Visual Analysis of the Overarm Throw and Related Sport Skills: Training and Transfer Effects

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Effects of a visual-discrimination training program on participants’ ability to analyze overarm throwing performances was studied. Also examined was the extent to which transfer occurred in analyzing three related overarm skills (the badminton overhand clear, tennis serve, and volleyball serve) and one unrelated skill (the standing long jump). After the pretest, the training group \( (n = 13) \) was shown the visual-discrimination program. The control group \( (n = 13) \) received no training. The two-way ANOVA, with repeated measures, showed no significant differences between the groups for any skills on the pretest, but statistically significant differences between groups’ posttest scores for all skills, except the standing long jump.

Various research studies have shown the need for training in the qualitative analysis of skills if preservice students are to analyze motor performances successfully. Studies on the qualitative analysis of skills have consistently shown that participants who receive specialized training are significantly more accurate at detecting errors in performance than nontrained counterparts (Bell, 1987; Gangstead & Beveridge, 1984; Halverson, 1987; Harrison, 1973; Kanieneis, 1980; Kniffen, 1986; Morrison & Harrison, 1985; Morrison & Reeve, 1986,1988; Nielsen & Beauchamp, 1992; Walkley & Kelly, 1989; Wilkinson, 1992). Although training improves the individual’s ability to detect errors of performance in motor skills, many questions remain to be addressed.

One such question is whether specialized training can be designed to produce a transfer of learning to detect errors in performance of related skills. Alberto and Troutman (1986) recognize this as stimulus generalization. Wilkinson (1992) found stimulus generalization when, after completing training, participants were able to analyze selected critical performance features on untreated skills that were common to the critical performance features of the treated skills. The participants acquired “the concept of response acceptability for the critical performance feature of ‘staggered stance, knees flexed’ in the forearm pass [instructional] component” (p. 191), which assisted participants in accurately diagnosing errors in two untreated skills, the volleyball overhand pass and the overhand serve. The training promoted transfer of learning by teaching the concept of oppositional stance; the
type of foot placement used in the efficient execution of various sport skills. Without training, participants recognized the concept of oppositional stance and used it in their visual analysis of the overhead pass and overhead serve, skills that also use an oppositional stance.

Because it is important in education to isolate instructional variables that reliably produce generalized changes across behaviors, settings, participants, or a combination of these (Stokes & Baer, 1977) the stimulus generalization found in Wilkinson's (1992) study is worthy of consideration for the design of training programs in the visual analysis of skills. Given the large number of sport activities and motor skills that teachers and coaches are expected to teach proficiently, it would seem time- and cost-effective to consider the plausibility of training for transfer.

Current Models in Qualitative Skill Analysis Training

In contrast to the earlier approaches to teaching qualitative skill analysis that emphasized taxonomies of common performance errors (Higgins, 1970; Vanderbeck, 1977), several qualitative skill analysis training models have been presented more recently in the literature. Where earlier approaches emphasized recognition of errors staged by elite performers, current models provide contrasting examples and nonexamples of authentic performances. Current models emphasize cue acquisition and cue interpretation within one of three approaches. The three basic models that have been proposed are: the general model (Gangstead & Beveridge, 1984), the skill-specific model proposed by Morrison and Reeve (1986), and the pattern-specific model based on kinesiological concepts (Nielsen & Beauchamp, 1992). All models have shown success in producing improvements in participant's ability to analyze errors in motor performances.

The general model proposed and tested by Gangstead and Beveridge (1984) is "organized into common patterns of movement (e.g., overarm, underhand and sidearm patterns; striking patterns; nonsupport and suspension movements; and twisting and rotational movements)" (p. 64). The model directs the observer’s attention "from the 'hub' or slowest moving part of the body during the skill attempt, progressively outward, until final attention is paid to the motion of the extremities, which are often the fastest moving body parts" (p. 63). Gangstead and Beveridge (1984) go on to say,

If observers develop a pattern of looking at the “hub” of the wheel (center of gravity of the body) first, then observe the “spokes” (extremities) and the “rim” (resultant angular movements), their task of analysis would proceed in an orderly, concise, and efficient manner. (p. 63)

The model is considered general in that its framework can be applied to many different types of motor performances. The observer’s attention is focused on the temporal aspects of the performance (preparation, action and follow through), as well as the body segments (path of hub, body weight, trunk action, head action, leg action, arm action, and impact/release). Gangstead and Beveridge's (1984) model also provided an observational tool to analyze movement, with the freedom and flexibility of adjusting the framework to suit the needs of a specific skill observed.

Morrison and Reeve (1986) used the skill-specific model to examine the effect training had on the analysis of related and unrelated skills. In their study, one
A videotape training program in catching, striking, and throwing, and another group was shown a training program in the soccer instep kick. All participants were pretested on their ability to analyze the throw, catch, and strike. Participants who received training in the soccer instep kick were not significantly better in analyzing the throw, strike, or catch at posttest, whereas participants receiving training in the throw, strike, and catch were better in their analysis. It was concluded that skill-specific training is needed if transfer of learning to other skills is to occur.

Morrison and Reeve's (1986) study, however, did not compare the effect that training in one of the general movement patterns (throwing, kicking, striking, catching) had on participants' ability to analyze sport skills based on the same general movement pattern. Their study demonstrated that training in the visual analysis of the throw, strike, and catch had an effect on visually analyzing those skills, but that training in the soccer instep kick, a different general movement pattern, did not generalize to analyzing the throw, strike, and catch. Their study did not test whether visual training in the sidearm striking movement pattern assisted in the visual analysis of sidearm strike-related skills such as baseball batting, the tennis forehand drive, a racquetball passing shot, or other sidearm skills.

Wilkinson (1992) also provided skill-specific training to study participants. A videotape training program was designed to teach participants to analyze three volleyball skills. Although participants were trained on a total of three skills, each intervention phase trained participants to analyze only one skill at a time. The first intervention phase trained participants to analyze the forearm pass only, with the other two skills, the overhead pass and overhead serve, remaining in baseline conditions. A generalization effect, however, was found between the first intervention (the forearm pass) and the skills that remained in baseline condition (the overhead pass and overhead serve) where participants were able to analyze one of the critical components that was common among the three skills: staggered stance, knees flexed. The slight induction effects were due to participants acquiring the concept of response acceptability for "staggered stance, knees flexed," which allowed participants to accurately analyze that critical component prior to the introduction of the interventions that taught participants how to analyze the overhead pass and overhead serve.

Nielsen and Beauchamp (1992) proposed a pattern-specific model based on kinesiological concepts. They studied related and unrelated skills to determine the effect of training in conceptual kinesiology on feedback patterns of undergraduate students. Assuming visual analysis of a skill is a precursor to providing feedback, the intervention consisted of a 12-week unit emphasizing a conceptual approach to visual analysis training. The integration of kinesiological knowledge and mechanical principles for a variety of skills and activities was used to teach the visual analysis of the skills. Novel skills not used during training were also tested. All participants received training, and differences between types of feedback statements (corrective-accurate-specific, corrective-accurate-general, inaccurate-corrective, and descriptive) were compared. A significant improvement for corrective-accurate-specific types of feedback for familiar and novel skills was found. Training did not appear to have an effect on the other types of feedback statements. Although Nielsen and Beauchamp (1992) described changes in the type of feedback statements provided by participants, they did not report the accuracy of the visual analysis of the skills observed. Although it is important to give more specific-skill-related feedback, participants could have learned to be more specific in their feedback statements without having learned to
be more accurate in their analysis of the movement responses in which they were providing the feedback. The accuracy of the analysis and the effect of the intervention on improving the analysis was omitted.

Broer and Zernicke (1979) and Kreighbaum and Barthels (1985) have long viewed the analysis of movement based on the theoretical principle that mechanically efficient performances of motor skills within a general movement pattern share common movement components. Although each motor skill is an adaptation of the general movement pattern and is influenced by the unique constraints that each specific activity demands, the mechanical principles governing each skill are based on mechanics of the general movement pattern. Each skill classified within the general pattern is unique, based on how the body’s segmental movements produce the desired accuracy and speed needed for each skill’s effectiveness. Even though sport-specific skills within a general movement pattern are slightly different in spatial and temporal terms, the basic general motor pattern, and thus the common critical components of the skills are the same. Consequently, it is the general motor pattern and the resulting common critical components of the movement pattern that are the basis for proposing a general movement pattern approach to training in the qualitative analysis of skills.

Although Kreighbaum and Barthels (1985) have claimed that because “the mechanical principles are the same for all skills in which an object is projected for the same mechanical purpose, developing the ability to analyze performances in terms of these principles and to correct mechanical errors is relatively easy” (p. 586), few studies have investigated the accuracy of their claim.

Transfer of Learning

Research that has dealt with transfer of learning has been concerned with an individual’s performance on a task that was not part of an intervention. A traditional method of quantifying transfer was proposed by Murdock (1957), and its use today continues to be supported by Magill (1985) and others. The percentage of transfer is the amount of improvement on the untreated task that could be attributable to the trained task. Where a high percentage is attained, the trained task had a strong influence on the individual’s performance on the untrained task; therefore, a substantial positive transfer of learning took place. The influence of the trained task can facilitate, hinder, or have no effect on the learning of a the new skill. Although several formulas have been proposed to determine intertask transfer, percentage of transfer avoids theoretical problems associated with other proposed formulas (Magill, 1985). Murdock’s (1957) formula for percentage of transfer is reflected in the following formula:

\[
\text{\% transfer} = \frac{\text{experimental group task B} - \text{control group Task B}}{\text{experimental group Task B} + \text{control group Task B}}
\]

Percentage of transfer is calculated by subtracting the control group’s posttest score on the untreated task (Task B) from the experimental group’s posttest mean score (Task B) divided by the total posttest scores achieved by both groups.
The Need for Transfer in Skill Analysis Training

Few training studies (Gangstead & Beveridge, 1984; Nielsen & Beauchamp, 1992) have investigated the use of a general approach in an attempt to produce visual analysis of specific skills. Nielsen and Beauchamp (1992) state, “Unfortunately, physical education teachers must teach a wide variety of physical activities but do not have the opportunity to gain an extensive knowledge base, or analytic expertise, in every activity they are responsible for” (p. 128). Further, what remains is a “practical challenge to provide such analytic training for the number of skills and activities normally found in the physical education program” (Nielsen & Beauchamp, 1992, p. 128).

Magill (1985) stated that all motor skills have common critical components and that the similarity between the components will influence the degree of transfer: “The higher the degree of similarity between the component parts of two skills or two performance situations, the greater the amount of positive transfer that can be expected between them” (p. 338). Although Magill’s discussion is used to describe transfer between performance on similar motor tasks, the theory that conceptual learning in one situation can transfer to another situation is worthy of attention in visual analysis training. The concept of transfer effects relating to mental processes and thinking dates back to Thorndike’s (1914) “identical elements theory.” Magill (1985) states, “This role of the similarity of components between two tasks or performance situations in the transfer of learning has been considered by learning theorists as a primary reason why transfer occurs between two tasks” (p. 338). Therefore, if transfer of learning is to occur, the instructional method used must emphasize the similarity of components between tasks. One instructional methodology is to emphasize the similarity among the critical components of different sport skills that relate to a general movement pattern, such as proposed by Broer and Zernicke (1979) and Kreighbaum and Barthels (1985).

This study analyzed the effects of a visual-discrimination training program on participants’ ability to visually analyze overarm throwing performances. Also examined was the extent to which transfer occurred in visually analyzing three related overarm skills (the badminton overhand clear, tennis serve, and volleyball serve) and one unrelated skill (the standing long jump). Transfer of learning was determined by using the formula proposed by Murdock (1957). All skills, with the exception of the standing long jump, are controlled-force-producing skills executed in an overarm manner and are described by Kreighbaum and Barthels (1985) as overarm-throw-related skills.

Method

Development of the Visual-Discrimination Training Program

The visual-discrimination training program was an instructional videotape. The instruction was based on the procedures used to teach concepts (Merrill & Tennyson, 1977) including (a) definition presentation, (b) expository presentation, (c) attribute isolation, (d) inquisitory practice, and (e) inquisitory test presentation.

I reviewed the technical literature to determine the critical components for the overarm throw to be used in the definition presentation. Six critical components (rotation of shoulders and hips away from target, ball moves downward then upward to a point near the ear, step forward with nonthrowing foot, rotation of hips...
and shoulders toward target, elbow lag, release ball target high) were determined for the overarm throwing pattern. Each critical component was used with the visual illustrations during training and were used to compare the critical components listed by participants on the answer sheet during the pretest and posttest.

After establishing the critical components, videotaped responses of children throwing were selected and sequenced into the expository and attribution phases of the instruction, contrasting examples and nonexamples of each critical component. All examples were presented first. Examples illustrated each critical component. As the visual illustration was displayed, a verbal cue describing each critical component was heard. The contrasting illustrations of nonexamples were then provided. Each nonexample visual illustration also provided a verbal cue that represented the incongruence of the critical component (e.g., child stepped forward with throwing foot, lack of rotation away from target). Two independent observers viewed the instructional videotape and came to a consensus with regard to the accuracy of the examples and nonexamples used in the training.

With the critical components previously established, two observers independently viewed and created an answer key for each critical component for each illustration used in the expository phase using stop action or slow motion when necessary. If disagreement arose, the observers and I studied the illustration in question and came to an agreement about its acceptability and use in training. Two illustrations were thought to be ambiguous by the independent observers and were replaced by two more appropriate illustrations.

Inquisitory practice provided participants with examples and nonexamples of each critical component. Participants viewed the critical components and mentally practiced determining which critical component or components were incorrectly performed during the observation. During the inquisitory practice, illustrations of various performance errors of the throw were shown. Immediately following the practice illustration, a verbal cue prompted the participant by presenting the correct visual analysis of the error. Participants compared their visual analysis with the verbal cue to determine if they were correct. The last portion of the training materials reviewed the illustrations of the six correctly performed critical components.

The inquisitory tests (pretest and posttest) were developed by selecting newly encountered and randomly sequenced instances of three overarm throws, a badminton overhand clear, a volleyball serve, a tennis serve, and a standing long jump. One overarm throw performance was performed correctly, and the other two overarm throw test items had several critical components performed incorrectly. Each of the other skills (overhand badminton clear, tennis serve, volleyball serve, and standing long jump) had at least one of the six critical components incorrectly performed. Once again, the two independent observer’s services were used. They viewed the inquisitory tests and came to a consensus with regard to the presence or absence of the critical components used in the testing materials. The observers independently viewed and completed an answer key by listing each critical component for each skill and then made a visual analysis for each item used on the visual test, using stop action or slow motion when necessary. One critical component for one test item was deemed inaccurate, and the answer key for the visual test was corrected. After revisions, there was 100% agreement between the independent observers and myself with regard to the accuracy and clarity of the inquisitory test items.
Participants and Setting

Twenty-six undergraduate physical education majors enrolled in two performance-based sports skills classes participated in the study. In one class, participants \((n = 13)\) were exposed to the visual-discrimination training program, which was designed to train participants to visually discriminate between correctly performed overarm throwing performances and incorrectly performed overarm throwing performances. No attempt was made to teach the participants how to analyze the throw-related sport skills. In the other class (the control group), participants \((n = 13)\) did not receive training in the visual analysis of skills.

Dependent Variable

The dependent measure was the mean number of correctly analyzed critical components for each skill viewed during the inquisitory tests. In order to make a judgment as to whether each critical component for the skill observed was performed correctly, the participant had to list each critical component correctly on the answer sheet. Although the dependent measure, the mean number of critical components judged correctly through visual analysis, is linked to the participant’s ability to list the critical components, the visual score alone was used as the dependent measure. The maximum score for each test item was 6, one for each correctly analyzed critical component for each skill.

Design

A pretest-posttest control group design was used. Visual training and control group participants \((n = 26)\) were given a pretest on the first day of class to measure their ability to visually analyze performance errors in a total of seven different test items: three different performances of the overarm throw, one performance each of an overhand badminton clear, a tennis serve, an overhand volleyball serve, and a standing long jump. Each test item consisted of showing the participants the same performance three times at normal speed, with a 3-second pause between each performance. Immediately following the viewing of each test item, the participants were given one minute to list on an answer sheet what they thought the six critical components were for the skill observed. After listing each critical component, participants had to judge whether each of the critical components listed were performed correctly. The testing procedure continued until the participants viewed all seven test items. Each participant’s answer sheet was compared to the answer key to determine if the participant had listed the correct critical component and, if so, to determine if the participant made the correct analysis regarding the correctness or incorrectness for each critical component listed. If participants did not list the critical component correctly, then any judgments made as to the correctness of the critical component could not be determined.

On completion of the pretest, participants in the visual training group viewed the 20-minute visual-discrimination training program, which presented front and side views of elementary school children executing the overarm throw with varying levels of skill.

Participants were required to discriminate between correctly and incorrectly performed overarm throw responses based upon my selection of a wide variety of acceptable and unacceptable illustrated performances. Some illustrations had only one critical component performed incorrectly, whereas others had combinations of
incorrectly performed critical components. All illustrations in the visual-discrimination training program were shown in slow motion and at normal speed. Test items were not included as illustrations in the training program. The control group ($n = 13$) did not receive any training.

On the following class day, both groups were given the posttest. The posttest consisted of a sufficient number and variety of randomly sequenced, newly encountered instances of the overarm throw and throw-related skills to allow a reliable and valid inference as to whether the instructional materials were sufficient in teaching the participants to discriminate between correctly and incorrectly performed critical components.

Reliability of the Dependent Measure

The final phase of the study required an independent observer to check my marking of each participant's answer sheet. With the accuracy of the answer key previously established by independent observers, an additional check was made to determine if the answer key was used accurately in assessing the participant’s performance on the visual test. The overall agreement between myself and the independent observer was 100%.

Data Analysis

Each skill’s score was analyzed using a two-factor repeated measures analysis of variance (Group $\times$ Test). There were two levels of the group factor (visual training and control) and two levels of the test factor (pretest and posttest). When significant interaction effects resulted, a one-way analysis of variance was calculated to determine simple effects.

Results

The purpose of this study was to determine if significant differences existed between the visual training group and the control group with respect to analyzing visually each of the five skills under investigation. The secondary purpose was to determine to what extent transfer of learning occurred on the four untreated skills. Means and standard deviations for the visual training and control groups on all five skills are presented in Table 1. Differences between the visual training group and control group are presented in Figure 1.

Overarm Throw

The two-way ANOVA calculated for the overarm throw revealed a significant group, $F(1, 24) = 161.185$, $p < .001$; test, $F(1, 24) = 132.675$, $p < .001$; and Group $\times$ Test interaction effect, $F(1, 24) = 118.811$, $p < .001$. Collapsed over test, the visual training group ($M = 3.12$) scored higher than the control group ($M = 0.74$). Collapsed over group, the posttest test score ($M = 2.89$) was significantly higher than the pretest test score ($M = 0.97$). The interaction of Group $\times$ Test revealed that the visual training group scored higher on the posttest than the pretest and also scored higher ($M = 4.974$) than the control group ($M = 0.795$) on the posttest. No significant difference was revealed between pretest and posttest for the control group.
Table 1  Pretest and Posttest Means and Standard Deviations for Visual Training and Control Groups

<table>
<thead>
<tr>
<th>Skill</th>
<th>Visual group</th>
<th>Control group</th>
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<tr>
<td></td>
<td>Pretest</td>
<td>Posttest</td>
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<tr>
<td>Overarm throw</td>
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<tr>
<td>Pretest</td>
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<tr>
<td>Posttest</td>
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<td>0.795</td>
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<tr>
<td>Badminton overhand clear</td>
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<tr>
<td>Pretest</td>
<td>0.231</td>
<td>0.308</td>
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<tr>
<td>Posttest</td>
<td>4.538*</td>
<td>0.154</td>
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<tr>
<td>Tennis serve</td>
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<tr>
<td>Pretest</td>
<td>0.308</td>
<td>0.385</td>
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<tr>
<td>Posttest</td>
<td>4.385*</td>
<td>0.462</td>
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<tr>
<td>Overhead volleyball serve</td>
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<tr>
<td>Pretest</td>
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<tr>
<td>Posttest</td>
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<td>0.692</td>
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<tr>
<td>Standing long jump</td>
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<tr>
<td>Pretest</td>
<td>0.308</td>
<td>0.308</td>
</tr>
<tr>
<td>Posttest</td>
<td>0.462</td>
<td>0.385</td>
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*Significant (*p < .001*) pretest to posttest improvement.

Figure 1 — Pretest and posttest mean scores for each group for each skill.
**Overhand Badminton Clear**

The two-way ANOVA calculated for the overhand badminton clear revealed a significant group, $F(1, 24) = 105.117, p < .001$; test, $F(1, 24) = 163.514, p < .001$; and Group x Test interaction effect, $F(1, 24) = 188.636, p < .001$.Collapsed over test, the visual training group ($M = 2.39$) scored higher than the control group ($M = 0.23$). Collapsed over group, the posttest score ($M = 2.35$) was significantly higher than the pretest score ($M = 0.27$). The interaction of Group x Test revealed that the visual training group scored higher on the posttest than the pretest and also scored higher ($M = 4.538$) than the control group ($M = 0.154$) on the posttest. No significant difference was revealed between pretest and posttest for the control group.

**Tennis Serve**

The two-way ANOVA calculated for the tennis serve revealed a significant group, $F(1, 24) = 75.758, p < .001$; test, $F(1, 24) = 194.400, p < .001$; and an interaction of Group x Test, $F(1, 24) = 180.267, p < .001$. Collapsed over test, the visual training group ($M = 2.37$) scored higher than the control group ($M = 0.42$). Collapsed over group, the posttest score ($M = 2.42$) was significantly higher than the pretest score ($M = 0.35$). The interaction of Group x Test revealed that the visual training group scored higher on the posttest than the pretest and also scored higher ($M = 4.385$) than the control group ($M = 0.462$) on the posttest. No significant difference was revealed between pretest and posttest for the control group.

**Overhand Volleyball Serve**

The two-way ANOVA calculated for the overhand volleyball serve revealed a significant group, $F(1, 24) = 42.850, p < .001$; test, $F(1, 24) = 50.081, p < .001$; and Group x Test interaction effect, $F(1, 24) = 44.948, p < .001$. Collapsed over test, the visual training group ($M = 2.27$) scored higher than the control group ($M = 0.65$). Collapsed over group, the posttest score ($M = 2.19$) was significantly higher than the pretest score ($M = 0.73$). The interaction of Group x Test revealed that the visual training group scored higher on the posttest than the pretest and also scored higher ($M = 3.692$) than the control group ($M = 0.692$) on the posttest. No significant difference was revealed between pretest and posttest for the control group.

**Standing Long Jump**

No significant effects were found for the standing long jump.

**Simple Effects**

The simple effect one-way ANOVAs calculated for each skill revealed that the groups’ mean pretest scores for each skill were not significantly different. The low mean pretest scores indicate all participants were unable to analyze visually any of the skills at the pretest and would not be prepared to accurately analyze common performance errors of the skills. The one-way ANOVA revealed significant differences ($p < .05$), however, between the groups’ mean posttest scores for each throw-related skill, with the visual training group achieving higher mean scores than the control group. No significant difference was found between the groups’ mean posttest scores for the standing long jump.
Transfer Effects

Using the formula suggested by Murdock (1957), there was a positive transfer of learning for the trained group for the overhand clear (93.4%), tennis serve (80.9%), and the volleyball serve (69.5%). Percentage of transfer for the jump was only 9%. Although the transfer for the standing long jump was positive, the transfer was weak.

Discussion

The results of this study support the findings of other researchers who have completed research on various methods for improving undergraduates' visual analysis of motor skills (Bell, 1987; Gangstead & Beveridge, 1984; Halverson, 1987; Harrison, 1973; Kamesneski, 1980; Kniffen, 1986; Morrison & Harrison, 1985; Morrison & Reeve, 1986, 1988; Nielsen & Beauchamp, 1992; Walkley & Kelly, 1989; Wilkinson, 1992). In all instances tested, except the standing long jump, the visual training group was significantly more accurate in analyzing performances of the overarm throw, as well as the throw-related skills, compared to the control group. As in previous studies, participants were virtually unable to recognize even the most obvious errors in performances of the overarm throw, overhand badminton clear, tennis serve, overhand volleyball serve, or standing long jump prior to training.

In addition, and more important, this study demonstrated that no significant differences existed for the posttest between groups for the unrelated skill, the standing long jump. All participants, regardless of their training, remained unable to analyze errors in the performance of a standing long jump. This finding has important implications for the planning of future training programs and provides support for the notion that skill-specific intervention techniques can be extended to a general movement approach that emphasizes the common critical components of skill-related movements.

This study demonstrated that the instructional methodology provided in the training can be conceptual and still produce effective results. Although different from the conceptual framework and instructional methodology used by Nielsen and Beauchamp (1992) or Gangstead and Beveridge (1984), this study demonstrated the effectiveness of yet another generic type of movement-analysis training program.

A lack of statistically significant differences between the groups’ posttest mean scores for the standing long jump, the one skill used in this study unrelated to the throw, demonstrated two important points. First, without training, the control group did not make significant improvements in the visual analysis of the standing long jump. This finding has been supported by all the studies previously reported that have investigated various instructional methodologies in the training of the visual analysis of skills. Second, the training generalizes to unrelated skills only if the instructional materials in the training program depict similarities between the common critical components of the related skills to the general movement pattern. Even though the visual-training group received instruction in how to analyze the overarm throw and improved their visual analysis of the overarm throw and throw-related skills over that of the control group participants, the visual-training group did not improve in the analysis of the standing long jump. The standing long
jump and throw-related skills have a different movement pattern and, thus, different critical components. This study has shown that training must be related to a general movement pattern associated with the specific sport skill, not skill specific, as thought previously by some researchers. Qualitative analysis of skills is not a generic ability of physical education majors (Locke, 1972), and any substantial transfer of learning that does occur is due to the similarities the skills have to the critical components of the general movement pattern.

This study was an initial attempt to find a time-efficient way of incorporating qualitative skill analysis training programs into the professional development of physical educators. The weak transfer associated with the visual analysis of the standing long jump suggests that learning to analyze the overarm throw and its critical components does not promote an accurate visual analysis of skills unrelated to the general movement pattern of the overarm throw. The low percentage of transfer for the standing long jump may be a function of readiness to observe, but this “readiness” does not assure an accurate visual analysis of the skill observed. Readiness to observe or “learning how to pay attention” may have accounted for the small increase in scores.

In this study, the dependent measure was the mean score achieved on a visual test: how many of the critical components listed by the participants were correctly analyzed. Given this, the opportunity to make a judgment as to the correctness of a critical component was dependent upon each participant listing each critical component accurately. However, the participants in the control group were not given any training or information whatsoever, not even the knowledge of what critical components were being used in the training program. Since learning to analyze visually is dependent first upon knowing the critical components of the skill being observed, the dependent measure in this study represents a mean score that is linked to the knowledge of the critical components. It was impossible in this study to determine how accurate the control participants might have been if they had been given a list of the critical components prior to taking the posttest. Future studies need to investigate the extent to which the visual analysis of sport skills can be achieved when a control group receives the list of the critical components only.

In addition, the major weakness of this study was the scoring system used. Participants were given two choices for responding to the correctness of the critical components: correct and incorrect. If a participant learned the critical components of the throw and listed each one correctly on the answer sheet, then the participant would have a 50% chance of achieving the correct answer without correctly analyzing the response. Participants in the visual group, however, had slightly higher than 50% accuracy on the posttest in the analysis of the overarm throw (83%), the badminton overhead clear (76%), the tennis serve (73%), and the overhand volleyball serve (62%). Future studies need to consider other methods of analyzing/scoring that will reduce the possibility of guessing.

Although this study was an initial attempt to find a more time-efficient way of producing improvement across untreated skills, additional studies using other general movement patterns (e.g., balance-related activities, sidearm-related activities, underarm related-activities, kicking-related activities) must be completed to further test the proposition that learning to visually analyze specific sport skills can be based on learning to analyze the common critical components of the general movement pattern to which they belong.
References


