cues (n=16), and C3=direct instruction including elements from other conditions plus CFU, feedback and closure (n=15). Cognitive scores were only measured post-test to avoid cueing participants during pre-testing.

#### *Process Scores*

A stratified random assignment strategy was used to insure that mean pre-test process scores were similar across conditions (C1 = 61.9, C2 =

58.1, C3 = 58.7) across grades ( $K = 58.6$ ,  $1st = 56.7$ ,  $2nd = 62.8$ ), and gender ( $M = 62.3$ ,  $F = 57.2$ ). Since there were no significant grade differences in pre-test process scores, gain scores

were collapsed across grade and analyzed using a 3 (condition) X 2 (gender) ANOVA. Even though there were no pre-test gender differences, gender was utilized as an independent variable due to a “catch up” effect that has been found for girls when learning motor skills (Light et al., 2000; Treanor et al., 1997; Walkwitz, Lee, & Thomas, 1993).

The ANOVA revealed significant main effects for condition ( $F [2, 41] = 5.41, p = .008$ ) and gender ( $F [1, 41] = 5.26, p = .027$ ). Tukey post-hoc tests indicated that gain scores were significantly higher for C3 (24.67%) than for C1 (3.13%) and for females (19.6%) than for males (7.7%). No other main effects or interactions reached significance.

#### *Cognitive Scores*

Since students’ knowledge of cues was assessed using rather transparent questions, cognitive scores were assessed using a post-test only to avoid contaminating students’ knowledge of the critical elements with a pre-test. Knowledge of the critical elements was analyzed using a 3 (condition) x 3 (grade) x 2 (gender) ANOVA. All independent variables were used since it was not possible to collapse across pre-test scores. The only significant finding was a main effect for condition ( $F [2, 29] = 58.61, p < .001$ ). A Tukey post-hoc test indicated that all conditions were significantly different from one another with C3 producing the highest scores (96.67%) followed by C2 (66.63%) and C1 (7.81%).

#### *WVUTES Data*

WVUTES data were not collected on the C1 teacher since he stood aside after introducing the task, serving only to supervise and ensure the participants’ safety. Detailed notes taken by trained observers indicated that no instruction or feedback was provided in C1. Based on WVUTES data, C2 students did not receive any feedback for the encouragement, positive feedback, or corrective feedback categories. A 0.09 rate-per-minute (rpm) of feedback for lesson three was recorded

for a reflexive “good job” statement provided at the end of the lesson when all students had finished the jumping tasks.

Data collected on average rpm for feedback provided across all three lessons for C3 included: encouragement (0.24), positive feedback (4.29), and corrective feedback (2.57). Data revealed similar percentages of time spent in instructional and non-instructional activities during all three lessons for both C2 and C3. The C2 teacher (14.97%) spent half as much time managing his group as the C3 teacher (28.02%). This difference may be due to the C3 teacher’s tendency to provide refining tasks which were preceded by a freeze signal, pausing, and waiting for student attention. Since C2 provided no feedback, less feedback-related management was necessary. Finally, C2 exhibited general observation behavior almost five times (38.65%) longer than C3 (7.91%). Again, since C2 provided no feedback, general observation was the only pedagogical skill available.

#### **Discussion**

The present study showed that when provided with quality instruction, children increase their performance of the critical elements of the standing long jump as well as their knowledge of performance cues. As such, the present findings provide additional support for the efficacy of direct instruction as a means by which to optimize basic skill development. When more components of direct instruction were included in the teaching episodes, greater improvement in students’ performance was observed. There was a linear increase in students’ ability to exhibit the critical elements of the standing broad jump from C1 to C2 to C3. However, the finding that process change scores for C2 and C3 participants were not significantly different supports the value of providing demonstrations and cues during lesson introductions to enhance learner’s skill development, but fails to support the additional contribution of corrective feedback and CFU. However, it should be noted that management was higher in C3 than C2 and

although management behavior was related to obtaining student attention to provide feedback, this still could have attenuated the efficacy of instruction during practice. Another relevant issue concerning process change scores is the relationship between gender and performance. In the present study, young girls' performance of the standing long jump critical elements improved much more than young boys. It is likely that this phenomenon represents the same 'catch-up' effect previously noted in the literature (e.g., Light et al., 2000; Treanor et al., 1997; Walkwitz, Lee, & Thomas, 1993). When provided with quality instruction, young females tend to close the performance gap that has been noted on basic motor skill tests (Nelson, Thomas, & Nelson, 1991; Walkwitz, Lee, & Thomas, 1993).

The difference across conditions for the cognitive measure indicated that participants in all three conditions demonstrated significantly different scores in their recall of performance cues. This linear increase in cognitive scores is likely a function of more complete direct instruction across conditions. The relationship between cognitive recall and process change scores was moderate but significant ( $r = 0.382$ ,  $p = .008$ ). Differences in cognitive recall may be due to: a) thorough CFU after the introductory demonstration, b) the provision of corrective feedback focused exclusively on the performance cues during practice, or c) lesson closure including demonstration and CFU. The value of this finding is twofold; one, the more components of the direct instruction model participants received, the greater their cognitive recall, and two, these findings support Rink's (1996) assertion that "students who practice at a higher level of processing learn more" (p. 177).

It is important to couch these findings with a concern for what works with a full class of 20 or more children. Given the size of the intervention groups (5-6 per treatment, per class), caution must be recommended when interpreting the applicability of these findings to whole-class instructional settings. Since it has been acknowledged

(Hastie & Saunders, 1991; Solmon, Worthy & Carter, 1993; Templin, 1989) that class size impacts both amount of feedback received and opportunities to respond, the present study is but one step in determining whether the presence or absence of specific pedagogical components of direct instruction are responsible for increased student learning of basic motor skills.

It is important that future studies address how to more actively engage learners in large classes to optimally improve basic motor skills. The finding that young learners benefited more from receiving teacher feedback than those receiving no feedback supports the notion that teachers need to improve the provision of feedback, primarily through the provision of refining tasks during instruction. Teachers' ability to refine motor performance rests largely on their mastery of performance cues and skill analysis. In this study the more components of direct instruction learners received, the more gains in knowledge and performance they demonstrated. This supports the value of direct instruction in the provision of quality physical education instruction. Future studies are needed to examine if direct instruction alone is the key, or if as Sweeting and Rink (1999) suggested, instructional interventions employing both direct instruction and an environmental design are needed to optimize student learning at different stages of skill development.

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Drs. Suzan F. Ayers is a faculty member at Western Michigan University; Dr. Lynn D. Housner, Mr. Scott Dietrich, Ha Young Kim, and Mary Pearson are all at West Virginia University; Dr. Rachel Gurvitch is a faculty member at Georgia State University; Dr. Tony Pritchard teaches at the University of South Carolina-Spartanburg; and Mr. Matthew Dell'Orso is on the faculty at Shepherd College.