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The effects of peer tutoring on sport skill analytic ability

Halverson, Paula Dee, Ph.D.
The Ohio State University, 1987

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THE EFFECTS OF PEER TUTORING ON
SPORT SKILL ANALYTIC ABILITY

DISSERTATION

Presented in Partial Fulfillment of the Requirements
for the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
Paula Dee Halverson, B.A., M.S.

The Ohio State University
1987

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In memory of

John and Naomi
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And finally, I honor my family and especially my children who always commit 100% to their goals, providing living examples of excellence. Congratulations!
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CHAPTER I
INTRODUCTION

While it can be argued that academic learning time (ALT) was the most important educational variable of the last decade, it has become apparent in recent years that researchers moved beyond ALT to consider more specifically the quality of the learner's involvement (Stallings, 1985; Marliave and Filby in Fisher and Berliner, 1985). Educational researchers have begun to focus on the nature of the task, the communication of the task to the learner, the nature of the learner's responding, and the quality of the feedback provided the learner.

In physical education and athletics, feedback has always been thought to be an important learning variable. Successful practice and subsequent improvement of students, is thought to be partially attributable to the ability of the teacher/coach to analyze the performance accurately and provide the right feedback to the learner. While the general types and frequencies of feedback have been widely studied in physical education teaching research (Van Houten, 1980; Anderson and Barrette, 1978; Cheffers and Mancini, 1978; Laubach and Costello, 1978; and Fishman and Tobey, 1972) less has been done to study the accuracy of the feedback related to the student's performance on which the feedback is based.
The research conducted in this area has led to the conclusion that most physical education teachers do not possess sufficient skill analysis expertise to provide accurate, specific, feedback to learners.

In recent years, strong concern has been expressed in the professional literature of physical education regarding the need to help physical education preservice teacher candidates acquire skill analysis abilities as part of their teacher education program (Hoffman, 1977a, b & c and Armstrong, 1984).

There have been few investigations about how to accomplish this training task. Until recently, research has shown only that the traditional course in kinesiology does not result in skill analytic training that enables students to identify the critical elements and common performance errors of students. This research led Hoffman (1984), the leader in this area, to call for more attention to what he referred to as "pedagogical kinesiology"; that is, training in which the ability to analyze skills as they are performed in physical education and sports practices, was the major objective.

One of the first skill analysis training studies was reported by Gangstead and Beveridge (1984). Since then, researchers in the sport pedagogy doctoral program at The Ohio State University have undertaken a series of studies to examine various aspects and models for helping preservice physical education majors acquire skill analytic ability
(Kniffen, 1985; Wilkinson, 1986; Harrari, 1986). It is within this context that the study reported here was undertaken.

Both in the physical education literature as well as in literature of applied behavior analysis of learning, augmented feedback from a teacher or coach has been considered to be of fundamental importance to student learning (Siedentop, 1983; Van Houton, 1980). Feedback is supposed to be accurate, precise, and related to the prescribed task. But, within this literature, there is a general assumption (often implied) that teachers and coaches know the subject matter well enough to recognize critical performance elements and common performance errors. Research thus far indicates that this has been an erroneous assumption (Anderson and Barrette, 1978; Laubach and Costello, 1978; Fishman and Tobey, 1972 and Widenback, 1977).

It appears that if physical education teacher educators want their preservice candidates to acquire skill analytic abilities, they must teach them to the candidates directly; these abilities do not appear to develop from a more general study of kinesiology or biomechanics (Hoffman, 1977). If this premise is accepted, then the next issue becomes how to do it well and how to do it efficiently. The "how to do it well" issue relates to the effectiveness of a training program, particularly in developing skill analytic abilities that generalize to "live" settings. The "how to do it efficiently" issue relates to the resources necessary to accomplish the training task well. Kniffen (1985), and Wilkinson (1986) showed that physical education majors
could acquire high levels of skill in analytic accuracy through programs involving slow motion and stop action videotape training. It was the purpose of the present study to assess the degree to which similar kinds of analytic skills could be acquired through a peer tutoring program within a regular physical education class.

Hoffman (1977c) provided physical education teacher educators with some guidelines for a pedagogical kinesiology.

1. Movement responses or critical elements of performance for any given sport skill can be categorized into systematic taxonomies.

2. Teachers must be trained to discriminate correct and incorrect response characteristics for a given sport skill through observation training programs.

3. Sport skills should be evaluated on a qualitative basis with specific parameters for each response.

4. Knowledge of mechanical principles did not help teachers distinguish the difference between correct and incorrect movement responses.

5. Skill analysis training was best accomplished in simulated or field based settings where real performance efforts, not contrived, are studied.

6. The terminology of pedagogical kinesiology was based on brief summary labels and sharp picture words that are specific to the skills being analyzed.
7. Instrumentation for training and evaluation of a student's ability to analyze sport skills was an important key in the development of pedagogical kinesiology (Hoffman, 1977c).

Physical educators teach "live" individuals in a physical education gym or field setting. In this study, consequently, the investigator taught pre-physical education majors skill analysis which required learning the critical elements, practicing observation, analysis, diagnosis, and feedback on a peer partner. Peer tutoring coupled with direct instruction was one successful solution to providing more individualized, accurate feedback in the classroom. Peer tutoring provided a practical, inexpensive method for increasing sport skill analytic ability among physical educators. This researcher also wanted to determine if performing skills would enhance skill analytic ability of physical educators.

The training materials needed to be arranged to approximate the complexities of movement responses witnessed in the natural environment. Reciprocal peer partner performances during learning, provided authentic responses of live subjects. This enabled subjects to practice analysis and feedback in a realistic setting. Using the principles of instructional design and applied research technology, peer tutoring was used in the teaching of skill analysis.
Statement of the Problem

The purpose of this experimental study was to investigate the effectiveness of Peer Tutoring on the ability of pre-service physical education majors to analyze sport skill performance.

The secondary problem of this study was to examine the relationship between the subject's efficient performance of the critical elements and the ability to accurately analyze sport skill performance.

Related Questions:

1. How accurately do subjects verbally identify the critical elements of select sport skills during baseline conditions prior to intervention training?

2. How accurately do subjects verbally identify the critical elements of select sport skills as a result of participation in the Peer Tutoring Program?

3. How accurately do subjects visually analyze sport skills under baseline conditions prior to intervention?

4. How accurately do subjects visually analyze sport skills as a result of participation in the Peer Tutoring Program?

5. What is the relationship between verbal identification of the critical performance elements and the visual ability to recognize each of the sport skill performances prior to intervention?
6. What is the relationship between verbal identification of the critical performance elements and the visual ability to recognize each of the sport skill performances following intervention?

7. What is the relationship between efficient execution of the critical performance elements of each sport skill and the ability to verbally identify the critical performance elements of the sport skills following intervention?

8. What is the relationship between efficient execution of the critical performance elements of each sport skill and the ability to visually recognize the critical performance elements of the select sport skills following intervention?

9. Which sport skills did subjects find most difficult to analyze efficiently in this study?

**Significance of the Study**

This study examined peer tutoring coupled with direct instructions as an intervention strategy for developing sport skill analytic proficiency of future physical education teachers and coaches. The study consequently provided physical education curriculum designers with information on developing skill analytic instruction based on empirical research findings.

This research provided knowledge concerning verbal, visual and kinesthetic ability related to the teaching of sport skill analysis.
This study investigated the relationship between the accuracy in analyzing sport skill and the execution of the same sport skills by the subject. This study possibly provided information concerning the need for physical education students to be skilled in the performance of sport skills to assist them in giving more accurate feedback to learners.

**Limitations of the Study**

This study was limited by two factors:

1. This study was limited to undergraduate students enrolled in Physical Education 213 Movement Fundamentals and Basic Gymnastics at The Ohio State University, spring quarter, 1987.

2. This study was limited to the following six select sport skills as described in Tables 1 through 7 and illustrated in Appendix H:

   a) prone-to-prone headstand
   b) back straddle roll
   c) standing long jump
   d) cartwheel
   e) batting from a tee
   f) ball throw

3. The pre-test and maintenance test videotapes, as well as the probe videotapes, included films of middle school students (grades 6, 7, 8, 9) from three Columbus City Schools.
Assumptions of the Study

The following five basic assumptions prefaced this study:

1. The ability to analyze sport skills was measurable.
2. Critical performance elements were established for the efficient execution of a sport skill (Arend and Higgins, 1976).
3. The critical elements that comprise a sport skill can be defined, observed, and measured.
4. Based on the knowledge of experts the critical elements of each sport skill were selected.
5. The undergraduate college students who participated in this study constituted a representative sample of learners.
6. The middle-school students who participated in the videotaping of sport skills constituted a representative sample of learners.

Definitions of Terms

For the purpose of this study, the following definitions have been included:

Analytic ability - The ability to correctly identify the critical elements of a sport skill and indicate whether each element was correct, incorrect or missing (Kniffen, 1985).

Baseline - The measure of behavior or performance of a subject in the absence of the independent variable or experimental treatment.

Original data served as the objective basis or baseline by which to
evaluate any observed changes in behavior following intervention (Cooper, Heron & Heward, 1987).

Closed skill - Predictable movement within a fixed environment. The event was fixed, stable or controlled, and did not require much anticipation or environmental prediction (Whiting, 1972).

Critical element - One specific characteristic important to a series of movements. When combined, critical performance elements form a successfully performed sport skill.

Correct execution of performed critical performance element - Demonstrating established criterion or action as set up by expert consensus in this study (Welford, 1972).

Cross age tutoring - When an older, more experienced student taught a younger, inexperienced student.

Discrimination "The restriction of responding to certain stimulus situations and not to others" (Sulzer-Azaroff, 1977, p. 515).

Generalization - Transfer of learning from one behavior to another, from one subject to another, or from one subject to another, or from one setting to another as a function of previous treatment. (Cooper, Heron, Heward, 1987)

Intervention - The systematic introduction of the independent variables. In this study: peer tutoring practice analyzing critical performance elements.

Multiple baseline research design - Across behaviors, across conditions or across subjects. Multiple baseline has the advantage of not
returning to baseline to demonstrate experimental control. The investigator systematically introduced the independent variable into each baseline data series in a staggered or time-lagged manner. When intervention is introduced, change in the dependent variable occurred, and when intervention is not introduced no change occurs. Experimental control has been demonstrated. (Tawney and Gast, 1984)

Peer-Tutoring - One student teaching another student of approximately the same age and skill level. In this study the definition was limited to one student giving feedback to a peer on critical performance elements of a sport skill. The partners were of approximately the same age and experience.

Performance - a performance is a motor activity that has been or is about to be executed. (Wickstrom, 1977, p. 7)

Plenty of perfect practice - Opportunities to respond that are accurate. Critical elements of skill are utilized. Specifically corrective feedback is required. Adelaide College (Siedentop, 1983).

Probe - Periodic measurement of responses during baseline and pre-intervention. A probe is conducted intermittently on behaviors to be held in baseline; trained later, and a probe may be conducted periodically after treatment to determine if the intervention/treatment was maintained. (Tawney and Gast 1984, p. 69-70).

Reciprocal Peer Tutoring - Partners of approximately the same age and the same experience observed the performance of one another. Each gave
analytic feedback on the correctness or incorrectness of every response of their partner.

Response - A single instance of behavior. One opportunity to respond.

Skill analysis - The act of identifying errors in a learner's performance. A process by which a teacher or coach systematically observes motor responses of his students and thus, identifies discrepancies between actual and desired response characteristics (Hoffman, 1977b, p. 1).

Skill analytic proficiency or ability - performing skill analysis with 75% or better accuracy. The process by which the teacher or the coach systematically observed the responses of students and identified discrepancies between actual and desired response characteristics.

Sport Skill - an advanced or refined version of a fundamental skill that was used in a particular sport: For example, high jump related to jump . . . golf drive related to swing.

Spotting or spotted - To physically assist a gymnast . . . to manually support the performance of a skill or be close enough to performance to provide safety-support if needed.

Verbal identification - The ability to recall and produce a permanent record of the critical elements of a sport skill.

Verbal label - A concise key phrase that sums up the experts more complete description of critical performance elements.

Visual analysis - The ability to visually differentiate between correct and incorrect performances of a critical performance element.
Visual identification – The ability to accurately recognize the critical performance element during its execution.

Stimulus control – Stimulus control occurs when the antecedent (cue), systematically effects or becomes linked with the response behavior. The controlling stimuli are referred to as discriminative stimuli. The more probable the behavior, the more the response is under stimulus control.

Stimulus fading – The gradual removal of prompts, allowing the discriminating stimulus only to occasion the response.

Summary

Sport skill analysis has been established as the most important ability of a physical educator, stated Hoffman (1977c) and Armstrong (1984). Pre-service physical education majors lacked ability to perform accurate sport skill analysis reported Kniffen, (1985); Anderson (1978); Wilkinson (1986); Harari (1986) and Hoffman (1974). They added that physical education majors had little or no knowledge of verbal or visual critical performance elements of sport skills. For students to learn and improve, they must be given accurate feedback on the most important aspects of the skill in question. Hoffman illustrated this; He asked inservice physical educators to describe the major flaw in a film of the ball throw. The filmed subject stepped on the upsilateral foot. This error was detected by only 12.5% of the physical education teachers tested. Hoffman (1974) concluded:
The demands of most teaching and coaching environments require the teacher to analyze movement in situ, without benefit of rigorous controls, high-speed camera, motion analyzer, or fancy computer software. The physical education teacher evaluates movement, not by exacting quantitative means, but by visually collecting the essence of a movement, filtering out irrelevant events, and focusing on discrepancies between the observed and the desired response. In the absence of preserved graphic records of the movement, the teacher conducts ex post facto analyses of rapidly decaying precepts that are etched not on film but on the illusory territory of the mind's eye. (p. 74)

The purpose of this research was to determine whether undergraduate physical education students could improve their ability to analyze middle-school students performing select sport skills as a result of reciprocal peer tutoring and instruction. Hoffman (1977) reminded us that examples are plentiful where coaches have broken through perceptual barriers to offer highly detailed, accurate diagnosis of performance without cameras or electronic devices.

The following ideas gleaned from empirical research and based on tenets of pedagogical kinesiology guided this investigator:

1. Arend and Higgins (1976) discovered that the observers must know in advance specifically what to look for in sport skill analysis. The instructor stressed the importance of specifically watching the first two critical elements, the main central action of the skill or the "last two" critical elements. Few observers could watch a performance indiscriminately and come up with accurate, corrective feedback.
(2) The more opportunities the learner had to practice performing the skill, observing the skill, evaluating the correctness or incorrectness of the skill, the more proficient the learner became in sport skill analytic ability. Marlowe and Filby in Fisher and Berliner (1985); in Stallings in Fisher and Berliner (1985); and Doyle (1979).

(3) To become proficient at sport skill analysis, an additional characteristic was needed. A determined decision to scrutinize skill performance well, equipped the observer to give specific, corrective, accurate feedback. This feedback definitely assisted the students and performers. This investigator concluded that whether the analytic skill was gained through excellent performance, excellent officiating, excellent coaching or excellent teaching experience, may not have been as vital to accuracy as the observers decision to use behavioral techniques to acquire analytic proficiency.

Synthesizing the research, one concluded that the more coaching experience, the more teaching experience, the more observation and the more sport skill analysis one does, the more proficient one should become. However, the human quality of dedication, conscientiousness, or desire to increase the learning and/or winning performance of the students involved, appeared to increase skill analytic proficiency. This characteristic is not easily measured, described or observed, but this investigator believes it to be a catalytic ingredient. Through stimulus control, accurate feedback on the correctness or incorrectness of the critical elements may increase. Would assisting a peer partner
motivate learning as well as practicing on a computer? Would physical involvement, action, participation increase acquisition of skill analytic ability?
CHAPTER II
REVIEW OF THE RELATED LITERATURE

The literature related to this investigation will be discussed under five content areas: (A) sport skill analysis as a pedagogical subject, (B) feedback and skill analysis, (C) observation: a prerequisite to sport skill analysis, (D) the effect of kinesiological experience on sport skill analytic proficiency, (E) coaching experience and teaching experience as they relate to sport skill analytic proficiency, (F) models for training skill analytic proficiency and (G) peer tutoring as a learning strategy.

**Skill Analysis as a Pedagogical Subject**

Within a pedagogical setting, the correct analysis of a sport skill was a precursor of diagnostic or prescriptive feedback. The ultimate object was to facilitate learning.

Past concern for the development of competence in movement analysis has been very limited. It has been assumed that the associated skills are acquired through courses such as biomechanics, motor learning, and teaching methodology and are rehearsed through various types of clinical teaching experiences. The ineffectiveness of this process is clearly evident in the limited ability of many teachers to administer appropriate feedback. Research has shown that many factors influence analytic proficiency and that through the manipulation of these factors effective training in movement analysis can take place. This cannot occur haphazardly, however. It must be the result of systematically employed
training with a specific focus on the development of proficiency in movement analysis. (Armstrong, 1984, p. 31)

Therefore, the pedagogical kinesiologist, must understand the factors which affected the acquisition of skills, including the structure of tasks and the sequential relationships between task components. It was particularly important that the teacher recognized the correct and incorrect responses in sport skills and knew why deficiencies decreased excellence of performance. Provisions for training future physical educators in the movement analytic process should be included in any teacher preparation program. Unfortunately, reported Hoffman (1977) and Armstrong (1974), this is not the case.

Given the clearly established role of feedback in learning, the importance of developing competence in movement analysis became apparent. Hay (1973) expressed his awareness and concern when he stated:

In regard to introductory courses in biomechanics, I am concerned about the current trend toward decreasing the time devoted to the qualitative method of analysis and increasing that devoted to quantitative methods such as cinematography, electrogoniometry, force measurement and electromyography. The qualitative method—the biomechanical evaluation of human movements by visual inspection—is without question the most important analytical tool used by practicing teachers of physical education . . . a substantial mastery of the qualitative method is the first, and perhaps, the most important thing, we should attempt to give them. (Hay, 1973, p. 4)
Unlike traditional kinesiology, the main focus of pedagogical kinesiology was the nature of motor responses emitted by learners and the manner in which teachers perceived and synthesized information regarding these student responses in teaching. Interaction of the teacher with the performance of the learner was the central focus. The pedagogical kinesiologist, and thus the physical educator, accepted a challenging, but well-defined responsibility in the teacher education program.

The respected reputation acquired by expert gymnastics, diving, and track coaches, for example, frequently can be traced to their apparent ability to relay response information to their athletes based on accurate and reliable evaluations of their movements.

In reality, neither the advances and application of kinesiological technology nor the increased consumption of the fruits of this technology by students in kinesiology courses has proved to be a potent factor in developing the particular type of skill analysis used in teaching physical education. The student who understands the fundamental concepts of kinesiology and demonstrates a high degree of analytic proficiency in the kinesiology class continues to be no less perplexed in his attempts to analyze a learner's golf swing than the student who was poor in kinesiology. Locke has tabbed the undergraduate kinesiology course a "dry well as an influence on teacher behavior" (Locke, 1972) and kinesiologists who have had occasion to observe the teaching of some of their former students must concede his point. (Hoffman, 1974, p. 74)

In traditional kinesiology, skill analysis has been pursued as a research focus to gain insight into the mechanical features of human
motion through quantitative verification of the kinematic composition of specific motor responses.

Sport skill analysis in physical education was found to be more qualitative not quantitative, and more subjective than academic. Analyses were conducted to assess the behavior of learners rather than to understand mechanical phenomena associated with movement or to test theoretical specifications.

Competency-based teacher education proposed that two operations, diagnosis and prescription, were at the heart of motor skills teaching. Teachers must continually elicit responses, observe performances, and evaluate the learner responses comparing them to pre-established criterion standards. Hoffman (1977) explained on the basis of the evaluation, teachers made decisions concerning the type of prescription that was necessary to minimize the deficit between the observed skill and the desired behavioral state of the learner. Teachers who cannot identify critical elements in the response of the learner, or who cannot interpret their significance in relationship to goal attainment of the skill, were likely to commit serious mistakes as they moved into the prescriptive phase of teaching.

Whiting (1972) stated that as the student progressed from being a relatively unskilled to a relatively skilled performer, there was need for successful refinement both in his information processing ability and in his improved response to feedback. An example of excellence should be set up in the analyzer as well as the student. The data
regarding the state of affairs following each action/response must be compared with the established goal or standard. Welford (1972) suggested that discrepancy between the present skill performance and the goal that remained after each round of data analysis provided what is perhaps the most embracing operation in teaching. The more that discrepancies were reduced, by practice responses, the more skilled the student became.

Feedback and Skill Analysis

In education, there was a widespread conviction among learning and instruction theorists that teacher feedback following a learner's response was essential if learning and skilled behavior were to result (Armstrong, 1984; Van Houten, 1980; Siedentop, 1986; Bilodeau & Bilodeau, 1977; Hoffman, 1980; Paese, 1985). However, the variability and lack of specificity that characterized teacher feedback showed that many physical educators lacked knowledge and/or communication skills to administer accurate feedback. (Anderson, 1975; Tobey, 1974; Fishman, 1975; Cheffers & Mancini, 1975).

Assuming that most teachers possess the innate intellectual and perceptual capacity to administer good feedback, their failure to do so would appear to be most likely a function of inadequate training . . . It seems quite logical that feedback from teachers who are skilled in this prefeedback process is likely to supply the information necessary for response modification. Thus, competence in movement analysis appears to be an important precursor to competence in feedback administration. Given the clearly established role of feedback in learning, the
importance of developing competence in movement analysis becomes apparent. (Armstrong, 1984, p. 27)

Wiedenback (1978) recorded augmented feedback using a modified version of Fishman's system. Descriptive feedback only occurred in three out of 367 instances. Results indicated that teachers emitted more feedback following incorrect than correct responses. A feedback pattern for correct movement was usually verbal and referred to whole movement. Feedback following an incorrect response was sometimes accompanied by visual demonstration.

The training procedure was designed to ensure that most responses came under strong stimulus response and were correctly performed in the early stages of learning.

**Observation: A Prerequisite to Sport Skill Analysis**

Feedback was essential to learning, and sport skill analytic proficiency was essential for accurate feedback. Accurate observation skills may be the prerequisite for increasing skill analytic ability.

One possibility involves the process of observation. Sport performance is characterized by diverse movement patterns often performed at high rates of speed. Under these circumstances the observer must prioritize the movement components and determine a visual search strategy that will ensure that those of greatest importance are seen. On this basis it has been hypothesized that knowing where to look and how to look enhances one's analytic proficiency. (Armstrong, 1984, p. 29)
Little was known about observing as a teaching skill. Hoffman (1974) and Armstrong (1984) revitalized Kretchmar, Sherman and Mooney's request that research must determine a training program to develop keen observation for effective skill analysis. They recognized that a typical execution of a sport skill represents multiple stimuli as skeletal segments speed through space. Each movement, regardless of its relevance to the outcome, competed for the observer's attention. The observer as well as the performer must be placed under strong stimulus response. Practice observing the presence or absence of critical elements must take place. A consistent procedure was needed to organize the spatial and temporal components of the learner's responses.

Brown (1982) stated that observation must be specific and deliberate to be effective. Brown divided visual evaluation techniques for observing physical skills into the following categories:

1. Vantage Point of Observation.
   a. Appropriate distance from performers was established for entire sequence of body movements to be seen.
   b. Correct angle to see the total skill was established.
   c. Vertical or horizontal reference lines were established.
   d. Movement simplification occurred as "hub," and slower moving body parts (not extremities) were watched.
   e. Separate components of a short complicated skill were observed.
f. Complex skills were divided into the preparation, approach, action, follow through and finish/landing.

2. Balance and stability were at the base of support.

3. Movement relationships: Movement or muscle tension which did not positively contribute to the desired performance wasted physical effort and led to inefficiency and fatigue.

4. Range of movement: Speed/force and the range of motion of body parts was observed.

Hoffman (1974) reiterated that we must teach teachers how to deliberately observe and conduct movement analysis. The competence of a trainee to observe movement, detect performance errors and communicate information about movement, was best practiced and evaluated in a simulated or field-based setting (Hoffman, 1977). He developed a three-level model which included hierarchically ordered operations:

1. Observing the response of the learner. Integrity of observation was mandatory, declared Kretchmar et al. (1949). Observational ability was influenced by a number of factors. From student teacher journals maintained systematically over ten weeks, Barrett (1983) discovered students reported distraction as a major problem. The teachers observing skills were under weak stimulus control. Teachers needed practice observing under a number of different conditions and settings. Consistent stimulus control must be established and repetitious practice sessions must take place until the
teachers are not distracted by nondiscriminative stimuli. (Siedentop, 1987).

2. Evaluating the response after learner. During observation, the quality of the evaluation required that movements be sorted into categories of correct and incorrect, and efficient and inefficient. The quality of the evaluation was determined by the accuracy of reporting on the crucial elements of the performance.

3. Diagnosing the response of the learner. Beyond observation and evaluation was the task of diagnosing the cause and correction of the observed area. Hay (1973) reemphasized that diagnosing was difficult. One often recognized the symptom of malperformance, but failed to ascertain cause and correction. Using their three step model, Hoffman and Armstrong (1975) conducted a study which involved teaching physical education majors the critical elements of the standing long jump. They observed significant short term effects when physical education undergraduates received visual training in observing both correct and incorrect performances. Students trained under "correct patterns only" tended to see motor responses as conforming to correct performance criteria when in fact they did not!

Similarly, Robertson and Halverson in Barrett, (1983) described teaching as having the following three components: (1) observing, (2) interpreting, and (3) decision-making. These researchers emphasized that the skill of observing must be made more tangible, utilizing form and substance.
To address these concerns, Dodl (1973) designed a Competency Based Teacher Education Model. Sport skill analysis training began in a simple simulated context and evolved to a more complex work setting. Trainees were first required to demonstrate knowledge of the critical elements. Following mastery, Dodl (1973) recommended assessment of visual performance in a simulated context. Range and frequency of errors were controlled. Last, competency in skill analysis and feedback were assessed in the complex setting of the gym and field of play where the evaluation did not control for type and frequency of errors.

Bard and Flury (1980) found the visual search patterns of experienced observers (coaches and judges) were under strong stimulus control compared to those of inexperienced observers. The logical conclusion is that physical activity instructors should be provided with behavioral training to develop effective visual search strategies and should receive extensive practice in the application of these strategies.

The Effect of Kinesiological Experience on Skill Analytic Proficiency

Based on the literature there was reason to believe that a relationship existed between kinesiological experience and analytic ability. Which kind of experience, and how much of it was effective in improving skill analytic proficiency was the question. One way to
develop this ability was for the experimental students in Physical Education 213 to perform the skills which their students will be attempting to learn. "Ability to diagnose difficulty comes largely from ability to perform the skill correctly; . . . the actual involvement in performing and learning is a vital aspect of the analytic process," declared Vanier and Fait in (Armstrong, 1977, p. 59). It has been hypothesized that to effectively analyze motor skills, physical activity instructors must have extensive experience in the performance of those skills. Two studies acknowledged evidence to support this premise (Harari, 1986; and Girardin & Hanson, 1967). The error detection proficiency of subjects was found to be positively correlated to the performance experiences of subjects. The conclusions of Harari (1986) revealed that competitive gymnasts and former competitive gymnasts scored significantly higher than general physical education teachers and undergraduate physical education majors. A significant effect was calculated for the experimental group on the dependent variable, visual skill analysis score ($F = 58.73; 9 .001$). No statistical differences were found between the inservice teachers with five or more years of general teaching experience and the preservice physical education majors. The mean scores for the former competitive gymnastics background group and the gymnasts were 100% larger than the mean scores of the other group. The highest mean scores were achieved by the subjects with a competitive gymnastics background and teaching experience.
Wilkinson (1987) examined the relationship between proficiency in volleyball performance skills (serve, forearm pass and overhead pass) and skill analytic proficiency. In reference to performance skills, the Fisher tests for interaction showed no significant differences (p .05) between skill groups (high skilled, medium skilled and low skilled), and their ability to identify critical performance elements. There were no significant differences among varying skill levels in the visual or verbal identification of critical performance elements prior to, or following, the intervention in Wilkinson's research.

A study by Gordon and Osborne (1972) collaborated lack of relationship between performance skill in tennis and accuracy in evaluating tennis performances. Proficiency in identifying critical elements of motor patterns has been linked to some sort of experience. (Hoffman & Sembianete, 1974; Hoffman & Armstrong, 1975; Arend & Higgins, 1976; Biscan & Hoffman, 1976). If it is not performance experience and skill that increases skill analytic proficiency, what kind of experience is needed for an instructor to detect correct and incorrect motor responses of learners?

Coaching Experience and Teaching Experience as They Relate to Sport Skill Analytic Proficiency

In addition to the issue of performance experience, the aspect of coaching/teaching experience has been examined as it relates to analytic proficiency.
Barrett (1983) studied how coaches and physical education teachers observe. Walker, an international coach of track and field, spoke of "locking in" and holding the movement pattern in the "mind's eye" long enough to study the behavior.

Another nationally known teacher, Ellen Griffin, said when coaching golf she observed long enough to watch a pattern develop and notice a consistent weakness or strength or both. Griffin defined a weakness as a number of related errors. When this happened, she then looked for the cause. Both coaches observed relationships between body parts, not just a single action of one part.

From these ideas Barrett (1983) hypothesized a model which conceptionalized and described observing as a teaching skill. The ability to perceive the learner and the environment accurately, demands seeing what was actually there and not what was thought to be there. The model suggested by Barrett utilizes three steps:

1. selecting specific critical features that will be the focus of the observation;

2. identifying the best positions from which to observe these features;

3. deciding how to actually look at these features in terms of what to look for, when to look, and how long to look at the movement.

Barrett (1983) advised prioritizing the identified critical elements because the learner can only attend to so much at a time. She encouraged focusing on incorrect features of the whole body, and
filtering out all irrelevant events. Finally, Barrett (1983) stressed focusing on discrepancies between the observed and desired responses.

Virtually all studies related to this issue have demonstrated a positive relationship between coaching/teaching experience and analytic proficiency (Armstrong, 1984; Biscan et al., 1976; Hoffman et al., 1975; and Moody, 1976). Subjects scoring highest in analytic proficiency were those having the most intense coaching/performance experience. In three studies where groups were compared analyzing an unrelated task with which they had no prior experience, no difference was found between the subjects. This suggested a direct relationship between performance experience and analytic ability (Armstrong, 1972).

Additional evidence was made available in a study which compared the skill analytic proficiency of a group of adult softball and baseball players and coaches with the skill analytic ability of general physical educators. Hoffman et al. (1975) required subjects to compare filmed techniques of model batters against specific illustrated variations in test films. The coaches and players scored significantly higher than the teachers. Interestingly, all of the physical educators had graduated from programs in physical education and completed at least one kinesiology course. Few of the coaches or players had attended college and none had professional teacher preparation (Hoffman, 1977).

Similarly, Hoffman et al. (1975) found that the performance of baseball coaches was superior to that of physical education and
classroom teachers on an analytic task involving batting. Biscan et al. (1976) found that the analytic proficiency of physical education teachers was superior to that of classroom teachers when a tumbling task was used. However, when a novel movement pattern was taught, reviewed and analyzed, the proficiency did not transfer (Armstrong, 1985).

These results suggested that various components of the analytical process may be specific to individual skills or possibly categories of skills. Additionally, the findings of Hoffman et al. also provided an indication as to the role of various types of experiences in influencing analytic proficiency (Armstrong & Hoffman, 1979; Imwold & Hoffman, 1983).

Armstrong (1984) disclosed that instructional expertise reflected the ability to produce positive changes in a learner's motor behavior. It may be appropriate to conclude that physical activity instructors should be provided with extensive experience in the administration of systematic movement analysis strategies in both clinical and field-based settings.

Armstrong and Hoffman (1980) hypothesized that experienced teachers, when compared to those with less experience, should demonstrate a superior level of proficiency in detecting errors in performance within their areas of expertise. Forty professional tennis teachers with an average of 18.5 years experience, and forty undergraduate physical education majors with an average of 1.9 years of
experience, took a 15-error-detection test observing 15 right-handed players execute the forehand stroke. The score of the subject on the Error Detection Test was determined by subtracting the total number of incorrect responses from 180 possible responses. A three-way ANOVA was conducted. Results of this analysis indicated a main effect for the variable experience [$F(1,72) = 7.81, p .04]$]. A review of the data indicated an accuracy score of 78.3 percent for the experienced subjects, and 70.8 percent for the inexperienced subjects. Also, experienced subjects exhibited fewer false alarms (13.25) than inexperienced subjects (16.23). The finding that experienced tennis teachers demonstrated a greater degree of error detection proficiency than inexperienced subjects is consistent with previous studies. Experience in playing and/or teaching a skill only facilitated a 7.81 gain in perception of motor response elements (Armstrong et al., 1980). This researcher concluded that 18.5 years of playing or teaching is a large investment for such a small gain in skill analytic ability.

The design of Armstrong et al.'s 1980 study "Teaching Experience and Knowledge of Performer Error Identification Competency," did not permit a differentiation between the effects of playing tennis and the effects of teaching tennis. Data from other studies (Armstrong, 1976) have suggested that mere playing experience is unlikely to facilitate analytic proficiency. The variable performance competence did not influence scores of either group in observing and analyzing the performance of tennis players.
If the relationship between kinesthetic experience and skill analytic proficiency was established and the complexities understood, analytic ability could be maximized through controlled manipulation of kinesthetic learning experiences in the training of teachers. Until recently, research had failed to control a critical factor, the extent and type of performance experience.

Armstrong (1977) designed and conducted a study to control the independent variable, extent of performance experience. Using a novel movement pattern and a controlled number of practices, each subject experienced learning a novel dance skill. No direct feedback was given. The subjects then viewed twenty filmed examples. Subjects were to evaluate performance of critical elements. Results of the data analysis failed to support the hypothesis that extent of kinesthetic experience and analytic ability are positively related. The results suggested that experience in performing a sport skill did not enhance one's ability to analyze that sport skill. On the basis of Gordon & Osborne (1972), Wilkinson (1986), Armstrong (1977), and a number of related studies reviewed by Armstrong (1984, p. 28), this researcher concluded that requiring physical education majors to acquire experience in sport performance improved their ability to perform and model skills, but did not guarantee proficiency in movement analysis.

The purpose of the Imwold et al. (1983) study, "Visual Recognition of a Gymnastic Skill by Experienced and Inexperienced Instructors" was to determine the relationship between teaching experience and sport
skill analysis. The study compared three groups with different levels of gymnastic teaching experience. Twenty gymnastic coaches (specialists), twenty veteran physical education teachers (generalists) and twenty pre-service physical education teachers (novices) were assessed using a unique film/slide testing technique. Results confirmed findings of previous studies which showed skill analysis to be a function of experience and familiarity with the skill. Specialists demonstrated 54 percent accuracy, generalists demonstrated, 47 percent accuracy, and novices demonstrated 46 percent accuracy. Previous studies have found the same margin of accuracy between subjects trained to identify errors and those untrained (Hoffman et al., 1975) and between experienced and inexperienced tennis teachers (Armstrong et al., 1979; Biscan et al., 1976; Hoffman et al., 1975). The subject who has performed, practiced and studied the specific components of the skill tends to have more proficiency in analyzing movement. (Hoffman et al., 1975; Biscan et al., 1976; Armstrong et al., 1979; Imwold et al., 1983; Armstrong, 1984; and Harari, 1986). Of particular interest is the finding of five of these studies that proficiency in analyzing one type of sport skill did not appear to generalize to other types of sport skill. For example, the physical education majors who had just successfully completed intensive skill analytic training in volleyball, with Wilkinson (1986) scored no higher than the other four groups in the gymnastic study of Harari (1986). These findings implied that little transfer of skill analytic training
in volleyball carried over to gymnastics. Skill analysis proficiency may need to be taught deliberately for each sport.

**Models for Training Skill Analytic Proficiency**

Of particular relevance to developing pedagogical competence are those studies that enhanced analytic proficiency through specialized training. Armstrong (1984) reported that of the three studies in which he was involved, two demonstrated that deliberate training improved analytic proficiency. Programs involving extensive visual experiences and examples of errors produced the best results. Armstrong suggested that physical education instructors should be provided with structured training experiences specifically focusing on competence in movement analysis.

To date, there is no published record of any system having been developed that would enable teacher education faculty to assess trainee competency in identifying performance errors in those skills commonly taught in the public schools. (Hoffman, 1977, p. 3)

Until recently, the programs that appeared to come close to formally assessing trainee competency in skill analysis involved kinesiological analysis using written examinations on mechanical principles. Although firmly embedded in our training tradition these measures were lacking in two respects. First, they failed to meet the most lenient standards of validity; the nature and purpose of skill analysis taught in kinesiology class bears little relationship to the nature and purpose of sport skill analysis required in teaching motor
skills (Hoffman, 1977). Because a few models and studies had been
developed, Lockes' (1972) statement that the field is a "dry well," was
a little less appropriate in 1987.

Methodological approaches to skill analytic training were
developed by Gangstead (1985). Research by Gangstead and Beveridge
(1984) proclaimed that systematic long-term analytical instruction
using an observation framework helps physical educators organize
spatial and temporal aspects of movement.

In both studies, two components of the analytic process were
assessed:

a. short term retention of observed motor responses

b. knowledge of correct motoric patterns

Preparation, action and follow-through phases were given special
attention. The model suggested that subjects selectively attend to the
primary body segments. They emphasized the importance of first
focusing on the "hub" or slower moving, large parts of the body. Next,
one should progressively focus on the outward, faster moving
extremities.

The purpose of the Ganstead et al. (1984) study was to
investigate the effectiveness of three methodological approaches to
sport skill analysis instruction:

1. the observation model.

2. the "correct-only" model.

3. the "common errors" model.
The experimental group utilized the methodological models, while the control group received no specific strategy. Gangstead (1983) reported that the experimental group analyzed skills to a significantly greater degree than did the control group.

Kniffen (1985) and Wilkinson (1986) found that at the pretest, physical education majors and pre-physical education majors (not yet admitted to the program) lacked proficiency in visually discriminating critical elements of sport skills. Following videotape instruction, however, both Kniffen (1985) and Wilkinson (1986) reported significant improvement of verbal and visual discrimination of critical sports elements. Subsequent to videotape instruction, a positive linear relationship existed between verbal and visual improvement of the ability to discriminate. As the ability of the subject to recall verbal labels increased, it acted as a cue for visual discrimination of critical elements to increase. Kniffen (1985) and Wilkinson (1986) concurred that visual analysis cannot be attempted without mastery of verbal identification of critical elements of a skill.

Kniffen (1985) supported the hypothesis that analytic skills can be acquired through specialized training programs. Highly skilled college students provided examples of each skill on video training tape. Utilizing the Keller Personalized System of Instruction (PSI), the subjects learned the materials at their own pace. Their analytic ability was first assessed on a videotape test, and finally in a school setting viewing real student performances. The sport skills used in
this investigation were cartwheel, long jump, throwing and batting. Kniffen (1985) reported that instructional videotapes were very effective in helping undergraduate students identify the correct and incorrect critical elements.

Wilkinson (1986) developed the Volleyball Skill Analysis Visual Discrimination Training Program to teach skill analysis proficiency. The training package format involved the following three components in observing volleyball skills:

1. Stop action
2. Slow motion
3. Normal speed

Efficient and inefficient subjects presented visual displays at all three speeds. Subjects participating in the Volleyball Skill Analysis Visual Discrimination Training Program significantly improved in verbal identification and visual analytic ability of the critical elements as compared to the control group who received only basic instruction in volleyball. Correct and incorrect exemplars were used because the value of negative examples was recommended by Locke (1972), Hoffman & Armstrong (1975), and Ulrich (1977).

As in the research study by Kniffen (1985), a self-paced personalized system of instruction was used in Ulrich's (1977) study. A Golf Swing Error Detection/Correction Module was developed which enabled the trainee to discover golf swing problems. Visual materials, the most accurate sensory input vehicle reported, were selected as the
media used. Pictures, slides, videotapes and films provided views of simulated staged golf swings. As in previous studies, Ulrich (1977) reported the urgency of making adjustments and corrections immediately after initial learning so indiscriminate stimulus would not hinder progress. The model formulated by Ulrich, first presented "Errors in the Address Position," a 35mm film. Next, "Swing Errors," a 16mm split screen color film was viewed.

The Golf Swing Error Detection Correction Module was used over a three-year period with randomly selected students enrolled in required golf classes for physical education trainees. Results were mixed. Class instruction appeared to report more favorable responses than self-paced instruction groups. Since Ulrich (1977) reported no pre-test/post-test scores or measurements of student growth, results of skill analysis proficiency are vague.

Golf was also the game scrutinized by Skrinar (1978). The study was titled, "The Effect of Performance Outcome on The Analytic Ability of Experienced Golf Instructors." The subjects were randomly assigned to a knowledge-of-outcome-group or a no-knowledge group. Results were similar for both groups. Showing subjects the flight of the golf ball, the distance traveled by the golf ball, and final result of the golf ball, made no difference to the skill analytic proficiency of the subject. Observing the action of the performer and analyzing the presence or absence of critical performance elements enabled the instructor to give more accurate feedback.
Peer Tutoring as a Learning Strategy

Over the past two decades, psychological and educational research has established convincing data that students can influence the psychomotor, cognitive and affective development of one another. The literature clearly indicated that students produce behavioral changes in their peers (Kalfus, 1984; Damon, 1984; Cooke, Heron & Heward, 1983; Mizden and Linton, 1983; Goldberger, 1982; Donder and Nietupski, 1981, and McGee, 1971). While reviewing the literature, peer tutoring referred to one student teaching another student of approximately the same age and skill level. Cross-age tutoring referred to older students teaching younger students. Reciprocal peer tutoring referred to students of approximately the same age and skill level teaching each other. In this study, one student performed the skill being learned, and received specific corrective feedback; next this student observed their partner perform the skill being learned and gave specific corrective feedback.

Damon (1984) stated that peer tutoring not only increased task learning, but peer tutoring also significantly enhanced social skill development. Damon (1984) continued proposing that certain educational material may be more readily grasped through adult-child instruction. The recent interest in peer-based learning has risen from a number of converging trends within psychology and education. Cognitive developmental psychologists in the Piaget tradition used peer interaction as means of providing children with uniquely constructive
feedback, while Soviet psychologists in the Vygotsky tradition studied the special thought processes engendered by peer communication (Damon, 1984).

Experimenting with peer tutoring in the schools has established the instructional benefits of peer interaction for the tutor, as well as the tutee. The conceptual foundation for a peer-based plan included the listed principles:

1. Peer tutoring offers an effective, low-cost supplement to adult teaching.

2. Peer tutoring aided the efforts of teachers to provide individualized learning experiences for their students.

3. The experience of peer communication helped a student master social processes; (such as, increased participation and augmentation), and cognitive processes (such as, verification and criticism).

4. Peer interaction introduced students to the process of generating ideas and solutions with mutual respect. Peer learning helped underachieving groups of students overcome their motivational deficits. Through mutual feedback, peers motivated one another to abandon misconceptions and try better solutions to skill development.

A peer tutoring spelling game using a token economy system with social reinforcement was successfully conducted by Delquadri (1985). Peers gave error correction and dramatically improved the spelling performances of learning disabled third graders. Eighteen average
peers also improved their spelling scores through the same procedure, though not to the same degree.

Palinscar (1984) compared the effectiveness of peer tutoring with three other instructional methods of teaching reading. Four groups of seventh graders were given identical developmental reading materials designed to teach four strategies: question generating, content clarification and prediction, and summarizing. Initially the teacher did a considerable amount of direct instructing and modeling of the four strategies to be learned. The first intervention used was reciprocal peer teaching using corrective feedback. As instruction progressed the students were given more and more responsibility for initiating and sustaining the dialogue while the teacher guided the practice.

The second technique used was reciprocal teaching with more peer practice. This was identical to the first procedure except that after four days the students continued to practice the strategies by writing summaries and questions, listing points to be clarified, and predicting outcomes on segments of the text. Teacher feedback was minimal. The third procedure for the control group utilized no peer practice and no peer feedback. The teacher still demonstrated each strategy to be learned. The fourth technique was treated control in which the students were only given worksheet activities on the four categories. Results indicated that the most effective instructional procedure of the four was reciprocal teaching with corrective feedback. The
instructional procedure showing the second greatest learning gain was reciprocal teaching with practice. Palincsar (1984) stated that the findings suggested the importance of reciprocal peer feedback.

Palincsar and Brown (1983) dealt with reciprocal teaching in a reading comprehension study. The most successful intervention was teaching students how to locate information and to use reciprocal teaching. This technique revealed the greatest improvement from baseline. The reciprocal teaching procedure was a powerful intervention for improving comprehension. Correct responses increased from fifteen percent during baseline to eighty percent following reciprocal teaching. As a result of this procedure, these students achieved their most accurate and stable reading performance to date. This level of accomplishment was retained during the maintenance phase of the study.

Palincsar et al. (1983) studied a simpler intervention labeled "Locating Reading Information." It was superior to no intervention, but the effects were not as impressive, nor as enduring, as the effects of reciprocal peer teaching.

Cooke et al. (1983) presented a model that utilized peer tutoring and proved to be effective and manageable in improving reading and math. These researchers mainly reported on development of a classwide sight-word and math-fact peer tutoring program for the primary grades. The Cook, Heron, Heward model was based on three years of research through Project Interaction, a federally funded model project from the
U.S. Office of Education. Project Interaction verified that regular education students and special education students could successfully share in a classwide peer tutoring program. The program used reciprocal peer tutoring. That is, each student served in the role of both tutor and student for his partner within the same session. Cooke et al. (1983) reported that reciprocal peer tutoring had the advantage of providing students with equal opportunities to enjoy and gain skills from both roles of performer and tutor. Another feature of reciprocal peer tutoring was that each student was as equally "privileged" and as equally active as the others.

In physical education, peer tutoring programs have also been successful, especially with exceptional children. The Physical Education Opportunity Program for Exceptional Learners (PEOPEL) was initiated in Phoenix, Arizona, at West High School as an ESEA Title III project designed to provide a successful physical education experience for exceptional learners. The PEOPEL program was field-tested for five years. Pre-post testing evaluated physical fitness, skill acquisition and student attitude toward physical education. Result's are not based on a controlled experiment. The PEOPLE program used trained student aides for peer instruction. Smaller class size and individualized learning were among the educational improvements implemented. Peer tutoring resulted in a lower student-teacher ratio than both regular physical education and adapted physical education classes. Long, Irmer, Burkett, Glasenapp, and Odenkirk (1980) stressed the importance
of training the aides one semester prior to the implementation of classes. Peer tutors must have successfully completed a semester of physical education and an interview with their counselor. If chosen, they attended student aide training. The class was titled Physical Education Careers Class for Student Aides. It carried advanced physical education credit. PEOPEL materials have been developed, implemented, reviewed and revised. They included a Student Aide Training Manual and PEOPEL Teachers' Guide. The teachers' guide contained 35 units of instruction. Each unit contained task-analyzed sequences of activities in different sports such as gymnastics, swimming, individualized sports and team sports. Pre- and post-tests were included and administered. Student progress was charted using the format in the training guide.

Similarly to PEOPEL project, Tanner (1977) was challenged by the problem: how can a regular physical education program for 490 junior high school students be conducted when funds can only pay for one half-time physical education teacher? The faculty and staff came up with many innovative ideas such as (1) Train academic teachers to teach physical education to their homerooms. The half-time physical educator acted as consultant and rotated where help was needed. (2) Teach movement education instead of physical education. This revealed the need for time-consuming inservice training which was more costly than a half-time teacher. (3) Transport and train high school students interested in the helping-professions to work with the certified
physical education teacher. This choice lowered pupil-teacher ratio allowing many more students to participate; this approach was selected.

Thus, Tanner (1977) developed and implemented a physical education program with an emphasis on fitness utilizing a cross-age tutoring model. A corollary goal was to provide positive learning experiences for both tutors and tutees as in a physical education program taught by a trained teacher on a full-time basis. Meeting state standards was an administrative mandate.

Tanner (1977) structured and implemented a cross-tutoring model that was invaluable. He then developed a brief student tutoring manual. The results of his subjects were equal to, or surpassed previous test scores conducted in the traditional physical education fitness program.

Techniques of applied behavioral analysis, such as reinforcement, were directly incorporated in Tanner's program. Additionally, a less comprehensive program by Rush and Aylon, (1984) employed peer coaching in a soccer program. Peer behavioral coaching was compared to the conventional method. The behavioral method included: (a) systematic use of verbal instructions and feedback, (b) positive and negative reinforcement, (c) positive practice, and (d) time out. The results reported thirty-three to sixty-six percent increase in soccer skill performance for all nine subjects previously deficient at baseline in headings, goal kicks and effective throw-ins.
Review of literature disclosed successful use of peer and cross-
tutoring and teaching not only in regular physical education,
adapted physical education, but also in University physical education
teacher preparation. Metzler, (1984); Siedentop, 1988; Hawkins,
Wiegand & Landin, (1985); and Belka, (1985) reported peer teaching as a
technique used with undergraduate physical education majors. They were
assigned to prepare brief instruction on one technique or one skill.
Customarily, the first micro peer teaching presentation was taught one
to one. The next assignment was taught to a small group of peers.
Initial teaching experiences often lasted no longer than five minutes.
Peers gave specific feedback on the objectives of the lesson and then
took their turn teaching.

At The Ohio State University, physical education majors subsequent
experience was ten to fifteen minutes long and required inclusion of a
hierarchical teaching progression. The assignment included interaction
with, and feedback from the peers. The process and feedback
interaction was reciprocated. The third lesson simulated a total
lesson plan for a physical education class. This lesson usually lasted
twenty to thirty minutes and was taught to a still larger group of
peers. Each lesson progressed, "built on yesterdays lesson," and
included an introduction to new material. Increased Academic Learning
Time-Physical Education, efficient management with a decreased
percentage of waiting-for-opportunities-to-respond, were required
components of the student's planning and implementation. At The Ohio
State University peers collected data using The Ohio State University Academic Learning Time-Physical Education instrument to give the physical education majors precise feedback on how they used the teaching time (Siedentop, 1986).

Damon (1984) listed guidelines and principles of peer tutoring/teaching from educational and psychological research findings:

1. Tutors should be supervised by credentialed adult teachers.
2. Tutoring instructions must be well-planned, clear and easy to follow for the tutors.
3. Tutors must have the ability to follow directions.

Equipping the tutor with teaching skills and effective techniques requires specific training procedures (Tanner, 1977; Cooke et al. 1983; Long et al. 1980).

4. Students should be encouraged to assume both the role of tutor and tutee.
5. Tutoring should be done on a one-to-one basis as often as possible.
6. The same tutor and tutee should be paired over a substantial period of time enabling a personal relationship to develop between them.
7. Unless special circumstances dictate differently, peer tutors should be two or three years older than the student whom they teach.

The model Cooke used found the principle of differential ages
unnecessary and inconvenient because it required programming of tutors into and out of regular class assignments.

Peer tutoring, cross tutoring, and reciprocal peer tutoring are all reported successful in the literature. This writer found positive gains with all subject matter at every grade level in every setting where tutoring was used, indicating peers were capable of giving feedback to assist learning.
Chapter III is divided into five main sections. Selection of Subjects is section one. Next, the Dependent Variable, Sport Skill Analytic Ability is discussed in: (a) selection of the critical performance elements, (b) pre-test and maintenance test videotape construction, (c) reliability, (d) written test of critical elements of sport skills, (e) verbal and visual sport skill analysis test, (f) "live" peer sport skill analysis and sport skill performance.

The third section concerns development and description of the Independent Variable, Peer Tutoring. It is discussed in: (a) designing illustrations and worksheets, (b) structuring peer tutoring instructions, (c) validity and (d) reliability.

Research Design is section four followed by Data Collection Procedure, section five.

Selection of Subjects

Subjects for this study were selected from the total population of students enrolled in Physical Education 213, Movement Fundamentals and Basic Gymnastics, at The Ohio State University, Spring Quarter, 1987. Each subject read and signed Subject Standard Release form in compliance with the guidelines established by the Human Subjects
Committee of The Ohio State University. A copy of this form may be found in Appendix A. Prior to taking the pre-test, each subject completed a personal history, as summarized on Table 1. Background information concerning each subject included (1) age, (2) sex, (3) college rank, (4) major, (5) skill analysis course experience, and (6) gymnastic team experience. This allowed the investigator to match subjects.

All subjects took the sport skill analysis verbal and visual pre-test to determine their entry level skill and knowledge. The criteria for evaluating sport skill analysis ability were based on the number of correct and incorrect critical elements compared to the master key. The total sample completing the pre-test totalled fifty-one (n=51). Of that total, the number of subjects completing the pre-test in section one, totalled forty-three (n=43). Their pre-tests were scored, recorded and the students were then stratified by an Ohio State University Graduate Assistant and the investigator. One half of the sample became the experimental group and was assigned to the investigator. The matched half became the control group and those students were assigned to an experienced gymnastic coach and lecturer in physical education at The Ohio State University.

The third group was an intact Physical Education 213 class. For the balance of this study, this group was referred to as the "regular instruction group." The number of subjects completing the pre-test in the "regular instruction" group were sixteen (n=16). They were taught
### Table 1
Experimental Subject Background Information

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>SEX</th>
<th>AGE</th>
<th>COLLEGE STANDING</th>
<th>MAJOR</th>
<th>SKILL LEVEL</th>
<th>EXPERIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>M</td>
<td>20</td>
<td>Sophomore</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>1B</td>
<td>M</td>
<td>20</td>
<td>Sophomore</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>2A</td>
<td>M</td>
<td>18</td>
<td>Freshman</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>2B</td>
<td>M</td>
<td>21</td>
<td>Junior</td>
<td>Physical Education</td>
<td>Med.</td>
<td>No</td>
</tr>
<tr>
<td>3A</td>
<td>F</td>
<td>19</td>
<td>Sophomore</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>3B</td>
<td>F</td>
<td>23</td>
<td>Senior</td>
<td>Exercise Science</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>4A</td>
<td>M</td>
<td>18</td>
<td>Freshman</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>4B</td>
<td>F</td>
<td>19</td>
<td>Sophomore</td>
<td>Physical Education</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>5A</td>
<td>M</td>
<td>20</td>
<td>Sophomore</td>
<td>Physical Education</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>5B</td>
<td>M</td>
<td>18</td>
<td>Freshman</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>6A</td>
<td>M</td>
<td>20</td>
<td>Sophomore</td>
<td>Physical Education</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>6B</td>
<td>F</td>
<td>19</td>
<td>Sophomore</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>7A</td>
<td>M</td>
<td>20</td>
<td>Junior</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>7B</td>
<td>F</td>
<td>18</td>
<td>Freshman</td>
<td>Physical Education</td>
<td>Med.</td>
<td>No</td>
</tr>
<tr>
<td>8A</td>
<td>F</td>
<td>24</td>
<td>Senior</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
<tr>
<td>8B</td>
<td>F</td>
<td>22</td>
<td>Junior</td>
<td>Physical Education</td>
<td>Med.</td>
<td>No</td>
</tr>
<tr>
<td>9A</td>
<td>M</td>
<td>20</td>
<td>Sophomore</td>
<td>Exercise Science</td>
<td>Low</td>
<td>No</td>
</tr>
<tr>
<td>9B</td>
<td>F</td>
<td>23</td>
<td>Senior</td>
<td>Recreation</td>
<td>High</td>
<td>Gymnastics</td>
</tr>
<tr>
<td>10A</td>
<td>F</td>
<td>18</td>
<td>Freshman</td>
<td>Physical Education</td>
<td>Med.</td>
<td>No</td>
</tr>
<tr>
<td>10B</td>
<td>M</td>
<td>19</td>
<td>Freshman</td>
<td>Physical Education</td>
<td>High</td>
<td>No</td>
</tr>
</tbody>
</table>

Skill Level was how many critical performance elements (six x four) that the subject performed correctly. The four skills analyzed were prone to prone head stand, back straddle roll, cartwheel and long jump. 24-22 = High skill, 21-20 = Medium skill, 19 or below = Low skill level.

Experience refers to attending any class that conducted sport skill analysis; no subject had this experience. The second experience was participation on any gymnastics team. Only one subject had this experience.
by an expert gymnastic coach, with former experience in competition. It is customary for this professor at The Ohio State University to teach this class. Regular instruction using the critical elements of the same skills took place. Peer spotting and incidental peer feedback occurred, but the instructor and students were kept naive regarding the specific Peer Tutoring Training Program. The number of subjects completing the pre-test in the regular instruction group totalled sixteen (n=16). Testing took place the first day of class to establish baseline performance.

**Dependent Variable: Sport Skill Analytic Ability**

**Selection of Critical Performance Elements**

Six sport skills were selected for this study: The prone-to-prone head stand, the backward straddle roll, the cartwheel, the standing long jump, the overhand throw, and batting from a tee. These skills were chosen because (1) they were closed skills representing predictable movement requirements within a fixed environment (Beveridge and Gangstead, 1984; Kniffen, 1985); (2) these skills have commonly been taught in most physical education classes from elementary to college level; (3) these skills represented a variety of types of skills: balance, hand-eye coordination, swinging, striking, propulsion, jumping and throwing (Wickstrom, 1970); and (4) skills taught were part of the regular class content.
A comprehensive review of the literature was conducted for each skill; the investigator selected the six most commonly cited performance points or critical features for each skill. These will be referred to as "critical elements." The critical elements represent the aspects of the skill performance the experts deem necessary in order to successfully execute each skill. The critical elements also represented the aspects of skill performance that the investigator taught and emphasized in the study.

After tallying a consensus of expert opinion of the 6 most critical elements of each sport skill, detailed descriptions of each were formed. From those, brief verbal labels were synthesized for each critical element.

Tables 2 through 7 show the expert's opinions on performance elements for each skill under investigation.

Table 2 shows the six elements most commonly cited by experts for the prone-to-prone headstand. Those were:

1. Lie on stomach with the full body extended. Place forehead, hairline on tumbling mat forward of hands. Place hands shoulder width apart to form a triangle. Elbows should be bent; hand and arms should be firm.

2. Place one-third weight equally on forehead and one-third weight on each hand. Balance.

3. Lift hips in a "controlled draw" overhead as in a tripod; keep legs extended.
Table 2
Prone to Prone Head Stand Critical Performance Elements

Starting position: Lie on stomach, body fully extended.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Place hairline /forehead on mat forward of hands to form a triangle (elbows bent; hands and arms strong)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Place hands shoulder width apart behind Head place 1/3 wt. on forehead, 1/3 wt. on each hand (not all on head).</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Lift (controlled draw) hips overhead (like tripod but legs are extended).</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>4. Lift both legs together to inverted position, full extension vertically.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Hold full extension for three full seconds; keep calf and thigh muscles taut (toes pointed, legs straight).</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>6. Lower both legs together keeping hips overhead (control piked position), then slide toes and controlled, extended legs to prone position.</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
4. Lift both legs together to inverted position at full extension
vertically.

5. Hold full-extension for three full seconds; keep thigh and
calf muscles taut, toes pointed and legs straight.

6. Lower both legs together keeping hips over head. Control the
piked position, then slide toes and controlled, extended legs back to
prone starting position.

Table 3 shows the six critical elements most commonly cited by
experts for the backward straddle roll. These were:

1. Begin with legs straight and wide spread in straddle position.
Legs must remain extended throughout skill. Chest and head are focused
forward.

2. Tuck chin, bent forward and place hand on tumbling mat between
legs.

3. Hands must take body weight in center of straddled legs as
seat is lowered; roll backward on to the buttocks.

4. Transfer both hands beside head, pushing body backwards
vigorously. Maintain momentum.

5. Hips go over head and extended legs pass the vertical plane.

6. Land equally on balls of both feet. Lift hands off mat as
trunk is straightened to upright position.

Table 4 shows the six critical elements commonly cited by experts
for the cartwheel. Those were:

1. Head should be up and arms extended upward throughout; lead
foot must be established.
Table 3
Backward Straddle Roll Critical Performance Elements

<table>
<thead>
<tr>
<th></th>
<th>1. Straddle stand: Legs straight and wide spread (legs remain extended).</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>2. Tuck chin/bend trunk forward (place hands back between legs).</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>3. Hands must take weight in center as body (legs &amp; seat) are lowered. Roll backward onto buttocks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>4. Transfer both hands beside head, pushing body backwards vigorously.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>5. Hips go overhead and extended legs pass the vertical plane.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Land on balls of both feet. Raise hands off mat/straighten trunk to upright position.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

TAYLOR, BAJIN, ZIVIC
SOTGIULIA, G.
RYZER
MCCLAIN
KIDNEY
COOPER
THE CONSENSUS
Table 4

Cartwheel Critical Performance Elements

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1. Focus: Head up and arms extended throughout. Established lead foot. | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 2. Lunge: Swing lead hand to mat, then 2nd hand to mat. | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 3. Swing legs up one at a time; maintain separation. | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 4. Body fully extended in a vertical position or through a vertical plane. Handstand position. | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 5. "Foot...foot" landing pattern or lower lead leg to mat and 2nd leg to mat. | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 6. Finish in balanced side stand position. | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
2. Lunge, bending trunk; swing lead hand to mat then second hand to mat as:

3. Legs are swung up one at a time with leg separation and extension maintained;

4. Body is fully extended in a vertical position until:

5. Lead foot, second foot land one at a time.

6. Finish in a balanced side stand position: head, chest, trunk up with arms extended up diagonally.

In an attempt to limit the critical elements to six, the investigator collapsed two critical elements into lunge and swing lead hand to mat. This action is labeled critical element #2.

Table 5 shows the six critical elements most commonly cited by experts for the long jump. These were:

1. Head and chest are kept straight ahead throughout: From a comfortable stance, a deep 90 degrees or less crouch is taken.

2. Arms must be swung back 45 degrees or more toward parallel to ground.

3. Full body extension (forceful extension of hips, knees, ankles and arms).

4. Legs are lifted high; as hips are flexed, legs extend.

5. Knees are flexed just as heels hit the tumbling mat as:

6. Arms are driven forward to carry jumper forward.

Table 6 shows the six critical elements most commonly cited by experts for the long jump.
<table>
<thead>
<tr>
<th></th>
<th>Standing Long Jump Critical Performance Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Focus: Head and Chest straight ahead throughout.</td>
</tr>
<tr>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
| 2. | Deep crouch.  
    | Arms swing back. |
|    | X | X | X | X | X |
| 3. | Full body extension. |
|    | X | X | X | X | X | X | X |
| 4. | Lift legs high; hips flexed;  
    | legs extended. |
|    | X | X | X | X | X | X | X |
| 5. | Bend knees just as heels hit sand/ground as: Deep crouch landing  
    | with arms in front of body. |
|    | X | X | X |
| 6. | Drive arms forward to carry jumper forward. |
|    | X | X | X | X | X |
| 7. | Chin to chest. |
|    | X | X |

**Table Notes:**

- THE CONSENSUS
- SEATON & SCHMIDTACH
- HAY
- ARMBRESTER, CHAMIN, MUSKER
**Table 6**

Overhand Throw Critical Performance Elements

<table>
<thead>
<tr>
<th>Focus: Eyes on Target.</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Side to target; weight on rear foot.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Ball-throwing hand, elbow and arm back and up.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3. Step in opposition toward target.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Rotation of hips, trunk and shoulder.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Elbow leads, forearm extended in overhand/arm throw.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6. Wrist snaps toward target; wt. transfers forward as arm crosses over body in follow-through.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Those were:

1. Eyes are focused on target; glove and shoulder point to target.
2. Weight should be on rear foot as body is opened up. Ball-throwing hand, elbow and arm move back and up by throwing shoulder.
3. Step in opposition toward target as:
4. Trunk and ball throwing are rotated toward target;
5. Elbow leads, forearm is extended on ball throwing side.
6. Wrist is snapped toward target as hand and arm cross over body in follow-through.

In an attempt to limit the critical elements to six, the investigator collapsed three elements into two. "Side to target; weight on rear foot" became number one. "Ball-throwing hand, elbow and arm back and up" became number two.

Table 7 shows the six critical elements most commonly cited by experts for batting.

Those were:

1. Head must be held still; eyes must be kept on ball throughout; bat is cocked back behind head; weight is kept back. Elbows are held up and away from body.
2. Step in closed stride toward pitcher.
3. Rotate body full as:
4. Bat is swung level with straight arms;
5. Ball is met in front of body toward pitcher;
Table 7
Batting Critical Performance Elements

<table>
<thead>
<tr>
<th>Focus: Head still; eyes on ball throughout.</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bat cocked back behind head; elbows away from body.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Step in closed stride.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Full body rotation.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Level swing with straight arms.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Meet ball in front of you, toward the pitcher.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Maximum wrist rotation; complete swing through ball.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Next in sequence the critical elements were made brief and identified with verbal labels. They remained in chronological order to match their actual occurrence when the skill was correctly performed.

**Pre-Test and Maintenance Test Videotape Construction**

A pre-test was needed to evaluate the baseline sport skill analytic ability of the experimental subjects in Physical Education 213. Similarly a maintenance test was needed to evaluate the sport skill analytic ability of the subjects following intervention. Kniffen (1985) developed the thorough plan of technology that was replicated in this study.

A sample of two hundred and eight middle school students performing the six sport skills selected were videotaped. The Ohio State University was granted permission by the principals and physical education teachers of three middle schools in Columbus, Ohio to videotape sixth through ninth grade boys and girls during regularly scheduled physical education classes.

A portable Panasonic VHS color videotape camera and tape deck were used to videotape the students. A twelve-foot by nine-foot off-white muslin backdrop was hung to provide a viewing background of uniform color and eliminate distracting visual stimuli. The students to be videotaped were centered at a starting line one foot in length. Students were positioned on this line three to four feet from the backdrop to prevent any interference with, or movement of the muslin.
The camera was secured to a tripod positioned in line with, and fifteen to eighteen feet away from, the center of the marked starting line. The tripod was vertically adjusted to elevate the camera four and a half to five feet from the floor. The horizontal adjustment was loosened to allow for slight movement in order to accommodate student movement during taping. The zoom lens was adjusted to make each student appear as large as possible on the camera monitor without any body part disappearing from view during skill execution. Zoom lens adjustment was also made to accommodate the various heights of students. During the initiation of each skill, the camera was moved slightly to the right to make the student appear in the left third of the camera monitor.

The equipment needed for student performance of these skills included gymnastic mats for the tumbling skills and long jump; batting tee for the battings; a whiffle ball for the overhand throw.

Arrangements were made for the procedure used in filming. Three visits were made to each school for videotaping. The camera and personnel became, over the course of these visits, a familiar part of the scenery, reducing reactivity.

Prior to each skill performance, students were given the same standard instruction: "Please perform the skill as well as possible." Wickstrom (1977) indicated that a full effort on the part of the performer is necessary for reliable analysis; too little or too much effort leads to distortion of the skill.
Following each performance, the camera was left on for ten seconds recording the backdrop to allow enough blank tape between subjects for future videotape editing. Time was recorded by voice on each tape. Minutes and seconds were announced as locator cues which provided a means of locating and identifying each student for replay and editing. In the final test tapes the students were numbered and announced verbally preceding each performance to correspond with the answer sheet.

After viewing two hundred and eight performances, fifty-four, performances were selected and edited into the final test tapes. To be selected, a performer occupied two thirds or more of the vertical height of the television monitor thus providing a satisfactory viewing picture. Critical elements were apparent: either incorrect, correct or missing. The picture had to be clear without blurring, bouncing or fading. During editing, the performance was recorded three times at normal speed to allow the physical education 213 subjects the opportunity to view three consecutive replays of the same middle school student performing the same skill. Each "instant replay" was separated by three seconds of blank tape. Twenty student performances were selected for the pre-test, twenty similar, but different, student performances were selected for the maintenance test and fourteen similar but different student performances were selected for the probe tests. Examples from each skill were presented; some students performed all critical elements incorrectly, some students
performed all critical elements correctly and some students performed a combination of correct and incorrect elements. The middle school students exemplified the variation of sport performances one normally finds in a physical education class as witnessed twenty years by the investigator. Appendices C through E show the order of skills and the critical elements performed correctly and incorrectly in pre-test, maintenance test and probe tests.

Once the pre-test and maintenance test were developed, each critical performance element was visually inspected by an associate professor and three graduate students, who had gymnastic coaching experience. The use of slow motion and stop action film were used to determine presence or absence of critical performance elements if decisive interobserver agreement was not established. A clear, plastic sheet was placed on the monitor; straight lines were drawn (on the sheet) through the axis of the body segments. A protractor was used to determine degrees of flexion or extension when necessary.

**Reliability**

Cooper, et al. (1987) and Tawney and Gast (1984) define reliability as the extent to which independent observers agree on what they see and evaluate. In this study, the data are all permanent products, captured by the non-judgmental lens of a videotape camera and recording equipment. This assures greater accuracy of data collection and evaluation. The filmed performances of the critical
elements were viewed and analyzed independently by four observers, each of whom had equal or greater gymnastics knowledge than the researcher. These experts verified the presence or absence of each critical performance element in each visual test. The following formula was used to establish interobserver agreement:

\[
\text{Interobserver Agreement} = \frac{\text{Agreements}}{\text{Agreements} + \text{Disagreement}} \times 100
\]

Responses were made to each of the 432 critical elements as correct or incorrect. When the investigator and the independent observers agreed on the correct and incorrect performance of critical performance elements, that evaluation was included on the master answer key of pre-test, maintenance test and visual-verbal probe test. Disagreements were intervals in which one observer recorded a response that opposed the other observers. Interobserver agreement on the responses for the pre-test resulted in the following:

\[
\text{Interobserver Agreement} = \frac{176}{180} \times 100 = .9777
\]

The four items disagreed upon were examined again using slow motion or stop motion videotape controls. A final determination was made as follows:

Subject three: critical element number five "overarm throw." In slow motion all observers agreed that this subject threw sidearm,
so element number five was marked incorrect on master key.

Subject eight: critical element number one: "bat back, weight back." All observers had written question marks on item one, because the student had placed her body 150° toward third base (instead of toward the pitcher's mound). Stop motion viewing revealed that in fact the bat and body weight were back. Element one was marked correct on the master answer key.

Subject eleven: critical element number two "lead hand to mat . . . second hand to the mat . . ." The investigator thought the subject had placed both hands on the mat simultaneously, but in slow motion the hands were placed separately and the element was marked correct on the master answer key. 100% was reached on all other items.

Interobserver agreement on the responses for the maintenance test coincidentally resulted in the same:

\[
\text{Interobserver Agreement} = \frac{176}{180} \times 100 = .9777
\]

The four items disagreed upon were examined again using slow motion or stop motion videotape controls. A final determination was made as follows:

Subject one: critical element number one "Deep crouch of 90° or less." This element was recorded as incorrect on the master key. 100% agreement occurred when viewing slow motion; no deep crouch occurred.
Subject three: critical element number five, "elbow lead, forearm extension in overhand throw," was marked correct on master key. 100% agreement was reached when viewed in slow motion.

Subject six: critical element number six, "finish swing through ball using maximum wrist rotation." When viewed in slow motion, 100% agreed that no wrist rotation, and little follow through occurred. Number six was then marked incorrect on the master answer key.

Subject nineteen: critical element number five includes "overhand throw." In slow motion all observers agreed that this subject threw sidearm so element number five was marked incorrect on the master answer key. All other critical elements on the maintenance test were agreed on 100%.

Once the pre-test and maintenance videotape tests were thoroughly checked for reliability, the master answer key and student test forms were finalized.

Videotape pre-tests were administered to all subjects attending either section of Physical Education 213. Instructions for the pre-test and maintenance are Appendix B. They were asked to list the critical elements of the six sport skills previously defined and record the correctness or incorrectness of the twenty performances they viewed. The same television monitors, video cassette tape, video cassette recorder, playback unit and classroom were reserved for both morning
and afternoon sections. In addition, this identical arrangement was controlled for the probe and maintenance testing of all subjects.

Subject answer sheets (see Appendices C through F) collected in baseline, intervention, and maintenance phases of the study were graded independently by a graduate student from The Ohio State University as well as the investigator. Each used a master answer key by which to compare the answers of the student.

The grading of the responses first involved the matching of the written six critical elements to the established critical elements of each skill on the master key. Failure to write an element leaving a space blank, was marked as an error. Any written element that was vague or confusing in meaning was marked as an error. If half of a critical element was listed, one half credit was given. Furthermore, no credit was given for visual discrimination if no written critical element was listed on the left or when the corresponding critical element was graded as an error.

The number of correct responses for verbal (written critical elements) were symbolized with a (A). The number of correct responses for visual discrimination of critical elements performed correctly or incorrectly were indicated with a (●) and plotted on the graph. In either case the highest score was six.

At the completion of marking all pre-tests, they were graphed. The independent graduate student observer, again checked every item to
be certain they were graphed properly. Five errors existed making
Interobserver Agreement = \frac{691}{696} \times 100 = 0.992

**Written Test of Critical Elements of Sport Skills**

Following learning the skill-of-the-day, a written test was
administered to all experimental subjects to measure their verbal-
knowledge-only of the six critical elements. Beveridge and Gangstead
This established the readiness of subjects to precede to peer tutoring
practice of sport skill analysis. Subsequently, the Peer Tutoring
Skill Analysis Model provided many opportunities to perform correctly.

Siedentop (1983) investigated Adelaide College, which promised
"plenty of perfect practice" to their physical education students.
This model was adapted for the Peer Tutoring Skill Analysis Program.
Many opportunities to perform correctly were structured into the
treatment. Both in skill analysis and skill performance, specific
corrective and positive feedback was given so that experimental
subjects in Physical Education 213 knew how close they were coming to
achieving 100% correct responses.

The Applied Behavioral Analysis technique of shaping was
incorporated, especially if the skill was new to the student. The
students were reinforced for closer approximations to the terminal
objective. The performer was given brief correction and a verbal
prompt of the critical element not performed. Each student was praised for the critical elements performed correctly.

Verbal and Visual Sport Skill Analysis Tests

Sessions to test verbal and visual sport skill analytic ability followed sessions of peer tutor and peer performance practice at skill analysis. All experimental subjects viewed two video-taped performances of the skill they had practiced. They wrote the six critical elements of the skill and then evaluated the correctness or incorrectness of the filmed performances. Each performance had been chosen from the same two hundred and eight middle school performances.

On the same videotape shown at this session, three performances of an untaught skill, untreated, were probed. Subjects were asked to write down the six critical elements of the skill and judge the correctness or incorrectness of the performance. This completed session two.

"Live" Peer Sport Skill Analysis and Sport Skill Performance

Session four concluded peer tutoring for each skill. A "live" peer tutoring of skill analysis and partner-performance occurred. In addition, a videotape of every experimental subject performing the skill, and conducting skill analysis of the performance of his partner, was made. This established a permanent product of their sport skill analysis by which expert independent observers could compare competency.
Kniffen (1985) established the precise videotape specifications that were once again replicated by this researcher. In addition, black 12" by 9" numbers were placed in front of the off-white muslin backdrop to clearly identify each experimental subject.

1. Subjects 1A and 1B were first instructed to list the six critical elements of the skill.

2. The designated skill was performed by partner 1A. Subject 1A was instructed, "Please perform your best cartwheel." While performer 1A performed the cartwheel, tutor partner 1B conducted skill analysis on the live performance, determining the correct or incorrect performance of the critical elements.

3. Partner 1A was asked to perform a second cartwheel. "Please do your best cartwheel again." If any critical elements were absent or poorly performed on the first response, the subject could correct these elements on the second response. If subject 1A improved the performance of the critical elements, 1B reflected the improvement that could be detected.

4. If subject 1A performed less efficiently, skill analysis of the first performance was used.

5. Peer partner 1B performed in succession after 1A. Next, the team rotated to a gymnastic station. 2A and 2B performed sport skill analysis next. This procedure continued until all 10 couples had been videotaped.
Each subject averaged 3 minutes total time. The peer partner was allotted 30 seconds of this total time to visually skill analyze each performance; few needed the entire time. The experimental group of 20 subjects averaged one hour to complete the total videotaping of skill analytic process. This included warm-up and stretching time as well as procedural review time. Evaluation sheets from peer verbal/visual skill analysis can be seen in Appendix F.

The researcher and a physical education graduate student with whom interobserver agreement had been previously established at 97.7% independently conducted skill analysis of each experimental subject.

The videotape performances were watched at regular speed. In most instances 100% agreement occurred so the peer-partner skill analysis test was compared to the master key. If a critical element was judged differently by the independent observers, slow motion or stop action was used to re-scrutinize and reach 100% interobserver agreement. Then the peer partner skill analysis test was compared to the master key.

Concurrently with peer skill analysis and video-taped performances, each partnership rotated through instructional gymnastic stunts and rhythmic gymnastic activities to ensure that little waiting occurred.

The control group was taught in a separate, matted apparatus gymnasium. Vaulting, rings, parallel bars and balance beam were among their activities. Halfway through the quarter, experimental and control groups exchanged instructors. Each received the other half of the
course content. The investigator found it helpful to arrive one hour early and arrange the videotape camera, tripod, V.C.R. cassette playback unit, television monitors, extension cords, lights, temperature, tapes, tumbling mats, muslin backdrop, test and answer forms, filming signs, subject identification numbers, peer learning packets, masking tape, pencils and other needed supplies. All educational equipment was reserved eight weeks in advance to guarantee availability and equality controlled for every test environment.

The Independent Variable: Development and Description of the Peer Tutoring Program

Designing Illustrations and Worksheets

Many current textbooks written by cited experts contained illustrations of the sport skill being taught, or depictions of one or several critical elements. Some examples used simple stick figures to illustrate the targeted skill. Based on the expert consensus, the investigator sketched the six critical elements of each of the six sport skills under analysis. Subsequently, an artist re-drew the sketches to make them clear and complete. These drawings became a vital component of the training program. Worksheets were designed to enable the experimental subjects to learn the critical elements as illustrated and labeled. A worksheet using the same illustrations without labels enabled the class to practice filling in the names of the critical elements based on pictures only. The worksheets were then removed and
students wrote the critical elements without prompts. Illustrations and worksheets may be seen in Appendix H.

The critical elements for each skill were defined in observable and measureable terms. This information was presented in visual and verbal form. Illustrations of the six critical elements of each skill were included. In addition, the critical elements were identified with brief verbal labels and listed in chronological order from one to six to match the occurrence when the sport skill was performed correctly.

A behavioral procedure called stimulus response was used. Simple responses already in the repertoire of the peer tutor were reinforced to form more complex behaviors in a stimulus response chain (Cooper, Heron and Heward, 1987). Each response, except the last, produced the stimulus (SD) for naming the next critical element. The last response that occurred in the presence of a stimulus (SD) but not in its absence was said to be under stimulus control. (Martin and Pear, 1983)

To further ensure stimulus control, discrimination training was used. Additional prompts increased learning. Picture forms of each of the six critical elements of each sport skill were used to illustrate each element and act as prompts. The instructor said, "The cartwheel has six main critical elements. Read the labels of each critical element as illustrated and labeled. Now we will repeat the labels aloud together." The class then looked at the pictures, and read the labels aloud. Thus the brief labels identified each element and
served as clear, bold and obvious verbal prompts. Note that prompted responses are not under stimulus control, however.

There are three basic types of prompts. Many skills in gymnastics lend themselves to all three prompts as listed:

1. **Visual Prompts.** The correct technique of each skill was modeled subsequent to learning the verbal labels. Illustrations of the correct techniques were also used. To maintain experimental control, illustrations of skills taught were distributed and collected daily so that the training package was not inadvertently viewed by members of the control group. This procedure also ensures the exposure of materials to experimental subjects.

2. **Verbal Prompts.** Stimulus "cues" such as, "stretch your body," "hand, hand, foot, foot," "push with your hands," and "sit-in-a-chair" were verbalized. Initially, the names of the critical elements were typed as labels under the picture forms on the worksheets provided to each subject.

3. **Physical Prompts.** Assisted students in developing the kinesthetic "feel" of the skill. Most beginners in gymnastics need to be physically supported or "spotted" through gymnastic skills. The first phase of Peer Tutoring Skill Analysis Program was to teach the physical education majors to correctly name and define the six critical elements of each skill. Direct instruction was used for the introduction of the six critical elements of each skill and practice in naming and defining the critical elements of each skill.
The use of prompts was gradually faded. Pictures without labels were subsequently used to ascertain the knowledge of the critical elements gained by the subjects. Next, both written and verbal prompts were totally withdrawn; subjects were required to write down the six critical elements without any illustrations or prompts. Scoring 100% qualified subjects to conduct peer tutoring and physical practice of the skill with their peer partners.

**Structuring Peer Tutoring Instructions**

The second phase in developing the Sport Skill Analysis Program was structuring the Peer Tutoring Instructions. A review of the literature revealed success in the use of peer tutoring to increase learning. Tanner (1979), Long et al. (1980); and Cooke et al. (1983) reported peer tutoring was a productive, positive experience when well structured. This research reported that even very young, very seriously handicapped students were successful and efficient in carrying out their tutoring responsibilities when under stimulus control. Cooke et al. (1983) cautioned that without sufficient training, peer tutoring quickly became chaotic and wasted class time. Time to train tutoring skills of students must be allotted. Essential skills should be learned first and secondary skills then learned after these basics are performed. See Appendix G for Peer Tutoring Instructions used in this study.
Blanchard and Johnson (1986) stressed the importance of one minute of goal setting and one minute of corrective feedback if the goals are not completed. If the goals are met Blanchard and Johnson (1986) suggest one minute of positive feedback. Cooke et al. (1983) agreed that instructors should give plenty of positive reinforcement to all tutors for their accurate and appropriate skill analysis. Prompting, praising, giving specific, corrective feedback and positive reinforcement are behavior principles to enhance peer tutoring or any learning.

Reliability

Cooper et al. (1987), and Tawney and Gast (1984) state that an intervention is reliable if the same results are produced when the treatment is repeated. By using multiple baseline design and probing baseline skills until treated, the researcher checked reliability. The data may be suitably relied upon because the measure yielded similar findings on successive trials. In this study the treatment was effective on twenty subjects over six skills.

Research Design

The nature of the independent variable in the present study was most compatible with the multiple probe and multiple baseline across behaviors, research design. The experimental logic of the multiple baseline and multiple probe design is explained by Baer, Wolf and Risley (1968) as follows:
In the multiple baseline technique, a number of responses are identified and measured over time to provide baselines against which changes can be evaluated. With these baselines established, the experimenter applies an experimental variable to one of the behaviors, produces a change in it, and perhaps notes little or no change in the other baselines. If so, rather than reversing the just produced change, he instead applies the experimental variable to one of the other as yet unchanged responses. If it changes at that point, evidence is accruing that the experimental variable is indeed effective and that the prior change was not simply a matter of coincidence. The variable may be applied to still another response, and so on. The experimenter is attempting to show that he has a reliable experimental variable in that each behavior changes maximally only when the experimental variable is applied to it. (p. 94)

The purpose of the single subject design was to apply the experimental variable to one behavior, attempting to change that behavior (skill analytic proficiency of the backward straddle roll, for example) while retaining all other dependent variables in baseline. The independent experimental variable was then applied in a systematic way to each of the other behaviors. Skill analytic proficiency was developed for the headstand, cartwheel and finally the long jump.

The method of Baer et al. (1968) was maintained in the study until the experimental treatment had been presented to all behaviors. Thus experimental control was demonstrated when the introduction of the treatment variable produced a change in the target behavior even while other target behaviors remained at baseline levels. To produce such an experimental condition required the use of independent target
behaviors. A basic assumption is that targeted behaviors are independent from one another. If they should happen to covary, then the controlling effects of the treatment variable are subject to question.

In this study, four independent variables (i.e., reciprocal teaching instructional packages) were sequentially introduced to four separate dependent analytic behaviors (the analysis of prone-to-prone headstand, backward straddle roll, standing long jump and cartwheel). Twenty different subjects and their partners received the treatment over each of the four sport skills.

In addition to the single subject research design, a research design that provided a quasi-experimental pre-test/maintenance-test control group was chosen in order to compare changes in sport skill analytic ability between experimental and control groups (Campbell and Stanley, 1966).

The total sample consisted of three groups: the experimental group (n=20), the class control group (n=16), and the regular instruction class (n=15). All subjects were members of Physical Education 213 Movement Fundamental Basic Gymnastic Skills class. All subjects in experimental and control groups were stratified according to pre-test results. Those scoring well on the skill analysis pre-test, those scoring around the average and those scoring poorly were stratified, and then randomly assigned to the experimental group or the
control group so that an equal number from each level belonged to each group.

The experimental (treatment) group and the control (non-treatment) group were students from one intact Physical Education 213 class. The regular instruction group (n=15) were students enrolled in another intact Physical Education 213 class. The experimental (treatment) group received the Peer Tutoring Sport Skill Analysis Program. Verbal and visual materials as well as physical performance of the sport skills attempted to focus the attention of subjects on the six critical elements of each skill. The control group and the regular instruction group were taught by expert gymnastic instructors from The Ohio State University. The experimental treatment group was taught by the investigator. The control group was not given any information contained in the training program. The course instructor was kept intentionally uninformed as to the content of the training program as well as to the specific critical elements that were emphasized in the experimental section. All groups completed the pre-test and maintenance test. This data was used to make comparisons among the experimental group, control group and regular instruction group.

Data Collection Procedures

All subjects in the experimental, control and regular instruction groups of Physical Education 213 were given a pre-test on six selected sport skills. Videotape Test Instructions may be read in Appendix B. All filmed performances were repeated three times at regular speed.
The pre-test viewed by the subjects consisted of four baseball throws, four batting responses, four cartwheels, three back straddle rolls, three prone-to-prone headstands and two long jump performances. Each subject was asked to list the six critical elements for each skill and then judge whether the subject performed correctly or incorrectly. The answer sheets used by the subjects during the pre-test and maintenance test are included in Appendices C and D.

The data generated by the three groups during the pre-test provided a measure of the baseline ability of each subject to determine critical performance elements and analyze regular speed sport skill performances.

After introduction of the peer tutoring procedures, subjects chose partners (retained throughout the research). Partners were presented with data folders identified with the names and numbers of each. Partner tutoring instructions and worksheets were enclosed. They may be seen in Appendix G. The folders were handed to and collected from the experimental subjects preceding and following each training day. These folders and all intervention materials were maintained in a box by the investigator. The investigator took inventory of each folder each day. Learned information was removed by the investigator and new information was added. No items were ever missing. Every effort was made to avoid exposure of the independent variable treatment materials to the control or regular instruction groups. Experimental subjects were requested to refrain from discussing the peer tutoring sport skill
analysis training outside of class. Peer practice took place during Physical Education 213 class time only. The experimental subjects were not allowed to copy training materials nor remove any material from the gym.

Next in succession, the written-test-only, the verbal-visual probe and the live-peer tutoring test, produced permanent products from which data could be retained. Data were checked for reliability by the independent observer and the investigator.

After completing peer tutoring and performance practice, the experimental subjects watched two videotaped performances of the learned skill as performed by middle school students in an actual physical education class setting. Next a baseline level skill was also shown on the videotape. As in all videotaped tests the performances were repeated three times at regular speed. Experimental subjects wrote down the critical elements they considered most vital to the performance of the skill. Analysis of correctness and incorrectness of each critical element was evaluated.

The final session of peer tutoring data was collected as all subjects did sport skill analysis of two live performances by their partner and then reciprocated. All were videotaped providing a permanent product. The investigator and the independent observer viewed the videotaped performances judging correctness or incorrectness of each element of performed skills. The investigation and independent observer had six disagrees out of nine hundred sixty items making
interobserver agreement $\frac{954}{960} \times 100 = 99\%$. The six times that there were differences of decision, the performance was reviewed and scrutinized in slow motion by the investigator and independent observer. Correctness or incorrectness was easily decided at slow speeds. Their agreed upon answer was then compared to the responses of the undergraduate subjects. Almost 100% of the time both observers agreed upon the written answers of each subject.

The results of this dissertation research clearly showed that the peer tutoring program was effective in assisting undergraduate students in learning the critical elements of sport skills. Peer tutoring also increased ability to visually discriminate between correct or incorrect performances of those critical elements. An experimentally significant difference was found between skill analytic ability of experimental subjects at baseline and following intervention.
CHAPTER IV
ANALYSIS AND DISCUSSION OF DATA

This chapter presents the findings of the study: The Effects of Peer Tutoring on Skill Analytic Ability.

The chapter is divided into the following sections: (a) the reliability of the dependent variable (test materials), (b) rationale for visual inspection of data (c) graphed multiple baseline data for each experimental subject (d) data analysis of individual experimental subjects (e) results of control group and regular instruction group and (f) a discussion of the research questions investigated.

Single subject design refers to a strategy that documents changes in behavior of the individual subject. Tawney and Gast (1984) said it was possible to demonstrate a functional relationship between intervention and change in behavior. Through empirical verification, behavior change occurred because the intervention occurred and for no other likely reason.

Reliability of the Dependent Variable

Chapter three presented a summary of the procedures for data collection and evaluation of student responses. The methods used for conducting reliability tests were also discussed. This section presents the outcome of those reliability checks.

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Directions for scoring test answer sheets were established and standards were made consistent. A reliability check was conducted on each question of every subject to determine the accuracy of the grading by the researcher. A copy of the master key and a copy of the answer sheet of each subject was given to the independent scorer. Each scorer had their own set of illustrated and labeled critical elements in addition to the master answer key. The independent scorers knew the critical elements as thoroughly as the investigator. Interobserver agreement had been established and rechecked on almost a daily basis from conception of the study. To maintain consistency, one assistant graded every pre-test and every maintenance test simultaneously with the investigator. The second assistant graded every experimental subject peer tutoring intervention test, probe tests and live videotape tests. In every case, grading occurred independently but simultaneously with the investigator. Half of a critical element was given half credit. If any two half credits occurred among the potential six, one point was awarded. In final totals, if a partial credit stood alone, it was not counted. Wilkinson (1986) and Kniffen (1985) established that if the words or descriptions in an answer were vague or confusing to the skill performance, they were marked incorrect. If the critical element was more than one position above, or one position below the established order, it received no credit, this allowed a three line variable. In almost every case the critical elements that were in an incorrect sequence were also so vague or
incorrectly described, that they were marked wrong before hierarchy had to be considered.

The independent scorers scrutinized, graded and checked the recording of each item of data in this study to establish that all data are accurate.

Results of the pre-test showed the independent scorer and the researcher disagreed on twenty-nine verbal critical elements out of the total six thousand two hundred forty written items on the pre-test; this produced interscorer agreement of $\frac{6211 \text{ agrees}}{6340 \text{ agrees + disagrees}} \times 100 = .995$ interobserver agreement.

Also in the pre-test, the independent scorer and the researcher disagreed on seven visual critical elements out of the total, six thousand two hundred forty visual analysis elements producing $\frac{6233 \text{ agrees}}{6240 \text{ agrees + disagrees}} \times 100 = .998$.

In the maintenance test the independent scorer and the researcher disagreed on eight verbal (written) elements out of the total six thousand two hundred forty items; this produced $\frac{6232 \times 100}{2240} = .998$ interobserver agreement.

On the maintenance test the independent scorer and the researcher disagreed on five visual critical elements out of the total six thousand two hundred forty visual analysis items. This resulted in $\frac{6235 \times 100}{6240} = .999$ agreement. The grand total of disagreements between independent scorer and the researcher equalled forty-nine for pre-test
and maintenance test making interscorer agreement:

\[ \frac{6191 \text{ agrees}}{6240 \text{ agrees + disagrees}} \times 100 = 0.992 \text{ overall I.O.A.} \]

Disparity in agreement can be explained by several factors. First, the subjects often wrote vague or confusing critical elements during baseline tests. In addition, grading standards had been established that half-credit would be given for the presence of a partial critical element when there were often two actions required by the experts. After intervention, the experimental subjects were not given this advantage because they had been taught each critical element correctly as a total action.

The last concern was regarding order of the critical elements. At baseline some subjects placed vague descriptions in incorrect sequences. The skill could not possibly be performed by following these critical elements. During baseline the independent observer would remind the investigator to think like a scientist and not a supportive teacher. After the introduction of the independent variable no exceptions were made for the experimental subjects. Experimental subjects had to have precise labels in exact order, which makes the true gain from baseline to maintenance even greater than it appears in the data.

After grading a few pre-tests, the independent scorer and the researcher were consistent and precise regarding definitions. This resulted in an overall 99% interscorer agreement demonstrating a high level of reliability.
After peer tutoring was taught, the written/verbal test-only followed in succession. This written test of the six critical elements was a prerequisite to peer tutoring. Stimulus response and direct instruction were coupled with worksheet practice. There were four hundred and eighty items and 100% agreement.

A subsequent test of the dependent variable, skill analytic proficiency, occurred following each treatment. It has been labeled the "probe test" for this study. The subject did skill analysis (verbal and visual) on three videotaped performances. The first two were performances of recently treated skills; the third performance tested was a skill remaining untreated in baseline. 3,120 items were corrected. As explained in Chapter III, master answer keys had been developed earlier, using three independent observers. Though the established master key was used to grade the "probe tests," fourteen disagreements arose and critical elements needed to be re-examined. Eight of the fourteen critical elements were untaught sport skills remaining at baseline. Creative student answers containing partial facts in confusing sequences are challenging to evaluate. The independent scorer and the researcher disagreed on fourteen items resulting in \( \frac{3160 \text{ agrees}}{3120 \text{ agrees} + \text{disagrees}} \times 100 = .995 \) interscorer agreement.

The final test of the dependent variable was "live" peer performance and skill analysis. There were nine hundred and sixty verbal items to correct and nine hundred and sixty visual test items to
correct; of those there were only three disagreements on verbal elements. Interscorer agreement = \( \frac{957 \text{ agrees}}{960 \text{ agrees + disagrees}} \times 100 = .996 \).

Of the total nine hundred and sixty visual elements to evaluate, there were five disagreements. Interscorer agreement = \( \frac{955 \text{ agrees}}{960 \text{ agrees + disagrees}} \times 100 = .994 \).

The results of the reliability tests revealed that the scorers gave a slight over estimation of the ability of each subject to analyze skills during baseline tests. Half-elements and elements slightly-out of order were given credit. After the intervention keep in mind that the experimental subjects had to write the exact critical element in the precise order of expert consensus.

Rationale For Visual Inspection of Data

Significance in applied behavioral research is based on the magnitude of behavioral change within individual subjects. Cooper et al. (1987) stated that "Graphic display of behavioral data has proven the most effective means of detecting, analyzing and communicating these aspects of behavior change" (p. 108). In the visual analysis of graphed data, differences between baseline and experimental conditions have to be clearly evident and reliable for a convincing demonstration of change.

Cooper et al. (1987): Parsonson and Baer (in Kratochwill 1978) and Tawney and Gast (1984), reminded us that applied behavior analysis is
characterized by the search for and demonstration of experimental control over socially important behavior. Experimental control achieved by intervening and causing a predictable change in the behavior of an individual, can be reliably and repeatedly produced. In order to objectively document and quantify behavior change, direct and repeated measurement was conducted. The product of these precisely planned and systematically observed interventions are data. Graphs are a simple, visual format for displaying the data. The graph serves as a very complete method of recording and storing data. Cooper et al. (1987) added that graphs illustrated the fundamental properties of behavioral change over time, level, trend and cyclic variability. To produce a visual change significant enough to be seen on a graph the change is actually greater than that necessary to produce a statistically significant change.

**Graphed Multiple Baseline Subject Data**

The results of peer tutoring on skill analysis ability were illustrated in a multiple baseline, probe graph for each subject. Tawney and Gast (1984), Cooper et al. (1981) stressed the importance of (1) number of data points plotted within a condition, (2) the level of stability and changes within each level and between conditions, (3) trend direction and (4) stability and changes in trend within and between conditions. "Visual analysis of graphed data is a conservative method of determining the significance of behavior change; only
variables able to produce meaningful effects repeatedly are considered
significant, and weak and unstable variables are screened out" (Cooper
et al., 1987, p. 139).

Assessment session number one reports the results of the pre-test
(dependent variable) at baseline. The number of correct responses for
verbal critical elements was symbolized with a: $\triangle$ and plotted on the
graph of each subject. The number of correct responses for visual
discrimination of critical elements performed was indicated by: $\bullet$.

Assessment sessions two through thirteen reported the results of
the peer tutoring intervention (the independent variable) on the
dependent variable. One sport skill at a time received the peer
tutoring treatment beginning with prone-to-prone headstand down through
the long jump. The untreated sport skill remained in baseline and were
probed systematically.

When "live" peer tutoring skill analysis was assessed, the number
of correct visual discriminations were symbolized with $\square$. The
correct verbal identification of critical element continued to be
symbolized with $\triangle$. In all cases the highest possible score was six.

To assist in interpretation of the data, a bar graph accompanies
the multiple baseline graph of each subject. The bar graph represents
the data as mean scores of critical elements identified correctly
verbally and discriminated correctly visually.
Data Analysis of the Individual Experimental Subjects

Each Experimental Subject has two graphs and a discussion of individual results. Assessment session number one utilized the Pre-Test of Sport Skill Analysis (dependent variable). This established baseline ability of each subject to verbally identify the critical elements and visually discriminate the correct and incorrect performances of critical elements in select sport skills.

Peer Tutoring (independent variable) was practiced in assessment session two (prone-to-prone headstand), five (backward straddle roll), eight (cartwheel) and eleven (long jump). Direct instruction was used to place the student knowledge of critical elements under stimulus control. Experimental subjects were given a written test on verbal identification of the critical elements.

Assessment Sessions three (prone-to-prone headstand) six (backward straddle roll), nine (cartwheel) and twelve (long jump) followed peer performance practice and peer skill analysis practice. Videotaped performances of middleschool students tested both verbal and visual abilities to conduct skill analysis. Untreated skills were "probe-tested" via the same videotape.

"Live" Peer Analysis took place in assessment sessions four (prone/prone headstand), seven (backward straddle roll), ten (cartwheel) and thirteen (long jump).

Assessment session number fourteen utilized the Maintenance Test of Sport Skill Analysis (dependent variable).
The data for subject one A are found in Figures 1 and 2 and Tables 8, 9, 10, 11, and 12. Subject one A was a high skilled male subject.

Baseline scores of subject one A were low and stable across all six sport skills. Verbal identification of critical elements established a baseline mean of 0.7. Baseline scores for visual analysis of critical elements showed a mean of 0.5.

Verbal identification of the critical performance elements increased abruptly upon intervention and stabilized at a perfect 6.0 level for 100% of the four treated sport skills. During maintenance testing, verbal identification continued to score a high mean of 5.8.

Following intervention, subject one A also showed abrupt substantial gain in visual analysis ability establishing a 5.7 mean. During maintenance testing, visual discrimination had a slight decrease to a mean of 5.2.

During live peer performance, this subject performed 100% of all critical elements correctly and was rated 6.0 by peer partner, independent scorer and the investigator. When conducting peer partner skill analysis, subject one A scored a high mean of 5.9 for the four sport skills.

One sport skill, the long jump, showed increase when probed before intervention. The increase was from 1.0 verbal identification and 1.0 visual discrimination to 2.0 verbal identification and 2.0 visual discrimination of critical elements of the long jump.
ASSOCIATION SESSIONS

• VISUAL ANALYSIS OF CRITICAL ELEMENTS
□ "LIVE" PEER VISUAL ANALYSIS OF CRITICAL ELEMENTS
△ VERBAL(WRITTEN) IDENTIFICATION OF CRITICAL ELEMENTS

Figure 1. Number of Critical Performance Elements Analyzed by Subject One A
Figure 2. Mean Number of Critical Performance Elements Analyzed by Subject One A
<table>
<thead>
<tr>
<th>Experimental Subject</th>
<th>Pre-test</th>
<th>Peer Tutoring</th>
<th>Test Maintenance</th>
</tr>
</thead>
<tbody>
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Mean .15 .07 5.95 5.78
Std. Devia. .37 .23 .22 .29
Table 9
Mean Number of Critical Performance Elements Correctly Identified
by the Experimental Group: Back Straddle Roll

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<th>Peer Tutoring</th>
<th>Test Maintenance</th>
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Mean: .43  .26  5.75  5.71
Std. Devia: .73  .45  .55  .60
Table 10
Mean Number of Critical Performance Elements Correctly Identified
by the Experimental Group: Cartwheel

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<th>Test Maintenance</th>
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Mean .75 .37 5.75 5.11
Std. Devia. .79 .50 .44 .45
Table 11
Mean Number of Critical Performance Elements Correctly Identified by the Experimental Group: Long Jump

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<th>Test Maintenance</th>
</tr>
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Mean: 7.55 5.58 5.04 5.04
Std. Devia: .36 .73 .41 .70
Table 12
Mean Number of Critical Performance Elements Correctly Identified by the Experimental Group: Ball Throw and Batting

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<th>Maintenance Verbal</th>
<th>Visual</th>
<th>Pre-Test Verbal</th>
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Means: 1.05 .56 .80 .30 .63 .24 .80 .28
Std. Devia: .83 .55 .52 .44 .48 .32 .52 .41
The data for subject one B are found in Figures 3 and 4 and Tables 8, 9, 10, 11, and 12. Subject one B was male of high skill ability. Subject one B had the most consistently high verbal identification ability at baseline of any other subject. The mean for verbal identification was 1.35. Though that is still low, subject one B knew some partial elements. Fragments of critical elements were well described; order and awareness of performance was clear with this subject. The mean for visual discrimination was a typical mean of 0.6.

Verbal identification of the critical performance elements increased abruptly upon intervention and stabilized at a high 100% perfect level. This level continued during maintenance testing at a mean of 6.0. Visual discrimination was at a nearly perfect 5.9 level. Following peer tutoring skill analysis ability remained at a high 5.7 level throughout the maintenance testing.

Untreated softball/baseball skills remained at a mean of .05 both in verbal identification and visual discrimination.

Subject one B performed twenty-two out of twenty-four performance elements correctly during live peer tutoring. That placed him in the high skilled category. Peer analysis of his partner was a perfect 6.0 in verbal identification and a perfect 6.0 in visual discrimination throughout all four treated sport skills.

The data for subject two A are found in Figures 5 and 6 and Tables 8, 9, 10, 11 and 12. Subject two A was a high skilled male.
Figure 3. Number of Critical Performance Elements Analyzed by Subject One B
Figure 4. Mean Number of Critical Performance Elements Analyzed by Subject One B
Subject two A had baselines that were low and stable across all skills. The subject scored a 0.7 mean on verbal identification and a 0.5 mean on visual discrimination prior to the independent variable. Verbal identification of the critical performance elements increased abruptly upon intervention and stabilized at a high 100%, 6.0 perfect level. In visual discrimination, the mean was 5.7 correct critical elements analyzed out of six.

The ability of the subject remained at a high, steady state throughout maintenance. 5.8 was the mean for verbal identification of critical elements, and 5.5 was the mean for visual discrimination of the critical performance elements. Live peer tutoring skill analysis of the partner was conducted at a mean of 5.5 for all four skills. The personal performance of subject two A was scored at a mean of 5.5. Prone-to-prone headstand and long jump received 6.0 and back straddle roll and cartwheels received 5.0 from the three evaluators.

Untreated baseball/softball skills had a baseline mean of 1.0 in verbal identification. This remained the mean throughout maintenance testing. The baseline mean for visual discrimination was an even lower .05. By maintenance testing it had decreased to .03.

The behaviors that were treated made an abrupt and substantial gain in skill analysis ability; those skills untreated made no gain.

The data for subject two B are found in Figures 7 and 8 and Tables 8, 9, 10, 11 and 12. Subject two B was a male of medium skill.
Figure 5. Number of Critical Performance Elements Analyzed by Subject Two A
Figure 6. Mean Number of Critical Performance Elements Analyzed by Subject Two A
Subject two B had extremely low baselines. The mean for verbal identification as well as the mean for visual discrimination was almost zero 0.1.

After introducing peer tutoring skill analysis, the verbal identification of the critical performance elements increased abruptly and stabilized at a high 5.9 mean. The visual discrimination ability was less consistent but the mean was still a strong 5.6. This level remained stable during maintenance, though slightly lower. The final mean for verbal identification was 5.4 and the final mean for visual discrimination of critical elements was 5.3.

This subject had more variance during the study than most subjects. Baseline mean for the cartwheel was 0.0. It remained at 0.0 during probes at pre-intervention. After intervention verbal identification hit a mean of 5.6 and stabilized at 5.5 by maintenance testing. Visual discrimination of the cartwheel established a mean of 4.3 during treatment and the mean increased to 5.5 by maintenance.

At baseline the backward straddle roll had a mean of 0.0. When probed the verbal identification of critical elements inducted to 3.0 and visual discrimination increased to 1.0. Verbal identification increased to a 6.0 mean upon introduction of intervention, and visual discrimination improved to 4.8. Visual discrimination was 6.0 by maintenance.

Skill analysis of batting which remained untreated, had a mean of 0.0 at baseline and maintenance. The baseline mean for the untreated
Figure 7. Number of Critical Performance Elements Analyzed by Subject Two B
Figure 8. Mean Number of Critical Performance Elements Analyzed by Subject Two B
ball throw was also 0.0. The mean increased to 1.0 by the probe both visually and verbally; ball throw inducted to 2.0 verbally and 1.5 visually by maintenance testing.

This subject made substantial gains with the experience of peer tutoring. The total mean for verbal analysis improved from 0.1 to 5.4. The total mean for visual analysis proved from 0.0 to 5.3. During live peer tutor skill analysis, a perfect 6.0 was scored for verbal identification of the critical performance elements. A high, stable 5.5 mean was recorded for visual discrimination of the critical performance elements of the partner. This practice should assist the subject in giving accurate feedback to other students.

The data for subject three A are found in Figures 9 and 10 and Tables 8, 9, 10, 11 and 12. Subject three A is a female of high skill.

Subject three A had baselines that were low and stable across all six skills and remained the same throughout pre-intervention and probe tests.

Verbal identification of the critical performance elements increased abruptly upon peer tutoring and stabilized at 100%, 6.0 level. Visual discrimination of critical performance elements increased upon intervention to a 5.8 mean. 6.0 was the verbal and visual mean for the prone-to-prone headstand and the long jump.

During live peer tutoring, subject three established an almost perfect mean of 5.9 in verbal and visual discrimination of the critical elements of the performance of the partner. Subject three A also
Figure 9. Number of Critical Performance Elements Analyzed by Subject Three A
Figure 10. Mean Number of Critical Performance Elements Analyzed by Subject Three A
earned a perfect 6.0 evaluation of all four skills when this subject performed for live peer tutoring. This was the unanimous score of all interobserver scorers and partner three B.

This subject appears to have developed ability to do sport skill analysis in a consistently dependable manner. The two times that scores were below 6.0 were during observation of one cartwheel performance and one long jump performance that caused more errors by more subjects than any other responses of the middle school students.

The data for subject three B are found in Figures 11 and 12 and Tables 8, 9, 10, 11 and 12. Subject three B was a female of high skill. During sport skill performance this subject scored 6.0 on 100% of all critical performance elements.

Subject three B had low but variable baseline scores. Identification of critical elements verbally, was recorded at a mean of 1.3; however this hides the true finding that verbal identification of the critical elements for the long jump and ball throw averaged 2.3. All other skills scored a mean of 0.3, almost zero.

The visual discrimination of critical elements had a mean of 0.5. The visual discrimination of the long jump and the ball throw were 1.5 and 1.0 respectively; all other visual skill analysis of critical elements recorded at 0.0. Though knowledge of critical elements was low, more appeared known about long jump and ball throw.

Upon intervention, verbal identification of the critical performance elements increased abruptly upon intervention, and
Figure 11. Number of Critical Performance Elements Analyzed by Subject Three B
Figure 12. Mean Number of Critical Performance Elements Analyzed by Subject Three B
stabilized at 100% accuracy: 6.0. This level remained at 100% through maintenance checks.

Visual analysis of the critical performance elements also improved abruptly along with the intervention for each of the four skills. The mean was 5.8. The ability of the subject to visually analyze the critical performance elements was more variable at maintenance testing but the mean was still high and stable at 5.6. The lowest visual discrimination gain was in the cartwheel.

Live peer tutoring produced a perfect 6.0 verbal identification of all critical performance elements. The mean for visual discrimination during peer tutoring was an almost perfect 5.8. Batting and ball throw remained at or below baseline levels during maintenance.

The data for subject four A are found in Figures 13 and 14 and Tables 8, 9, 10, 11 and 12. Subject four A was a high skilled male who performed 100% of the critical elements correctly. The subject scored among the very highest in verbal identification and visual discrimination of all sport skills treated in the study.

Subject four A had baselines that were low and stable across all skills. The mean for verbal identification of all critical elements for all skills was 0.8. At baseline, the highest number of critical elements identified verbally was 2.0 for the cartwheel. The baseline mean for number of critical elements visually discriminated was 0.3 almost zero.
Figure 13. Number of Critical Performance Elements Analyzed by Subject Four A
Figure 14. Mean Number of Critical Performance Elements Analyzed by Subject Four A
Verbal identification of the critical performance elements increased abruptly upon intervention and stabilized at a perfect 100% level. The verbal mean remained at 6.0 throughout maintenance.

Visual analysis of the critical performance elements improved abruptly to a 5.7 mean upon introduction of peer tutoring. The mean increased to 5.9, an almost perfect 6.0 level by maintenance testing.

Live peer tutoring revealed verbal ability to identify sport skill critical elements at an excellent 6.0 level once again. Visual ability to analyze live performances of a peer had an almost equal mean of 5.9 correct out of 6.0.

Untreated baseball/softball skills remained at a 0.0 level for sport skill analysis ability both verbally and visually. Where the independent variable was introduced the behavior improved substantially. Where the independent variable was not introduced the behavior remained unchanged.

The data for subject four B are found in Figures 15 and 16 and Tables 8, 9, 10, 11 and 12. Subject four B was a high skilled female in this study.

The mean for verbal identification of critical elements was a low and stable 1.1 at baseline. The ability to visually discriminate correct and incorrect critical elements at baseline was 0.4 almost zero. Probes of untreated sport skills remained equally low and stable.
Figure 15. Number of Critical Performance Elements Analyzed by Subject Four B
Figure 16. Mean of Critical Performance Elements Analyzed by Subject Four B
Upon intervention, verbal identification of the critical elements increased abruptly to almost 100% correct identification. This stabilized at a near perfect 5.8 throughout the maintenance testing.

Visual analysis of the critical performance elements improved abruptly to a mean of 5.5 upon learning peer tutoring. The mean remained at an almost identical level of 5.4 during maintenance.

During live peer tutoring, verbal identification of critical performance elements hit a high 6.0 for 100% of the sport skills. Visual analysis of the subjects partner had a mean of 5.5. The subject analyzed 6.0 critical elements correctly 100% of the time for back straddle roll and long jump. The subject analyzed 5.0 of the critical elements correctly for the prone-to-prone headstand and the cartwheel.

During the maintenance test, the subject scored at a high mean of 6.0 in verbal identification and 5.8 in visual discrimination of the prone-to-prone headstand, the back straddle roll and the cartwheel. The total mean again masked the fact that though the verbal identification ability remained at 5.0 for the long jump, visual discrimination of correct or incorrect critical elements of the long jump fell to a low 3.5.

The data for subject five A are found in Figures 17 and 18 and Tables 8, 9, 10, 11 and 12. Subject five A was a male of high skill.

The subject had baselines that were low but inconsistent. The verbal identification mean was 0.7; this was a composite of 0.0 for prone-to-prone headstand, backward straddle roll and cartwheel, 2.3 for
Figure 17. Number of Critical Performance Elements Analyzed by Subject Five A
Figure 18. Mean Number of Critical Performance Elements Analyzed by Subject Five A
the long jump and ball throw, and 1.0 for the verbal identification of batting.

The mean for visual discrimination of critical elements was 0.7. The highest number of correct elements identified were for the long jump at 2.3 and the ball throw 1.6.

Upon intervention, verbal identification of the critical elements increased abruptly to a perfect level of 6.0 for 100% of the treated sport skills. This remained at 6.0 throughout live peer tutoring and maintenance testing as well.

Upon intervention, visual discrimination of critical elements increased to 5.6 correctly analyzed. The mean score for visual discrimination during maintenance was 5.6.

The untreated throwing skill had a decreased mean both verbally and visually. The batting skill increased from baseline knowledge of 1.0 verbal critical element to 2.0 and from 0.0 ability to discriminate visually to 1.0 correct critical elements in batting.

Peer tutoring did significantly improve the ability of subject five A to skill analyze sport skill performances.

The data for subject five B are found in Figures 19 and 20 and Tables 8, 9, 10, 11 and 12. Subject five B was a high skilled male.

Subject five B had baselines that were the lowest, most stable across all six skills. The visual discrimination baseline was 0.0. The verbal identification mean at baseline was almost zero 0.2.
Figure 19. Number of Critical Performance Elements Analyzed by Subject Five B
Figure 20. Mean Number of Critical Performance Elements Analyzed by Subject Five B
Together verbal identification and visual discrimination recorded a mean of 0.1 at baseline.

Upon introduction of peer tutoring, the verbal identification increased to a perfect 6.0. It remained high and steady at 5.7 through maintenance testing.

Visual discrimination increased to 5.6 upon introduction of the independent variable and ability to analyze sport skill performances improved to 5.7 by maintenance testing. Those means include live peer analysis that scored 6.0 verbally and 5.5 in visual discrimination.

The untreated ball throw increased from 0.0 verbal identification to 1.0 and remained low and stable throughout maintenance. The ability to visually discriminate critical elements had a baseline of 0.0 and remained the same through maintenance tests. Verbal identification of batting elements established a 1.0 mean at baseline and inducted to 2.0 by maintenance testing. Visual discrimination of correct and incorrect batting elements recorded a baseline mean of 0.0. When probed, the visual mean had increased to 1.0 and by maintenance testing had leveled off at 0.7.

The data for subject six A are found in Figures 21 and 22 and Tables 8, 9, 10, 11 and 12. Subject six A was a low skilled male. During live peer performance subject, this subject failed to perform five critical elements.

Subject six A had low and stable baselines across all six sport skills. In visual discrimination a mean of 0.1 was established.
Figure 21. Number of Critical Performance Elements Analyzed by Subject Six A
Figure 22. Mean Number of Critical Performance Elements Analyzed by Subject Six A
Regarding verbal identification of critical elements, the baseline was 0.7. Five skills were analyzed at a 0.0 level and the ball throw had a baseline mean of 2.0 critical elements identified.

Upon intervention, verbal identification of the critical performance elements of all four skills increased to a high mean of 5.8. Visual discrimination of critical elements also increased but to a slightly lesser mean level of 5.5.

At maintenance testing the increase in verbal skill analytic proficiency remained quite stable at 5.3. The ability of the subject to do visual discrimination of correct and incorrect performance elements decreased to 4.3, one of the lowest maintenance levels for any subject. Untreated baseball/softball skills remained as they were at baseline.

The subject did well in live peer tutoring. Verbal identification of critical elements was high and stable at 5.8 for the four treated sport skills. Visual discrimination of the partner performances was also a high and stable 5.8 mean.

The data for subject six B are found in Figures 23 and 24 and Tables 8, 9, 10, 11 and 12. Subject six B was a female of high skill performance level. Subject six B was the ideal subject for a researcher. At baseline, subject six B scored 0.0 in verbal identification of critical elements and 0.0 visual discrimination of critical elements for all six sport skills studied.
Figure 23. Number of Critical Performance Elements Analyzed by Subject Six B
Figure 24. Mean Number of Critical Performance Elements Analyzed by Subject Six B
When peer tutoring was introduced, the verbal identification ability increased abruptly to a mean of 6.0 over all four treated skills. The visual ability to skill analyze increased abruptly to a mean of 5.8, almost a perfect 6.0 as well. This level continued throughout the training program through maintenance testing of all four sport skills intervened upon. The mean average was 6.0 for verbal identification and 5.6 for visual discrimination of critical elements.

During live peer tutoring, verbal identification scored a mean of 6.0, a perfect 100% correct level for all sport skills intervened upon. The visual ability to skill analyze live performances also increased abruptly to a mean of 5.8 almost perfect 6.0. These high, stable levels continued throughout the training program to maintenance testing of all four sport skills. The mean average was 6.0 for verbal identification and 5.6 for verbal discrimination.

Both untreated baseball/softball skills remained at 0.0 level in verbal identification and visual discrimination at maintenance as they had been in baseline tests.

The data for subject seven A are found in Figures 25 and 26 and Tables 8, 9, 10, 11 and 12. Subject seven A was a high skilled male.

Subject seven A had baselines that were low and stable across all six skills. All six skills remained at 0.0 or no higher than 1.0 while at baseline or probed. The untreated baseball/softball skills retained a mean of 0.0 for visual discrimination of critical elements and 0.3 for verbal identification throughout maintenance testing.
Figure 25. Number of Critical Performance Elements Analyzed by Subject Seven A
Figure 26. Mean Number of Critical Performance Elements Analyzed by Subject Seven A
Peer tutoring did produce an abrupt and substantial improvement. Verbal identification increased to 6.0 in all four treated skills; visual discrimination scored a mean of 5.7. By maintenance, visual analysis of the prone-to-prone headstand, long jump and backward straddle roll improved to 6.0. Visual discrimination of the critical elements of the cartwheel and long jump were at a lower 4.0 level.

During maintenance, subject seven A had 100% verbal identification of critical elements at a perfect 6.0. The visual discrimination mean was 5.6. During live peer tutoring, subject seven A had one visual discrimination response with only four elements correct; this was in the cartwheel. Visual analysis of the cartwheel during maintenance returned to a high, stable 5.5. By maintenance, the mean for all skills was 5.6.

The untreated sport skills both maintained a mean of 0.0 in visual discrimination and 1.0 in verbal identification of the critical performance elements.

The data for subject seven B are found in Figures 27 and 28 and Tables 8, 9, 10, 11 and 12. Subject seven B was a medium skilled female.

Subject seven B had baselines that were less stable and slightly higher than most subjects. The mean for verbal identification was 1.4. This was composed of the 2.0 mean for the cartwheel and the ball throw and 0.9 for the prone-to-prone headstand, backward straddle roll, long jump, and batting.
Figure 27. Number of Critical Performance Elements Analyzed by Subject Seven B
Figure 28. Mean Number of Critical Performance Elements Analyzed by Subject Seven B
There may have been some induction in the 3.0 mean for verbal identification of the critical elements of the backward straddle roll following introduction of the independent variable. Visual discrimination of the critical elements also increased simultaneously to 2.0 as peer tutoring was introduced. Verbal identification of the critical elements of the long jump increased to 2.0 and visual discrimination of the critical elements of the long jump inducted to 2.0.

Upon intervention, verbal identification of the critical performance elements increased substantially. In all four skills the mean climbed to 6.0 and remained 100% at 6.0 through maintenance testing. Visual analysis of the critical performance elements did improve abruptly along with the intervention. The visual discrimination mean was an almost equally perfect 5.8. Maintenance of visual ability to discriminate correct and incorrect critical elements remained at a high 5.7 mean.

When probe checks were administered, the subject had increased verbal identification of the critical performance elements of all skills up to a 2.0 mean. Visual discrimination skill analysis increased to 2.0 mean also. An interesting fact is that by maintenance testing, batting that had inducted to 3.0 during intervention, returned to 1.0 in verbal identification and 0.0 in visual analytic ability.
The data for subject eight A are found in Figures 29 and 30 and Tables 8, 9, 10, 11 and 12. Subject eight A was a female of high skill level.

Subject eight A demonstrated low and stable baseline scores in all six skills. The verbal mean for all six baseline skills was a low 0.9. Visual discrimination of the critical elements for all six skills was a low 0.6.

Verbal identification of the critical performance elements increased abruptly upon intervention and stabilized at a high level. Subject eight A increased and maintained a verbal identification ability of the critical elements at a 6.0 perfect level for all treated skills. This continued in live peer skill analysis as well as maintenance testing.

Visual analysis of the critical performance elements also improved abruptly with the introduction of the intervention for each skill. The mean for visual discrimination of correct and incorrect performance of critical elements was 5.3. Live peer tutor visual analysis was included in this mean. Coincidently peer analysis had a 5.3 visual mean exactly.

Probe checks revealed that the overall verbal identification mean remained at 1.4. The overall visual discrimination mean was 1.0. Though these scores are low and stable, the back straddle roll and the cartwheel did induct by one critical element to 2.0 as the subject learned skill analysis.
Figure 29. Number of Critical Performance Elements Analyzed by Subject Eight A
Figure 30. Mean Number of Critical Performance Elements Analyzed by Subject Eight A
The untreated baseball/softball skills remained at low, stable baseline levels.

The data for subject eight B are found in Figures 31 and 32 and Tables 8, 9, 10, 11 and 12. Subject eight B was a medium skilled, female subject.

Subject eight B established baselines that were low and stable across all six skills. The verbal mean was 0.8 at baseline and continued the same through probe checks. The visual mean was even lower during baseline, registering 0.4. This mean included all later probes, preceding intervention, as well.

Verbal identification of all critical performance elements increased abruptly to 100% 6.0 following introduction of peer tutoring. This level remained throughout maintenance testing. All six critical elements were identified correctly for all of the treated skills.

Visual analysis of the critical performance elements also improved abruptly upon intervention. The ability of the subject to visually analyze was more variable than the perfect 6.0 score for verbal identification. The visual discrimination mean was 5.0 for the long jump, and the cartwheel, and 6.0 for the prone-to-prone headstand and the backward straddle roll.

In general, where the intervention was introduced a significant change in behavior occurred. Where the intervention was not introduced, no change occurred.
Figure 31. Number of Critical Performance Elements Analyzed by Subject Eight B
Figure 32. Mean Number of Critical Performance Elements Analyzed by Subject Eight B
The data for subject nine A are found in Figures 33 and 34 and Tables 8, 9, 10, 11 and 12. Subject nine A was a male of low skill who failed to perform five of twenty-four critical elements correctly.

Subject nine A had baselines that were low and stable across all six skills. The baseline mean for verbal identification was 0.4. The subject knew 2.0 critical elements for the long jump, 1.0 for the ball throw and 0.0 for all other skills in the study. The baseline mean for visual discrimination of all six skills was 0.3 revealing no skill analytic proficiency for these skills before intervention.

Verbal identification of the critical performance elements increased abruptly upon intervention and stabilized at 100%, perfect 6.0 level. This mean included live peer skill analysis which was 6.0 for all sport skills.

Ability to identify critical performance elements remained high throughout the maintenance test as well, though only 5.0 critical elements were named for cartwheel, backward straddle roll and long jump.

Visual analysis of the critical performance elements improved abruptly along with the intervention for all four skills. The average visual mean was 5.7. This subject scored 6.0 on all live peer tutor skill analysis. The maintenance score for visual discrimination established a mean of 5.3. The greatest variation occurred during one videotaped performance of the long jump. The subject identified only four critical elements during this one middle school student response.
Figure 33. Number of Critical Performance Elements Analyzed by Subject Nine A
Figure 34. Mean Number of Critical Performance Elements Analyzed by Subject Nine A
During probe checks, one finds that all untreated skills remained at baseline levels. The biggest gain was a slight increase from 0.0 to 1.0 in the backward straddle roll. The increased gain occurred both verbally and visually.

The independent variable did significantly improve the ability of subject nine A to verbally and visually analyze the correct and incorrect critical performance elements.

The data for subject nine B are found in Figures 35 and 36 and Tables 8, 9, 10, 11 and 12. Subject nine B was a female high skilled subject. This is the only subject who had participated on a gymnastic team.

Subject nine B had baseline scores that were low and stable. The mean for verbal identification of critical elements was 0.7. The highest baseline verbal identification score was for the cartwheel. In this case the subject named 2.0 critical elements correctly.

The baseline mean for visual discrimination was 0.4; visual discrimination remained at this low level throughout pre-intervention probes except when the subject viewed the backward straddle roll. Two critical performance elements were correctly named and visually discriminated. Three of the critical elements were verbally identified, of the six deemed necessary by experts. Gymnastic performing background may have assisted the subject once the peer tutoring skill analysis intervention was introduced.
Figure 35. Number of Critical Performance Elements Analyzed by Subject Nine B.
Figure 36. Mean Number of Critical Performance Elements Analyzed by Subject Nine B
The untreated baseball/softball skills remained at 0.0 throughout probes and maintenance.

Verbal identification of the critical performance elements increased abruptly upon intervention and stabilized at a high 6.0 level. Subject nine B increased and maintained the ability to verbally identify the critical performance elements with 100% accuracy. This level continued through maintenance testing at a 6.0, 100% accuracy.

Visual analysis of the critical performance elements improved abruptly as peer tutoring of each skill was introduced. Subject nine B had a visual discrimination mean of 5.7 critical elements correctly analyzed following intervention. This high level was retained through maintenance testing. The fewest number of critical elements visually discriminated correctly during this study was four, during the same cartwheel performance of a middle school student, that gave so many other experimental subjects a problem.

The intervention did significantly improve the verbal identification and the visual discrimination ability of subject nine B.

The data for subject ten A are found in Figures 37 and 38 and Tables 8, 9, 10, 11 and 12. Subject ten A was a high skilled female.

Subject ten A had baselines that were low and stable across all six sport skills. The mean score for verbal identification was 0.7. This same level remained during pre-intervention probes. The baseline mean for visual discrimination of critical elements was 0.5; once again these levels held constant throughout the pre-intervention probes.
Figure 37. Number of Critical Performance Elements Analyzed by Subject Ten A
Figure 38. Mean Number of Critical Performance Elements Analyzed by Subject Ten A
Verbal identification of the critical performance elements increased abruptly with the introduction of the peer tutoring package, and remained at a perfect 6.0 level for 100% of the sport skills throughout maintenance.

Visual analysis of the critical performance elements also improved abruptly with the introduction of peer tutoring. Six critical elements were discriminated correctly in most every response. The mean was 5.7 which improved by maintenance testing to 5.8.

Maintenance of visual analytic ability remained at an almost perfect 6.0 level except for one response to a long jump. In that case, the subject identified four out of six critical performance elements correctly. Live peer analysis established 6.0 established means of verbally and 6.0 visually for 100% of all treated sport skills.

The independent variable did significantly improve the verbal identification of critical performance elements and the ability to visually discriminate correct and incorrect critical performance elements of sport skills.

The data for subject ten B are found in Figures 39 and 40 and Tables 8, 9, 10, 11 and 12. Subject ten B was a male, medium skilled subject.

Baseline scores for verbal identification and visual discrimination of all six skills were the lowest and most stable of all subjects. Verbal identification was 0.3 and visual discrimination was
Figure 39. Number of Critical Performance Elements Analyzed by Subject Ten B
Figure 40. Mean Number of Critical Performance Elements Analyzed by Subject Ten b
The subject had no knowledge of critical performance elements for any of the six skills.

Upon introduction of peer tutor practice, verbal identification of the critical performance elements increased abruptly; they then stabilized at a high 6.0, 100% perfect level. This 6.0 level continued throughout the maintenance tests.

Visual analysis of the critical performance elements likewise improved abruptly upon application of the intervention for each of the four sport skills treated. A 5.8 mean for the long jump and a 5.5 mean for all other treated skills was established. Skill analysis of live peer performances maintained a high and consistent mean of 5.5 for all four treated skills. The mean for visual discrimination remained at the same high and stable 5.5 level.

Pre-intervention probes of all baseline skills remained at 0.3 verbally and 0.0 visually. There was an induction to 1.0 visual discrimination and 2.0 verbal identification recorded during the probe of the backward straddle roll.

The independent variable made a substantial improvement in the total skill analytic proficiency of subject ten B.

Discussion of the Research Questions Investigated

This section answers the research questions which are listed in Chapter I. Each question is presented then followed by an analysis of the pertinent data.
Research Question #1. How accurately do subjects verbally identify the critical elements of select sport skills during baseline conditions prior to intervention training?

Data indicate that all subjects' ability to verbally identify the critical performance elements was very low prior to intervention. Tables 8-18 disclose individual skill analysis means and standard deviations for each sport skill under investigation. Table 19 presents means for all 51 subjects. Experimental group, control group and regular instruction group all scored equally poorly at baseline. Each subject was asked to list, in writing, what they considered the six most important elements of each sport skill videotaped. Of the fifty-one subjects, raw data revealed that the greatest number of known critical performance elements was two (recorded by six subjects for the backward straddle roll; two recorded by five subjects for the cartwheel; two recorded by nine subjects for the long jump, two recorded by eight subjects for the ball throw and only two recorded by two subjects for batting). Of the 51 subjects, the majority knew less than one critical performance element. Typically the critical performance elements listed by subjects were too vague, too general or unlisted. The accuracy of subject responses in comparison to the critical elements selected by experts for each sport was seldom related. None of the experimental subjects had any previous instruction covering skill analysis. If a critical element could not be properly identified and listed in writing, then no decision could be
Table 13
Mean Number of Critical Performance Elements
Correctly Identified By Control Group

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Std. Devia: .30 .19 .48 .39 .65 .46 .73 .60
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Std. Devia. .72 .48 .83 .37 .63 .36 .54 .31
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<td>0.0</td>
<td>1.0</td>
<td>0.7</td>
<td>2.0</td>
<td>1.0</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>14</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.5</td>
<td>1.0</td>
<td>0.2</td>
<td>1.0</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>2.0</td>
<td>1.2</td>
<td>1.0</td>
<td>0.0</td>
<td>2.0</td>
<td>0.7</td>
<td>2.0</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>.47</td>
<td>.26</td>
<td>.73</td>
<td>.07</td>
<td>.72</td>
<td>.28</td>
<td>1.20</td>
<td>.51</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Devia.</td>
<td>.64</td>
<td>.43</td>
<td>.70</td>
<td>.18</td>
<td>.59</td>
<td>.35</td>
<td>.56</td>
<td>.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
made regarding whether a performance constituted a correct response or an incorrect response. The verbal and visual were scored as incorrect. This explains the fact that data triangles (Δ) indicating verbal identification are always even with, or above visual discrimination data dots (●). Subjects cannot visually discriminate what they cannot verbally identify. The performance of the majority of subjects at baseline illustrate that principle. Prior to intervention the mean number of critical performance elements verbally identified by all subjects (N=51) for the prone-to-prone headstand was 0.15; for the backward straddle roll was 0.503; for the cartwheel was 0.60; for the long jump was 0.703; for the ball throw was 0.70 and for batting was 0.593.

Research Question #2: How accurately do subjects verbally identify the critical elements of select sport skills as a result of participation in the Peer Tutoring Program?

Following introduction of Peer Tutoring, the ability of each experimental subject to verbally identify critical elements of the treated skills increased significantly. The multiple baseline graphs and bar graphs (Figures 1-40) and Tables 8-12) display that experimental subjects wrote the precise critical elements after intervention and throughout maintenance. Experimental subjects 1B, 4A, 4B, 6B, 7A, 7B, 8A, 8B and 9A achieved perfect 100% recall of all six (6.0) critical elements for all four intervened upon skills. Experimental subjects 1A, 3B, 5B and 9B consistently scored twenty-
Table 19
Means for Verbal Analysis Tests of All Subjects
(N=51) Prior To Intervention

<table>
<thead>
<tr>
<th>SKILL</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prone Headstand</td>
<td>51</td>
<td>0.15</td>
<td>0.36</td>
</tr>
<tr>
<td>Back Straddle Roll</td>
<td>51</td>
<td>0.50</td>
<td>0.68</td>
</tr>
<tr>
<td>Cartwheel</td>
<td>51</td>
<td>0.60</td>
<td>0.71</td>
</tr>
<tr>
<td>Long Jump</td>
<td>51</td>
<td>0.70</td>
<td>0.72</td>
</tr>
<tr>
<td>Ball Throw</td>
<td>51</td>
<td>0.70</td>
<td>0.72</td>
</tr>
<tr>
<td>Batting</td>
<td>51</td>
<td>0.62</td>
<td>0.57</td>
</tr>
</tbody>
</table>

three out of twenty-four times. Subjects 2A, 2B, 3A, and 10B had a perfect 6.0 twenty-two out of twenty-four elements. The lowest scores of experimental subjects after intervention, were nineteen 6.0's out of twenty-four critical elements; the remaining scores were 5.0 accurate critical performance elements out of 6.0. No experimental subject scored less than 5.0 in verbal identification of critical performance elements following peer tutoring. The means for all experimental subjects verbal ability following intervention can be seen in Table 20.
Table 20
Means for Verbal Identification by Experimental Subjects at the Conclusion of Maintenance Testing

<table>
<thead>
<tr>
<th>SKILL</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prone Headstand</td>
<td>20</td>
<td>5.95</td>
<td>.22</td>
</tr>
<tr>
<td>Back Straddle Roll</td>
<td>20</td>
<td>5.75</td>
<td>.55</td>
</tr>
<tr>
<td>Cartwheel</td>
<td>20</td>
<td>5.75</td>
<td>.44</td>
</tr>
<tr>
<td>Long Jump</td>
<td>20</td>
<td>5.80</td>
<td>.41</td>
</tr>
<tr>
<td>Ball Throw</td>
<td>20</td>
<td>0.80</td>
<td>.52</td>
</tr>
<tr>
<td>Batting</td>
<td>20</td>
<td>0.80</td>
<td>.52</td>
</tr>
</tbody>
</table>

The data are clear that the twenty-four critical elements learned, were highly specific to the skills studied. When peer tutoring, using direct instruction was taught, behavior improved significantly. Where peer tutoring wasn't introduced, behavior (such as skill analysis of batting and ball throwing) remained at baseline or very near baseline figures. At the conclusion of the intervention for prone-to-prone headstand, the mean verbal identification score was 5.95; the backward straddle roll was 5.68; the cartwheel was 5.75; and the long jump was 5.80.
Research Question #3: How accurately do subjects visually analyze sport skills under baseline conditions prior to intervention?

Baseline data indicate that all subjects' ability to visually discriminate the critical performance elements of sport skills was extremely low prior to intervention.

Tables 8-12 present data of the experimental group. Table 13-15 present data of the regular instruction group and Tables 16-18 present data for the control group. All three groups were very similar in baseline ability to skill analyze. The mean number of visually analyzed critical elements by all subjects (N=51) prior to intervention can be found in Table 21. The mean number of critical elements correctly analyzed visually were 0.86 for the prone-to-prone headstand; were 0.126 for the back straddle roll; were .276 for the cartwheel; .336 for the long jump; were .353 for the ball throw and were .231 for batting. Baseline data disclosed that the subjects were unable to discriminate correct from incorrect performances fo sport skills. The subjects apparently did not know what to observe in each sport skill performance on videotape. This data supports that of Kniffen (1985) and Wilkinson (1986).

Research Question #4: How accurately did experimental subjects visually analyze sport skills as a result of participation in the Peer Tutoring Program?

Peer Tutoring produced substantial improvement in visual discrimination. Following intervention training, subjects were able to
Table 21  
Means for Visual Analysis of All Subjects (N=51)  
Prior to Intervention

<table>
<thead>
<tr>
<th>SKILL</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prone Headstand</td>
<td>51</td>
<td>.09</td>
<td>.26</td>
</tr>
<tr>
<td>Back Straddle Roll</td>
<td>51</td>
<td>.13</td>
<td>.43</td>
</tr>
<tr>
<td>Cartwheel</td>
<td>51</td>
<td>.27</td>
<td>.42</td>
</tr>
<tr>
<td>Long Jump</td>
<td>51</td>
<td>.34</td>
<td>.45</td>
</tr>
<tr>
<td>Ball Throw</td>
<td>51</td>
<td>.35</td>
<td>.49</td>
</tr>
<tr>
<td>Batting</td>
<td>51</td>
<td>.25</td>
<td>.34</td>
</tr>
</tbody>
</table>

discriminate the difference between correct and incorrect performances of critical elements. The gain was at a significantly high level of success compared to baseline testing. Effective discrimination of critical performance elements was sustained throughout "live" peer analysis and maintenance tests. The mean number of critical performance elements visually identified by the experimental group compared to the combined control group may be seen in Table 22.

Significant differences between subjects in the experimental group (who received the intervention) compared to the control group and
Table 22
Maintenance Means and Standard Deviations for Visual Discrimination Ability of Experimental Group Following Peer Tutoring

<table>
<thead>
<tr>
<th>SKILL</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prone Headstand</td>
<td>20</td>
<td>5.78</td>
<td>.29</td>
</tr>
<tr>
<td>Back Straddle Roll</td>
<td>20</td>
<td>5.71</td>
<td>.60</td>
</tr>
<tr>
<td>Cartwheel</td>
<td>20</td>
<td>5.11</td>
<td>.45</td>
</tr>
<tr>
<td>Long Jump</td>
<td>20</td>
<td>5.04</td>
<td>.70</td>
</tr>
<tr>
<td>Ball Throw</td>
<td>20</td>
<td>0.30</td>
<td>.44</td>
</tr>
<tr>
<td>Batting</td>
<td>20</td>
<td>0.28</td>
<td>.41</td>
</tr>
</tbody>
</table>

regular instruction group can be seen in Tables 8 through 18. The results of individual experimental subjects may be seen in Tables 8-12. There was not a significant difference between the control group (who had no instruction on the studied skills) and the regular instruction group (who performed, peer spotted, but received no specific skill analysis through peer tutoring). The regular instruction group was closer to identifying one critical element in the gymnastic skills and batting. The control group scored slightly higher in long jump and ball throw. Please note that the baseball/softball skills were not
taught to any of the three groups. Batting and Ball Throw remained in baseline and were probed through maintenance to ascertain if generalization or induction occurred. Both verbal and visual analysis for throwing and batting remained very low and relatively unchanged for all three groups. The greatest improvement (0.44) occurred in verbal identification of cartwheel and (0.40) in batting by the regular instruction group. Wilkinson (1986) stated that learning one critical element or even up to two critical elements is not enough knowledge for a future teacher or coach to make a socially significant contribution to students as deemed necessary by Wolf (1978).

Research Question #5: What is the relationship between verbal identification of the critical elements and visual discrimination of sport skill performance prior to intervention?

A very strong positive relationship existed between verbal identification and visual recognition of critical performance elements prior to intervention. To determine that a substantial relationship existed, a Pearson-Product moment correlation coefficient (p < .05) was calculated. The r was computed by comparing the verbal identification score (Total number of correctly recalled critical elements throughout baseline) with the corresponding visual discrimination score (Total number of critical elements accurately analyzed as correct or incorrect) Table 23 lists the two variables means and the standard deviations. The correlation between the verbal recall scores and the visual discrimination scores produced on r of .944 at .0001 level of
significance with P value less than .05 apriori. This data demonstrated that the ability to discriminate visually the correct and incorrect performance of sport skills depend on the knowledge of the verbal labels and descriptions of the critical performance elements.

Research Question #6: What is the relationship between verbal identification of the critical elements and visual discrimination of each sport skill performance following intervention?

Pearson product moment correlation (p .05) coefficient was calculated by comparing each verbal recall score (Total number of correctly recalled critical elements after intervention through maintenance testing) with the corresponding visual discrimination score (Total number of correctly analyzed elements after intervention through maintenance testing). Table 23 lists the two variables. The correlation between the verbal recall scores and the visual discrimination scores produced an r of .692 (significance at the .001 level). (P value less than .05 apriori). The Pearson Product Moment Correlation Coefficient indicated that a substantial relationship existed between a subject's ability to verbally identify and visually discriminate critical performance elements following intervention and during maintenance testing. This data once again demonstrated that visual analysis or visual discrimination of correct and incorrect performance cannot be attempted without precise knowledge and verbal identification of the critical performance elements.
Table 23

Verbal and Visual Baseline Totals and
Verbal and Visual Intervention Totals

<table>
<thead>
<tr>
<th>EXPERIMENTAL SUBJECTS</th>
<th>VERBAL BASELINE TOTALS</th>
<th>VISUAL BASELINE TOTALS</th>
<th>VERBAL INTERVENTION TOTALS</th>
<th>VISUAL INTERVENTION TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>26</td>
<td>16</td>
<td>146</td>
<td>124</td>
</tr>
<tr>
<td>1B</td>
<td>43</td>
<td>23</td>
<td>163</td>
<td>130</td>
</tr>
<tr>
<td>2A</td>
<td>25</td>
<td>12</td>
<td>143</td>
<td>121</td>
</tr>
<tr>
<td>2B</td>
<td>10</td>
<td>7</td>
<td>124</td>
<td>95</td>
</tr>
<tr>
<td>3A</td>
<td>17</td>
<td>7</td>
<td>130</td>
<td>111</td>
</tr>
<tr>
<td>3B</td>
<td>24</td>
<td>10</td>
<td>144</td>
<td>127</td>
</tr>
<tr>
<td>4A</td>
<td>24</td>
<td>14</td>
<td>138</td>
<td>127</td>
</tr>
<tr>
<td>4B</td>
<td>31</td>
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<td>5A</td>
<td>36</td>
<td>23</td>
<td>152</td>
<td>126</td>
</tr>
<tr>
<td>5B</td>
<td>18</td>
<td>7</td>
<td>117</td>
<td>112</td>
</tr>
<tr>
<td>6A</td>
<td>25</td>
<td>14</td>
<td>124</td>
<td>96</td>
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<tr>
<td>6B</td>
<td>3</td>
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<td>7A</td>
<td>10</td>
<td>2</td>
<td>130</td>
<td>117</td>
</tr>
<tr>
<td>7B</td>
<td>42</td>
<td>24</td>
<td>164</td>
<td>130</td>
</tr>
<tr>
<td>8A</td>
<td>17</td>
<td>11</td>
<td>130</td>
<td>121</td>
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<tr>
<td>8B</td>
<td>30</td>
<td>23</td>
<td>143</td>
<td>107</td>
</tr>
<tr>
<td>9A</td>
<td>21</td>
<td>12</td>
<td>138</td>
<td>110</td>
</tr>
<tr>
<td>9B</td>
<td>19</td>
<td>12</td>
<td>139</td>
<td>113</td>
</tr>
<tr>
<td>10A</td>
<td>23</td>
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<td>132</td>
<td>100</td>
</tr>
<tr>
<td>10B</td>
<td>10</td>
<td>3</td>
<td>127</td>
<td>106</td>
</tr>
</tbody>
</table>

Mean          22.70   12.55   137.05   114.35
Std. Devia.  10.47   6.92    12.68    22.70
Research Question #7: What is the relationship between efficient execution (skill performance) of the critical elements and the ability to verbally identify the critical performance elements of the sport skill following intervention?

There was a negligible association between the skill performance of an experimental subject and the ability to verbally identify critical performance elements. To ascertain if a relationship existed, Pearson-Product moment correlation coefficient (p < .05) was calculated. The r was computed by comparing the total points scored on all physical skill performance tests (potential total was 24) to the verbal identification score of the subject (total number of correctly recalled critical elements throughout the study).

Table 24 lists the two variables and the scores of each subject. The correlation between the verbal recall scores and the subject's skill (in this study) produced an r of .004 (significance at .05 level). This implies that any subject high skilled or low, can be taught the identification labels of the critical elements through stimulus control.

Research Question #8: What is the relationship between efficient execution of the critical performance elements of each sport skill and the ability to visually discriminate the critical performance elements of the sport skill following intervention?

There was a positive moderate association between skill performance ability (in this study) and the ability to visually discriminate
correct and incorrect performances of critical elements. To determine that a positive, moderate association existed, a Pearson Product moment correlation coefficient (p .05) was calculated. The r was computed by comparing the visual identification score (total number of correctly recalled critical elements) throughout intervention and maintenance testing, to the skill performance score of experimental subjects. There were twenty-four potential points.

Table 24 lists the two variables, means and standard deviations. The correlation between the skill performance of each subject and the visual analysis ability produced an r of .397 at the p .05 level of significance. This implies that the better skilled experimental subjects did visual analysis moderately better than the poorer skilled experimental Table 24 subjects. They were able to discriminate correct and incorrect critical elements at a slightly more efficient level.

Research Question #9: Which sport skill or specific sport skill performance did subjects find most difficult to analyze efficiently in the maintenance test?

Each time an experimental subject visually analyzed fewer than five critical elements correctly, that response was identified on Table 25. This list reveals the sport skill most difficult-to-analyze was the cartwheel. A total of sixteen errors occurred observing performances one and four of the cartwheel (maintenance test). The second most difficult-to-analyze sport skill was the long jump. Eight errors were recorded on performance number two; four errors ...
Table 24

Total Performance Points for Experimental Subjects (N=20)
Correct Verbal and Visual Critical Elements After Intervention

<table>
<thead>
<tr>
<th>EXPERIMENTAL SUBJECTS</th>
<th>SKILL PERFORMANCE</th>
<th>VERBAL TOTAL</th>
<th>VISUAL TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>24</td>
<td>146</td>
<td>124</td>
</tr>
<tr>
<td>1B</td>
<td>23</td>
<td>163</td>
<td>130</td>
</tr>
<tr>
<td>2A</td>
<td>22</td>
<td>143</td>
<td>121</td>
</tr>
<tr>
<td>2B</td>
<td>21</td>
<td>124</td>
<td>95</td>
</tr>
<tr>
<td>3A</td>
<td>24</td>
<td>130</td>
<td>111</td>
</tr>
<tr>
<td>3B</td>
<td>24</td>
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<tr>
<td>4A</td>
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<td>127</td>
</tr>
<tr>
<td>4B</td>
<td>24</td>
<td>134</td>
<td>100</td>
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<tr>
<td>5A</td>
<td>23</td>
<td>152</td>
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</tr>
<tr>
<td>5B</td>
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<td>117</td>
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<tr>
<td>6A</td>
<td>19</td>
<td>124</td>
<td>96</td>
</tr>
<tr>
<td>6B</td>
<td>24</td>
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<td>114</td>
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<tr>
<td>7A</td>
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<td>130</td>
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<td>7B</td>
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<tr>
<td>8A</td>
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<td>121</td>
</tr>
<tr>
<td>8B</td>
<td>21</td>
<td>143</td>
<td>107</td>
</tr>
<tr>
<td>9A</td>
<td>19</td>
<td>138</td>
<td>110</td>
</tr>
<tr>
<td>9B</td>
<td>23</td>
<td>139</td>
<td>113</td>
</tr>
<tr>
<td>10A</td>
<td>22</td>
<td>132</td>
<td>100</td>
</tr>
<tr>
<td>10B</td>
<td>20</td>
<td>127</td>
<td>106</td>
</tr>
</tbody>
</table>

Mean 22.35 137.05 114.35
Std. Devia. (1.81) (12.68) (22.70)
Table 25

<table>
<thead>
<tr>
<th>Experimental Subject</th>
<th>Sport Skill</th>
<th>Videotaped Performance Number</th>
<th>Number of Critical Elements Correctly Identified on Maintenance Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>9B</td>
<td>Cartwheel</td>
<td>#1 &amp; #4</td>
<td>four each</td>
</tr>
<tr>
<td>1A</td>
<td>Cartwheel</td>
<td>#1 &amp; #4</td>
<td>four each</td>
</tr>
<tr>
<td>2A</td>
<td>Cartwheel</td>
<td>#1 &amp; #4</td>
<td>four each</td>
</tr>
<tr>
<td>3A</td>
<td>Long Jump</td>
<td>#2</td>
<td>four each</td>
</tr>
<tr>
<td>3B</td>
<td>Cartwheel</td>
<td>#1, 2 &amp; #4</td>
<td>four each</td>
</tr>
<tr>
<td>4B</td>
<td>Long Jump</td>
<td>#2 &amp; #1</td>
<td>four each</td>
</tr>
<tr>
<td>5A</td>
<td>Cartwheel</td>
<td>#1</td>
<td>four each</td>
</tr>
<tr>
<td>8A</td>
<td>Cartwheel</td>
<td>#1</td>
<td>four each</td>
</tr>
<tr>
<td></td>
<td>Long Jump</td>
<td>#1 &amp; #2</td>
<td></td>
</tr>
<tr>
<td>8B</td>
<td>Cartwheel</td>
<td>#1</td>
<td>four each</td>
</tr>
<tr>
<td></td>
<td>Long Jump</td>
<td>#2</td>
<td></td>
</tr>
<tr>
<td>5B</td>
<td>Cartwheel</td>
<td>#1 &amp; #4</td>
<td>four each</td>
</tr>
<tr>
<td>6A</td>
<td>Cartwheel</td>
<td>#1 &amp; #4</td>
<td>four each</td>
</tr>
<tr>
<td></td>
<td>Long Jump</td>
<td>#1 &amp; #2</td>
<td></td>
</tr>
<tr>
<td>6B</td>
<td>Cartwheel</td>
<td>#1 &amp; #4</td>
<td>four each</td>
</tr>
<tr>
<td>7A</td>
<td>Long Jump</td>
<td>#2</td>
<td>four each</td>
</tr>
<tr>
<td>10A</td>
<td>Long Jump</td>
<td>#2</td>
<td>four each</td>
</tr>
<tr>
<td>10B</td>
<td>Long Jump</td>
<td>#2</td>
<td>four each</td>
</tr>
</tbody>
</table>
were recorded on performance number two; four errors were recorded on number one of the long jump (maintenance test). There were a total of 360 visual responses for the cartwheel and 360 visual responses for the long jump so sixteen and eight errors respectively are relatively few.

Verbal identification scores were never below 5.0.

1. Sport skill critical elements missed, were combinations of correct and incorrect performances of the elements in each case.

2. These cartwheel and long jump performances were the fastest total body movements in the test.

3. The answers chosen, once again earned 100% interobserver agreement. Slow motion was used by the scorers however and the subjects weren't given this advantage.

Discussion

The purpose of this study was to determine if Peer Tutor Sport Skill Analysis could improve the ability of undergraduates to analyze the skill performances of middle school students as well as analyze and give feedback to peer partners.

The graphic analysis of multiple baseline data demonstrated clearly that Peer Tutoring Skill Analysis produced significant effects. Experimental subjects increased verbal identification and visual discrimination of critical performance elements. The data demonstrates that peer tutoring practice significantly increased the ability of every subject to analyze "live" peer partner performances, as well as
videotaped performances of a variety of middle school students in real setting.

A strength of this study lies in its replication across twenty different subjects analyzing four sport skills. Results replicated in baseline, intervention and maintenance testing, established reliability of the treatment effect.

Peer Tutoring produced not only an experimentally significant difference between baseline pre-tests and intervention/maintenance testing, but demonstrated a socially significant educational change. A measureable behavioral change occurred as each experimental subject developed skill analysis ability. Hoffman (1977a, b, c) labeled skill analysis the most important skill a physical educator may acquire.

Kniffen (1985) suggested that future teacher/coaches should recall five critical elements of a sport skill 90% of the time and correctly discriminate critical elements as correct or incorrect 70% or more of the time to be of clinical or social significance.

This study established that those criterion can be achieved. First, experts must establish correct, consistent, agreed-upon critical elements for every skill taught in physical education. Subsequently, effective teacher preparation programs must include deliberately teaching skill analysis proficiently.

The control group (who were not taught the skills in this study) and the regular instruction group (who were taught gymnastic skills by an expert teacher/coach) did not improve in skill analysis. One might
assume that ability to discriminate correct and incorrect performances would result from instructor demonstration, peer spotting and participation in a gymnastic, basic movement course; this clearly was not a valid assumption.

The data clearly show that precise critical elements of a specific skill must be deliberately taught and practiced. Relationships between skills, or critical elements that are "in-common" between two skills, must be specifically trained; the relationship must be taught. Both the control group and the regular instruction group did many skills in the family-of-skills that were studied. Teachers must not assume that even college students transfer learning to related areas. Unless students learn, practice what they learn, and are held accountable for that specific learning, the learning does not occur.

Kniffen (1985) found that once critical performance elements and skill analysis of a specific sport skill are learned, the ability to analyze that skill can generalize to live subjects as well as videotaped subjects. The results of this research support the findings of Kniffen (1985) and Wilkinson (1986).
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to investigate the effects of Peer Tutoring Training on skill analytic proficiency. Few empirical studies have been conducted to examine the results of Peer Tutoring using direct instruction on the acquisition of sport skill analytic ability. Can peer partner reciprocal practice increase the ability of undergraduate students to conduct sport skill analysis? Can administering and receiving feedback on the correct and incorrect live performances of the critical elements improve skill analytic ability? Specifically, can peer tutoring and plenty of live practice enable physical education students to verbally identify the critical elements of select sport skills and visually discriminate those critical elements? Can the student analyze the correct, incorrect or missing elements when viewing middle school students on videotape?

A single subject, multiple baseline research design was utilized to test the ability of each subject to conduct sport skill analysis. The baseline phase allowed for measurement of subject ability to identify critical elements and discriminate those elements as correct or incorrect prior to introduction of the peer tutoring intervention.
Subjects viewed authentic middle school students performing sport skills on videotape.

The intervention phase consisted of direct instruction of the six critical elements along with the use of illustrated worksheets. This was followed by peer tutoring during practice. Measurement of the ability of subjects to analyze the sport skills practice (plus probes of those baseline skills not yet taught) occurred at the end of each intervention session. The generalization phase during intervention, provided the test of the ability of each experimental subject to analyze authentic performances of their peer partner performing "live."

Maintenance testing occurred during the last class session. A videotape test evaluated skill analytic maintenance. A videotape, similar to but different than the pre-test, was presented. Different typical middle school students performed the same skills in a regular physical education setting.

Fifty-one undergraduate physical education students from Physical Education 213, Movement Fundamentals and Basic Gymnastics assessed the effects of Peer Tutoring training on the acquisition and maintenance of sport skill analytic ability. The classes met twice a week for ten weeks. The peer tutoring intervention was conducted for five weeks and then instructors exchanged classes; experimental group and control group switched and continued the other half of regular instruction. The total sample (N=51) included an experimental group (N=20), a
control group (N=16) and a regular instruction class (N=15) which were subjects enrolled in one intact class.

The experimental group received the Peer Tutoring Training Program. This group was taught by the investigator. The control group, originally N=20, was a matched-half with the experimental group; based on pre-test scores, they were randomly divided. The control group was taught by the experienced expert gymnastic teacher/coach/performer. The control group was deliberately taught different gymnastic and movement skills called for in the curriculum guide and kept naive as to the critical elements taught to the experimental group.

The regular instruction group was also taught by an experienced, expert gymnastic teacher/coach. The gymnastic skills and basic movements were taught introducing critical elements and peer-spotting as usual. The regular instructor did not deliberately teach peer-tutoring nor peer-feedback on the critical elements however.

**Conclusions**

Within the framework of this investigation, the following conclusions are justified:

1. Subjects (pre-service physical education students) do not demonstrate knowledge of the critical performance elements of prone-to-prone headstand, long jump, ball throw or batting under baseline conditions. The ability to verbally identify
critical elements of sport skills was very poor across all subjects (experimental, control and regular instruction groups) in this study. Students generally identified one or two elements out of six.

2. Subjects (preservice physical education students) do not demonstrate the ability to visually analyze the critical performance elements of the prone-to-prone headstand, back straddle roll, cartwheel, long jump, ball throw or batting when first enrolled in a Basic Movement and Gymnastic Class for physical education majors. The ability to visually discriminate critical elements correctly or incorrectly performed was very poor across all subjects under baseline conditions. Subjects were generally able to discriminate one-half element to one and one-half elements out of six.

3. A significant functional effect for both verbal identification and visual discrimination occurred for the experimental group. They improved abruptly and substantially in skill analysis of all four treated skills as a result of the Peer Tutoring Program.

4. The subjects participating in the Peer Tutoring Skill Analysis Program significantly improved in verbal identification and visual analytic ability of the critical performances compared to the control group and the regular instruction group.
5. The ball throw and batting skills, that remained untreated for all groups, remained at low baseline levels through maintenance.

6. Sport skill analytic ability acquired through peer tutoring and direct instruction, was successfully generalized to "live" skill analysis. This peer tutoring was recorded as a permanent product on videotape.

7. Sport skill analytic ability acquired through peer tutoring was successfully maintained on through the maintenance test. Experimental subjects even maintained high scores on the prone-to-prone headstand and back straddle roll that were taught in the first two weeks and never reviewed.

8. Pre-test and post-test scores for the control group were not significantly different than the scores earned by the regular instruction group. Students did not learn skill analysis of sport skills by merely participating in the skills or watching the critical elements demonstrated. If the critical elements and how to analyze them, are not specifically taught, they are not learned.

9. A direct positive relationship existed between ability to verbally identify the critical elements of a sport skill and the ability to visually discriminate critical elements as correct or incorrect.
10. The most difficult skill to analyze, in this study, was the cartwheel. Determining if hips and legs were extended up and over shoulders (elements number three and four) was challenging. The cartwheel was a fast total body movement.

11. Providing systematic instruction in visual analysis of sport skills, must be a deliberate, precisely planned instructional experience based on behavioral principles of learning.

**Recommendations For Future Research**

Based on the findings in this study, implications for future research are recommended:

1. Compare peer tutoring technique to interactive videodisk instruction of skill analysis. Establish identical critical elements of identical skills. Time, cost, instructor variables must be equal and controlled.

2. Accurate critical elements, based on expert consensus, must be established for every major skill taught in physical education! Review of literature and direct conversation with "experts" reveal major blind-spots in teacher/coach/performers selection of critical elements. As an example, two major omissions are **footwork**: moving one's feet to get-in-line with a sport ball or object (tennis, volleyball, racquetball, soccer, baseball, etc.) and **watching-the-ball** or sport object
all the way to the point of contact (racket, forearms, bat, glove, foot, etc.). These are first priority. An athlete can do a dozen other "critical elements" efficiently and if the athlete has not moved to the proper relationship to the object, nor looked-at-the-object-long-enough-to-make contact, other critical elements can be thrown in the trash!! Ignorantly selected critical elements are as bad as not teaching skill analysis at all. Giving inaccurate feedback is worse than giving no feedback.

3. This study should be replicated for inservice physical educators interested in improving skill analytic proficiency.

4. This study should be replicated for high school physical education students. Pre-test and posttest skill performance level, as well as skill analytic proficiency.

5. This study should be replicated involving elite athletes performing and analyzing advanced skills.

6. Further research in skill analysis of open sport skills or different closed sport skills should be conducted. No more than five or six critical elements should be analyzed per skill.

7. The experimental subjects in this study, should be retested in approximately one year to again determine the maintenance level of their skill analytic ability.
8. As the experimental subjects in this study participate in elementary/secondary cores and student teaching, it would be valuable to retest their skill analytic ability in-the-field compared to those student teachers untrained in peer tutoring.

9. Shouldn't increased skill analysis ability, relate to increased skill performance ability? In each skill methodology class for physical educators, peer tutoring could enhance the acquisition of performance skill and skill analytic ability simultaneously. Peer tutoring is an inexpensive way to give each student a personal teacher/coach. Peer tutoring also holds each physical education major accountable and responsible for observing a partner's performances and giving accurate feedback on correct and incorrect critical performance elements. As Wilkinson (1986) stated so appropriately:

Most physical education majors spend a large part of their professional training learning to efficiently perform motor skills. Given the limited time available in the teacher education curriculum, teacher educators need to consider the scope and timing of the skill analysis portion of the professional preparation program so that professionals will enter the work force prepared to deliver accurate and timely feedback to pupils performing in the gymnasium. (p. 296)
APPENDIX A

SUBJECT STANDARD RELEASE FORM
STANDARD RELEASE FORM

Teacher Education Laboratory
College of Education
The Ohio State University

I hereby give permission to the College of Education of The Ohio State University to record and copyright photographic, video, and/or audio recordings made of me. I also agree to participate in skill analysis study and peer tutoring in Physical Education 213. My identity will remain confidential.

I waive the right to approve the finished production, or to limit educational uses of the finished production.

I attest that I am of legal age and that I agree to the above conditions.

Signed: _____________________________________________________

male or female (circle one please)

Date: ________________ College Year: Fr. Soph. JR. Sr.
(circle one please)

Address: _______________________Major: _____________________

________________________________________

Have you completed an ACADEMIC CLASS in methodology of SKILL ANALYSIS? Yes or No. If yes, Name of course?

Were you on gymnastic team or in adv. gymnastics? Y or N?
APPENDIX B

INSTRUCTIONS FOR PRE-TEST AND MAINTENANCE TEST

VIDEOTAPE VIEWING
VIDEO TAPE TEST INSTRUCTIONS

Thank you for participating in Physical Education 213 research. Please WRITE YOUR NAME ON EACH PAGE OF THIS TEST NOW AND SIGN THE RELEASE FORM.

You are about to observe a video cassette tape of a number of different students performing various sport skills. These are actual performances taken from live school settings where students are performing skills as well as they know how. Each student you will observe will be referred to as a subject and will be given a number.

2. YOU WILL SEE EACH SUBJECT'S PERFORMANCE OF THE SAME SKILL REPEATED THREE TIMES AT NORMAL SPEED.
3. UPON COMPLETION OF THE THIRD SHOWING, YOU MUST ANALYZE THE PERFORMANCE YOU JUST OBSERVED.
4. Identify the presence or absence of the SIX MOST CRITICAL ELEMENTS (performance points of importance).
5. CIRCLE CORRECT IF THE ELEMENT IS CORRECTLY PERFORMED.
6. CIRCLE INCORRECT IF THE ELEMENT IS INCORRECTLY PERFORMED (or missing completely).
7. BE CERTAIN YOU CIRCLE THE ANSWER IN LINE WITH THE CRITICAL ELEMENT YOU WROTE DOWN. ALSO BE CERTAIN YOU ARE REFERRING TO THE CORRECT SUBJECT AS ANNOUNCED ON THE VIDEO.
APPENDIX C
SPORT SKILL ANALYSIS PRE-TEST AND MASTER ANSWER KEY
P.E. 213 PRE-TEST SKILL ANALYSIS

Name__________________________

LONG JUMP: Six Critical Elements

Circle One:
Correct or Incorrect/Missing

Subject 1

1. Correct Incorrect Deep crouch 90°
2. Correct Incorrect Arms swing back 45°
3. Correct Incorrect Full body extension
4. Correct Incorrect Lift legs high: hips flexed
5. Correct Incorrect Deep crouch landing
6. Correct Incorrect Drive arms forward

Subject 2

1. Correct Incorrect (same as above)
2. Correct Incorrect
3. Correct Incorrect
4. Correct Incorrect
5. Correct Incorrect
6. Correct Incorrect
# BALL THROW: Six Critical Elements

Circle One:
Correct or Incorrect/Missing

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<td>4.</td>
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**Subject 4**

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<td>4.</td>
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<td>6.</td>
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**Subject 5**

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<td>3.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
</tr>
<tr>
<td>5.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
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<tr>
<td>6.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
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</table>

**Subject 6**

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<td>2.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
</tr>
<tr>
<td>3.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
</tr>
<tr>
<td>4.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
</tr>
<tr>
<td>5.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
</tr>
<tr>
<td>6.</td>
<td><strong>Correct</strong></td>
<td>Incorrect</td>
</tr>
</tbody>
</table>
BATTING: Six Critical Elements

Circle One:
Correct or Incorrect/Missing

<table>
<thead>
<tr>
<th>Subject 7</th>
<th>Subject 8</th>
<th>Subject 9</th>
<th>Subject 10</th>
</tr>
</thead>
</table>

- Incorrect Head still & eyes on ball; wt & bat back
- Incorrect Step in closed stride twd. pitcher
- Incorrect Full body rotation as:
- Incorrect Level swing; straight arms
- Incorrect Meet ball in front (twd. pitcher)
- Incorrect Swing through ball: rotate wrists

(subjects 7 to 10 are similar to subject 7)
CARTWHEEL: Six Critical Elements

Circle One:
Correct or Incorrect/Missing

1. Correct Incorrect
   Establish lead foot
2. Correct Incorrect
   Lunge; 1st hand to mat, 2nd hand
3. Correct Incorrect
   Swing legs up one at a time
4. Correct Incorrect
   Fully ext. body; legs separated
5. Correct Incorrect
   Foot-foot landing pattern
6. Correct Incorrect
   Finish in balanced side stand

Subject 11

Subject 12

Subject 13

Subject 14
PRONE TO PRONE HEADSTAND: Six Critical Elements

Circle One:
Correct or Incorrect/Missing

Subject 15

1. Correct Incorrect Forehead on mat; form with hands
2. Correct Incorrect 1/3 wt. on each hand, 1/3 on forehead
3. Correct Incorrect Lift hips overhead; legs ext.
4. Correct Incorrect Lift legs together to full extension
5. Correct Incorrect Hold 3", lower legs & keep hips up
6. Correct Incorrect Toes, legs, thighs return to prone

Subject 16

1. Correct Incorrect (same as above)
2. Correct Incorrect
3. Correct Incorrect
4. Correct Incorrect
5. Correct Incorrect
6. Correct Incorrect

Subject 17

1. Correct Incorrect
2. Correct Incorrect
3. Correct Incorrect
4. Correct Incorrect
5. Correct Incorrect
6. Correct Incorrect
BACK STRADDLE ROLL: Six Critical Elements

Subject 18

Circle One: Correct or Incorrect/Missing

1. Correct Incorrect Straddle stand; legs ext. always
2. Correct Incorrect Tuck chin; bend trunk, hands reach back
3. Correct Incorrect Wt. on hands as roll to buttocks
4. Correct Incorrect Hands beside head; push body over
5. Correct Incorrect Hips & ext. legs go overhead
6. Correct Incorrect Land on feet; ext. trunk & arms

Subject 19

1. Correct Incorrect (same as above)
2. Correct Incorrect
3. Correct Incorrect
4. Correct Incorrect
5. Correct Incorrect
6. Correct Incorrect

Subject 20

Circle One: Correct or Incorrect/Missing

1. Correct Incorrect
2. Correct Incorrect
3. Correct Incorrect
4. Correct Incorrect
5. Correct Incorrect
6. Correct Incorrect
APPENDIX D

PROBE TEST AND MASTER ANSWER KEY
PROBE ONE

Name

PRONE TO PRONE HEADSTAND: SIX CRITICAL ELEMENTS

Circle One: Correct or Incorrect/Missing

SUBJECT 1

1. **Correct** Incorrect Forehead, hands back form
2. **Correct** Incorrect Place 1/3 wt. on forehead & each hand
3. **Correct** Incorrect Draw hips overhead: legs extended
4. **Correct** Incorrect Lift legs together to full extension
5. **Correct** Incorrect Hold 3"; lower legs & keep hips up
6. **Correct** Incorrect Return toes legs, hips body to prone pos.

SUBJECT 2

1. **Correct** Incorrect __________________
2. **Correct** Incorrect __________________
3. **Correct** Incorrect __________________
4. **Correct** Incorrect __________________
5. **Correct** Incorrect __________________
6. **Correct** Incorrect __________________

REPEAT ABOVE PLEASE

BACK STRADDLE:

SUBJECT 3

1. Correct **Incorrect** Straddle stand; legs ext always
2. Correct **Incorrect** Tuck chin, bend trunk reach hands back
3. Correct **Incorrect** Hands take wt as roll back on buttocks
4. Correct **Incorrect** Transfer hands by ear; push hips/body over
5. Correct Incorrect Hips and ext. legs overhead
6. Correct Incorrect Land on feet; ext. trunk & arms
## PROBE TWO

### BACK STRADDLE ROLL:

**SIX CRITICAL ELEMENTS**

**Circle One: Correct or Incorrect Missing**

**SUBJECT 1**

1. **Correct** [Incorrect] Straddle stand; legs ext. always
2. **Correct** Incorrect Tuck chin; bend trunk, hands reach back
3. **Correct** Incorrect Wt. on hands as roll to buttocks
4. **Correct** Incorrect Hands beside head; push body over
5. **Correct** Incorrect Hips & extended legs go overhead
6. **Correct** Incorrect Land on feet; ext. trunk & arms

**SUBJECT 2**

1. **Correct** Incorrect (same as above)
2. **Correct** Incorrect ______________________
3. **Correct** Incorrect ______________________
4. **Correct** Incorrect ______________________
5. **Correct** Incorrect ______________________
6. **Correct** Incorrect ______________________

### CARTWHEEL:

**SUBJECT 3**

1. **Correct** Incorrect Establish lead foot
2. **Correct** Incorrect Lunge; 1st hand to mat; 2nd hand
3. **Correct** Incorrect Swing legs up one at a time
4. **Correct** Incorrect Fully ext. body; legs separated
5. **Correct** Incorrect Foot, foot landing pattern
6. **Correct** [Incorrect] Finish in balanced sidestand
PROBE THREE

Name ________________________________

CARTWHEEL: SIX CRITICAL ELEMENTS

Circle one: Correct or Incorrect/Missing

1. Correct Incorrect  Establish lead foot
2. Correct Incorrect  Lunge; 1st hand to mat; 2nd hand
3. Correct Incorrect  Swing legs up one at a time
4. Correct Incorrect  Fully ext. body; legs separated
5. Correct Incorrect  Foot, foot landing pattern
6. Correct Incorrect  Finish in balanced sidestand

SUBJECT 1

SUBJECT 2

1. Correct Incorrect  (same as above)
2. Correct Incorrect  
3. Correct Incorrect  
4. Correct Incorrect  
5. Correct Incorrect  
6. Correct Incorrect  

LONG JUMP: SUBJECT 3

1. Correct Incorrect  Deep crouch 90°
2. Correct Incorrect  Arms swing back 45°+
3. Correct Incorrect  Full body extension
4. Correct Incorrect  Lift legs high; hips flexed
5. Correct Incorrect  Deep crouch landing
6. Correct Incorrect  Drive arms forward
**PROBE FOUR**

Name__________________________

**LONG JUMP:**

<table>
<thead>
<tr>
<th>Circle One: Correct or Incorrect/Missing</th>
<th>SIX CRITICAL ELEMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correct</td>
<td>Incorrect</td>
</tr>
<tr>
<td>2. Correct</td>
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<tr>
<td>3. Correct</td>
<td>Incorrect</td>
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<td>4. Correct</td>
<td>Incorrect</td>
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<tr>
<td>5. Correct</td>
<td>Incorrect</td>
</tr>
<tr>
<td>6. Correct</td>
<td>Incorrect</td>
</tr>
</tbody>
</table>

**SUBJECT 2**

| 1. Correct | Incorrect |
| 2. Correct | Incorrect |
| 3. Correct | Incorrect |
| 4. Correct | Incorrect |
| 5. Correct | Incorrect |
| 6. Correct | Incorrect |

**OVERHAND THROW:**

| 1. Correct | Incorrect |
| 2. Correct | Incorrect |
| 3. Correct | Incorrect |
| 4. Correct | Incorrect |
| 5. Correct | Incorrect |
| 6. Correct | Incorrect |

**BATTING:**

| 1. Correct | Incorrect |
| 2. Correct | Incorrect |
| 3. Correct | Incorrect |
| 4. Correct | Incorrect |
| 5. Correct | Incorrect |
| 6. Correct | Incorrect |
APPENDIX E

"LIVE" PEER TUTOR SKILL ANALYSIS TEST FORM

Example: SUBJECT 1A ANALYSES PARTNER 1B
### FILM TEST ONE

**Name**

**PRONE TO PRONE HEADSTAND:**

<table>
<thead>
<tr>
<th>Circle One: Correct or Incorrect/Missing</th>
<th>SUBJECT 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correct Incorrect</td>
<td>Forehead on mat; form with hands</td>
</tr>
<tr>
<td>2. Correct Incorrect</td>
<td>1/3 wt. on each hand, 1/3 on forehead</td>
</tr>
<tr>
<td>3. Correct Incorrect</td>
<td>Lift hips overhead; legs extended</td>
</tr>
<tr>
<td>4. Correct Incorrect</td>
<td>Lift legs together to full extension</td>
</tr>
<tr>
<td>5. Correct Incorrect</td>
<td>Hold 3&quot;; lower legs &amp; keep hips up</td>
</tr>
<tr>
<td>6. Correct Incorrect</td>
<td>Toes, legs thighs return to prone</td>
</tr>
</tbody>
</table>

### FILM TEST TWO

**Name**

**BACK STRADDLE ROLL:**

<table>
<thead>
<tr>
<th>Circle One: Correct or Incorrect/Missing</th>
<th>SUBJECT 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correct Incorrect</td>
<td>Straddle stand: legs ext. always</td>
</tr>
<tr>
<td>2. Correct Incorrect</td>
<td>Tuck chin; bend trunk, hands reach back</td>
</tr>
<tr>
<td>3. Correct Incorrect</td>
<td>Wt. on hands as roll to buttocks</td>
</tr>
<tr>
<td>4. Correct Incorrect</td>
<td>Hands beside head; push body over</td>
</tr>
<tr>
<td>5. Correct Incorrect</td>
<td>Hips &amp; ext. legs go overhead</td>
</tr>
<tr>
<td>6. Correct Incorrect</td>
<td>Land on feet; ext. trunk &amp; arms</td>
</tr>
</tbody>
</table>
### FILM
### TEST THREE

**Name________________**

**CARTWHEEL:** SIX CRITICAL ELEMENTS

Circle One: Correct or Incorrect/Missing

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<th>Incorrect</th>
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<td>6</td>
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</tbody>
</table>

**SUBJECT 1**

1. **Correct** Incorrect  
   Establish lead foot

2. **Correct** Incorrect  
   Lunge; 1st hand to mat, 2nd hand

3. **Correct** Incorrect  
   Swing legs up one at a time

4. **Correct** Incorrect  
   Fully ext. body; legs separated

5. **Correct** Incorrect  
   Foot, foot landing pattern

6. **Correct** Incorrect  
   Finish in balanced side stand

### FILM
### TEST FOUR

**Name________________**

**LONG JUMP:** SIX CRITICAL ELEMENTS

Circle One: Correct or Incorrect/Missing

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</table>

**SUBJECT 1**

1. **Correct** Incorrect  
   Deep crouch 90° or less

2. **Correct** Incorrect  
   Arms swing back 45° or more

3. **Correct** Incorrect  
   Full body extension

4. **Correct** Incorrect  
   Lift legs high; hips flexed

5. **Correct** Incorrect  
   Deep crouch landing

6. **Correct** Incorrect  
   Drive arms forward
APPENDIX F

SPORT SKILL ANALYSIS MAINTENANCE TEST AND MASTER ANSWER KEY
<table>
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<tr>
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<td>Deep crouch 90°</td>
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<tr>
<td>2</td>
<td>Correct</td>
<td>Incorrect</td>
<td>Arms swing back 45°</td>
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<tr>
<td>3</td>
<td>Correct</td>
<td>Incorrect</td>
<td>Full body extension</td>
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<td>4</td>
<td>Correct</td>
<td>Incorrect</td>
<td>Lift legs high: hips flexed</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>5</td>
<td>Correct</td>
<td>Incorrect</td>
<td>Deep crouch landing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Correct</td>
<td>Incorrect</td>
<td>Drive arms forward</td>
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<td>Correct</td>
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</table>
BALL THROW: SIX CRITICAL ELEMENTS

Circle one: Correct or incorrect/missing

SUBJECT 3

1. Correct Incorrect
2. Correct Incorrect
3. Correct Incorrect
4. Correct Incorrect
5. Correct Incorrect
6. Correct Incorrect

- Side to target; weight on rear foot
- Hand, elbow, arm back & open up
- Step in opposition toward target
- Full body rotation
- Elbow lead; forearm extend
- Follow-thru in overhand throw

SUBJECT 4

1. Correct Incorrect
2. Correct Incorrect
3. Correct Incorrect
4. Correct Incorrect
5. Correct Incorrect
6. Correct Incorrect

(same as above)
<table>
<thead>
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<th>SUBJECT 6</th>
<th>SUBJECT 7</th>
<th>SUBJECT 8</th>
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<td><strong>Circle one: Correct or incorrect/missing</strong></td>
<td><strong>Circle one: Correct or incorrect/missing</strong></td>
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<td>(same as above)</td>
<td>1. Correct Incorrect</td>
<td>(same as above)</td>
</tr>
<tr>
<td>2. Correct Incorrect</td>
<td>Head still &amp; eyes on ball; wt &amp; bat back</td>
<td>2. Correct Incorrect</td>
<td>Head still &amp; eyes on ball; wt &amp; bat back</td>
</tr>
<tr>
<td>3. Correct Incorrect</td>
<td>Step in closed stride twd. pitcher</td>
<td>3. Correct Incorrect</td>
<td>Step in closed stride twd. pitcher</td>
</tr>
<tr>
<td>4. Incorrect Correct</td>
<td>Full body rotation as:</td>
<td>4. Incorrect Correct</td>
<td>Full body rotation as:</td>
</tr>
<tr>
<td>5. Correct Incorrect</td>
<td>Level swing; straight arms</td>
<td>5. Correct Incorrect</td>
<td>Level swing; straight arms</td>
</tr>
<tr>
<td>6. Correct Incorrect</td>
<td>Meet ball in front (twd pitcher)</td>
<td>6. Correct Incorrect</td>
<td>Meet ball in front (twd pitcher)</td>
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<tr>
<td>7. Correct Incorrect</td>
<td>Swing through ball; rotate wrists</td>
<td>7. Correct Incorrect</td>
<td>Swing through ball; rotate wrists</td>
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<td>8. Correct Incorrect</td>
<td>(same as above)</td>
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</table>
CARTWHEEL: SIX CRITICAL ELEMENTS

Circle one: Correct or Incorrect/Missing

1. Correct Incorrect Establish lead foot
2. Correct Incorrect Lunge; 1st hand to mat 2nd hand
3. Correct Incorrect Swing legs up one at a time
4. Correct Incorrect Fully extend body; legs separated
5. Correct Incorrect Foot, foot landing pattern
6. Correct Incorrect Finish in a balanced sidestand

SUBJECT 9

SUBJECT 10

SUBJECT 11

SUBJECT 12
Name ____________________________

**PRONE TO PRONE HEADSTAND:**

<table>
<thead>
<tr>
<th>Circle One: Correct or Incorrect/Missing</th>
<th>SIX CRITICAL ELEMENTS</th>
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</thead>
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<tr>
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<td>SUBJECT 13</td>
</tr>
<tr>
<td>1. Correct</td>
<td>Forehead on mat; form with hands</td>
</tr>
<tr>
<td>2. Correct</td>
<td>1/3 wt. on each hand 1/3 on forehead</td>
</tr>
<tr>
<td>3. Correct</td>
<td>Lift hips overhead; legs extended</td>
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<tr>
<td>4. Correct</td>
<td>Lift legs together to full extension</td>
</tr>
<tr>
<td>5. Correct</td>
<td>Hold 3&quot;, lower legs &amp; keep hips up</td>
</tr>
<tr>
<td>6. Correct</td>
<td>Toes, legs, thighs return to prone</td>
</tr>
</tbody>
</table>

|                                        | SUBJECT 14             |
| 1. Correct                             | (same as above)        |
| 2. Correct                             |                        |
| 3. Correct                             |                        |
| 4. Correct                             |                        |
| 5. Correct                             |                        |
| 6. Correct                             |                        |

|                                        | SUBJECT 15             |
| 1. Correct                             |                        |
| 2. Correct                             |                        |
| 3. Correct                             |                        |
| 4. Correct                             |                        |
| 5. Correct                             |                        |
| 6. Correct                             |                        |
### BACK STRADDLE ROLL:

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<tr>
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#### SIX CRITICAL ELEMENTS

**SUBJECT 16**

1. **Correct** Incorrect
   - Straddle stand; legs ext. always
2. **Correct** Incorrect
   - Tuck chin; bend trunk, hands reach back
3. **Correct** Incorrect
   - Wt. on hands as roll to buttocks
4. **Correct** Incorrect
   - Hands beside head; push body
5. **Correct** Incorrect
   - Hips & extended legs go overhead
6. **Correct** Incorrect
   - Land on feet; ext. trunk & arms

**SUBJECT 17**

1. **Correct** Incorrect
   - (same as above)
2. **Correct** Incorrect
3. **Correct** Incorrect
4. **Correct** Incorrect
5. **Correct** Incorrect
6. **Correct** Incorrect

**SUBJECT 18**

1. **Correct** Incorrect
2. **Correct** Incorrect
3. **Correct** Incorrect
4. **Correct** Incorrect
5. **Correct** Incorrect
6. **Correct** Incorrect
APPENDIX G

PEER TUTORING INSTRUCTIONS
PLENTY OF PERFECT PEER TUTORING AND PERFORMANCE PRACTICE

WHAT ARE WE DOING AND WHY?

Hoffman (1977a, b, c) said that skill analysis is the most essential skill needed by a physical educator. He defines **skill analysis** as the act of identifying errors in the performance of a learner. Skill analysis is a process by which a teacher or coach systematically observes motor responses of his students and identifies discrepancies between actual and desired responses.

Physical educators have been reported to be lacking in the ability to do skill analysis accurately (Armstrong, 1984; Anderson and Barrette, 1978; Cheffers and Mancini, 1978; Costello and Laubach, 1978; Fishman and Tobey, 1978; Kniffen, 1985; Harari, 1986; and Wilkinson, 1986). In this class we will learn what experts say are the most critical elements for select sport skills. You will physically perform these sport skills and your partner will analyze your performance and give accurate feedback on correct and incorrect critical elements. You will then reciprocate and analyze the performance of your partner, giving accurate feedback on correct and incorrect critical elements.
OUTLINE OF RECIPROCAL PEER-TUTOR SKILLS ANALYSIS

I. LEARN THE SIX CRITICAL ELEMENTS OF A SKILL

A. Worksheets with illustrations and labels.
   1. Please read the critical elements to yourself as you look at the illustrations.
   2. Class: Read the critical elements aloud together with instructor.

B. Worksheets with illustrations and NO LABELS.
   LIST the six (6) critical elements under the appropriate illustration.

C. NO WORKSHEETS; Practice visualization of ideal, illustrated performance with no prompts.

D. Written Test: Each student will be given a numbered, lined test form with the name of the skill at the top. NO INFORMATION AND NO ILLUSTRATIONS. List the six (6) critical performance elements of this skill. You must answer all correctly 100% to proceed to performance and peer tutoring.

II. LEARNING PEER TUTORING; OBSERVE IT "MODELED"

You are responsible for giving feedback on the Critical Elements to your partner. Preceding actual physical practice of the skills, the skill was modeled. The class watched for the correct/incorrect performance of the FIRST TWO CRITICAL ELEMENTS, the third and fourth critical element, then the last
two critical elements. Analysis and discussion of the skill followed.

A. 1. TUTOR PARTNER: Please watch your partner's performance. Evaluate if either of the FIRST TWO CRITICAL ELEMENTS are incorrectly performed (or missing).

2. PERFORMING PARTNER: Please perform the skill to the best of your ability using all critical elements.

3. TUTOR PARTNER: Give immediate, brief, specific corrective feedback on the FIRST TWO CRITICAL ELEMENTS only.

B. Repeat exactly the above procedure. Watch for the third and fourth critical elements (the "HUB", HIPS and primary ACTION of the skill). Give immediate, BRIEF FEEDBACK on whether the critical elements were SPECIFICALLY CORRECT. For example: "Your hips remained balanced overhead." - "You lifted your legs together and straight."

C. REPEAT THE ABOVE PROCESS: TUTOR PARTNER analyze the last two critical elements. The PERFORMING PARTNER performs the skill to the best of their ability.

D. Repeat the above procedure a fourth time: TUTOR PARTNER watch for the most EFFICIENTLY PERFORMED CRITICAL ELEMENTS. Give POSITIVE FEEDBACK on the best critical element(s). The major critical element performed inefficiently must also be re-emphasized.
III. LEARNING SKILL PERFORMANCE RECIPROCAL PEER TUTORING

A.  1. Partners, please change responsibilities now. If you were TUTOR PARTNER, you are now PERFORMING PARTNER. If you were PERFORMING PARTNER you are now TUTOR PARTNER.

2. TUTOR PARTNER: Please watch your partner's performance carefully. Determine if either of the FIRST TWO CRITICAL ELEMENTS were incorrectly performed (or missing).

3. PERFORMING PARTNER: Please perform the skill to the best of your ability using all of the critical elements.

4. TUTOR PARTNER: Give immediate, brief, specific corrective feedback. Determine if any of the FIRST CRITICAL ELEMENTS WERE incorrectly performed (or missing).

B.  1. Repeat the above procedure: TUTOR PARTNER analyze PERFORMING PARTNER'S SKILL to determine if the third and fourth "HUB" CRITICAL ELEMENTS were correctly performed (or missing).

2. PERFORMING PARTNER: Perform the skill to the best of your ability.

C. Just like "B" except LAST THREE CRITICAL ELEMENTS.

D. The above process is repeated a third time. TUTOR PARTNER: Please give POSITIVE FEEDBACK on the MOST EFFICIENTLY PERFORMED CRITICAL ELEMENT. The major
critical element inefficiently performed must also be re-emphasized.

E. REVERSE RESPONSIBILITIES AND REPEAT ENTIRE PROCEDURE AGAIN. This will give each of you a minimum of sixteen opportunities to respond as TUTOR PARTNER and PERFORMER.

IV. LIVE PERFORMANCE TESTING STATION FOR PEER TUTORS
A. Please write down the six most critical elements of the skill on the test form.
B. TUTOR PARTNER: Please be ready to watch for the correct or incorrect performance of ALL SIX CRITICAL ELEMENTS of skill number one.
C. PERFORMING PARTNER: Would you please perform your best prone to prone head stand for your peer partner.
D. TUTOR PARTNER: Please circle incorrect (or missing) CRITICAL ELEMENTS as well as CORRECTLY FORMED CRITICAL ELEMENTS that occur in their best performance.
E. EXCHANGE RESPONSIBILITIES: Performing Partner become Tutor Partner and Tutor Partner become Performing Partner.
F. NEW PERFORMING PARTNER: Please perform your best skill for your peer tutor.
G. TUTOR PARTNER: Please circle incorrectly performed critical elements as well as those correctly performed critical elements.
V. RHYTHMIC GYMNASTICS AND STUNT STATIONS

A. When you and your partner are not being filmed and tested; you are assigned to either GYMNASTIC/STUNT STATION or PRACTICE CRITICAL ELEMENTS STATION.

B. PRACTICE PERFORMANCE AND SKILL ANALYSIS OF SIX CRITICAL ELEMENTS: Performing Partner performs and Tutor Partner analyses for the absence or presence of six critical elements.

C. Next you will rotate to the performing--skill analysis--filming station; next you rotate to the rhythmic gymnastic/stunt station.

VI. VIDEO CASSETTE RECORDER "SKILL-OF-THE-DAY" TEST.

A. Two examples of recorded performances of the skill we are studying for the day will be tested on the same form as pre- and post-tests.

B. An example of skills in baseline will be tested on the Video-Cassette playback unit also.
APPENDIX H

PEER TUTOR WORKSHEETS

1. Illustrations With Labels
2. Practice Sheets With Illustrations Only
Figure 1. Illustrations of Prone-to-Prone Headstand: Critical Elements

- **Figure 1**: Illustrations of Prone-to-Prone Headstand: Critical Elements
FIGURE 2. WORKSHEET OF PRONE-TO-PRONE HEADSTAND: CRITICAL ELEMENTS
| STRADDLE STAND: LEGS | TUCK CHIN: BEND TRUNK | HANDS TAKE WEIGHT, AS
| REMAIN EXTEND, ALWAYS | FWD. HANDS REACH BACK... | ROLL BACK ON BUTTOCKS

| TRANSFER HANDS BESIDE HEAD; | HIPS & LEGS GO OVER HEAD | LAND ON BOTH BALLS-OF-
| PUSH HIPS & BODY BACKWARDS | | FEET RAISE HANDS & TRUNK.

**Figure 3. Illustrations of Back Straddle Roll: Critical Elements**
FIGURE 4. WORKSHEET OF BACK STRADDLE ROLL: CRITICAL ELEMENTS
LEAD FOOT ESTABLISHED
LUNGE: LEAD HAND TO MAT
... 2ND HAND TO MAT
SWING LEGS UP (ONE AT A TIME) HIPS OVER SHOULDERS

BODY FULLY EXTENDED
FOOT, FOOT LANDING
LEGS SEPARATED
PATTERN
FINISH IN A BALANCED SIDE STAND POSITION

FIGURE 5. ILLUSTRATIONS OF CARTWHEEL: CRITICAL ELEMENTS
<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
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<td><img src="image3" alt="Cartwheel Step 3" /></td>
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<tr>
<td>Step 4</td>
<td>Step 5</td>
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<td><img src="image6" alt="Cartwheel Step 6" /></td>
</tr>
</tbody>
</table>

**Figure 6: Worksheet of Cartwheel: Critical Elements**
90° DEEP CROUCH (Head and chest ahead throughout)

ARMS SWING BACK 45°

FULL BODY EXTENSION

LIFT LEGS HIGH; HIPS FLEXED & LEGS EXTENDED

DEEP CROUCH LANDING (as heels hit ground)

DRIVE ARMS FORWARD (to carry jumper forward)

FIGURE 7. ILLUSTRATIONS OF LONG JUMP: CRITICAL ELEMENTS
FIGURE 8. WORKSHEET OF LONG JUMP: CRITICAL ELEMENTS
SIDE TO TARGET WEIGHT
ON REAR FOOT
FULL BODY ROTATION

BALL THROWING HAND & ELBOW
6 ARM BACK, UP & OPENED
ELBOW LEAD, FOREARM
EXTEND IN OVERHAND THROW

STEP IN OPPOSITION
TOWARD TARGET
TRANSFER WEIGHT FORWARD.
WRIST-SNAP AS ARM FollowS
THROUGH

FIGURE 9. ILLUSTRATIONS OF OVERHAND BALL THROW: CRITICAL ELEMENTS
HEAD STILL; EYES ON BALL  
BAT BACK: WEIGHT BACK (toward pitcher)  
LEVEL SWING WITH STRAIGHT ARMS

STEP IN CLOSED STRIDE (toward pitcher)  
MEET BALL IN FRONT OF YOU (mid. pitcher)

FULL BODY ROTATION. (as ball is hit)  
FINISH SWING THROUGH BALL: WRIST ROTAT. MAX.

FIGURE 10. ILLUSTRATIONS OF BATTING: CRITICAL ELEMENTS
LIST OF REFERENCES


McGill, L. J. O. (1982). Developing the skills of mental replay in sports coaches - a model to explore the possibilities, Paper presented at the 7th Commonwealth and International Conference on sport, physical education, recreation and dance, Brisbane, Australia.


