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# EFFECTS OF INTERACTIVE, COMPUTER-BASED, CD-ROM INSTRUCTION ON IMPROVING PSYCHOMOTOR SKILL ANALYSIS ABILITY OF SOCCER SKILLS

by

Kemal Makasci

A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Doctor of Philosophy

Major: Administration, Curriculum & Instruction

(Physical Education and Teacher Education)

Under the Supervision of Professors Charles J. Ansorge and Richard J. Schmidt

Lincoln, Nebraska

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GRADUATE COLLEGE
UNIVERSITY OF NEBRASKA

# EFFECTS OF INTERACTIVE, COMPUTER-BASED, CD-ROM INSTRUCTION ON IMPROVING PSYCHOMOTOR SKILL ANALYSIS OF SOCCER SKILLS

Kemal Makasci, Ph.D.

University of Nebraska, 2000

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The purpose of this study was to examine the effectiveness of interactive, computer-based, CD-ROM instruction on improving the accuracy of qualitatively analyzing the following selected soccer skills: (a) thigh control, (b) shooting the ball with instep of the foot, and (c) heading the ball with a two-footed take-off in the air. Inexperienced subjects were 40 males and females between 19 and 40 years of age who had no previous soccer experience. They were randomly assigned to either a Conventional Group (n = 20) or an Experiment Group (n = 20). A 2 x 2 x 2 (Method x Time x Group) repeated measure ANOVA was used to analyze the data. The dependent variables were the scores on the number of correctly described and/or recalled verbal descriptions of each critical element for each of the three soccer skills, and the number of correctly analyzed visual discriminations for the critical elements during a pretest and posttest period for each of the three soccer skills. The intervention phase of the study was a CD-ROM training program for the Experiment Group; a two-week traditional instructional program was completed by subjects in the Conventional Group. The CD-ROM instruction included verbal description and visual discrimination tasks. Real-time speed motion, slow motion, and stop action of six critical elements and five major common errors for the three soccer skills from a variety of performances (inexperienced,

intermediate, and experienced) were presented on a computer. Traditional instruction included a listing of biomechanical principles presented to subjects. Results indicated that the CD-ROM training was more effective than traditional instruction on both the verbal description task and the visual discrimination task. The two training instructions were effective on the verbal description task, but CD-ROM instruction was significantly ($p < .05$) better than traditional instruction. No significant improvement on the visual discrimination task was found after receiving the traditional instruction while CD-ROM instruction was significantly improved in qualitatively analyzing the three soccer skills for the Experiment Group.

For my Mother and Father

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## INTRODUCTION

Qualitative analysis of a psychomotor sport skill is defined as "the systematic observation and introspective judgment of the quality of human movement for the purpose of providing the most appropriate intervention to improve performance" (Knudson & Morrison, 1996, p. 31). The need to develop and examine a training procedure integrating technological products such as video and computer in a laboratory setting is the focus of this study that examines the effective analysis of soccer skills.

The investigation of qualitative sport skill analysis is important to the field of physical education teacher effectiveness and coaching effectiveness because visual information is indispensable in psychomotor skill analysis and the learning task (Chou, 1990). Learning requires visually attending to improve competencies that are significant and necessary elements during the teaching process since the learner must see a modeling of the performance skill to recognize and imitate the movement. Visual attention needs the response prompts in analyzing the performance movement to increase the probability of the correct response that will be performed in the presence of the natural stimulus discrimination. When the response is not performed in the presence of the new stimuli between stimulus classes, stimulus discrimination occurs by providing the ability to accurately identify, analyze and judge incorrect movement skill for the teacher or the coach. Since stimulus discrimination is a relatively precise degree of control, it is a fundamental procedure for teaching a concept (Cooper, Heron & Heward, 1987). Therefore, the teacher or the coach needs to observe and visually analyze the performer's movement skill to make a judgment about the learner's performance problems.

The major problem in visually analyzing psychomotor skills is that visually recognizing the major goal of the psychomotor skill is essential while visually discriminating whether the critical elements are performed correctly or incorrectly is important prior to intervention (Hoffman, 1974; 1977a; 1977b; 1983). However, the integration of the technological products such as camera, video, and/or computer provides important visual information from a different viewpoint of the movement skill in teaching and coaching. Knudson and Kluka (1997) declared that the analyst's visual capacity, without the aid of these technological abilities, cannot accurately observe and collect sufficient data of fast movements. Similarly, Knudson (2000) stated that the analyst should use slow motion and stop action to gather information on a movement skill. These technological products allow the teacher or the coach to determine the errors for each critical element of the movement skill. One of the most important concepts in teaching is that stimulus discrimination can be enhanced throughout the context of qualitatively analyzing psychomotor sport skills. Furthermore, training in physical education does not develop the analytical skills needed to analyze learner's movement skills (Biscan & Hoffman, 1976).

It is important to perceive how utilization of electronic learning materials differs and how it affects the quality of learning visual literacy to improve the ability to qualitatively analyze sport skills. If the analyst is trained to see strengths and weaknesses for each skill performance in the laboratory setting, the given instruction may positively affect the analyst's visual ability to qualitatively analyze soccer skills in a live setting so that the effective augmented feedback can be provided for the player to achieve

successful performance movement by the teacher or the coach. Furthermore, experience in performing, teaching, and coaching a psychomotor skill has been indicated to improve a subject's ability to accurately analyze sport skills (Beveridge & Gangstead, 1988; Biscan & Hoffman, 1976; Drummond, 1987; Wilkinson, 1986). Hence, this study will examine the effectiveness of interactive, computer-based, CD-ROM instruction on improving the ability to qualitatively analyze the critical elements of selected psychomotor skills in soccer.

## Statement of Problem

Skill analysis is a process used to systematically observe, analyze, evaluate, diagnose and intervene in a psychomotor skill or a movement performance (Hoffman, 1977b). This systematic process includes "identifying discrepancies between actual and desired response characteristics" (Hoffman, 1977b, p. 46).

Psychomotor skill analysis is an important prescriptive assessment in physical education and sports to determine what and/or how functional variables influence the performer's ability to perform psychomotor skills (Hoffman, 1977b). The functional variables describe the biomechanical and anatomical knowledge base for the performed movement skill by looking at what conditions cause either correct or incorrect body movement. Hoffman (1977b) emphasized that the knowledge of mechanical principles is not necessarily enough to identify the differences between correct and incorrect critical elements of the movement skill. Therefore, most teachers or coaches would recognize that defects of visual ability and/or visual deficits might impede the skill analysis process in the physical education and sport setting. These may include visual discrimination

difficulties, visual memory disorders, poor eye-hand coordination, and a slow rate of perception. When these visual problems exist, learning may be incomplete; inaccurate, or may not occur at all. Because determining the quality of a performer's movement skill is a critical component of the teaching and learning process, skill analysis is an important analytical process that is an individualized ability that depends on the cognitive and knowledge base (Beveridge & Gangstead, 1988; Biscan & Hoffman, 1976; Drummond, 1987; Leis, 1994, Wilkinson, 1986).

Training individual skill analysis abilities has been investigated by focusing on the following major methods: observation training, visual discrimination training, and diagnostic training by providing feedback during the intervention. The following studies examined these methods in physical education and sport.

Beveridge and Gangstead (1984) emphasized the substantial advantage of sequentially observing and analyzing movement skills by focusing on the temporal aspects (phases of the movement) and spatial aspects (movement of the body segments) for the critical elements. These two observation aspects in qualitative analysis of the movement skill are categorized to analyze the critical elements in relation to body segments. First, preparation, execution, and follow-through are the phases of the movement skill. Second, the specific focus of the body segments and/or body components can be classified from the larger and slower to the smaller and faster body parts. This method was designed by the Utah Skills Analysis Test (USKAT) which included two parts: the perceptual test (visual memory of performance) and the knowledge test (diagnosis of correct critical elements) (Beveridge & Gangstead, 1984;

1988). These studies provided videotape illustrations for correct and incorrect performances of selected sport skills from sagittal and frontal views.

Harper (1994) developed a method to improve the ability to qualitatively observe and analyze the standing long jump using a video medium and in a live setting. The method included a visual content instruction that was composed of two parts for the experiment group. First, computer-directed videodisc (CDV) instruction consisted of an IBM PS/2 50Z, Pioneer LD-8000 videodisc player, and an IBM Infowindow Display Unit. The special interactive instruction, including positive feedback, was introduced by employing help courses with performance points (giving a test while presenting critical elements in real time speed from a perpendicular side view), a practice section (giving the jumping performance checklist for critical elements while controlling jumping performance view at any speed, frame by frame, slow motion, real time, or fast forward), and a verification section (completing the checklist at 87.5% success from two executions of standing long jump for eight critical elements on each checklist). Second, a teacher-directed videodisc instruction (TDV), including positive feedback, was presented which was similar to the CDV methodology. Also, the control group received a posttest to analyze long jump performances in the video and live environment only. Harper (1994) concluded that the teacher-directed videodisc instruction and the computer-directed videodisc instruction were significantly better ($p < .0001$) than the control group in a video medium to analyze the long jump performances. The results also indicated that the teacher-directed videodisc instruction was significantly better than the computer-directed

videodisc instruction in a live setting, but no significant difference was found between the computer-directed videodisc instruction and the control group.

Visual discrimination training has focused on visually recognizing and distinguishing the correct and incorrect critical elements of the performed motor skill (Biscan & Hoffman, 1976). As an example, the visual ability to analyze sport skills (not generic ability) has been related to the visual literacy learning skills used by individuals (Morrison & Reeve, 1993). To optimize learning visual analysis of sport skills depends on the individualized capacity of nonverbal sensory information that is enhanced by the knowledge of biomechanical and kinesiological principles, knowledge of skill components, and the ability to visualize a correct mental picture in a live setting and laboratory setting (Morrison & Reeve, 1993).

Kniffin's (1985) individualized videotape training methodology study employed the use of the Panasonic VHS color videotape camera and videotape. The training videotapes presented two major analyzing tasks at normal speed, slow motion and stop action while viewing selected closed sport skills. The analyzing tasks consisted of verbal identification while identifying correct and incorrect critical elements focusing on the most common errors and employing cue words and visual discrimination that identified the presence and/or absence of critical elements. During the stop action the portion of the video segment, a clear overlay was placed on the screen and lines were drawn on the body's appendages to determine degrees of flexion or extension in the sagittal plane for three of the five critical elements (visual inspection). Another feature of the training program was the presentation of scene-by-scene still images of the standing long jump on

a storyboard presented on 3-inch x 5-inch index cards. Kniffin (1985) concluded that the ability of verbal identification (correct and incorrect critical elements) and visual discrimination (presence and/or absence of critical elements) in physical education was improved by using individualized videotape training that included slow motion and stop action analysis.

Halverson (1987) replicated Kniffin's (1985) video instruction to examine the effects of peer tutoring on the ability to analyze sport skill. Halverson (1987) concluded there was a positive relationship between the ability to verbally identify the critical elements of a sport skill and to visually discriminate as to whether they were performed correctly or incorrectly. Hence, peer tutoring improved the ability of subjects to analyze the six critical elements for each sport skill not only on the videotape but also in a live setting.

Diagnostic training has been focused on the process of accurately understanding and identifying or discriminating the discrepancy between correct and incorrect performance errors (the biomechanical knowledge-base of analyzing body segments to determine the errors of the movement skill rather than directly looking for the cause of the error) of the learner's response (Hoffman 1977b; 1983). In this context, the judgment depends on the quality of observational skill which verbally defines the goal of the movement, critical elements, and common errors that must be corrected by providing feedback to improve the student's or the player's psychomotor skill movement (Morton, 1989; Wilkinson, 1986; 1990; 1991).