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The effects of two training programs on the ability of preservice physical education majors to observe the developmental steps in the overarm throw for force

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THE EFFECTS OF TWO TRAINING PROGRAMS ON THE ABILITY OF PRESERVICE PHYSICAL EDUCATION MAJORS TO OBSERVE THE DEVELOPMENTAL STEPS IN THE OVERARM THROW FOR FORCE

by

Frederick I. Bell

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Approved by

Dissertation Advisor

APPROVAL PAGE

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ABSTRACT

BELL, FREDERICK I. Ed.D. The Effects of Two Training Programs on the Ability of Preservice Physical Education Majors to Observe the Developmental Steps in the Overarm Throw for Force. (1987) Directed by Dr. Kate R. Barrett. Pp. 118.

The purpose of this study was to determine the effect of two training programs on the ability of physcial education majors to observe and identify the developmental steps in the overarm throw for force. Twenty nine physical education majors participated in one of two training groups: a verbal-only group or a verbal-visual group.

Two videotapes were constructed: a training videotape and a test videotape. A pretest-posttest design was utilized with a retention test being administered three weeks after the posttest. Two scores were determined: a motor development observation score and a confidence score. Two nonparametric tests were used to analyse the data: within-group differences were analysed with the Friedman test and between-group differences were analysed with the Mann-Whitney U test. Results indicated that: (a) both groups significantly improved their motor development observation scores from the pretest to the posttest, (b) there were no significant differences between the groups on the posttest, (c) the verbal-visual group scored significantly higher than the verbal-only group on the retention test, (d) there were no significant differences between the posttest and the retention test within the two groups, (e) the feet and the trunk were the easiest components for which to identify the steps of development, and (f) subjects remained very confident in their ability to identify the steps of development in the OTFF throughout this study.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

LIST OF TABLES

Page

CHAPTER I

INTRODUCTION AND SIGNIFICANCE

Physical education teachers encounter a unique problem when they teach. They must base most of their pedagogical decisions upon the information gained from students' movement responses which are available for perception only momentarily. The quality of information gained and the corresponding quality of the teaching decisions are dependent upon the physical education teacher's ability to accurately observe and quickly interpret these movement responses.

For decades, the physical education literature has identified observing as an important skill in effective teaching. Huelster (1939) indicated that the ability to observe others' physical performances was a critical skill for teachers. Recognition of the importance of observation in teaching was reinforced by Kretchmar, Sherman and Mooney (1949) who stated "without being able to see what is being done by an individual...the teacher is helpless in knowing what next to do in his teaching" (p.241). More recently, Imwold and Hoffman(1983) reemphasized this commitment to teaching teachers how to observe when they stated "the ability to accurately observe learner responses as a precursor to corrective feedback stands as one of the most important yet least investigated operations in motor skill instruction" (p. 149).

Traditionally, preservice teachers received their training in analysing motor skills in kinesiology and/or biomechanics courses. Although this training provided important theoretical knowledge relating to the quantitative analysis of motor skills, it provided limited practical knowledge for the qualitative analysis required by teachers in the gymnasium. The advanced technological equipment and analytical methodologies utilized in the biomechanics laboratory fail to assist the physical education teacher who is faced with a gymnasium filled with students and equipment, all of which may be moving at any given instant. For teachers interested in motor skill development, the identification of motor performance within this extremely complex visual array is perceptually very difficult and something for which they are ill prepared. Teacher preparation programs must begin to develop courses which attempt to train preservice teachers in the qualitative analysis of motor skills necessary for effective teaching.

Before such courses can be developed there needs to be sufficient knowledge about what to observe and how to observe movement. Recently, there has been renewed interest in examining the teaching process in light of the perceptual demands placed on the teacher. For example, models of teaching have been developed which include observation as a fundamental pedagogical skill (Bressan & Weiss, 1982; Roberton & Halverson, 1984). Observation has been delineated in a hypothetical model (Barrett, 1983) and has been the focus of a small number of studies which have investigated the role of observation in teaching and in the analysis of motor skills (Allison, 1985; Armstrong & Hoffman, 1979; Bell, Barrett & Allison, 1985; Gangstead, 1982; Kniffen, 1985).

The need to develop teachers' abilities in observing the qualitative changes that occur in movement is also reflected in the recent increase in the use of motor development knowledge to design curriculum for elementary school physical education programs (Graham, Holt/Hale, McEwen, & Parker, 1980; Logsdon, Barrett, Ammons, Broer, Halverson, McGee, & Roberton, 1984; Nichols, 1986). Textbooks have presented a developmental approach to teaching elementary school physical education. They are based on the implicit assumption that teachers have the ability to identify students' current level of motor skill ability which should assist with pedagogical decisions that match student ability levels to optimally challenging content.

If effective teaching in physical education involves the teacher's accurate perception of student movement responses and if teacher preparation programs do not develop this teaching skill, preservice teachers may be unprepared for the tasks which they will encounter in their role as teachers. Skillful teachers have the ability to observe the critical features of a motor skill and can interpret what was seen on the basis of their understanding of movement. The teacher who is unable to see the relevant cues in the performance of a motor skill lacks a fundamental pedagogical skill necessary to guide the acquisition of skillful movement by students. The major responsibility confronting teacher educators is to identify the knowledge and the nature of the experiences necessary to enhance the observation ability of preservice teachers.

Statement of Purpose

The purpose of this study was to determine the effects of two training programs on the ability of physical education majors to observe and identify the developmental steps in the fundamental motor skill of the overarm throw for force (OTFF). Specifically, this study examines the following research questions and hypotheses:

1. Can subjects visually discriminate the developmental steps in the OTFF after intervention training? The hypothesis was that there will be no significant differences between the pretest motor development observation scores and the posttest motor development observation scores within the verbal-only and verbal-visual groups.

2. Is there a difference in the effect of the two training programs on the ability of subjects to visually discriminate the developmental steps in the OTFF? The hypothesis was that there will be no significant differences in posttest motor development observation scores between the verbal-only and verbal-visual groups.

3. What are the effects of intervention training on visual discrimination subsequent to a three-week retention period? The hypotheses were: (a) there will be no significant differences between the posttest motor development observation scores and the retention motor development observation scores within the verbal-only and verbal-visual groups, and (b) there will be no significant differences in retention motor development observation scores between the verbal-only and verbal-visual groups.

4. Are certain components in the OTFF easier to visually discriminate than others after intervention training?

5. How confident are subjects in their ability to discriminate the developmental steps in the OTFF before and after intervention training?

Definition of Terms

The terms used in this study were operationally defined as follows:

1. Component Approach to Motor Development- an orientation to the development of motor skills which acknowledges the development of component parts at different rates within an individual and between individuals (Roberton, 1977).

2. Confidence score- the degree of certainty to which subjects have responded correctly to the motor development observation test items.

3. Criterion of Improvement in Observing- an increase in the accuracy and precision in identifying the developmental steps of the OTFF (Gibson, 1953).

4. Intervention Training Program- a planned sequence of experiences leading to proficiency in specified patterns of stimulus-response relationships (Muler, 1962, p.32). In this study, there are two different training programs: a verbal-only training program that included a verbal explanation of the developmental steps in the five components of the OTFF and a verbal-visual training program that included a verbal explanation and a visual representation of these developmental steps as well as visual practice in observing these steps of development.

5. Motor Development Observation Score- the total number of correct responses on the motor development observation test.

6. Observation-the ability to perceive accurately both the movement

response of the learner and the environment in which the response takes place (Barrett, 1983).

7. Overarm Throw For Force- a fundamental motor skill involving an overarm throw pattern in which maximum distance is desired.

8. Retention Period- the three week period between administering the posttest and the retention test.

Research Assumptions

This study was conducted with knowledge of the following assumptions:

1. The training program includes the salient information for understanding the development of the five components in the OTFF.

2. The student answer sheet is a valid method for determining the physical education majors' ability to observe the development of the OTFF.

3. Physical education majors honestly indicate on the student answer sheet what they see in the student movement responses.

4. Physical education majors honestly indicate the degree of confidence they have in identifying the steps of development in the OTFF.

Scope of the Study

This study must be interpreted with the following boundaries:

1. Subjects in this study were 29 physical education majors enrolled at the University of North Carolina at Greensboro and Appalachian State University at Boone, North Carolina.

2. The approach to motor development adopted for this study was the component approach as outlined by Roberton and Halverson (1984).

3. Data were collected during the spring semester, 1985.

4. The training programs consisted of one hour of instruction with the verbal-only group and two hours of instruction with the verbal-visual group.

5. Instruction in the training programs involved lecture, demonstration and videotape recordings.

CHAPTER II
REVIEW OF LITERATURE

A review of the literature as it relates to observing is examined in this chapter and is organized into four major sections: Gibson's theory of perceptual development, training studies in perceptual development, observing in physical education, and research in observing in physical education.

Gibson's Theory of Perceptual Development

Observing has been identified as a critical pedagogical skill and as a focus for research in physical education for decades. There has been a noticable absence, however, in most of this work in identifying a perceptual theory to assist with the interpretation and study of observing. For the purpose of this study, Gibson's (1969) theory of perceptual development was selected as a theoretical model because of its ability to explain how the concept of observing is examined.

Gibson's theory of perceptual development is based upon differentiation theory. The fundamental assumption in this theory is that stimuli in the environment possess information which is the source of varied perceptions. Gibson (1969) believed it is "the structure in the stimulus that constitutes information about the world" (p. 14). This assumption led to a functional definition of perception as a "process by which we obtain firsthand information about the world around us" (Gibson, 1969, p.3). At any given time, however, an individual is faced with a multitude of stimuli each of which gains its character and structure from the qualitative variability from other stimuli. It is this stimulus variability that causes human beings to organize a visual field in a definite manner.

The way in which an individual processes continuous environmental stimuli into discrete events is what Clement (1978) referred to as perceptual structure. How people process perceptual structure and how changes in perceptual selection occur is still in the formative stages. What is known is that people learn what structure to extract from the visual array. This is the fundamental principle of Gibson's (1969) definition of perceptual learning which she defined as "an increase in the ability to extract information from the environment as a result of experience and practice with stimulation coming from it" (p. 4). This learning process refers to an improvement in the ability of the perceiver to discriminate between the complex stimulus information available. Newtson (1976) described the perceptual learning process in terms of a change in the perceptual strategies adopted by the perceiver. In reoccurring situations, a skilled observer develops a set of predictive features for use in observation which may assist in the selection of the relevant critical features. "Skilled observers may adopt monitoring priorities such that the appearance of a given feature may cause the observer to cease monitoring another...or to be vigilante for other actions" (Newtson, 1976, p. 121).

According to differentiation theory, the criterion for perceptual learning is a response in a discriminating way to a stimulus not responded to previously. This new response to a previously unknown stimulus necessitates a refinement of three perceptual processes: (a) the specificity of response to a stimulus or a set of stimuli with repeated exposure to that stimulus, (b) the ability of the perceiver to identify the properties and patterns of a stimulus not previously responded to, and (c) the detection of the distinctive features relative to the object being perceived (Gibson, 1969).

The increase in specificity of response to a stimulus is a result of the perceiver abstracting the invariant, differentiated properties of that stimulus. Through differentiation, there is reduced generalization and increasing attention to the fine differences along a stimulus dimension (Gibson, 1969). Clement (1978) referred to this process of reducing uncertainty in stimuli as redundancy which he indicated is "related to the ease of encoding, judgements of pattern goodness, labelling of stimuli and discriminability of stimuli" (p. 80).

With this increase in specificity of response there is a corresponding filtering out of irrelevant, randomly varying stimuli. This filtering out process can be explained by the limited processing capacity which exists in most information processing models. Schmidt (1982) proposed a general information processing model which included three stages (a) stimulus identification, (b) response selection, and (c) response programming. This study focused on the first of these stages, namely, the encoding and identification of stimuli in the visual array. During this first stage, many stimuli enter the system for potential processing, however, because of the limited processing capacity within the perceiver, only a few stimuli are encoded and analysed. This is referred to as selective attention.

Early theories of attention identified selective attention as occurring somewhere between the sensory system and the memory system. Attention was limited due to the time and spatial limitations associated with processing information (Broadbend, 1958; Welford, 1960). Because of the extremely complex and dynamic environment in which teachers perform and in light of the information processing limitations, it becomes imperative for teachers to selectively attend to stimuli which provide the most meaningful information for the perceptual task under question. As Newtson (1976) indicated, a skilled observer must "select the least redundant set of critical features for perceptual organization of the event thus ensuring maximal information gain" (p. 120). What individuals attend to and how they perceive events is dependent upon many factors.

Gates (1968) and Matlin (1983) suggested that our attention is directed towards certain stimulus features such as size, color, speed, intensity, similarity and closure. Gates (1968) further suggested that stimuli which are different from the rest of the visual field attract one's attention. Another source which directs our attention is the perceptual task assigned the observer as well as the environment in which the task must be performed (Garner, 1974; Gibson, 1969). Different strategies of perception are utilized depending on whether an individual must discriminate, identify or categorize. Each of these functions may cause different stimulus features to be attended to as may a change in the perceptual environment (Garner, 1974). Intrinsic cognitive motives may also determine which stimuli become the focus of attention (Gibson, 1969). There is an intrinsic need to acquire information from the environment which is directed by peoples' attitudes, values and the culture in which they live.

Another factor affecting what one attends to is the level of perceptual organization (Newtson, 1976). According to Newtson (1976), observers have a range of analysis when monitoring human behavior. This range extends from fine-unit to large-unit analysis. The type of behavior and the environment in which the behavior occurs determine where in this range a person will analyze the observed behavior. Newtson (1976) suggested that the level of perceptual organization can be altered by instruction. Subjects trained to analyse sequences of behavior into small or fine units tended to analyse experimental behaviors into much smaller units than subjects who were trained to analyse in large units.

With refinement of these factors which influence what an individual will attend to, two conclusions are warranted. First, it becomes evident that perception is an active process. The perceiver, through visual search, scanning, selecting and filtering gains information about stimuli. Second, perception is adaptive. Through repeated exposure to a stimulus array, the salient features of that array can be identified which results in order and efficiency. Gibson (1969) summarizes this adaptive process with the identification of three trends in perceptual development. The first trend is an increase in the specificity of discrimination brought about by (a) a decrease in stimulus generalization, (b) a reduction of variability in discrimination, and (c) a reduction in discrimination time. The second trend is an optimization of attention which is characterized by more sustained and more systematic visual exploration. The third trend is an increase in the economy of information pickup and the search for invariance brought about by (a) detection of distinctive features that distinguish objects, (b) knowledge of invariants or the relation that remains constant over change, and (c) processing of larger units of structure.

These trends in perceptual development which explain the adaptive characteristic of perception provide the theoretical base for understanding and interpreting this investigation. They also provide a rationale for conducting studies in perceptual development which focus on training individuals to perceive. The next section of this review summarizes the training studies in perceptual development.

Training Studies in Perceptual Development

Within psychology, perceptual tasks are divided into four major categories each of which require the perceiver to make different judgements: (a) detection tasks which require an indication of the presence or absence of stimulation, (b) discrimination tasks which require an indication of the differences between two or more stimuli presented simultaneously or in immediate succession, (c) recognition tasks which require identification of a stimulus from a larger set of stimuli, and (d) identification tasks which require a unique response for each stimulus presented which necessitates an absolute judgement (Gibson, 1969). The issue which is fundamental to all investigations into perceptual learning is can perception be improved and what are the conditions most favorable for perceptual learning.

Historically, training studies in perceptual development focused on recognition tasks. Prior to World War II the field of psychology was void of theoretically sound procedures for designing training programs for any level of perceptual task. Early instructional efforts remained conjecture at best and were designed to teach military and non military personnel to identify aircraft. Instructors attempted to teach recognition skills by presenting various views of aircraft and requiring trainees to commit the critical features of these aircraft to memory. Hobbs (1947) discovered that certain spatial judgements of Air Force gunners was improved when they received training in a simulator which depicted the flight of target planes. Similar improvements were also found in target distance, depth and speed subsequent to training programs (Biel & Brown, 1949; Gibson, 1953). Allan (1958) examined the Sargent Aircraft Recognition Training System which incorporated individualized learning of the distinctive features of aircraft. Results from this study revealed that trainees who used the Sargent system scored significantly better on a recognition test than trainees who used a more traditional training program.

The Sargent system was one of the first attempts to design a training program which focused on distinctive features rather that on total form which reflected a Gestalt philosophy. Bramely (1973) attempted to determine whether training programs which were based upon distinctive features were superior to total form training programs in the identification of tanks. Four different training programs were developed and compared: (a) method one which involved discriminating the vehicle based upon the features of the whole vehicle, (b) method two which involved discriminating the vehicle based upon distinctive features without the whole vehicle configuration, (c) method three which involved discriminating the vehicle based upon a combination of the whole vehicle, critical features and labels to assist identifying the critical features, and (d) method four which involved discriminating the vehicle based upon the conditions outlined in method three but subjects had to answer questions regarding the details of the vehicle prior to giving their answer. The last training method attempted to ensure that subjects learned what the critical features of the tank were. A sample of inexperienced officers, junior NCO's and infantry recruits were assigned to each of the four training programs. A recognition test was administered 15 minutes after training and a recall test was administered 90 minutes after training. Analysis of the data revealed a significant difference between the recognition test and the recall test. When the training methods were compared Method four proved to be the most effective. The training program which ensured that subjects know the critical features of stimuli appear to result in better discrimination learning than training programs which do not focus on these features or leave this knowledge to chance.

Subsequent to these early training studies Gibson (1969) outlined several principles which should be considered when designing training programs in perception. In a multi-discrimination learning task, learning takes place when the dimensions of difference between stimuli in a given set are discovered. Training programs should also ensure that distinctive features are emphasized. These features are best learned under conditions of graded contrast along certain dimensions. Discrimination is enhanced when feature differences are maximized and highlighted in a stimulus array.

These principles underlying training programs in perception were presented to aid the reader in evaluating the training programs designed in physical education. The next section of this review of literature examines the role of observing in physical education, what people see within our field and how various investigators have attempted to teach preservice physical education teachers to see movement.

The Role of Observing in Physical Education

Although teacher educators have identified observing as a critical pedagogical skill, teacher preparation programs continue to overlook how this skill can be developed in preservice teachers. In this study, observing is defined as "the ability to perceive accurately both the movement response of the learner and the environment in which the response is taking place" (Barrett, 1983, p. 22). This section of the review of literature will examine: (a) observing as a teaching skill (b) observing in the teaching process, and (c) models of observing.

Observing as a Teaching Skill

Effective teachers in physical education make appropriate pedagogical decisions based upon the movement responses of their students. Before these decisions can be made, however, these teachers must be able to accurately observe what motor responses occurred. It is this ability to observe movement that Kretchmar, Sherman and Mooney (1949) indicated was "sufficiently independent of other performance abilities to require special treatment in its own right..." (p. 242). Locke (1972) summarized the fundamental importance of observing in teaching when he stated "at the heart of (pedagogical variables) lies the teacher's ability...to identify critical cues and the key components of movement" (p. 381).

Researchers outside the field of physical education also have recognized observing as an important teaching skill. For example, in child development Irwin and Bushnell (1980) outlined five reasons why observing is important in teaching: (a) to generate ideas, (b) to answer questions, (c) to provide a more realistic picture of behaviors or events, (d) to understand student behavior, and (e) to evaluate student performance. With these five purposes of observing in mind they underline the importance of a teacher's ability to observe by stating "... to be a good observer...can make a critical difference to what you (as a teacher) do. And what you do about what you see can make a critical difference to the child" (Irwin & Bushnell, 1980, p. vii). As applied to physical education this critical difference refers to the teacher's ability to assist with the process of skill development based upon the information gained through observing that child.

Hoffman (1977) stressed that teaching involved delivering accurate feedback to students subsequent to observing their movement responses. He indicated, however, that if a teacher could not observe accurately, the feedback provided to the student would be either too general or false. The realization that observing is a critical teaching skill led Hoffman (1977) to conclude that researchers need to identify the types of training experiences that will contribute to the development of this pedagogical skill and conceptual frameworks that could be used to assist teachers in their observation of student movement responses.

Barrett (1979) emphasized that being a skillful observer necessitates a thorough understanding of movement. She believes that the broader and more thorough one's knowledge of movement is the more successful one will be as an observer. Of critical importance to this knowledge base is an understanding of the concept of critical features as they relate to movement because it is this concept that will direct and limit what is essential to see during the observation process. As Barrett (1981) stated "the way we understand movement must allow us to perceive...it in such a way that the critical features...are the focus of our observation" (p. 5). The question that therefore arises is how does one determine the critical features which will guide the observation process? What is required is a framework for analysing movement which identifies the critical features of the movement under question. For this reason Roberton and Halverson's (1984) developmental model of movement was adopted for this study.

<u>Observing in the Teaching Process</u>

For the purpose of this study, teaching is defined as "the process of professional decision making and the translation of these decisions into actions that make learning more probable, more efficient, more predictable and more economical" (Hunter, 1971. p. 146). All of these decisions require a sound knowledge of movement and an ability to perceive the dynamic events in the learning environment. In light of this definition of teaching, observing has been identified as a fundamental skill in recent models of the teaching process.

Roberton and Halverson (1984) described teaching as a three step process. First, the teacher must observe the movement responses of the students. This involves objectively identifying what the students did. Once this has been done, the teacher must interpret or explain the meaning of what was seen. To do this successfully, the teacher requires a strong knowledge base. From these interpretations the teacher must then decide what to do next. As Barrett (1984) indicated "observing, interpreting and decision-making are interrelated and occur continuously throughout the physical education lesson" (p. 296). This model revealed the fundamental importance of observing in teaching. Without the ability to observe accurately what takes place in the gymnasium, a teacher will be unable to make effective pedagogical decisions.

In a paper outlining a prescriptive theory of instruction Bressan and Weiss (1982) selected observation as central to the process of teaching. In this theory, observation is defined as a "purposeful and systematic search for information about the occurrence of predetermined qualities and/or quantities in student performance" (p. 42). Through observation of student movement responses, a teacher can then identify optimum challenges and teaching behaviors which will enhance the development of student confidence, competence, and persistence in moving. The third process of instruction involved the teacher reflecting on the effectiveness of his/her teaching by comparing what actually occurred in the learning environment to the stated purposes of physical education. In order for steps two and three of this theory of instruction to be successful in developing " movement involvement" of students, teachers must first obtain information about student movement responses through observation.

Hoffman (1982) in a diagnostic prescriptive model of skills teaching outlined a three step process involved in clinical diagnosis. The first step involved observing the learner's response and retaining this information for later comparison with a desired response. The second step involved evaluating the learner's response in light of the discrepancy between the actual and desired response. Obviously the accuracy of the judgement in this phase of the model is dependent upon the accuracy of the observing in the first phase. The last step in this model involved diagnosing the cause of the observed discrepancy. Observing once again is the foundation upon which all other decisions in the teaching process are made.

Models of Observing

In addition to being identified as a critical skill in the process of teaching, researchers in physical education have designed models of observing to assist with the analysis of motor skills and to serve as a heuristic device in promoting further research. Initial work by Cooper, Adrian and Glassow (1972) on an observational model to facilitate the organization of the spatial and temporal components of movement was later refined by Davis and Knight (1977). In this observational model the observer first focuses attention on the temporal phasing components that relate to the preparation, action and follow-through of the motor response. Attention is then focused on the spatial dimensions of the motor response. Davis and Knight (1977) listed various body components starting with the slowest moving component, the trunk, and ending with the fastest moving components involved in the movement. The authors also provide several critical features that can be utilized by the observer at various stages of the model. This model provides a method for systematically observing movement with the intention of identifying performance errors.

McGill (1982) developed a model for observation and analysis of motor skills based upon mental replay. In this model of observation, teachers observe motor responses and retain an image of this response in their mind. This observed motor response is then compared with an ideal performance of the same motor skill through a process McGill (1982) labelled as mental replay. Mental replay was defined as "the ability to watch another's motor performance and then replay what was seen in their mind's eye" (McGill, 1982. p. 1). In order to determine the characteristics of the ideal performance a mental template must be developed. McGill (1982) outlined a seven step process for standardizing the critical features of motor skill mental templates. These critical features then served as the foci for observation and the standard for comparison.

Barrett (1983) hypothesized a model of observing in order to identify its structural components. In her model observing has three components. The first is deciding what to observe which requires the ability to analyse and the ability to identify critical features. As Barrett (1983) stated "deciding specifically what to observe at a given time is a sophisticated idea and should not be underestimated as to its complexity or as to its significance in relation to skillful observing" (p. 25). The second component is planning how to observe. This involves selecting relevant critical features, identifying the most advantageous positions from which to observe these features and deciding how to actually look at these features. The third component is knowing what factors influence the ability to observe. These factors include personal knowledge, the mental state of the observer, the size of the teaching area, the number of students and the type and amount of equipment utilized.

These three components provided the framework for designing this study. The training programs in this study provided the content for deciding what to observe. The observation training methodology combined with the filming techniques employed in capturing the motor responses on film provided some structure and control over how to observe. The decisions to film a single subject in a controlled environment, to use slow motion repetitions of the motor skill, to minimize the responsibilities of the observer while observing, to train in small groups and to allow subjects to observe many repetitions of the motor skill provided some control over the factors which affect one's ability to observe.

Research on Observing in Physical Education

Observing has been used for a number of purposes in teacher education programs. The spectrum of purposes ranges from teacher educators who simply want preservice teachers to see what life in a classroom is like to teacher educators who want observational sessions to develop appropriate pedagogical behaviors. The research which has been conducted on observing in physical education has focused on two levels: a descriptive analysis of observing in physical education and the effects of training programs on observing in physical education.

A Descriptive Analysis of Observing in Physical Education

The descriptive research on observing motor skills has examined three main issues: (a) the entry levels of observing in preservice teachers, (b) the relationship of skill level and observing , and (c) the role of teaching/coaching experience in observing.

Entry levels of observing. Two recent studies have attempted to determine what physical education majors see when observing demonstration lessons. Allison (1985) selected six junior-level physical education majors to observe in a field experience setting demonstration lessons in educational games, gymnastics, and dance. Two introspective research techniques, thinking aloud and stimulated recall, were utilized to determine what the majors observed in these lessons. A constant comparative analytic strategy was used to describe the content of and the perceptual processes adopted by the majors. Results of this study revealed that subjects focused their attention on three categories of behavior: (a) the students' movement responses, (b) the organizational tasks and patterns, and (c) the nonmovement characteristics of the students. Allison (1985) also discovered that the majors relied upon three main perceptual processes which included the use of expectancy set, contrast, and evaluation. Although there appeared to be no relationship between the content of observing and perceptual processes utilized by the majors, Allison (1985) suggested that some rudimentary strategies of observing were evident.

In a similar study of what physical education majors see in a field experience setting, Bell, Barrett, and Allison (1985) categorized the written statements of what 21 majors reported observing in a 15-minute games lesson. An analytic inductive technique for classifying the observations resulted in the formation of18 categories. Analysis of these observations indicated that these majors varied considerably in the actual number of observations recorded as well as in their focus of attention. Subjects made primarily non-evaluative statements about the teacher, but they made primarily evaluative statements about the students. Of particular interest in this study was the extremely low percentage of observation that focused on student movement responses. As Bell, Barrett, and Allison (1985) suggested "if improving students' (motor) skills is a primary objective of physical education teachers, this relatively small number of statements suggests that in early field experiences, students movement responses do not capture the preservice teachers' attention" (p. 88). These two studies revealed that physical education majors differ in what and how they observe physical education lessons. If teacher educators have specific purposes for observing in field experiences they must plan carefully so that attention can be focused on the desired events. Kleine and Periera (1970) emphasized the variability in what individuals see and the importance of guided practice in developing observing skills by stating "what a person sees (or fails to see) when he observes a classroom, is influenced as much by what he brings to the situation as by what actually takes place in the classroom" (p. 484). They go on to add that "it may well be that the experiences which students bring to observation make it difficult or impossible for them to see more than a limited spectrum of classroom events" (p. 484).

Skill level and observing. One of the first studies to examine the relationship between the ability to perform motor skills and the ability to diagnose performance errors in those same skills was conducted by Girardin and Hanson (1967). Thirty-two junior and senior physical education majors completed a knowledge test of the mechanical execution involved in a variety of gymnastics tumbling skills. Subjects were also evaluated on their ability to perform these gymnastics tumbling skills by expert judges. The majors then diagnosed performance errors in these tumbling skills which were performed on film by a demonstrator. Results of this study revealed significant relationships between performance ability and diagnostic ability as well as between knowledge and diagnostic ability. No relationship existed between performance ability and knowledge.

Osborne and Gordon (1972) examined the ability of 90 male college students enrolled in a beginning tennis class to identify correct and incorrect performances in the eastern forehand tennis stroke. The subjects were individually ranked on their ability to perform this tennis stroke. They subsequently viewed one tennis player perform 16 variations of the forehand stroke. Half the subjects evaluated each performance as either correct or incorrect while the other half received feedback subsequent to identifying the performances as correct or incorrect. Osborne and Gordon (1972) found no significant differences between the accuracy of ratings and the skill level of the subjects although they did find that the subjects were more successful in identifying correct performances than incorrect performances.

A third study which investigated the relationship between kinesthetic performance experience and analytic ability was conducted by Armstrong (1976). This study attempted to control the extent of performer experience by utilizing a novel motor skill. Subjects were volunteer physical education faculty and undergraduate physical education majors (n=33). They were assigned to one of three treatment groups. They then viewed six repetitions of the novel skill. Treatment group one practiced 10 repetitions of the skill and 20 repetitions of a similar skill. Treatment group two practiced 30 repetitions of the novel skill. Treatment group three practiced 30 repetitions of a similar skill. After receiving training in discriminating between four component parts of the novel skill, subjects attempted to identify these components in filmed repetitions of this skill. Armstrong (1976) found that kinesthetic experience did not influence analytic ability in this novel skill.

Although Armstrong's (1976) study supported the results of Osborne and Gordon (1972) the conflicting results in these three studies provided limited insight into the relationship between performance ability and observing ability. Research which focused on the role of teaching/coaching experience particularly as it related to mental imagery, however, did reveal some evidence which suggested there is a positive relationship between these two variables.

The role of teaching/coaching experience in observing. Initial studies that examined the role of teaching/coaching experience in observing also focused on mental imagery. The ability to determine performance errors in a motor skill or the ability to ascertain the step of development in a motor skill depends to a large extent on the observer's ability to: (a) understand the criteria which are necessary for the successful completion of the motor skill, and (b) retain this information in the form of a visual model to which the actual motor performance can be compared. Hoffman (1982) suggested that this comparison between the actual motor response and the desired motor response occurred in the evaluative phase of what he labelled analytic proficiency. Whiting (1972) described the ability to retain these internal criteria for the purpose of evaluation as a mental image. The role of mental imagery in observing motor skills was succinctly stated by Biscan and Hoffman (1976) who indicated "...the extent to which teachers can formulate and reproject a vivid image of the criterion response and accurately compare that image with the response under immediate observation, to a large degree, may determine proficiency in analysing skill" (p. 161). The fundamental purpose of training programs in perception can be related to this notion of mental imagery. Training in perception attempts to provide the criteria and opportunities to practice formulating these mental images of motor performances.

Moody (1967) was one of the first physical educators to examine the effects of experience on the ability to formulate mental images. University women who represented differences in experience, interest, and motor skill ability were subjects for this study. They included 14 physical education faculty, 18 senior physical educaton majors, and 19 freshman physical education majors and 26 freshman non-majors. Moody (1967) designed three mental imagery tests. The first test required subjects to recognize geometric images, which had been viewed previously, from among four similarly shaped images presented on 16mm film. The second test required subjects to repeat the procedures from test one with the only difference that a motor skill was substituted for the geometric shape. The third test required subjects to view a motor skill and then answer a series of five questions which related to specific performance details. The four groups showed no significant differences in their abilities on the first two imagery tests. Subjects who represented high levels of experience, interest and ability, however, scored significantly better on the third test which involved remembering the details of motor performance.

Hoffman and Sembiante (1975) conducted a study which attempted to determine the differential effects of formal sport training and coaching experience. They also tested the contribution of mental imagery to analytic proficiency. There were three groups in this study: (a) town recreation baseball and softball coaches who had no formal sport training, (b) physical education teachers who had some formal sport training but no coaching experience, and (c) subjects who had neither formal sport training or experience in athletics. All subjects were male and were tested on the Betts QMI Vividness of Imagery Scale and the Gordon Test of Visual Imagery Control. Analytic proficiency was measured by allowing subjects to view four repetitions of a prototype batting performance. Subsequent batting performances were then compared to this prototype and labelled as similar or different. This identical procedure was then repeated with a novel motor skill. Results of this study indicated that coaches scored significantly higher than teachers and the control group on the analysis of the batting skill, however, no significant differences were found in analytic ability in the novel skill. Significant correlations between analysis scores on both motor skills and the Gordon Imagery Control Test were reported. Hoffman and Sembiante (1975) concluded that the ability to formulate and control a visual image of prototype motor skills may be fundamental to analytic proficiency and that experience with a motor skill may be more important in determining analytic proficiency than formal professional training in physical education.

Differences in levels of experience was the focus for a study by Biscan and Hoffman (1976). Subjects in this study were experienced physical education teachers, undergraduate physical education students enrolled in a biomechanics course and junior high school teachers. All subjects viewed a prototype cartwheel on 16mm film and then were asked to compare ten other cartwheel performances to the prototype. As with the study by Hoffman and Sembiante (1975), a novel motor skill was analysed using identical procedures. Analysis of the data indicated familiarity with motor skills resulted in significantly better analytic ability. The physical education teachers and students were superior to classroom teachers in analytic proficiency with the cartwheel but any differences disappeared when analysing a novel motor skill.

The recognition of games strategy was the focus of a study by Arrighi (1974). In this study, field hockey coaches, club players, and college players viewed game situations on film. During these situations subjects described various aspects of game strategy which included (a) spacial relationships, (b) total offense-defense, (c) situation plays, (d) strategic theory, and (e) skill analysis. Verbal responses to these situations were then analysed and revealed that field hockey coaches described game strategy differently than both club and college players. Arrighi (1974) identified differences in the number of comments relating to spatial relationships and on/off ball play as the game strategies that differentiated coaches from players.

Armstrong and Hoffman (1979) conducted a study to determine whether there was a difference in the ability to detect performance errors in the tennis forehand between experienced and inexperienced tennis teachers. Subjects were assigned to one of four groups. These four groups were differentiated by the presence or absence of pre-response information on the performer's skill level (PCI) and post-response information on the outcome produced by the response (POI). Subjects then viewed 15 performances of the tennis forehand performed by tennis players who reproduced common performance errors. Experienced tennis teachers were significantly better at identifying performance errors than inexperienced tennis teachers. There were no significant differences between the PCI and POI treatment conditions which suggested the presence or absence of performance information did not affect error detection ability. Subsequent to analysing the types of errors committed by the experienced and inexperienced groups Armstrong and Hoffman (1979) discovered that the significantly better error detection scores of the experienced tennis teachers was not due to superior error detection ability but rather to the large frequency of false alarms or identifying an error when none was present committed by the inexperienced tennis teachers.

The effect of performance outcome information on analytic proficiency was also utilized by Skinar and Hoffman (1978). Experienced golf teachers were randomly assigned to two treatment groups: (a) group one received no verbal information concerning the outcome of the golf swing under consideration, and (b) group two received verbal information regarding the flight, direction, and distance of the ball in each golf swing. Subjects viewed six repetitions of three different golf swings at normal speed and responded to questions which focused on the presence or absence of critical body positions in various phases of the swing. Subjects also indicated the degree of confidence they had in their answers on a seven point confidence scale. Results indicated that performance outcome information had no effect on analytic proficiency or the degree of confidence golf teachers had in their answers.

Imwold and Hoffman (1983) compared three groups with different levels of gymnastic teaching experience in their ability to identify different components of the front handspring. Subjects represented (a) experienced gymnastics coaches with an average of eight years coaching experience and four years of competition, (b) elementary and secondary school teachers with an average of five years teaching experience but no formal training in gymnastics, and (c) undergraduate physical education majors with no formal training or competitive experience in gymnastics. Subjects viewed 13 performances for the hand spring on super-8 film and were required to identify a contour drawing which best represented the movement components under question. Imwold and Hoffman (1983) varied the number of components to be identified from one to four. Results indicated that the experienced coaches were significantly more accurate than the physical education teachers and coaches. Interestingly, there was no difference in analytic ability between the teachers and the majors. Although there were no differences in the perceptual strategies adopted by the three groups, the experienced coaches retained a high degree of accuracy on the flight component regardless of the number of components to be identified.

Three studies have examined the effects of experience on visual search strategies. Bard and Fleury (1976) studied the visual search strategies of experienced and inexperienced basketball players. Subjects viewed offensive basketball situations on slides and were required to indicate what they would do in each situation. Choices were passing, dribbling, shooting, or doing nothing. The number and the focus of eye fixations were monitored by an eye movement recorder and revealed that experienced basketball players not only had fewer eye fixations but also focused on different aspects of the game situations. Bard and Fleury (1976) determined that the experienced players focused on the defensive component of the game situation. Inexperienced players did not attend to this aspect of the game.

Bard, Fleury, Carriere, and Halle (1980) examined the visual search strategies of experienced and inexperienced gymnastics judges. The number and the focus of eye fixations were monitored while the judges scored compulsory and optional balance beam routines. Contrary to the Bard and Fleury (1976) study there were no differences in the number of eye fixations between the two groups, however, there were more eye fixations for the optional routines in both groups. The focus of eye fixations was a differentiating factor between the experienced and inexperienced judges which was similar to the Bard and Fleury (1976) study. Experienced gymnastics judges fixated on the upper part of the body while inexperienced judges fixated on the lower part of the body.

Neumaier (1982) continued this line of research with experienced and inexperienced gymnasts who viewed floor exercise routines. Results reinforced the conclusion from the two previous studies. Experienced gymnasts fixated on the central portion of the body whereas inexperienced gymnasts did not appear to concentrate on any one area of the body.

Although Reiken (1982) did not do a comparative study between levels of experience, she examined the characteristics of movement observed by experienced gymnastics coaches. Five women's gymnastics coaches participated in this study. Data were collected by recording the coaches' feedback and thinking aloud statements on videotape and audiotape. A stimulated recall session allowed the coaches to add information regarding the observed performances. Results indicated that these coaches observed (a) spatial qualities of movement rather that temporal or kinetic qualities, (b) the whole body rather that any particular part, and (c) incorrect rather than correct characteristics most frequently. Further analyses of the data indicated that these coaches anticipated the occurrence of certain events, compared observed performances to past performances, and attempted to identify the causes of the observed events. Reiken (1982) also identified the coaches' goals, the experience of the gymnast, and the proximity of a competition as variables that could influence the observations of the coaches.

The results of these studies on the role of teaching/coaching experience in observing enable the following conclusions to be made:

1. Practical experience with motor skills improved analytic proficiency.

2. Experience affected the content of what was seen and the perceptual processes adopted to obtain critical sport skill and games information.

3. Mental image formation was a critical component of successful analysis of sport skills.

4. Performance information prior to or subsequent to motor skill analysis did not affect analytic ability.

5. Experience may affect what characteristics of movement are observed.

The Effects of Training Programs on Observing

Training studies attempted to simplify the learning environment by minimizing the number of individuals to be observed and by selecting skills that were closer to the closed end of Robb's (1972) sport skill continuum. In all the training studies examined in this section of the review, observers were in the role of nonparticipant observers (Barrett, 1977) and usually observed motor skills on film or videotape rather than in live settings. Kniffen's (1985) study is one exception. In addition to viewing videotapes, he required subjects to observe live performances of the motor skills under investigation.

The first training studies in motor skill analysis involved developing films that focused on common performance errors. Homewood (1955) captured common errors in basketball. Mabry (1965) designed a film based on common errors in golf and Higgins (1970) utilized common errors and model performances of skills in volleyball. Unfortunately, these films were never empirically verified to determine their effectiveness in improving observing ability. In addition, these studies utilized skilled performers to demonstrate performance errors which Hoffman (1977) criticized as unrealistic and probably ineffective as a method to train individuals to analyse motor skills.

An early training study which adopted a different research paradigm than the error detection paradigm utilized in most other training studies was conducted by Robinson (1974). In this study, the training program presented the motor skills of running, throwing, and catching in a developmental context rather than as correct/incorrect performances. Robinson (1974) attempted to ascertain the ability of education majors and physical education majors to classify the motor performances of children executing selected gross motor patterns on film. Subjects in this study learned the developmental steps associated with each of three motor skills: running, the forceful overarm throw and catching. Two super 8mm films were developed: a criterion measurement film and an informational film. The test film had 30 trials of each skill with three repetitions of each trial at normal speed. The instructional film utilized a variety of normal and slow speeds. A pretest/posttest design with a control group and two experimental groups was utilized. The treatment occurred two days after the pretest and the posttest for the two experimental groups occurred three days after the treatment. Robinson (1974) concluded that the training program had no significant effect on the ability to identify the developmental steps in these motor skills. There were no significant differences between the two experimental groups on the posttest and no significant differences between the pretest and the posttest for the three groups. She admitted, however, there were several methodological problems in this study which may have affected the results. These problems related to the filming speed utilized to produce the films, the time required to rate the motor skills, the inclusion of side and front or back views of the motor performances, and the use of a jury method to validate the motor performances.

Hoffman and Armstrong (1975) attempted to determine whether training programs that included common performance errors and skilled performances were more effective in improving analytic proficiency than training programs with only skilled performances. Subjects in this study were 86 physical education majors who were enrolled in the freshman through senior years of their professional training program. They were randomly assigned to one of four training programs: (a) the correct only group, in which subjects studied the criteria associated with and observed correct performances of the motor skill, (b) the correct-verbal group, in which subjects were provided with descriptions of the performance criteria and were required to complete a verbal recognition test involving incorrect performance criteria statements, (c) the correct-error group, in which subjects studied the performance criteria, observed correct motor skill performance, and practiced identifying performance errors, and (d) a control group, in which subjects viewed a film of an unrelated sport skill. Subsequent to their training programs, subjects viewed 12 films depicting the standing long jump and were requested to answer questions about the presence or absence of the performance criteria. An ANOVA revealed that the correct-verbal and the correct-error groups scored significantly better than the control group. The correct-error group was significantly better at identifying performance errors than the correct only group. A retention test was administered three weeks after pretraining. Scores remained relatively stable over this interval.

In 1976, Ulrich implemented a training program which presented correct and incorrect images of golf swings on split-screen videotape and slides. The training involved a comparative analysis between correct and incorrect performances as viewed on these two media. Ulrich (1976) designed a five-step process to direct the comparative analysis. Students' attention was guided progressively by a series of questions that focused on (a) perceiving whether there was a difference in the images, (b) detecting what body parts were different, (c) analysing what effect this difference had on the flight of the ball, and (d) correcting the golf swing that was labelled as incorrect. No data were collected to verify the effectiveness of this training program on the analysis of the golf swing.

Craft (1977) developed a model to teach undergraduate physical education majors to observe movement using Rudolf Laban's movement framework. The model was composed of three interrelated elements; the observer, the movement framework and the environment. Three concepts related to the observer: developing an awareness of movement, developing concentration or to hold focus while observing and recognition of personal biases during observing. The movement framework was composed of Laban's four movement aspects: body awareness, space awareness, effort and relationships. There were two phases of the environment. The first phase related to the type of experiences used for observing. These were either simulated experiences on videotape or actual movement experiences. The second phase related to how these experiences were structured. Four different concepts were adopted to structure movement experiences: reduced complexity, additive process, unity, and practice.

The model was examined in a workshop consisting of 10 sessions, each of which was one and a half hours in length and extended over four weeks. Subjects in this study were 10 undergraduate physical education majors. Data were collected using subject logs, an instructor log, audio tapes, application tapes, and an outside evaluator. Analysis of the data revealed that the model was a functional means for developing observational skills in these majors. The model was also successful in affecting the majors' reported attitudes towards observing in physical education. Craft (1977) identified three problems the majors had while participating in her training process: (a) they had difficulty recognizing their personal biases, (b) they lacked an understanding of the importance of observing as a pedagogical skill, and (c) they did not recognize the difference between observing movement and analysing specific sport skills.

Bayless (1981) utilized prototype performances on film to train physical education majors to identify performance errors in the volleyball serve, set, and spike. The training program incorporated two different practice conditions: (a) visual only, and (b) audiovisual. The amount of practice during training varied as well with subjects receiving either one or three exposures to the prototype performances. Results from this study indicated that subjects who received visual only practice with one exposure scored significantly better on the error detection test than subjects in the other training programs.

Morrison (1982) developed an instructional unit to assist preservice and inservice elementary school physical education teachers with the analysis of selected fundamental motor skills. The motor skills selected for this study were throwing, catching and striking. The instructional unit consisted of a videotape which provided correction and teaching cues derived from fundamental movement principles. Criterion tests were developed using groups of children and one child at a time performing the selected motor skills. Subjects for this study were inservice teachers (n=53) and preservice teachers (n=18). They were randomly assigned to either a control or experimental group and were required to identify correct/incorrect performances and correcting performance cues on a criterion test. The test was administered to the experimental group two days after the instructional unit and again to both groups two months later. Multivariate and univariate analyses revealed subjects who viewed the videotape instructional unit scored significantly higher than the control group. There were no changes in the ability of either group to identify correct and incorrect performances from the first posttest to the second posttest.

Gangstead (1982) developed the Utah Skill Analysis Test to assess the analytic, perceptual, and diagnostic proficiencies in physical education majors. Four motor skills were selected for analysis: (a) the overarm throw (b) the standing long jump, (c) the stationary kick, and (d) batting. Subjects were 38 physical education majors who were divided into an experimental group which received 36 hours of training in the analysis of these motor skills and a control group which received no training at all. The training program extended over eight weeks and included visual and verbal practice in the observation and analysis of videotaped and live performances of these sport skills. Within each motor skill, four performances were selected to depict a range of possible errors that were likely to occur. Subjects were tested prior to the training program and again subsequent to the training program. T-tests were conducted between the two groups on the posttest scores of the three dependent variables. The training program resulted in a significant improvement in analytic, perceptual, and diagnostic proficiencies in the experimental group. T-tests were also conducted between pretest and posttest scores within each group and revealed a significant decline in the analytic and perceptual proficiencies within the control group whereas there were significant positive increases in all three dependent measures within the experimental group. Gangstead (1982) concluded that the instructional strategies adopted in this training program were effective in improving the analytic competency of physical education majors.

In the most recent study conducted by Kniffen (1985), an individualized approach to training was designed. A single subject multiple baseline research design was utilized to examine the effect of this instructional strategy on the ability of nine undergraduate physical education majors to verbally and visually analyse four motor skills. Kniffen (1985) selected the standing long jump, the overarm throw, the cartwheel, and batting from a tee as the motor skills to be analysed. Five critical elements were identified from skilled performances of each motor skill. These critical elements became the foci of attention during verbal and visual analyses on the test and training videotapes. The test videotape included 56 performances of the four motor skills. These performances were selected to represent a variety of correct and incorrect critical elements. Subjects were tested a total of six times in a two-week period. A unique component of this study was the testing of subjects' ability to transfer analytic skills acquired in a laboratory setting to a live school setting. Testing in the school setting involved the nine subjects observing individual performances of the four motor skills by sixth grade students. Each grade six student performed the requested skill once and then subjects analysed the performance. Kniffen (1985) videotaped these performances in order to establish reliability. Four ten-minute training videotapes were constructed utilizing skilled performers who exhibited the five critical elements for each motor skill. The training period or intervention phase of the study occurred on the four alternate days during the two-week testing period. Analysis of the baseline data revealed that: (a) verbal and visual analysis was poor in all subjects, (b) there was a significant improvement in verbal recall and visual discrimination subsequent to the training programs, and (c) subjects were able to successfully generalize analytic abilities acquired through individualized videotape instruction to a live school setting. Kniffen (1985) also discovered a positive correlation between verbal analysis and visual discrimination.

This review of training studies in observing motor skills warranted the following conclusions:

1. Perceptual training programs which focus on the critical features of motor skills result in improved qualitative sport skill analysis in laboratory

settings.

2. Perceptual training programs should combine correct or skilled performances with naturally occurring less skilled performances of motor skills.

3. Systematic visual discrimination training programs may result in improved analytic ability of live motor skill performance.

4. The ability to recall the critical features of motor skills may affect the ability to perceptually analyse those motor skills.

CHAPTER III

PROCEDURES

The purpose of this study was to determine the effects of two training programs on the ability of physical education majors to identify the developmental steps in the overarm throw for force. Subjects were randomly assigned to either a verbal-only or a verbal-visual training program. Data were collected prior to the training programs to determine initial observing abilities and twice subsequent to the training programs. This chapter describes the procedures in this study and is presented in three main sections: (a) selection of subjects, (b) videotape construction, and (c) data collection.

Selection of Subjects

The subjects for this study were 29 physical education majors from two universities: (a) the University of North Carolina at Greensboro (n= 6), and (b) Appalachian State University in Boone, North Carolina (n=23). All subjects were in their sophmore or junior year. The one male and five female subjects from UNC-G were enrolled in an introductory course focusing on understanding human movement. The six male and 17 female subjects from ASU were enrolled in a survey course in elementary school physical education.

Prior to volunteering to participate in this study, subjects were informed of the purpose of the study, the amount of time that would be involved, and the general design of the study. Subjects were required to complete an informed consent form and were then randomly assigned to one of two groups: (a) the verbal-only group or (b) the verbal-visual group. Permission to conduct the study was granted by the School of Health, Physical Education, Recreation and Dance's Human Subjects Review committee.

Videotape Construction

For the purpose of this research, two videotapes were constructed: (a) the overarm throw for force training videotape and (b) the overarm throw for force test videotape. Motor performances of the OTFF for the training and test videotapes came for two sources: (a) a 16mm film which captured the OTFF of 49 sixth grade students who attended Price Elementary School in Greensboro, North Carolina, and (b) a training film designed by Roberton and Halverson (1978) entitled The Developmental Steps in Forceful Overarm Throwing.

16mm Filming of Sixth Grade Students

Before constructing the two videotapes, 49 grade six students were filmed while they performed the OTFF. Each student was filmed from the side using a LOCAM model 51 camera with a Cosimicar television lens (12.5 mm lens, 1/3 shutter speed, 1.4 F stop at 100 fps). The camera was placed on a tripod approximately 20 feet from the center and perpendicular to the point of release for the throw. The tripod was vertically adjusted to allow the largest possible image at the point of release. The horizontal adjustment was locked in place to provide viewing of a 15-foot pathway to accommodate the preparatory and follow through phases of the throw.

The day before filming, students were familiarized with the procedures and given instructions about how to perform the motor skill. The instructions related to: (a) the 15-foot throwing area, (b) the zone for releasing the ball, and (c) the use of maximum force in the throw (Wickstrom, 1977). On the day of filming, these procedures and instructions were repeated for each student before individually performing the motor skill.

Establishing the content validity of the film.

The 49 trials of the OTFF were then coded by the investigator who was trained in using the component approach developed by Roberton and Halverson (1984). This approach to understanding how motor skills develop over time identifies for the observer not only the critical features of the OTFF but also provides a qualitative description of how each component changes over time. This approach to motor skill development assumes that the components of a motor skill develop at different rates both within an individual and between individuals. Roberton and Halverson (1984) have identified five components of the OTFF: (a) the feet, (b) the preparatory arm action, (c) the trunk, (d) the upper arm, and (e) the lower arm. Appendix A provides the names and a qualitative description of each step of development for this motor skill.

A Lafayette Film Analyser allowed frame by frame analysis of the 49 trials of the OTFF. Once this coding was completed the 16mm films were sent to Dr. Lolas E. Halverson, Director of the Motor Development and Child Study Center at the University of Wisconsin in Madison. All trials of the OTFF were coded by a trained coder from the center and a random sample of

20 trials were coded by Dr. Halverson. Only trials of the OTFF which had unanimous agreement between the three coders or between the trained coder and the investigator were selected for use in the two videotapes.

Construction of the Training Videotape

The training videotape was designed to visually depict the critical features of each step of development in the five components of the OTFF. The critical features were identified and described by Roberton and Halverson (1984). Longitudinal study of this motor skill has validated the steps of development for the trunk, humerus, and forearm components. The steps of development for the preparatory arm action and the feet are hypothesized.

Training videotape format. Each component of the OTFF on the training videotape was introduced by videotaping a title page which included the name of the component and the steps of development for that component (see Appendix B). This was followed by three repetitions of the exemplar trial of the OTFF for the step of development under question. The second repetition was videotaped in slow motion to allow slow motion analysis of the developmental steps. Following the last step of development for each component, a review page was videotaped. This review page included the name of each step of development for the component under question and a brief description of the critical features for each step of development (see Appendix C). The next section of the training tape outlined the series of decisions in the form of a decision tree that was necessary to identify the step of development for a particular component (see Appendix D). For example, the decision tree for the feet involved making three decisions: (a) whether there was a step taken, (b) if so, which foot was used, and (c) if the contralateral foot was used how long was the step. A similar decision tree was constructed for each of the five components in the OTFF.

The final section for each component on the training videotape was a practice quiz. The quiz was composed of eight different throws depicting the various steps of development for the component under question. Subjects observed five or six repetitions of each throw and then identified the step of development exhibited for that component. A description of the procedures used for the videotaping of these repetitions is included in the section on the test tape construction.

Training videotape construction. To get the exemplar trial transferred from the 16mm film to the videotape, a Motion Picture Data Analyser model 224-A MKVII was positioned approximately three feet from a portable screen. A Newvicon WV3150 video color camera was positioned the same distance and angle from the screen as the data analyser. While the 16mm image of the exemplar trial was projected on the screen, the video camera simultaneously videotaped this image. This procedure was conducted in a blackened room.

For each step of development in the five components of the OTFF the exemplar trial was videotaped three times. The first repetition of the exemplar trial was videotaped with the Motion Picture Data Analyser set at 24 frames per second. This allowed subjects to view the exemplar throw at the normal projection speed. The second repetition was videotaped with the

Motion Picture Data Analyser set at six frames per second to provide a slower motion image of the OTFF. This slower motion image was utilized in the training program to highlight the critical features of each step of development. The final repetition was videotaped with the Motion Picture Data Analyser set at 24 frames per second. This videotaping sequence was repeated for all steps of development in the training videotape.

A total of 13 different students were used for the exemplar trials for all steps of development on the training videotape. Nine trials came from the grade six class and four trials came from the training film by Roberton and Halverson (1978). This meant that two students were used as exemplar trials for two different components and two other students were used for three different components. The latter two students were from the training film and were used to depict the least skillful steps of development in three components. The reason they were utilized was due to the fact that no grade six students exhibited the least skillful steps of development in these three components. An attempt was made to balance the number of male (n=6) and female (n=7) students selected for exemplar trials on the training videotape to prevent any sex stereotyping by the subjects in this study.

With the exception of the two students used to depict the least skillful steps of development, the practice quizzes were composed of completely different trials than those used for the other part of the training tape. Five trials came from the training film and 21 trials came from the grade six class. Of these trials, 10 were male performers and 16 were female performers.

Construction of the Test Videotape

The test videotape was designed to assess the physical education majors' ability to identify the steps of development for the five components in the OTFF.

Testing videotape format. The test videotape was composed of 40 trials of the OTFF. An attempt was made to balance the number of male (n= 8) and female (n=12) subjects. All trials were performances by the grade six students which meant that some of the least skillful steps of development were not examined. Only trials of the OTFF which had unanimous agreement between the three coders or between the investigator and the trained coder were selected for the test videotape. Table 1 summarizes the total number of trials selected for each step of development for the five components on the test videotape.

Each trial on the test videotape related to one component in the OTFF. Subjects were informed of which component was the focus for each trial by viewing the name of the component first.

Table 1

Number of Trials on the Test Videotape for Steps of Development in Components of the OTFF

	Component				
Step	Feet	Upper Arm	Lower Arm	Trunk	Preparation
1	0	3	2	0	0
2	2	2	3	7	3
3	2	3	3	1	3
4	4	-	-	-	2

This was followed by five or six repetitions of the OTFF. The first two repetitions were videotaped with the Motion Picture Data Analyser set at 24 frames per second. The next two or three repetitions were videotaped with the Motion Picture Data Analyser set at six frames per second to provide subjects with slower motion images of the OTFF. The decision regarding the number of slower motion repetitions was based upon the number of decisions required to identify the step of development for the component under consideration (Halverson, 1985). For example, to identify the step of development for the upper arm the following decisions were required:

1. Is the upper arm oblique or aligned at the furthest point in opening up?

2. Is the upper arm lagging or independent at front facing?

Since two decisions were required, this trial would be seen twice at six fps. The other components requiring two repetitions at six fps were the lower arm and the trunk. The feet and the preparatory arm action required three decisions to identify the step of development and therefore required three repetitions at six fps. The last repetition for each component was at 100 fps. This pattern was repeated for all trials on the test videotape.

Test Videotape Construction. To get the exemplar trial transferred from the 16mm film to the test videotape, the procedures utilized in the construction of the training videotape were duplicated. The only exception in these procedures was the number of repetitions of each trial that were videotaped.

A total of 20 grade six students were used in the construction of the test videotape. None of these students appeared on the training videotape. Seven students were used as exemplar trials for one component; eight were used for two components; three were used for three components; two were used for four components. No student was used more than once within a component. An attempt was made to equalize the number of male (n=8) and female (n=12) students to minimize any sex stereotyping in the OTFF.

Data Collection

Data were collected over a period of four weeks. Table 2 summarizes the timetable for collecting the data.

Table 2

Timetable for Collecting Data for the Two Groups

	Group	
Day	Verbal-only	Verbal-visual
1	Pretest	Pretest
2	Training	Training Part 1
3	Posttest	Training Part 2
4		Posttest
25	Retention Test	Retention Test

Pretest Procedures

The pretest was taken in small groups that ranged in size from six to eight subjects. A small classroom served as the test site. Subjects sat in desks that were placed in a semicircle approximately 10 feet from a 25-inch color television monitor. The monitor was raised to a height of five feet to maximize viewing conditions. The researcher sat off to the side of the monitor with a remote control to stop and start the test videotape at appropriate places.

Prior to taking the pretest, subjects were provided with a verbal introduction to the study (See Appendix E). This introduction included: (a) the purpose of the study, (b) a brief overview of the component approach as a method to analyse motor skills, (c) a description of how a component developed in steps from the least skillful step to the most skillful step, and (d) the names and definitions of the five components in the OTFF.

At the start of the pretest, subjects read a set of instructions (see Appendix F) on the first page of their answer booklets. The instructions indicated that there were 40 trials of the OTFF in the test and that each trial would focus on one component of the OTFF. Subjects were directed to observe the five or six repetitions of each trial and were informed that the first two repetitions were videotaped with the Motion Picture Data Analyser set at 24 fps, the next two or three repetitions were videotaped with the analyser set at 6 fps, and the last repetition was at 24 fps. After observing the last trial, subjects were requested to make two decisions. The first decision was to indicate with a checkmark the step of development for the component in question. The steps of development for each component were numbered on a scale from one to three or from one to four depending on the component. Option one always corresponded to the least skillful step of development and option three or four always corresponded to the most skillful step of development. The second decision was to indicate with a checkmark the degree of confidence they had in the answer for the step of development. Options for the degree of confidence were on a scale that ranged from one to five. One corresponded to absolutely uncertain; two corresponded to fairly uncertain; three corresponded to undecided; four corresponded to fairly certain; five corresponded to absolutely certain (see Appendix F).

In order to familiarize the subjects with the format of the test, two example trials were included with the introduction. The first example focused on the feet and subjects viewed six repetitions of this trial and then indicated the step of development for the feet and the degree of confidence they had in this answer. The second trial focused on the upper arm. Subjects viewed five repetitions of this trial and repeated the answering process. Any questions relating to the test format were answered at this time. Subjects were informed that they would have as much time as they required to mark their answers after the last repetition of the trial.

To reduce confusion about which component was the focus of attention, the investigator read the name of the component at the same time it appeared on the television monitor. Following the last repetition of each trial the videotape was stopped until all subjects marked their answers in their answer booklet (see Appendix G). This procedure was repeated for the 40 trials of the OTFF. The pretest required one hour to administer.

Training Procedures

Training for both groups occurred in either the same classroom that was used for the pretest or in a large conference room which had long tables and individual chairs for the subjects. Training was completed in small groups that ranged in size from one to seven subjects. The group size varied due to scheduling problems with the subjects. Before beginning the training programs, subjects were requested not to talk about aspects of the study with anyone until after the final test. They were also requested to concentrate on the information in the training program and encouraged to ask questions if the information was not understood.

Verbal-only training procedures. The verbal-only group participated in a one-hour training program on day two of data collection. The purpose of this training program was to provide subjects with a verbal explanation of the developmental steps in the five components of the OTFF. This explanation was delivered by the investigator in a lecture type format from a prepared text which was followed verbatum. The text consisted of a qualitative description of these steps of development as described by Roberton and Halverson (1984). The names of each component and the corresponding steps of development were displayed on an overhead projector. After the last component of the OTFF was described, subjects reviewed the steps of development for each component. This review was in the form of two overheads. The first overhead outlined (a) the component,

(b) the steps of development for that component, and (c) a qualitative description of each step of development. The second overhead outlined the series of decisions that were required to identify the steps of development for each component. These decisions were in the form of a decision tree. There were no physical demonstrations or audiovisual representation of these steps of development. Subjects were required to sit and listen without moving during the training program and could not take notes. Any questions that subjects had were answered verbally.

Verbal-visual training procedures. The verbal-visual group participated in a two-hour training program. The first hour occurred on day two of data collection and covered three components: (a) the feet, (b) the preparatory arm action, and (c) the trunk. The second hour occurred on day three of data collection and covered two components: (a) the upper arm and (b) the lower arm. The purpose of the training program was to provide: (a) a verbal description of the developmental steps in the five components of the OTFF, (b) a visual representation on these steps of development, and (c) practice in observing these steps of development. The verbal description of the developmental steps came from the identical prepared text used with the verbal-only group. The visual representation of these steps was in the form of the training videotape. Practice in observing these steps occurred during the practice quiz at the end of each component on the training videotape. The training procedure involved seven steps:

1. The name of each step of development was provided on the videotape.

2. The first repetition of the exemplar trial was viewed on the videotape.

3. A verbal description of each step of development was read from the prepared text.

4. A demonstration of the step of development was provided by the investigator.

5. The second repetition of the exemplar trial was viewed in slow motion in order to point out the critical features of the step of development.

6. The third repetition of the expemplar trial was viewed.

7. Any questions were answered.

This procedure was repeated for each of the five components in the OTFF. Subjects in the verbal-visual group were permitted to move in order to experience the feeling of a step of development.

Following the last step of development in each component, subjects reviewed the steps of development in the identical fashion as the verbal-only group. Subjects viewed two overheads that summarized the steps of development for each component and outlined the decisions required to identify the steps of development. These overheads were followed by the practice quiz which provided the subjects with visual practice in identifying the steps of development. The practice quiz included eight trials of the OTFF which were videotaped in the identical format as the test videotape. Subjects viewed each trial and then indicated the step of development on a practice quiz answer sheet (see Appendix H). After the last trial, the investigator provided the correct answers for the eight trials.

if the subjects made any mistakes in identifying the step of development, the trial(s) in which the mistake(s) occurred were replayed until the mistake was clarified.

Posttest Procedures

The day following the completion of the training programs, subjects completed the posttest. The verbal-only group completed the posttest on day three of data collection and the verbal-visual group completed the posttest on day four of data collection. The posttest was identical to the pretest. The posttest procedures, location, and group size were the same as those of the pretest.

Retention Test Procedures

Exactly three weeks after the completion of the posttest, subjects completed the retention test. The retention test was the same test used in the pretest and the posttest. The retention test procedures, location and group size were similar to those in the other two tests.

Statistical Analysis

The pretest data were analysed with a one-way analysis of variance. Although it was recognized that larger sample sizes were preferred to justify the use of this parametric test, two different statistical consultants suggested this test be used in order to obtain information regarding the homogeneity of variance. The results of Bartlett's test of homogeneity would assist in determining the nature of the two groups in this study prior to the training programs.

Due to the small sample size of the verbal-only and the verbal-visual groups, two nonparametric statistical tests were selected to analyse the posttest and retention test data. The Mann-Whitney U Test was selected to determine whether there were any differences between the two independent groups after the training and retention periods. This test is one of the most powerful nonparametric tests and is the most useful alternative to the parametric t-test (Siegel, 1956). The Friedman Test was selected to determine whether there were any differences within the two groups in this study (Marascuilo & McSweeney, 1977). This test is used when samples are related rather than independent. Three different planned within-group comparisons were identified for each of the two groups: (a) the pretest motor development observation scores (MDS) with the posttest MDS, (b) the pretest MDS with the retention MDS, and (c) the posttest MDS and the retention MDS.

CHAPTER IV

ANALYSIS AND DISCUSSION OF DATA

This chapter has been organized to present the findings of the research as revealed by the data analysis. The following sections are included: (a) an analysis of pretest data, (b) an analysis of posttest data, (c) an analysis of retention test data, and (d) a discussion of the results.

Pretest Analysis

The test which subjects completed in this study was composed of two parts. The first part required subjects to identify the steps of development for the component under consideration and resulted in a motor development observation score. The second part required subjects to identify the degree of confidence they had in their answers to the first part of the test and resulted in a degree of confidence score.

Motor development observation scores were determined by the total number of trials that were identified correctly on the motor development part of the test. Table 3 provides the means, percentages, and standard deviations of the pretest motor development observation scores for the two groups. The mean scores were 16.35 and 15.17 respectively.

An analysis of variance was conducted on the pretest motor development observation scores in order to determine if any significant differences existed between the two groups prior to the training programs. Table 4 summarizes the results of the ANOVA.

Table 3

Pretest Motor Development Observation Scores for the Two Groups

Group	N	Mean	% Correct	Standard Deviation
Verbal-only	17	16.35	40.86	3.334
Verbal-visual	12	15.17	37.93	3.099

Note. Maximum score = 40

Table 4

Analysis of Variance of Pretest Motor Development Observation Scores Between the Two Groups

Source	D.F.	S.S.	Mean Squares	F. Ratio	Prob
Between	1	9.8993	9.8993	0.943	0.3402
Within	27	283.5490	10.5018		
Total	28	293.4483			

Bartlett's Test for Homogeneity of Variance

0.066 P = 0.797

The ANOVA indicated that there were no significant group differences in their ability to observe the developmental steps in the OTFF. The Bartlett's homogeneity test revealed that the two groups can be considered homogeneous and that randomization had been achieved.

The use of the component approach in this study permitted an analysis of the motor development observation scores for each of the five components in the OTFF. Table 5 provides the means and standard deviations of the motor development observation scores by component.

Table 5

Pretest Motor Development Observation Scores for the Five Components of the OTFF for the two Groups

	Verbal-only		Verbal-visual	
Component	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Feet	2.35	1.58	1.17	0.84
Upper Arm	4.47	1.28	4.33	1.30
Lower Arm	3.24	1.47	3.00	0.95
Trunk	3.88	1.50	4.00	1.21
Preparation	2.41	1.62	2.67	1.56

Note. Maximum score = 8

The two groups had the same pattern of results for the motor development observation scores in the five components of the OTFF. The highest motor development observation score was for the upper arm and the lowest score was for the feet.

Confidence scores were calculated utilizing point values which corresponded to the option checked on the confidence scale in the answer booklet. With the 40 trials on the test, the total possible confidence score was 200. Table 6 provides the means and standard deviations of confidence scores for the two groups.

Table 6

Pretest Confidence Scores for the Two Groups

Group	N	Mean	Standard Deviation
Verbal-only	17	149.71	19.50
Verbal-visual	12	139.92	17.17

Note. Maximum score = 200

Subjects from both groups felt more confident than not about their scores on the motor development test. The verbal-only group had a mean confidence score of 149.71 and the verbal-visual group had a mean confidence score of 139.92. Confidence scores were also calculated for each component in the OTFF. Table 7 provides an analysis of these confidence scores by component.

Table 7

Pretest Confidence Scores by Component for the Two Groups

Component	Verbal-only $\bar{X}$	Verbal-only S.D.	Verbal-visual $\bar{X}$	Verbal-visual S.D.
Feet	31.06	4.37	30.17	3.74
Upper Arm	29.94	3.80	27.75	3.65
Lower Arm	28.88	4.17	27.67	4.29
Trunk	30.71	4.50	28.67	5.03
Preparation	29.12	4.50	25.67	4.44

Note. Maximum score = 40

Subjects from both groups felt the most confident about their scores on the feet. The component about which they felt the second most confident was the trunk. The verbal-only group felt the least confident about the lower arm while the verbal-visual group felt the least confident about the preparation.

Posttest Analysis

Table 8 reports the means and standard deviations of the motor development observation scores for the two groups on the posttest. The change score reflects the difference between the pretest and the posttest motor development observation scores.

Table 8

Posttest Motor Development Observation Scores for the Two Groups

Group	N	Mean	S.D.	Change
Verbal-only	17	22.82	3.67	6.47
Verbal-visual	12	27.08	4.74	11.91

Note. Maximum score = 40

The verbal-visual group scored higher on the posttest than the verbal-only group. Both groups improved their motor development observation scores on the posttest, however, the verbal-visual group's improvement was 11.91 whereas that of the verbal-only group was 6.47. The posttest motor development observation score is analysed by component in Table 9.

Subsequent to the training programs, both experimental groups retained the identical pattern of results as revealed in the component analysis of pretest scores. Both groups had the highest motor development observation score for the feet and the lowest score for the lower arm. The change scores indicate that with the exception of the upper arm in the verbal-only group subjects improved their ability to identify the steps of development for the five components of the OTFF. The feet showed the greatest improvement for both groups while the upper arm and lower arm showed the least improvement. Subjects in the verbal-only group scored lower on the posttest than on the pretest for the upper arm.

Table 9

Posttest Motor Development Observation Scores by Component for the Two Groups

	Verbal-only			Verbal-visual		
Component	$\overline{X}$	S.D.	Change	$\overline{X}$	S.D.	Change
Feet	6.35	1.58	4.00	6.92	1.44	5.75
Upper Arm	4.18	1.02	-0.29	5.08	1.78	0.75
Lower Arm	3.47	0.87	0.23	4.08	0.79	1.08
Trunk	4.88	1.69	1.00	6.58	0.99	2.58
Preparation	3.94	1.71	1.53	4.42	1.44	1.75

Note. Maximum score = 8

In order to determine whether there was a significant difference between the two groups on the posttest motor development observation scores, a Mann-Whitney U test was used. Table 10 summarizes the results of this between group analysis. The Mann-Whitney U Test revealed no significant differences between the two groups on the posttest motor development observation scores.

Table 10

Mann-Whitney U Test for Between Group Differences on the Posttest Motor Development Observation Scores

Group	N	Sum of Ranks	U
Verbal-only	17	187.5	33.5
Verbal-visual	12	248.5	

Note. Critical value for N 12/17 = 57

To analyse the within group differences between the pretest and posttest motor development observation scores the Friedman Test was utilized. Table 11 indicates that there was a significant, positive increase in motor development observation scores from the pretest to the posttest in both groups. Since there were no significant between group differences on the posttest motor development observation scores, it would appear that participation in the verbal-only training program improved observing ability from the pretest to the posttest to the same degree as participation in the verbal-visual training program.

Confidence scores in both groups improved from the pretest to the posttest. Table 12 summarizes the means and standard deviations for the posttest confidence scores as well as a change score.

Table 11

Friedman Test for Within Group Differences Between the Pretest and Posttest Motor Development Observation Scores for the Two Groups

Group	N	Pre R	$\bar{R}$	Post R	$\bar{R}$	X2	Var. Est.	R-R
Verbal-only	17	49	2.882	23.5	1.382	20.91	1.141	1.50*
Verbal-visual	12	35	2.917	15.0	1.250	17.17	1.359	1.67*
Between	29	84	2.899	38.5	1.328	37.88	1.254	

Note. Significant at $p < .05$

Table 12

Posttest Confidence Scores for the Two Groups

Group	Mean	Standard Deviation	Change
Verbal-only	161.53	15.11	11.82
Verbal-visual	172.50	14.56	32.58

Note. Maximum score = 200

The change score reflects the difference between the pretest confidence score and the posttest confidence score. The verbal-visual group change score was 32.58 whereas the verbal-only group change score was 11.82.

Table 13 provides the posttest confidence scores for the five components of the OTFF for the two groups. A change score was calculated which reflected the difference in confidence score from the pretest to the posttest. The mean confidence scores increased for all components for both experimental groups subsequent to the training programs. Subjects were most confident about identifying the steps of development for the feet which was similar to the pretest. The trunk remained the component about which subjects felt the next most confident.

Table 13

Posttest Confidence Scores By Component for the Two Groups

	Verbal-only			Verbal-visual		
Component	$\bar{X}$	S.D.	Change	$\bar{X}$	S.D.	Change
Feet	35.82	3.76	4.76	37.33	2.42	7.16
Upper Arm	30.53	4.33	0.59	34.33	3.60	6.58
Lower Arm	30.75	2.82	1.87	32.17	3.31	6.00
Trunk	33.71	3.55	3.00	34.67	3.31	6.00
Preparation	30.71	3.72	1.59	34.00	4.31	8.33

Note. Maximim score = 40

The verbal-only group felt the least confident about the steps of development for the upper arm while the verbal-visual group felt least confident about the lower arm. The change in confidence scores between the pretest and the posttest for all components was greatest in the verbal-visual group. The largest gain in confidence for the verbal-visual group occurred in the preparation (8.33) and the feet (7.16) components. The largest gain in confidence for the verbal-only group occurred in the feet (4.76) and the trunk (3.00).

Retention Test Analysis

The retention test occurred three weeks after the posttest. Table 14 summarizes the results from this test. The change score is the difference between the posttest and the retention test motor development observation scores and indicates the direction and magnitude of the difference between these two tests. Both groups showed some decrement in performance on the retention test. The verbal-visual group declined by -2.91 while the verbal-only group declined by -1.00.

Table 14

Retention Test Motor Development Observation Scores for the Two Groups

Group	$\bar{X}$	S.D.	Change
Verbal-only	21.82	3.97	-1.00
Verbal-visual	24.17	2.79	-2.91

Note. Maximum score = 40

Table 15 provides the results of the retention test motor development observation scores for the five components of the OTFF. The change score is the difference between the posttest and the retention test motor development observation score. With the exception of the trunk for the verbal-only group and the feet for the verbal-visual group, there was some decrement in the ability of subjects to identify the steps of development for the other components.

Table 15

Retention Test Motor Development Observation Scores by Component for the Two Groups

	Verbal-only			Verbal-visual		
Component	$\bar{X}$	S.D.	Change	$\bar{X}$	S.D.	Change
Feet	6.29	1.65	-0.06	7.25	1.42	0.33
Upper Arm	3.53	1.38	-0.65	4.25	1.36	-0.83
Lower Arm	2.94	1.14	-0.53	3.25	0.75	-0.83
Trunk	5.18	1.74	0.30	5.33	1.61	-1.25
Preparation	3.88	1.58	-0.06	4.08	1.73	-0.34

Note. Maximum score = 8

The largest decrement for the verbal-only group occurred in the upper arm (-0.65) and for the verbal-visual group in the trunk (-1.25). There were two components for which there was an increase in mean scores from the posttest to the retention test. After the three week retention period, subjects in the verbal-only group were slightly better at identifying the steps of development in the trunk than in the posttest (0.30). Subjects in the verbal-visual group were slightly better at identifying the steps of development for the feet (0.33). The components for which scores remained the most constant in both groups were the feet (0.33) and preparation (-0.06).

A Mann-Whitney U test was conducted on the retention test motor development observation scores to determine if there was a significant difference between the two groups. Table 16 reveals that there was a significant difference between the two groups on the retention test. The verbal-visual group were significantly better in differentiating the steps of development after the three-week interval between the posttest and the retention test.

Table 16

Mann-Whitney U Test for Between Group Differences on the Retention Test Motor Development Observation Scores

Group	N	Sum of Ranks	U
Verbal-only	17	212	61.0*
Verbal-visual	12	221	

Note. Significant at $p < .05$

The Friedman test analysed the within group differences between the posttest and the retention test motor development observation scores. Table 17 indicates that retention motor development observation scores for both groups did not differ significantly from the posttest scores. The ability of subjects in both groups to identify the steps of development in the OTFF on the retention test was similar to their ability on the posttest.

Table 17

Friedman Test for Within Group Differences Between the Posttest and the Retention Test Motor Development Observation Scores for the Two Groups

Group	N	Post. R	$\bar{R}$	Retent. R	$\bar{R}$	X^2	Var. Est.	R - R
Verbal-only	17	23.5	1.38	29.5	1.74	20.91	1.141	-0.353
Verbal-visual	12	15	1.25	22.0	1.03	17.17	1.359	-0.583
Between	29	38.5	1.33	51.5	1.78	37.88	1.254	

Table 18 summarizes the confidence scores on the retention test for the two groups. The change score indicates the difference in confidence scores between the posttest and the retention test. The level of confidence in the verbal-only group on the retention test was 159.18 and 173.08 in the verbal-visual group . The verbal-only group showed a decline in confidence of -2.35 after the three-week interval whereas the verbal-visual group showed an increase of 0.58.

Table 18

Retention Test Confidence Scores for the Two Groups

Group	N	$\overline{X}$	S.D.	Change
Verbal-only	17	159.18	16.51	-2.35
Verbal-visual	12	173.08	17.14	0.58

Note. Maximum score = 200

Table 19 reveals the confidence scores by component for the retention test. Subjects in both groups showed much smaller variations in confidence between the posttest and retention test than between the pretest and the posttest. The components that caused the greatest change in confidence from the posttest to the retention test in the verbal-only group were the lower arm (-1.51) and the upper arm (-0.77) whereas in the verbal-visual group they were the trunk (1.08) and the upper arm (-1.00). The most stable confidence scores for the verbal-only group occurred in the feet (0.00) and for the verbal-visual group in the lower arm (0.41).

Table 19

Retention Test Confidence Scores by Component for the Two Groups

	Verbal-only			Verbal-visual		
Component	$\overline{X}$	S.D.	Change	$\overline{X}$	S.D.	Change
Feet	35.82	3.73	0.00	37.92	2.97	0.59
Upper Arm	29.76	4.25	-0.77	33.33	4.23	-1.00
Lower Arm	29.24	4.80	-1.51	32.58	4.38	0.41
Trunk	33.35	3.95	-0.36	35.75	3.60	1.08
Preparation	31.00	3.46	0.29	33.50	4.58	-0.50

Note. Maximum score = 40

Discussion of Results

The last section of this chapter presented the results of the analysis conducted on the data. This section includes a discussion of these results.

Pretest

In order to control the internal validity of this study, subjects were randomly assigned to either the verbal-only training group or the verbal-visual training group. An Anova and a Bartlett's test of homogeneity were utilized on the pretest motor development scores to determine whether randomization had been achieved. Results indicated there were no significant differences between the two groups; therefore they were considered homogenous at the beginning of this study.

When the mean motor development observation scores were analysed by component, subjects had the lowest scores on the feet and the preparatory arm action . These two components should be the easiest to differentiate perceptually since they are the slowest moving and involve the largest body parts in comparison to the other components. Conversely, the upper arm which is a relatively fast moving component and the trunk which is difficult to identify with only a side view (Halverson, 1985) were the two components that received the highest score. One reason that might explain these results is that this was the subjects' first exposure to motor development as an approach to analysing motor skills. One would assume that there would be a large percentage of guessing when asked to identify steps of development for the components of the OTFF. Since the feet and the preparation have four steps of development the chances of guessing correctly would be less than for the upper arm and the trunk which only have three steps of development.

Considering that this was a novel approach to analysing motor skills for these subjects, their confidence scores appear unusually high. The physical education majors may have considered the OTFF a very familiar motor skill and therefore they felt confident in their ability to analyse it. In addition to being physical education majors, two of the five female subjects from UNC-G and four of the 17 female subjects from ASU played on the varsity softball teams. The only male subject from UNC-G and two male subjects from ASU either played on club teams or had a background in baseball. Considering that what one attends to in a situation may be a result of our past experience with similar situations (Newtson, 1976) and the personal experience with the OTFF, subjects felt confident in their ability to analyse this motor skill. The fact remains, however, that the subjects in the present research were very confident about their ability to analyse the motor skill of throwing although they possessed no knowledge about the developmental approach utilized in this study. This inconsistency between actual knowledge and one's experience with a particular method for analysing motor skills is revealed in the pretest component confidence scores.

Posttest

The significant within-group differences between the pretest and the posttest for both groups indicated that both training programs were successful in enhancing the ability of these preservice physical education majors to identify the developmental steps in the OTFF. This training effect is consistent with other training studies in physical education (Gangstead, 1982; Hoffman & Armstrong, 1975; Kniffen, 1985; Morrison, 1982). The component approach to motor development for the particular motor skill under investigation can be taught to physical education majors and can make a significant difference in their ability to detect the distinctive features associated with the steps of development for the five components in this motor skill. According to Gibson's (1969) definition of perceptual learning, the subjects in both groups were able to extract pertinent information from previously unknown stimuli subsequent to the training programs. This was accomplished through participation in training programs that emphasized the principles underlying perceptual learning stressed by Gibson (1969). The training program in this study outlined the differences between the various steps of development and identified the distinctive features of each step of development. The use of the component approach also allowed for the graded contrast of these differences because the steps of development were presented from least skillful to most skillful.

The significant improvement in motor development observation scores on the posttest could also be attributed to the subjects' increased ability to analyse the overarm throw for force into finer units of analysis (Newtson, 1976). According to Newtson (1976), participation in training programs which focus on finer units of analysis result in changes in the level of perceptual organization of relevant information. Regardless of how this developmental information was delivered, either verbally or verbally with visual practice, these preservice majors were significantly better at identifying the steps of development in the OTFF after a short, intense training program.

Of particular interest in this study was the performance of the verbal-only group on the posttest. The Mann-Whitney test revealed no significant differences between the two groups on the posttest. Although the verbal-only group received no visual practice in identifying the steps of development in this motor skill, the verbal information appeared to be sufficient in improving their discrimination ability. This result contradicts one of the fundamental premises of perceptual learning which states that increased discrimination of stimulu occurs as a result of experience and practice with those stimuli (Gibson, 1969). As Newtson (1976) indicated, it is through repeated exposure to a particular set of stimuli that a perceiver becomes skillful in extracting the relevant critical features. Practical experience in observing appears to be a necessary condition for perceptual learning to occur.

The absence of a significant difference between the two training programs on the posttest may be attributable to three factors. First, the visual practice provided in the verbal-visual training program was not sufficient to distinguish it from the verbal-only group. Perhaps the verbal information provided the verbal-only group and the corresponding formation of mental images was enough to offset any differences in visual practice between the groups. Second, the training programs, were of insufficient length to produce differences in training effects. Not only did subjects need to acquire the perceptual skills necessary to identify the steps of development in this motor skill, they needed to understand a new method to analyse motor skills and perhaps the verbal-visual training program did not allow sufficient time for this to occur. The length of the training programs in this study were shorter than the training programs adopted by Gangstead (1982) but somewhat longer than Hoffman and Armstrong (1975) and Kniffen (1985). Third, the small sample size prevented the use of a more rigorous parametric analysis. A larger sample size would certainly have been preferred and perhaps would have resulted in a clearer differentiation between the training programs. The Mann-Whitney U test relies on a sum of rankings and is therefore affected when there are samples of unequal size. The verbal-visual group had five fewer subjects than the verbal-only group and any treatment effects may have been masked by this fact.

Although there was a significant improvement in observing ability in both groups after the training programs, posttest motor development scores remained relatively low. The verbal-only group identified 57% of the trials correctly; the verbal-visual group identified 68% of the trials correctly. The question arises as to whether these training programs are worthwhile considering the low posttest scores. Two points may help in formulating an answer to this question. First, data for this study were collected in the last month of the spring semester. The retention test occurred during the last week of classes. At this point in the semester, students are subjected to the stresses of completing term assignments and preparing for final examinations. These other responsibilities may have had an impact on the results of the posttest and the retention test. Second, despite the scheduling of data collection, subjects in the verbal-only group showed a 40% increase in their motor development observation score while the verbal-visual group showed a 79% increase. If these increases can occur within the limitations of this study, the merits of these training programs are unquestionable.

When the posttest motor development observation scores were analysed by component, there were changes in which components were easiest to differentiate when compared to the pretest motor development observation scores. The feet changed from being the most difficult to being the easiest which was reflected in this component having the largest change score.. Perceptually, this component should be the easiest since it involves the largest and slowest moving body parts. Subjects from both groups had the next highest motor development observation scores for the trunk. This is somewhat surprising considering the viewing angle required to identify the steps of development for this component, but understandable when one considers the trials for the trunk on the test videotape had the least variation in steps of development. Seven of the eight trials for this component were in step two of development which was a reflection of the development of the trunk in the grade six students. Subjects may have perceived the lack of variation within these trials for this component. The lower arm was the most difficult component to analyse in the posttest and the third easiest on the pretest. This change also reflects the degree of difficulty in perceptually identifying the steps of development in a component that is relatively small and fast moving.

The upper and lower arm showed the least improvement. To identify the steps of development in these components requires a decision at a critical moment in the throwing action. This moment is referred to as front facing and is difficult to identify unless the throwing action is viewed frame by frame on a motion picture analyser. Since subjects did not have the opportunity to view the throws at this speed it is understandable that these two components showed the least improvement from the pretest to the posttest.

If decisions about the steps of development for the upper arm, the lower arm and the trunk are dependent upon the observer obtaining critical perceptual information at specific moments in the throwing action and if these moments require specific viewing angles as well as frame by frame analysis, one must question whether the component approach is practical for teachers outside a laboratory setting. Perhaps this approach is best suited for purposes of professional preparation in what Hoffman (1977) identified as pedagogical kinesiology which could occur in a laboratory. To be of practical importance to teachers in the gymnasium, this component approach to motor development may need to be revised. One possible change that could make the component approach more practical in live settings is to reduce the number of steps of development for these three components. This may eliminate the need for frame by frame analysis and still be of assistance to teachers in making appropriate pedagogical decisions concerning students' abilities to perform motor skills.

The posttest confidence scores remained high in both groups. The change in confidence scores from the pretest to the posttest in the verbal-visual group, however, nearly tripled that of the verbal-only group. Practical experience in observing the steps of development and visual practice in identifying these steps greatly increased the degree of confidence of subjects in the verbal-visual group. If confidence levels can be raised subsequent to participation in a training program that provides the opportunity to practice observing and identifying the components of motor skills, perhaps these physical education majors will feel better prepared to assist with motor skill development as future teachers and coaches.

The component posttest confidence scores in the verbal-visual group reflected a pattern which was consistent with the degree of difficulty in observing these components. The preparatory arm action and the feet, which are the slowest moving and therefore easiest to observe, received the highest degree of confidence while the lower arm and trunk, which are faster moving and therefore more difficult to observe, received the lowest confidence scores. This pattern did not exist entirely in the verbal-only group. Although the feet received the highest confidence rating, the preparatory arm action was the fourth highest component. The trunk, which is probably the most difficult to observe considering the viewing angle, was the second highest component. Visual practice in identifying the steps of development in the OTFF provided the greatest confidence in the feet, which also had the highest motor development observation score, and the least confidence in the lower arm which had the lowest motor development observation score. Any conclusions about the relationship between visual practice and degree of confidence must be made with caution. Subjects in the verbal-visual group showed the greatest increase in confidence from the pretest to the posttest in the preparatory arm action. This change was not justified considering the low posttest motor development observation score for this component. Nonetheless, the physical education majors involved in this research can feel quite confident about something of which they know very little.

The Retention Test

Perhaps of greatest importance in this study is the significant between-group difference on the retention test. The Mann-Whitney test revealed that the verbal-visual group had significantly higher motor development observation scores than the verbal-only group on the retention test. Subjects who had visual practice in identifying the steps of development were able to retain this information significantly better than subjects who received the information verbally. If the ability to recall information for the purpose of identifying steps of development in the OTFF is dependent upon matching the mental images created in the training programs with the performances on videotape, then the visual practice segment of the verbal-visual training program was successful in creating more robust mental images. These images resulted in the verbal-visual subjects being more proficient in identifying the steps of development in the OTFF after the three week retention period.

There was only a slight decrement in motor development observation scores from the posttest to the retention test in both groups. The Friedman test revealed insignificant differences in the abilities of subjects in both groups to identify the steps of development in the OTFF from the posttest to the retention test. This consistency of performance between the posttest and the retention test is similar to the results of other studies that examined retention (Hoffman & Armstrong, 1975; Morrison, 1982). These stable motor development observation scores from the posttest to the retention test for both groups is somewhat confusing in light of the insignificant differences between the two groups on the posttest and the significant differences that occurred on the retention test. With the absence of significant within-group differences in performance on the motor development test from the posttest to the retention test and considering there were no between-group differences on the posttest, one might conclude that both training programs in this study had a similar effect on levels of retention. This conclusion is not substantiated by the significant between-group differences on the retention test. The verbal-visual training program was significantly better than the verbal-only training program in promoting long term improvement in the ability of these subjects to identify the steps of development in the OTFF.

Subjects in both groups were the most accurate in identifying the steps of development for the feet on the retention test. As was indicated in the posttest discussion, the feet are the easiest to differentiate since they move the slowest and involve the largest body segments. The same argument could be used for the preparatory arm action although this component ranked third in the verbal-only group and fourth in verbal-visual group. These two components, however, did remain the most constant from the posttest to the retention test which may indicate that stimuli that are comparatively easier to recognize are retained in longer term memory easier as well. Conversely, stimuli which are the hardest to differentiate due to size and speed, namely the upper arm, the lower arm and the trunk had the greatest decrement from the posttest to the retention test.

The retention test confidence scores remained very high with only slight changes from the posttest levels. The three-week interval between these two tests seemed to have almost no effect on levels of confidence. The verbal-visual group continued to be more confident than the verbal-only group which suggests that a greater sense of confidence is associated with professional training that includes more practical observational experiences in motor development. This increased self confidence acquired in professional preparation programs may be of substantial benefit to teachers as they attempt to acquire pedagogical skills in their initial teaching years.

Although the subjects revealed a high degree of confidence on the retention test, the relatively low motor development observation scores do not substantiate these levels of confidence. The verbal-only group identified 52% of the questions correctly on the retention test while the verbal-visual group identified 60% of the questions correctly. Considering these low motor development observation scores on the retention test one must question whether these subjects warranted such high confidence scores. Perhaps this result lends credibility to the statement that a little knowledge is worse than no knowledge at all.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the effect of two training programs on the ability of physical education majors to observe and identify the developmental steps in the overarm throw for force. Two training programs were developed based upon a component approach to motor development. One training program involved verbal instructions while the second training program involved the same verbal instructions but incorporated visual practice in identifying the steps of development for the five components of the OTFF. Twenty nine physical education majors volunteered to participate in this study. A pretest-posttest design was utilized to examine the effects of each training program. For the purpose of this study, two videotapes were constructed: a training videotape and a test videotape. The test videotape required subjects to identify the steps of development in 40 different throws and to identify the degree of confidence they had in their answers to the step of development. Subsequent to the pretest, subjects participated in either the verbal-only or verbal-visual training program. A posttest was then administered and then three weeks later a second posttest was administered to assess levels of retention. Within group differences were analysed by utilizing the Friedman test. Between group differences were analysed by utilizing the Mann-Whitney U test.

Conclusions

The data collected and analysed in this study substantiate the following conclusions which are organized according to the research questions and hypotheses:

Can subjects visually discriminate the developmental steps in the OTFF after intervention training? The hypothesis is that there will be no significant difference between the pretest and posttest motor development observation scores within the verbal-only and the verbal-visual groups.

1. The physical education majors in both groups were generally poor at identifying the steps of development in the OTFF prior to intervention training.

2. The physical education majors in both groups were significantly better at identifying the steps of development in the OTFF subsequent to intervention training. Therefore, the decision is to reject the null hypothesis.

Is there a difference in the effect of the two training programs on the ability of subjects to visually discriminate the developmental steps in the OTFF? The hypothesis is that there will be no significant differences in posttest motor development observation scores between the verbal-only and verbal-visual groups.

1. There was no significant difference in the effect of the two training programs on the ability of physical education majors to visually discriminate the developmental steps in the OTFF. Therefore, the decision

is to accept the null hypothesis.

What are the effects of intervention training on visual discrimination subsequent to a three week retention period? The hypotheses are: (a) there will be no significant differences between the posttest motor development observation scores and the retention motor development observation scores within the verbal-only and verbal-visual groups, and (b) there will be no significant differences in retention motor development observation scores between the verbal-only and verbal-visual groups.

1. The physical education majors in both groups retained posttest levels of visual discrimination after the three week retention period. Therefore, the decision is to accept the null hypothesis.

2. The physical education majors in the verbal-visual group scored significantly higher than the verbal-only group on the retention test. Therefore, the decision is to reject the null hypothesis.

Are certain components in the OTFF easier to visually discriminate than others subsequent ot intervention training?

1. The physical education majors consistently found the steps of development for the feet and the trunk to be the easiest to visually discriminate.

2. The physical education majors consistently found the steps of development for the lower arm to be the hardest to visually discriminate.

How confident are subjects in their ability to discriminate the developmental steps in the OTFF before and after intervention training?

1. The physical education majors in both groups were confident in their

ability to discriminate the developmental steps in the OTFF prior to the training programs.

2. The physical education majors in both groups showed a substantial increase in levels of confidence on the posttest.

3. The physical education majors in both groups retained the posttest levels of confidence on the retention test.

Recommendations

Based upon the results of this study, the following recommendations are suggested:

1. Examine the effects of similar training programs on other motor skills to which the component approach has been applied.

2. Examine these subjects in a follow-up study to assess levels of retention.

3. Examine the ability of physical education majors to visually discriminate the steps of development in the OTFF in live performances.

4. Compare the effects of these training programs between groups with varying degrees of experience.

5. Expand the context of this study to include interpretations and decisions in Roberton and Halverson's model of the teaching process.

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Appendix A

The Components and Steps of Development for the OTFF

(Roberton and Halverson, 1984)

Developmental Sequence for the Preparatory Arm Action

Step 1. No Backswing-the ball in the hand moves directly forward to release from the arm's original position when the hand first grasped the ball.

Step 2. Elbow and Humeral Flexion-the ball moves away from the intended line of flight to a position behind or alongside the head by upward flexion of the humerus and concomitant elbow flexion.

Step 3. Circular, upward backswing-the ball moves away from the intended line of flight to a position behind the head via a circular overhead movement with elbow extended, or an oblique swing back, or a vertical lift from the hip.

Step 4. Circular, downward backswing-the ball moves away from the intended line of flight to a position behind the head via a circular, down and back motion, which carries the hand below the waist.

Developmental Sequence for the Feet

Step 1. No step-the child throws from the initial foot position.

Step 2. Homolateral step-the child steps with the foot on the same side as the throwing hand.

Step 3. Contralateral, short step-the child steps with the foot on the opposite side from the throwing hand.

Step 4. Contralateral, long step-the child steps with the opposite foot a distance of over half the child's standing height.

Developmental Sequence for the Trunk

Step 1. No trunk action or forward-backward movements-only the arm is active in force production. Sometines, the forward thrust of the arm pulls the trunk into a passive left rotation (assuming a right-handed throw), but no twist-up precedes that action. If trunk action occurs, it accompanies the forward thrust of the arm by flexing forward at the hips. Preparatory extension sometimes precedes forward hip flexion.

Step 2. Upper trunk rotation or total trunk "block" rotation-the spine and pelvis both rotate away from the intended line of flight and then simultaneously begin forward rotation, acting as a unit or "block." Occasionally, only the upper spine twists away, then toward the direction of force. The pelvis, then, remains fixed, facing the line of flight, or joins the rotary movement after forward spinal rotation has begun.

Step 3. Differentiated rotation-the pelvis precedes the upper spine in initiating forward rotation. The child twists away from the intended line of ball flight and, then, begins forward rotation with the pelvis while the upper spine is still twisting away.

Developmental Sequence for the Upper Arm

Step 1. Humerus oblique-the humerus moves forward to ball release in a plane that intersects the trunk obliquely above or below the horizontal line of the shoulders. Occasionally, during the backswing, the humerus is placed at a right angle to the trunk, with the elbow pointing toward the target. It maintains this fixed position during the throw.

Step 2. Humerus aligned but independent-the humerus moves forward to ball release in a plane horizontally aligned with the shoulder, forming a right angle between humerus and trunk. By the time the shoulders (upper spine) reach front facing, the humerus (elbow) has moved independently ahead of the outline of the body (as seen from the side) via horizontal adduction at the shoulder.

Step 3. Humerus lags-the humerus moves forward to ball release horizontally aligned, but at the moment the shoulders (upper spine) reach front facing, the humerus remains within the outline of the body (as seen from the side). No horizontal adduction of the humerus occurs before front facing.

<u>Developmental Sequence for the Lower Arm</u>

Step 1. No forearm lag-the forearm and ball move steadily forward to ball release throughout the throwing action.

Step 2. Forearm lag-the forearm and ball appear to 'lag' i.e., to remain stationary behind the child or to move downward or backward in relation to him/her. The lagging forearm reaches its furthest point back, deepest point down, or last stationary point before the shoulders (upper spine) reach front facing.

Step 3. Delayed forearm lag-the lagging forearm delays reaching its final point of lag until the moment of front facing.

Appendix B

Title Page for the Feet

Steps of Development for the Feet

Step 1. No Movement

Step 2. Homolateral

Step 3. Opposite less than one half the standing height

Step 4. Opposite greater than one half the standing height

Appendix C

A Review Page for the Feet

Step 1. No Movement - both feet stay in the same spot.

Step 2. Homolateral - step with foot on the same side.

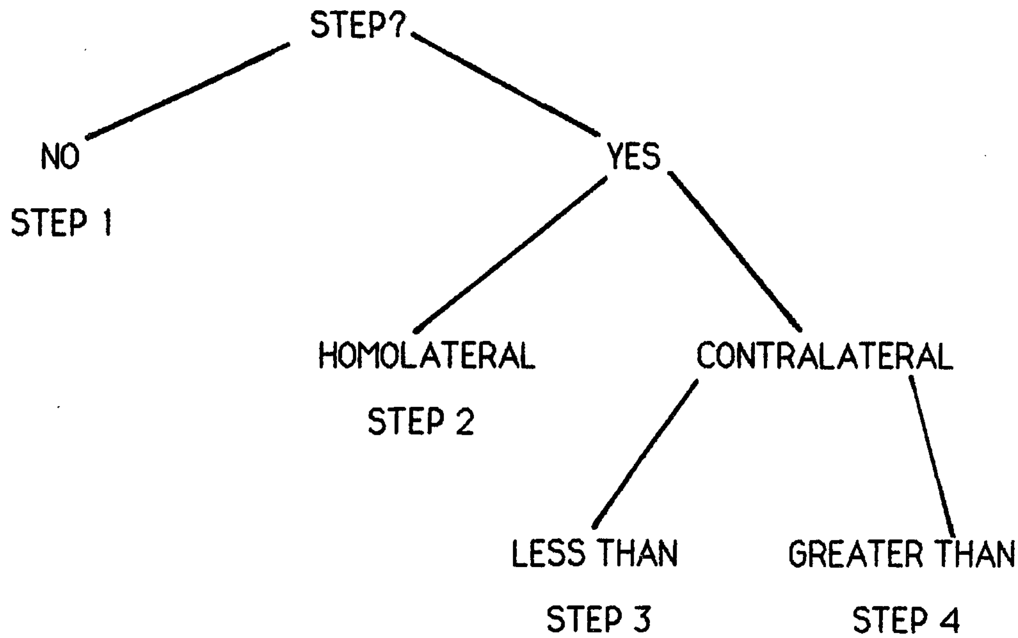
Step 3. Opposite less than one half - step with foot on the opposite side, less than one half the standing height.

Step 4. Opposite greater than one half - step with foot on the opposite side greater than one half standing height.

Appendix D

Decision Tree for the Feet

In order to determine the step of development for the feet, the following decisions must be made:



If there is no step then the feet are in step 1 of development. If there is a step, then the viewer must determine whether there is a step with the homolateral foot or the contralateral foot. If the step is with the homolateral foot, then the feet are in step 2 of development. If the step is with the contralateral foot, then the viewer must determine whether the step is less than one half the standing height or greater than one half the standing height of the thrower. If the step is less than one half the standing height of the thrower, then the feet are in step 3 of development. If the step is greater than one half the standing height of the thrower, then the feet are in step 4 of development.

Appendix E

The Verbal Introduction and Script for the Training Programs

Introduction to the Verbal-only Group

You are a part of a group that will receive only verbal information about the steps of development for the five components in the OTFF. Training to see the steps of development will occur after the final test sometime in the last week of April. Please do not talk about the study with other physical education majors because each group is receiving a different training program. I want you to concentrate during the one hour of verbal training to see if you can learn and remember the steps of development in the OTFF. Please feel free to ask questions whenever you do not understand anything I say. Remember, I can only explain the steps of development verbally. I can't demonstrate what they are until after you take the final test.

Introduction to the Verbal-visual Group

You are part of a group that will receive both verbal information and visual practice in identifying the steps of development for the five components in the OTFF. Please do not talk about the study with other physical education majors because each group is receiving a different training program. I want you to concentrate during the two hours of training to see if you can learn to identify the steps of development in the OTFF. Please feel free to ask questions whenever you do not understand anything I say.

The Script for the Training Programs

The first component we will look at is the Preparatory Arm Action. There are four steps of development for this component:

1. No Backswing-in the least skillful step of development, the ball moves directly forward to release from the arm's original position when the hand first grasps the ball

2. Elbow/Humerus Flexion-in step two, the ball moves away from the intended line of flight to a position behind or alongside the head by upward flexion of the humerus and elbow.

3. Circular Upward-the ball moves away from the intended line of flight to a position behind the head by means of:

(a) an oblique swing back or a vertical lift from the hip.

(b) a circular upward movement with the humerus abducted.

The difference between step two and step three is that there is abduction of the humerus in step three.

4. Circular Backward-in the most skillful preparatory arm action, the ball moves away from the intended line of flight to a position behind the head by means of a circular, down and back motion. The key factor to notice is that the hand falls below the waist during this motion.

In review, here are the four steps of development for the preparatory arm action:

OVERHEAD: REVIEW OF PREPARATORY ARM ACTION

OVERHEAD: DECISION TREE FOR THE PREPARATORY ARM ACTION

The second component we will observe is the feet. There are four steps of development for the feet in the OTFF:

1. No Movement-in step one, the thrower has no striding motion. Both feet stay in the same spot throughout the throw. This is the least skillful foot pattern.

2. Homolateral-in this step of development, the thrower takes a forward stride with the foot on the same side as the throwing hand. This, as you already know, is referred to in sports as a homolateral movement or movement that occurs on the "same side" of the body.

3. Opposite, Less Than One Half-in step three, there is a forward stride with the opposite foot. The length of this stride, however, is less than one half the standing height of the thrower. Now the difficulty in deciding between this step of development and the next step of development arises when the stride approaches exactly one half the standing height of the thrower. Short step threes and long step fours are easy to identify. When you get long step threes and short step fours you must decide if the stride looks shorter or longer than one half the standing height of the thrower.

4. Opposite, Greater Than One Half-the most skillful step of development in the feet involves the thrower making a stride forward with the opposite foot. The lenght of this stride is greater than one half the standing height of the thrower. The problem in identifying step four in the feet, is when the stride gets shorter and closer to the standing height of the thrower.

OVERHEAD: REVIEW OF STEPS FOR THE FEET

OVERHEAD: DECISION TREE FOR THE FEET

The third component in the OTFF is the trunk. The trunk has three steps of development:

1. No Action or Forward/Backward-in step one, only the arm is active in force production. No twisting up or rotation of the trunk precedes the throwing action. Sometimes the trunk flexes forward with the thrust of the arm. This forward motion is sometimes preceded by a backward extension of the trunk.

2. Block Rotation-in the second step of development for the trunk, the spine and pelvis both rotate away from the intended line of flight and then simultaneously begin forward rotation together. The rotation of the spine and pelvis together as a unit is called block rotation. Please note that the rotation begins when the lead foot touches the ground.

3. Differentiated Rotation-the difference between this step of development and step two is that the pelvis and spine move independently of each other. The pelvis begins to rotate forward before the upper spine. At times the pelvis can begin forward rotation and the upper spine can be still twisting away.

In review then, here are the three steps of development for the trunk:

OVERHEAD: REVIEW FOR THE TRUNK

OVERHEAD: DECISION TREE FOR THE TRUNK

The fourth component of the OTFF we are going to examine is the upper arm or humerus. There are three steps of development in the upper arm:

1. Oblique-in step one, the upper arm is either above or below the line of the shoulders. The decision as to whether the upper arm is above or

below the line of the shoulders can be made at two points in the throw:

(a) at the point of furthest opening up. Opening up refers to the arms spreading apart during the preparatory arm action or backswing. The furthest point in opening up occurs at the end of the backswing.

(b) at front facing. Front facing refers to a point in the throw when the shoulders are parallel with or facing the target of the throw. This point is the most critical in making the decision about whether the upper arm is in step one.

2. Independent-in step two, the upper arm is at a right angle to the trunk but at the moment of front facing-that is when the shoulders are facing the target-the upper arm has moved ahead of the trunk so that the elbow appears to be pointing at the target.

3. Lagging-in the most skillful step of development in the upper arm, there is a right angle between the upper arm and the trunk which is similar to step two. By the time the shoulders reach front facing, however, the upper arm is in line with the trunk so that the elbow is pointed toward the observer at the side.

Now lets review the three steps of development for the upper arm in the OTFF:

OVERHEAD: REVIEW OF THE UPPER ARM

OVERHEAD: DECISION TREE FOR THE UPPER ARM

The final component of the OTFF is the lower arm. There are three steps of development in this component:

1. No Lag-in the first step of development in the lower arm, the ball

moves steadily forward to ball release throughout the throwing motion.

2. Lag-in step two, the lower arm appears to remain stationary behind the thrower or to move downward or backward in relation to the thrower. The lower arm remains stationary even though there is movement in other parts of the body. This stationary or downward/backward movement is called "lagging". The lagging forearm in step two reaches it's furthest point back or deepest point down before the shoulders reach front facing.

3. Delayed Lag-in the most skillful step of development in the lower arm, the final point of the lag that is, the furthest point back, the deepest point down or the last stationary point is delayed until the moment the shoulders are in the front facing position.

Lets review the three steps of development for the lower arm:

OVERHEAD: REVIEW FOR THE LOWER ARM

OVERHEAD: DECISION TREE FOR THE LOWER ARM

Appendix F

Instructions for Taking the Test

This test is designed to assess your ability to identify the steps of development for various body components in the overarm throw for force. In this test you are asked to answer a total of 40 questions. Each question focuses on one component in the overarm throw for force.

For each question you will view 5 or 6 repetitions of an overarm throw for force. The first 2 repetitions will be in regular slow motion. The next 2 or 3 repetitions will be at 6 frames per second. The final repetition will be in regular slow motion.

In each question you will be asked to make 2 decisions:

1. Identify the step of development for the body component under consideration. You will check one option on the step of development scale which ranges from least skillful (1) to most skillful (3) or (4).

2. Identify the degree of confidence you have in your answer to the step of development. You will check one option on the degree of confidence scale which ranges from absolutely uncertain (1), fairly uncertain (2), undecided (3), fairly certain (4), to absolutely certain (5).

Here are two examples to familiarize you with the format of the test:

EXAMPLE 1. FEET

Step of Development				Degree of Confidence				
____	____	____	____	____	____	____	____	____
1	2	3	4	1	2	3	4	5

EXAMPLE 2. UPPER ARM

Step of Development			Degree of Confidence				
____	____	____	____	____	____	____	____
1	2	3	1	2	3	4	5

REMEMBER THE SCALES

Step of Development: 1 - least skillful
4 - most skillful

Degree of Confidence: 1 - absolutely uncertain
2 - fairly uncertain
3 - undecided
4 - fairly certain
5 - absolutely certain

You will have as much time as you require after the last repetition of the throw to mark your answers for the step of development and the degree of confidence you have in your answer.

Appendix G

Answer Booklet for the Test

STEP OF DEVELOPMENT | DEGREE OF CONFIDENCE

SCALE: 1 - least skillful | 1 - absolutely uncertain
3 or 4 - most skillful | 2 - fairly uncertain
3 - undecided
4 - fairly certain
5 - absolutely certain

---

1. Feet:

___ ___ ___ ___ ___ ___ ___ ___ ___
1 2 3 4 1 2 3 4 5

2. Upper arm:

___ ___ ___ ___ ___ ___ ___ ___

3. Lower arm:

___ ___ ___ ___ ___ ___ ___ ___

4. Trunk:

___ ___ ___ ___ ___ ___ ___ ___

5. Preparation:

___ ___ ___ ___ ___ ___ ___ ___ ___

6. Feet:

___ ___ ___ ___ ___ ___ ___ ___ ___

7. Upper arm:

___ ___ ___ ___ ___ ___ ___ ___

STEP OF DEVELOPMENT	DEGREE OF CONFIDENCE
8. Lower arm:	
___ ___ ___	___ ___ ___ ___ ___
9. Trunk:	
___ ___ ___	___ ___ ___ ___ ___
10. Preparation:	
___ ___ ___ ___	___ ___ ___ ___ ___
11. Feet:	
___ ___ ___ ___	___ ___ ___ ___ ___
12. Upper arm:	
___ ___ ___	___ ___ ___ ___ ___
13. Lower arm:	
___ ___ ___	___ ___ ___ ___ ___
14. Trunk:	
___ ___ ___	___ ___ ___ ___ ___
15. Preparation:	
___ ___ ___ ___	___ ___ ___ ___ ___
16. Feet:	
___ ___ ___ ___	___ ___ ___ ___ ___
17. Upper arm:	
___ ___ ___	___ ___ ___ ___ ___
18. Lower arm:	
___ ___ ___	___ ___ ___ ___ ___

STEP OF DEVELOPMENT	DEGREE OF CONFIDENCE
19. Trunk:	
___ ___ ___	___ ___ ___ ___ ___
20. Preparation:	
___ ___ ___ ___	___ ___ ___ ___ ___
21. Feet:	
___ ___ ___ ___	___ ___ ___ ___ ___
22. Upper arm:	
___ ___ ___	___ ___ ___ ___ ___
23. Lower arm:	
___ ___ ___	___ ___ ___ ___ ___
24. Trunk:	
___ ___ ___	___ ___ ___ ___ ___
25. Preparation:	
___ ___ ___ ___	___ ___ ___ ___ ___
26. Feet:	
___ ___ ___ ___	___ ___ ___ ___ ___
27. Upper arm:	
___ ___ ___	___ ___ ___ ___ ___
28. Lower arm:	
___ ___ ___	___ ___ ___ ___ ___
29. Trunk:	
___ ___ ___	___ ___ ___ ___ ___

STEP OF DEVELOPMENT	DEGREE OF CONFIDENCE
30. Preparation:	
___ ___ ___ ___	___ ___ ___ ___ ___
31. Feet:	
___ ___ ___ ___	___ ___ ___ ___ ___
32. Upper arm:	
___ ___ ___	___ ___ ___ ___ ___
33. Lower arm:	
___ ___ ___	___ ___ ___ ___ ___
34. Trunk:	
___ ___ ___	___ ___ ___ ___ ___
35. Preparation:	
___ ___ ___ ___	___ ___ ___ ___ ___
36. Feet:	
___ ___ ___ ___	___ ___ ___ ___ ___
37. Upper arm:	
___ ___ ___	___ ___ ___ ___ ___
38. Lower arm:	
___ ___ ___	___ ___ ___ ___ ___
39. Trunk:	
___ ___ ___	___ ___ ___ ___ ___
40. Preparation:	
___ ___ ___ ___	___ ___ ___ ___ ___

Appendix H

The Practice Quiz Answer Sheet for the Upper Arm and the Lower Arm

Upper Arm

1. ____ ____ ____
   1 2 3

2. ____ ____ ____
   1 2 3

3. ____ ____ ____
   1 2 3

4. ____ ____ ____
   1 2 3

5. ____ ____ ____
   1 2 3

6. ____ ____ ____
   1 2 3

7. ____ ____ ____
   1 2 3

8. ____ ____ ____
   1 2 3

Lower Arm

1. ____ ____ ____ ____ ____
   1 2 3 4 5

2. ____ ____ ____ ____ ____
   1 2 3 4 5

3. ____ ____ ____ ____ ____
   1 2 3 4 5

4. ____ ____ ____ ____ ____
   1 2 3 4 5

5. ____ ____ ____ ____ ____
   1 2 3 4 5

6. ____ ____ ____ ____ ____
   1 2 3 4 5

7. ____ ____ ____ ____ ____
   1 2 3 4 5

8. ____ ____ ____ ____ ____
   1 2 3 4 5