A COMPARATIVE ANALYSIS OF COGNITIVE DIFFERENCES AMONG FEMALE ELITE AND NONELITE HIGH SCHOOL FIELD HOCKEY PLAYERS AND HIGH SCHOOL PHYSICAL EDUCATION CLASS NONATHLETES

A Thesis

Presented to the

Department of Physical Education and Sport

State University of New York

College at Brockport

Brockport, New York

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Education

---

by

Linda B. Adams

December, 1991

STATE UNIVERSITY OF NEW YORK

COLLEGE AT BROCKPORT

BROCKPORT, NEW YORK

Department of Physical Education and Sport

le of Thesis: A COMPARATIVE ANALYSIS OF COGNITIVE DIFFERENCES AMONG FEMALE ELITE AND NONELITE HIGH SCHOOL FIELD HOCKEY PLAYERS AND HIGH SCHOOL PHYSICAL EDUCATION CLASS NONATHLETES.

hor: Linda B. Adams

d and Approved by: Daniel E. Smith

Francis X Shot

Marilyn Colby

e Submitted to the Department of Physical Education and Sport:

December 13, 1991

epted by the Department of Physical Education and Sport, State versity of New York, College at Brockport, in partial fulfillment of requirements for the degree Master of Science in Education ysical Education).

e: 2/25/92

Francis X Shot

Chairperson, Department of Physical Education and Sport

TABLE OF CONTENTS

CHAPTER IV - RESULTS

CHAPTER V - DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

APPENDICES

COMPLETED RESEARCH IN HEALTH, PHYSICAL EDUCATION, RECREATION, AND DANCE
State University College at Brockport
Brockport, New York

Joseph P. Winnick

Institutional Representative

ADAMS, Linda B. A comparative analysis of cognitive differences among female elite and nonelite high school field hockey players and high school physical education class nonathletes. M.S. in Ed. 1991; pp 87. (Dan Smith).

The Empire State Games Western Scholastic Field Hockey Team (n = 14), a high school field hockey team (n = 15), and nonathletes in a high school physical education class (n = 9) were given a battery of tests and inventories to compare mental aspects such as abstract visual reasoning, concentration, sport-confidence, psychological skills relevant to exceptional performance, and competitive anxiety. Analyses included multivariate analysis of variance for each cognitive category, oneway univariate analysis of variance for each subtest within a cognitive category, and a stepwise multiple regression technique to determine which tests made the greatest contribution to predicting group membership. Multiple analysis revealed that the elite group displayed significantly higher sport-confidence and selected psychological skills. Results of a stepwise multiple regression technique indicated that motivation, mental preparation, and team motivation accounted for 67% of the behavioral variance. A subsequent multivariate analysis within just the two field hockey

groups revealed that the top half of the elite group displayed significantly higher trait sport-confidence and motivation than the bottom half of the nonelite group. A stepwise multiple regression analysis found that motivation, trait sport-confidence, state sport-confidence, and sequencing of information accounted for 99% of the behavioral variance. The results of this investigation indicated that there are cognitive differences already significant at the high school level, and that these factors influence the development of perceived competence.

ACKNOWLEDGEMENTS

By waiting this long to go back to school to get my Masters, there are that many more people who have helped me get this far and to whom I am indebted.

First, a thank you to my parents, Elmer and Shirley Berner, who have always, and continue to, set an example of curiosity and love of knowledge.

To my husband Bill, sons Jamie and Toby, and daughter Kyle many thanks for all your support, encouragement, and patience during my "school days."

To the members of my committee: Dr. Dan Smith (chairperson), Dr. Marilyn Colby, and Dr. Frank Short — thank you for guiding me through the thesis process.

Gratefulness to Mary Jo Orzech, from the Brockport Academic Services Center, who first acknowledged that there was a way to match my thesis idea with a computer.

To all my former and present field hockey players at Eastridge High School and on the Empire State Games squads, whose playing of the game pulls me back to the field every autumn, thank you for your willingness to explore the game of field hockey with me.

And finally, to the O'Dell family for sharing their home, time, computer, and printer with me.

Ironically, this investigation compared differences in order to discover similarities within players of the game of field hockey. The results confirmed a feeling that has become clearer the longer I stay in coaching: that there is great empowerment when there is joy in what you're doing and that it is a privilege to help others find that joy.

CHAPTER I

INTRODUCTION

Need and Significance

In addition to being competent with the stick and ball during a game of field hockey is the desire and need to see play as it evolves, to anticipate and make appropriate decisions, and to feel confident that these decisions are correct. Field hockey is an open-skill sport of multiple inputs with changing time and space relationships among ball, stick, player, teammates, opponents, game conditions, game states, and game actions. Players must act, and react, to these dynamic situations.

Some players seem to possess an extra sense, a "game sense", that has them often in the right place at the right time doing the right thing. At the same time, however, there are others (who have been presented the same material) who never quite make the transition to a higher level of play. For the person teaching sport skills, it becomes increasingly clear that there is more than teaching the mechanics of a skill.

During more than twenty years of teaching and coaching field hockey, the investigator often wondered if this ability to play at a higher level involved thinking at a higher level. Were there differences in how players thought and what players though as they advanced up the playing continuum? If so, would that information alter the way

material should be presented or change a player's approach to the game?

The investigator's opportunity to coach an elite group of high school field hockey players seemed an ideal chance to see what the cognitive differences might be. That elite group, an average high school field hockey team, and an average physical education class were given a battery of cognitive tests. Results were assessed and compared.

In the process of this study, the investigator found that others have been intrigued about thinking and have found it to be a very complicated process. Within the last thirty years, breakthroughs in split-brain studies, contributions of computers and artificial intelligence, and studies of traits, cognitive processes, and knowledge have added to general theories of learning (Hunt & Lansman, 1982; Lohman, 1989; Prawat, 1985). In addition, as many attempts have been made to investigate competence in sport, the cognitive side of sport has taken on increasing importance. Perceptive decision-making in sport has evolved into a relatively new area called cognitive sport psychology. Straub and Williams (1984) state that:

> Cognitive sport psychology is the scientific study of the mental processes and memory structures of athletes in order to understand and enhance their individual and collective behaviors. According to this perspective, athletes are seen as active organisms who search, filter, selectively act on, reorganize, and create information. (p. 7)

Starkes (1987) also points out that:

> What had earlier been given credit for advantage in sport, such as quicker reaction time, depth perception, and peripheral vision, are now being joined by more cognitive aspects such as visual recall of structured information, use of advanced visual cues, and complex decision accuracy and speed. (pp. 146-147)

The study of individual differences in information processing has helped explain variation along another dimension. While some have focused on individual differences in memory and others on individual differences in perception, Hunt and Lansman (1982) have expanded the notion that individual differences in attentional capacity partially determine cognitive performance. They are especially concerned with conditions where people are forced to handle several tasks at once. It seems to them that the ability to shift and allot mental energy as needed is what partially determines cognitive performance.

Studies of the elite in many activities, not just sport (Allard & Burnett, 1985; Starkes, 1987), have shown that the expert sees the situation differently, saves information differently (encodes in chunks), and adds to the knowledge base differently than the nonexpert. This ability has to do with distinguishing the most appropriate choice and its relationship within the context of the situation (Glass & Holyoak, 1986).

While an expert in an area may individually feel a mastery of the subject content, thee is another factor that can figure into confirmation of this ability. Bloom (1981), in discussing mastery, notes that:

> mastery must be both a subjective recognition by the student of his competence and a public recognition by the school or society ... Subjectively, the student must gain feelings of control over ideas and skill. He must come to realize that he 'knows' and can do what the subject requires ... If different forms of evaluation inform the student of mastery of the subject, he will come to believe in his own mastery and competence ... discovery that he can adequately cope with a variety of tasks and problems ... (p. 163)

These outside sources could provide additional motivation.

Attempts have been made to investigate competence in sport and how it develops. Studies have been designed to more fully understand the place of cognition and its relationship to competence in sport. Singer and Gerson (1981) categorized motor skills and identified potential learner strategies, Griffin and Keogh (1982) developed a model for movement confidence with its effect on movement skill development, Vealey (1986) developed a model for sport confidence, and Thomas, French, and Humphries (1986) suggested the effect of a specific sport knowledge base on sport skill acquisition. Many of these studies have investigated the elite and nonelite in sport to help further define the cognitive advantage (Heyman, 1982 - the effect of performance history and selection; Highlen & Bennett, 1983 - comparison between open- and closed-skill athletes on psychological skills and training; Mahoney & Avener, 1977 - cognitive strategies and different methods of coping with stress; Mahoney, Gabriel, and Perkins, 1987 - assessment of psychological skills relevant to exceptional performance; Meyers, Cooke, Cullen, and Liles, 1979 - a

replication of the Mahoney and Avener study with athletes from a different sport).

Purpose

The purpose of this investigation was to describe cognitive differences among, and between, elite and nonelite high school female field hockey players and female high school physical education class nonathletes. Competence has been defined as "the ability to make appropriate decisions for a particular situation at the appropriate time" (Arnold, 1988, pp. 129-130). Since generally accepted differences between experts and novices include how they view information and how they handle information, this investigation looked at four components of abstract visual reasoning: the order of information (series), the classification of information, the patterns of information (matrices), and the conditions of information (topology) (Cattell, 1990).

In addition, since attention and attention allocation could figure decisively in an open-skill sport such as field hockey, the notion of concentration was considered. This was done by means of an actual concentration grid exercise, and also within the framework of an inventory that has been devised to assess psychological skills that differentiate skill level.

Finally, the contribution of confidence to competence in sport was examined, with sport-confidence "defined as the belief or degree of certainly individuals possess about their ability to be successful in sport" (Vealey, 1986, p. 222). Vealey has developed an interactional

sport-specific model of self-confidence in which sport-confidence is conceptualized into trait (SC-trait) and state (SC-state) components. A competitive orientation construct is also included in the model to account for individual differences in defining success in sport. Mahoney's inventory that contained the concentration theme was also used to look at the confidence theme and the Competitive State Anxiety Inventory (CSAI-2) examined pre-competition perceptions of challenge, threat, or both. Besides these instruments, team records were considered to confirm Heyman's (1982) suggestion that a very important relationship exists between the history of athletes and their later performance.

Specifically, the investigation attempted to answer the following questions:

1. Based of the Culture Fair Intelligence Test (CFIT), what are the differences among the elite and nonelite female field hockey players and nonathlete physical education class students on the subtests which measure the four components of abstract visual reasoning (the order, classification, patterns and conditions of information)?
2. As determined by the concentration grid exercise, what are the differences among the elite and nonelite female field hockey players and nonathlete physical education class students?
3. What are the differences in trait sport-confidence scores, state sport-confidence scores, and competitive orientation scores on

Vealey's inventory and matrix among the elite and nonelite female field hockey players and nonathlete physical education class students?

4. What are the differences in concentration and confidence scores on the Mahoney Psychological Skills Inventory for Sports among the elite and nonelite female field hockey players and nonathlete physical education class students?
5. What are the common characteristics revealed in the Sport History Questionnaire for the individuals in the elite group in relation to: their early start in organized competition, their extensive background in a variety of sport experiences, and their belonging to a school field hockey team with better than a .500 record?

Delimitations

The investigation was limited to the members of the Empire State Games Western Scholastic Field Hockey Team. These members of the selected group participated in the National High School Field Hockey Festival at Orlando, Florida during Thanksgiving week, 1991 and had all but one of the tests administered at that time.

Nonelite field hockey players were represented by members of the team which finished in fifth place (out of nine) in the Monroe County Field Hockey League. (Only one girl from this team had been selected to the Empire State Games squad and her scores were included with the elite scores. If any girl on this fifth place team had been selected to

First-Team All-County the previous fall but did not try out for the Empire State Games squad, she would have been ineligible for this investigation; however, there were none.) A control group was represented by members of a physical education class composed of junior and senior girls who were not members of a school athletic team that year.

Limitations

The elite group was a static group not selected at random, but by a panel of experts over the course of a two-day tryout. All of the original 16 regulars did not travel to the National High School Field Hockey Festival, so the elite group was represented by 13 original members and one alternate. All but one of the tests were given in Florida. The Mahoney test arrived three months after the trip, so it was mailed to each of the players to be filled out and returned as quickly as possible.

Age could have been a factor, although the Empire State Games elite players could not be older than a senior in high school to qualify for the scholastic division; most players on the nonelite team would not make their varsity squad until their junior year in high school.

The number of players in each group was fifteen or less, but this was determined by the limit for the elite squad. The nonelite group took the battery of tests after completion of its season.

Some of the tests are not specifically designed for sport. There was difficulty finding a test to assess visual spatial reasoning for the high

school age subject and older; the Cattell Culture Fair Intelligence Test (CFIT) measures abstract visual reasoning.

Definitions

Abstract visual reasoning: In Cattell's theory of intelligence, fluid abilities and crystallized abilities are two of the second-order factors of general intelligence. Fluid abilities include tests of memory span and spatial thinking. These abilities represent cognitive skills necessary for solving novel problems including nonverbal stimuli, with the knowledge necessary to solve such problems less influenced by academic experience (Bjorklund, 1989).

Elite: person with expertise in a particular activity (For the purpose of this investigation, elite will be used interchangeably with the term expert.)

Open-skill sport: characterized by an ongoing changing environment "requiring adaptation to other individuals and to the motion of objects" (Yazdy-Ugav, 1988, p. 292).

Game rules: what should and should not be done in a game. e.g.- In field hockey there are unique characteristics to help give it form: the ball may only be hit with the flat side of the stick (there are only "right-handed sticks"), a player may not obstruct an opponent with either her body or stick (may not protect the ball), there are limits on lifting the ball.

Game conditions: opportunities to respond presented by the game

Game state: what is happening at the moment in a game

Game actions: player reaction to game conditions

Concentration: the ability to sustain attention on selected stimuli for a period of time (Martens, 1987)

Sport-confidence: "the belief or degree of certainty individuals possess about their ability to be successful in sport" (Vealey, 1986, p. 222).

SC-trait: "the belief or degree of certainty individuals usually possess about their ability to be successful in sport" (Vealey, 1986, p. 223).

SC-state: "the belief or degree of certainty individuals possess at one particular moment about their ability to be successful in sport" (Vealey, 1986, p. 223).

Competitive orientation: "reflects an athlete's belief that attainment of a certain type of goal demonstrates competence and success (performing well and winning were selected as the goals upon which competitive orientations are based) ... Through successful sport experiences, athletes may become performance-oriented or outcome-oriented" (Vealey, 1986, p. 222-223). Competitive orientation would also imply an athlete's desire to beat other people and this would be more important than playing better than one had played in a previous game.

Motivation: concerned with the intensity and direction of behavior (Martens, 1987)

Competitive trait anxiety: a tendency to perceive competitive situations as threatening and to respond to these situations with feelings of apprehension and tension (Martens, 1987)

A-trait: is a personality disposition which is acquired through experience (Martens, 1987)

A-state: is the level of reaction which occurs when confronted with threatening stimuli (Martens, 1987)

CHAPTER II

REVIEW OF LITERATURE

Introduction

The first section of this chapter will be a review of research about performance competence. The second section will review literature on studies that have used similar methodology as used in this investigation. The final section of this chapter will review literature that has employed similar treatment of data as used in this investigation. Some major sections have been subdivided for further clarity. The chapter concludes with a brief summary.

Performance Competence

Expertise

de Groot's (1966) now classic study on cognitive differences between expert and novice chess players revealed that chess masters have total recall for chess formations as long as they have meaning within the context of the game and chess pieces are not randomly placed. Research has continued to confirm these cognitive differences in, and across, a variety of domains. Expertise comes from "the possession of a large body of accessible and usable knowledge" (Chi, Glaser, and Rees, 1982, p.8).

The experts' knowledge takes into account not only the physical properties (surface features) of a problem that the novices tend to focus

on, but also the laws or principles that apply to them. Experts seem to have explicit solution procedures that go beyond description and include action. In addition, experts seem to have explicit conditions for when specific solution procedures should apply. Meanwhile, experts also seem to find more implied meaning and relationships than novices do from the same stated problem. Experts seem to be able to better recall sequences of events, and these are often from a functional versus spatial viewpoint (Chi, Glaser, and Rees, 1982).

Although experts and novices have similar capacity to take in information, the experts qualitatively know what to do with it. Additionally, there seems to be an accompanying competence which implies the appropriate use of information at the right time. In the area of teacher effectiveness, the notion of teacher competency is girded by the approach that "good teachers have a large repertoire of teaching skills and make wise decisions about when to employ these skills" (Jewett & Bain, 1985, p. 213).

Sport Expertise

The idea of expertise extends into the arena of sports as well. Starkes (1987) states:

> Recent studies have pointed out that skilled athletes do not necessarily possess superior nervous systems but have developed the same advanced forms of declarative [what to do] and procedural [how to do] knowledge as experts in other tasks (pp. 146-147).

Allard and Burnett (1985) presented similar data to illustrate chunking and categorizing performance for sport experts. A comparable 5-second recall paradigm as used by Chase and Simon (1973 a, b) with chess players was attempted with the open-skill sport of basketball. Varsity players recalled more player positions correctly than did the intramural players, but only when recalling structured game positions. Allard and Burnett felt that:

> The recall task indicates that expert basketball players use the knowledge of the game in order to recall the briefly presented basketball play, and suggests that basketball knowledge might well be organized in the same sort of semantic network proposed for experts in skill domains that more obviously require cognitive involvement. (p. 300)

In further studies, Allard and Burnett (1985) were able to show that basketball players chunk information into more meaningful units than the novices (as had happened with the chess players) and represent a problem by its deep structure rather than the novices' surface structure (as had happened with the chess players). These investigators believe that this advanced store of sport-specific declarative and procedural knowledge is another indication of the cognitive aspect of sport.

Starkes (1987) assessed a range of both perceptual and cognitive abilities within a group of expert field hockey players (the Canadian Women's Field Hockey Team), a university team, and a novice group. The perceptual tasks included reaction time and anticipation time while the cognitive tasks included the recall of structured versus

unstructured game situations and the use of advance cues in shot prediction. She found that none of the perceptual tasks were significant in predicting skilled performers, "but that field hockey does have very definite structure and cognitive demands, and these do account in part for what makes an expert" (p. 158).

Meaningfulness

Giving meaningfulness to game rules, game conditions, game states, and game actions enhances the ability to add to the knowledge base. By discussing the nature of the game or skill in an "if then ..." fashion, the vocabulary of the sport helps in the process of going from cognitive (verbal, action-consequence stage) to associative (memory-chain of actions stage) to automatic stages of motor learning (Glass & Holyoak, 1986).

Attention to meaningfulness can be accomplished with the use of cues, rehearsal, and strategies. Especially if visual and spatial relationships are critical elements of the total performance, then they need to be presented and considered at the same time as the other skills of the game. Thomas, French, and Humphries (1986) found that the development of cognitive skills and the knowledge base proceeds at a faster rate than the acquisition of sport skills. Children knew what was needed at a certain point in the game but their skills did not always allow them to perform what was needed at that point.

Timing

Timing seems to be an important component of competence, and it is especially important in successful motor performance.

Overdorf (1990) emphasizes two distinct types of timing that play major roles in the successful performance of motor skills: internal and external timing. Internal timing involves the proper sequencing of movements between various body segments that contribute to the overall movement. Some sports require additional timing considerations as well. These are in open-skill sports, such as field hockey, which are characterized by performance in a changing, varying, moving environment. Here, internal timing is joined by performance of the movement in the right place at the right time relevant to the movement in the environment. One aspect associated with external timing is the ability to cognitively anticipate future movements in the environment and recognize the "best" timing. The process of predicting spatial and temporal changes is known as anticipation. Overdorf (1990) states:

> People sometimes equate anticipation with guessing and consequently believe anticipatory behavior cannot be trained. However, if one understands that anticipation is predicated by using present information, comparing it to past information, to predict the near future, then it is clear that anticipation is trainable. With this realization, it becomes obvious that we must teach our open skill athletes to have their movements match, in time and space, the ever-changing events in the environment. To overcome their inherent time lags, performers must mobilize their systems prior to an object's arrival. The more accurate the prediction, the greater their success in open skill sports. (pp. 68-69)

Anticipation can be done by determining the probability that an event will occur so that the number of alternatives to be monitored can be reduced. By developing "anticipatory schemata", players come to know which of the many events in a situation are likely to occur.

Timing is an important aspect in the hierarchy of psychomotor task classification. Singer and Gerson's (1981) model of motor behavior reflects a heavy emphasis on cognitive processes as descriptions of task components and pacing conditions help to contribute to the meaningfulness of the classification schema.

Vickers (1986) found that as the novice makes the transition to expert, there is an accompanying performer's understanding of the temporal organization of a complex movement sequence. When she introduced a task called a "restructuring task", she found skill level to be an important factor in the ability to resequence performance. Experts appeared to pick up movement information differently than the novices so that they were able to rearrange randomly-ordered photographs of a skilled performance into the correct order quicker and with less errors.

Aronld (1988), in discussing rational planning of the movement curriculum by objectives, notes the importance of contextual objectives in addition to the prerequisite skill objectives.

> Contextual objectives are not so much to do with the acquisition of basic skills in isolation but with their intelligent employment in a given context ... What is required is not a routinized or habitual response but a perceptive and intelligent one ... contextual

> objectives can be seen as various forms of skilled ability which can, in some degree, be planned for and discriminately implemented in terms of moves, tactics, ploys and strategies, all of which presuppose a mastery of prerequisite skills. All of this can be taught on the basis of: 'given this situation these responses are often appropriate' ... Such situations as these occur in all sports and can, within limits, be planned for and practiced. Competence is measured in terms of the ability to perform them in the appropriate circumstances at the right time. (pp. 129-130)

Attention - Concentration

Much research has been conducted on the manner in which humans take in, think about, and respond to information. An information-processing (IP) model assumes that several mental operations, called processing stages, occur between the onset of a stimulus and person's response. Presenting a stimulus initiates a sequence of processing stages, with each stage operating on the information available to it. The processes include: anticipating, identifying, categorizing, reviewing, storing, and retrieving. The components of the model include: stimuli, sense organs, filter (attention), perception, short-term memory (STM), long-term memory (LTM), decision-making, motor programs, muscles, internal feedback, and external feedback. For each of these components, learned and skilled performers differ (Anshel, 1990)

According to Martens (1987):

> Attention is a cognitive process whereby a person directs and maintains awareness of stimuli detected by the senses. Attention is influenced by the person's level of alertness and capacity to process the incoming information. (p. 138)

In addition to many external factors that compete for a person's attention (i.e. loud, large, novel, or moving stimuli), there are internal factors that influence attention as well (interest, mind set, and the ability to screen out irrelevant stimuli). When referring specifically to athletes, Martens suggests guidelines for improving attention selectivity. This includes focusing on task factors such as form and execution rather than on the score or pending outcome.

The changing nature of conditions in athletics puts a premium on the ability to shift and focus attention. "Concentration is the ability to sustain attention on selected stimuli for a period of time. Concentration is not improved by forcing the mid to attend, but by clearing the mind of distractors and becoming absorbed in the here and now." (Martens, 1987, p. 150)

Confidence

Greater attentional focusing and self-confidence are two factors that have consistently been found to be important variables related to athletic success (Gould, Weiss, and Weinberg, 1981; Highlen & Bennett, 1979; Highlen & Bennett, 1983; Mahoney & Avener, 1977; Meyers, Cooke, Cullen, and Liles, 1979).

Griffin and Keogh (1982) have developed a model for movement confidence that views confidence as an individual feeling of adequacy in a movement situation. They emphasized that movement confidence involves a cognitive evaluation of self in relation to task demands. The basic proposition in their model is that movement confidence is a

mediator in the processing of information related to movement performance. An important determinant of movement performance adequacy is attention in terms of load and attention.

Vealey (1986) developed an interactional, sport-specific model of self-confidence in which sport-confidence is conceptualized into trait (SC-trait) and state (SC-state) components. A competitive orientation construct was also included in the model to account for individual differences in defining success in sport.

According to Vealey:

> The model is based on an interactional paradigm in which the individual difference constructs of SC-trait and competitive orientation interact with the objective sport situation to produce SC-state. SC-state is predicted to be the most important mediator of behavior as it is based on the mutual influence of situational factors and individual differences. (pp. 223-224)

She goes on to point out that:

> The key finding of the investigation was that high SC-trait performance-oriented athletes were significantly higher in SC-state than all other groups. This finding suggests that the interaction of athletes' individual definitions of success with perception of their ability is related to their self-confidence when competing. (p. 239)

Heyman's (1982) data reanalysis on comparisons of successful and unsuccessful competitors clearly suggests that very important relationships exist between the history and selection of athletes and their later performance. He contends that, "athletes who are successful throughout the season could be expected to be less anxious about competition and should be more self-confident. It could be

argued that success positively reinforces thoughts about the sport" (p. 299). His reanalysis supports the view that comparisons of successful and unsuccessful competitors should include examinations of multiple variables, not just isolated psychological events that predict performance and whose alteration will dramatically change performance.

Bloom (1981) speaks about confidence when discussing master:

> At a deeper level is the student's self-concept. Each person searches for positive recognition of his worth and he comes to view himself as adequate in those areas where he receives assurance of his competence or success. For a student to view himself in a positive way, he must be given many opportunities to be rewarded. Mastery and its public recognition provide the necessary reassurance and reinforcement to help the student view himself as adequate. (p. 173)

Other Studies Using Similar Methods

Expert/Novice Studies

Alexander and Judy (1988) used a meta-analysis of expert/novice studies to explore the interaction of domain-specific and strategic knowledge and their relationship to academic performance. Although their investigation focused on studies that centered on school-related domains such as science and mathematics, they brought up some concerns that were relevant to this investigation.

They discovered that in many of the expert/novice studies analyzed, the subjects employed were college age or older; and they noted the need for investigations which would add to an understanding

of emerging relationships, such as that of children developing competencies. In addition, they found the terminology used to describe subjects was often ill-defined, and that comparisons between individuals or groups who had been labeled by such diverse terminology (expert, novice, postnovice, advanced novice, naive, skilled, unskilled, and nonexpert expert) might be misleading.

In sport, there are many levels of expertise. May studies deal with differences among athletes within the same sport or with differences among athletes between/among different sports. These studies cover a wide range of levels of skills. Many studies investigating elite athletes involve Olympic, nationally-ranked, or Division I collegiate athletes. Mahoney, Gabriel, and Perkins (1987) administered a questionnaire to a national sample of 713 male and female athletes from 23 sports. The athlete sample comprised 126 elite competitors, 141 preelite athletes, and 446 nonelite collegiate athletes. For their purposes, elite athletes were identified through records kept by the national governing bodies (NGB) or their equivalent in 17 sports. Elite was defined as athletes who placed fourth or above in the national championships or most recent Olympic or world championship in that sport. Preelite athletes were also designated by the NGBs, and the majority included athletes attending special training camps or junior national championships when tested for the study. Even the nonelite for the study belonged to major university athletic teams. By contrast, Thomas, French, and Humphries' (1986) study on knowledge development and performance

involved comparisons of expert and novice basketball players from two age groups: 8- to 10-year-olds and 11- to 12-year-olds. In each investigation, differences were noted for the levels determined by the researchers. Whatever the range of skill, noting similarities and differences between and among individuals and groups should help better define where the advantage lies.

Intelligence Tests

Personality and intelligence tests are often given to a group of subjects to predict achievement or to help explain differences. The Culture Fair Intelligence Test (Cattell's Test of "g") has been given with the High School Personality Questionnaire to predict school achievement (Barton, Dielman, and Cattell, 1972), and there seems to be a general concept of achievement consistently related to a set of personality and intelligence measures over all four achievement areas of math, science, social studies, and reading.

Personality and IQ measures have been used to compare differences among athletes from different sports (Salokum & Toriola, 1985) or to investigate the personality profiles of different levels of players within the same sport (Williams & Parkin, 1980). The personality factor B (intelligence) on the Cattell Sixteen Personality Factor Questionnaire has emerged on studies involving athletes from different sports (Kroll & Peterson, 1965 - collegiate football; Williams, 1975 - rowers; Williams & Parkin, 1980 - field hockey). Williams and Parkin (1980) note that although their study:

> was limited by the use of a test not specifically designed for the hockey situation, the findings supported the view that the psychological dimension is certainly worth studying to reach a more complete understanding of characteristics of sport participants. (p. 119)

Psychological Factors and Cognitive Strategies

Many of the studies on elite and nonelite athletes have involved the testing of psychological factors and cognitive strategies. Some studies have concentrated on differences between one specific sport: male gymnasts (Mahoney & Avener, 1977), racquetball players (Meyers, Cooke, Cullen, and Liles, 1979), field hockey (Williams & Parkin, 1980). Others have compared differences between two sports (Highlen & Bennett, 1983 - elite divers and wrestlers) or among a number of different sports (Mahoney, Gabriel, and Perkins, 1987 - 23 sports). Results and discussions have dealt with gender differences in general, differences between male and female elite athletes, differences between open- and closed-skill sport athletes, records of teams' past performances, and a host of other factors which have distinguished qualifiers from nonqualifiers within and between each sport type. Highlen and Bennett's (1983) study confirmed the collective literature's suggestion that self-confidence and concentration are two factors that differentiate all successful from nonsuccessful elite athletes.

Confidence

Until recently, self-confidence in sport ability has been associated with physical self-concept or perceived competence. Vealey (1986) introduced an interactional, sport-specific model of self-confidence and developed three instruments to measure the three components of her model. In her initial work on sport confidence, Vealey proposed that a performance orientation was associated with greater control and confidence and thus greater athletic success.

Gill (1986) developed a sport-specific, multi-dimensional measure of achievement orientation known as the Sport Orientation Questionnaire (SOQ). Gill and Dzewaltowski (1988) used the Vealey Competitive Orientation Inventory (COI) as part of their exploratory investigation of competitive orientation of collegiate athletes and nonathletes and found that when specifically considering the relative emphasis on outcome and performance (COI scores), athletes place more emphasis on performance and less on outcome than do nonathletes. Athletes do strive to win in competition, as reflected by their higher SOQ win orientation scores, but in terms of relative competitive orientation they place more emphasis on performance and less on outcome than do nonathletes.

The initial work of these investigators suggests that sport-specific achievement measures and constructs will provide greater insight into sport achievement and competitive behavior than is possible with more global achievement approaches (Gill & Dzewaltowski, 1988).

Sport Anxiety

Martens developed a model for sport anxiety to help explain the relationship between anxiety and performance. The trait component of the model addressed the tendency of an athlete to perceive competitive situations as threatening and to respond to these situations with feelings of apprehension and tension. The state component of the model addressed the level of reaction which occurs to precompetitive perceptions of challenge, threat, or both. In the process of developing a sport-specific inventory that measured the cognitive and somatic aspects of A-state, Martens, Burton, Vealey, Bump, and Smith (1990) found that cognitive A-state could be split into two separate components: cognitive A-state and state self-confidence. Further investigations revealed that these components are affected by individual (skill level, gender) and situational (sport type, time near competition) factors.

Treatment of the Data

Chapman (1980), in her investigation of the prediction of success in women's field hockey, employed a one-way analysis of variance to assess differences between groups of players according to their playing positions. The Scheffé post hoc test was applied when a significant F ratio indicated that differences existed.

In the Highlen and Bennett (1983) investigation on elite divers and wrestlers and the comparison between open- and closed-skill athletes, both discriminate function analyses and t-tests were conducted in order to identify qualifiers from nonqualifiers. However, the authors were also interested in characteristics of the entire sample. Therefore, items that did not differentiate qualifiers from nonqualifiers in either discriminate analysis or t-tests provided the basis for descriptive data on the entire group of elite athletes.

In a study by Shakeshaft (1971), means and standard deviations were computed from raw scores for each of the following groups: teachers of normal children, teachers of exceptional children, and teachers for emotional disturbed children. An independent t-test was computed for each of the sixteen personality traits to test the null hypothesis that there were no differences between group means of the 96 teachers of exceptional children and the 37 teachers of normal children. A one-way analysis of variance was employed to determine whether groups of children on selected disabilities differed significantly on any of the sixteen personality traits. The Student Newman-Keuls procedure was used for all post hoc analyses. The .05 level of significance was established for all statistical analyses.

Mahoney and Avener's (1977) exploratory study on the psychology of the elite athlete used their final competitive grouping as the dependent variable and correlations were performed to assess the relationship between some of the psychological aspects of the elite male

American gymnast and superior athletic performance. Starkes (1987) used a one-way analysis of groups (national, varsity, novice) for each dependent measure in her field hockey study on cognitive differences.

Summary

There is a history of studies investigating the differences between the elite and nonelite (experts and novices) on a wide range of subjects. These investigations have extended into the area of sport, and more recently into the cognitive advantage in sport.

Gould and Greenawalt (1981) have urged a liaison between the technical experts of specific sports and sport scientists that goes beyond the collection of information for statistical purposes.

> The methodological perspectives of one field have helped to enlarge and inform the content of the other ... team games are phenomena that a number of scientific perspectives can illuminate, and we would urge, out of our own direct experience, that cross-disciplinary approaches be explored much further. (pp. 283-284)

CHAPTER III

PROCEDURES

Introduction

The purpose of this investigation was to describe cognitive differences among elite and nonelite female-field hockey players and nonathletes in a physical education class on a variety of measures. These measures included: abstract visual reasoning, concentration, trait sport-confidence, state sport-confidence, competitive orientation, psychological skills relevant to exceptional performance, and competitive anxiety.

The first section of this chapter discusses the instruments used for data collection. The second section discusses the subjects used for this investigation. The final section discusses the procedures for collection of the data.

Instruments for Data Collection

Culture Fair Intelligence Test

The Culture Fair Intelligence Test (CFIT), also known as the Cattell Test of "g", is a nonverbal measure of an individual's intelligence. Cattell and Cattell (1990) state that:

> The Culture Fair was designed to measure fluid ability which involves basic skills that are less easily influenced by training and experience - the ability to understand relationships, to classify

objects and thoughts, and to deduce and apply basic principles - in short, raw reasoning power. (Bulletin)

The Culture Fair Intelligence Test - Level 2, Form A was used to test for abstract visual reasoning of the elite and nonelite female field hockey players and the physical education class nonathletes. Reliability of the Culture Fair Test: Scale 2 (Short Form A) is .76 for consistency over items while concept validity is .81. Level 3 (Short Form A) was also administered in case further differentiation was needed. Level 3 (Short Form A) is .74 for consistency over items while concept validity is .85 (Cattell and Cattell, 1990).

Participants of the test receive their own question booklet, a separate answer sheet, and a pencil. The person who administers the test reads the directions for each part of the test verbatim from an instruction booklet.

The CFIT - Level 2, Form A consists of: Test 1 (Series) - 12 items with 3 minutes of time allotted, Test 2 (Classifications) - 14 items with 4 minutes of time allotted, Test 3 (Matrices) - 12 items with 3 minutes of time allotted, and Test 4 (Conditions or Topology) - 8 items with 2 1/2 minutes of time allotted. The total time of this test is 12 1/2 minutes.

The CFIT - Level 3, Form A consists of: Test 1 (Series) - 13 items with 3 minutes of time allotted, Test 2 (Classifications) - 14 items with 4 minutes of time allotted, Test 3 (Matrices) - 13 items with 3 minutes of time allotted, and Test 4 (Conditions or Topology) - 10 items with

2 1/2 minutes of time allotted. The total time of this test is 12 1/2 minutes.

Directions and examples are given for each of the tests. A total score for the CFIT can be recorded, as well as separate scores for each of the four components of abstract visual reasoning.

Concentration Tests

Concentration Grid: Concentration of all three groups was tested via an actual concentration exercise (no reliability or validity available). As part of the American Coaching Effectiveness Program, this exercise in the Sports Psychology Workbook (Bump, 1989) helps evaluate a person's current ability to concentrate or sustain attention. Although the results of this exercise have not been previously used in any other studies, the investigator noticed a correlation between scores on this grid and skill level for her own high school field hockey team.

Each subject is given the concentration gird face down. Starting on the signal "Go!", the paper is turned over and then the subject finds "00" on the grid, puts a mark through it with a pencil, and proceeds to mark as many consecutive numbers as possible in the one-minute time limit. The grid consists of numbers from 00 to 99 which have been randomly placed on a grid of 100 squares.

The score is determined by checking to see that the marks are in consecutive order and that no number is skipped. If an error is discovered, that number is not counted and the total number of errors

is deducted from the original score. The original score is the highest number with a mark through it. (See Appendix A)

Mahoney's Psychological Skills Inventory for Sports (PSIS-5): The Mahoney Psychological Skills Inventory for Sports is a 45-item inventory used to assess themes of concentration, anxiety management, self-confidence, mental preparation, and motivation as a means of skill level differentiation. The themes of concentration and self-confidence were of particular interest. Internal consistency is found to be moderately respectable (Spearman-Brown coefficient = .72, Guttmen (Rulon) coefficient = .70, coefficient alpha for all items = .64; from Mahoney, M.J. (1989). The instrument is still experimental and there are no authorized group norms (national or international).

The Inventory consists of statements which deal with various aspects of athletic performance and competition. Each subject rates each statement according to how well it describes her own personal experience; from strongly disagree to strongly agree.

Sport Confidence

An interactional, sport-specific model of self-confidence was developed in which sport-confidence was conceptualized into trait (SC-trait) and state (SC-state) components. A competitive orientation construct was also included in the model to account for individual differences in defining success in sport (Vealey, 1986). Instruments for each component of the model were developed and validated. All three

instruments demonstrated adequate item discrimination, internal consistency, test-retest reliability, content validity, and concurrent validity (Vealey, 1986).

The Trait Sport-Confidence Inventory or TSCI consists of 13 items placed into an inventory format using a 9-point Likert scale. Subjects are asked to compare their confidence to the most confident athlete they know when responding to each item (comparison to a highly confident athlete anchored the top of the scale at a level the subjects would perceive as being very high) (Vealey, 1986). The State Sport-Confidence Inventory or SSCI follows a similar format, with the distinction being made that trait is how a person generally feels about performing successfully in competition and that state is how a person feels right now about performing successfully in the upcoming competition.

The distinguishing feature of the Competitive Orientation Inventory or COI is that it requires subjects to weigh both performance and outcome simultaneously. According to Vealey (1988):

> The COI uses a matrix format that contains 16 cells representing different situations in sport. Each cell represents a situation that combines a certain level of performance with a certain outcome. This matrix format forces subjects to weigh the value of both goals simultaneously. Subjects complete the inventory by assigning a number from 0 to 10 for each cell that represents how satisfied they would feel in that situation. Scoring the COI involves computing the proportion of the variance that is based on different outcomes (outcome score) and the proportion of the variance that is based on differences in performance (performance score). Thus, the outcome score represents how much the athletes' feelings of

satisfaction vary based on whether they win or lose, and the performance score represents how much athletes' feelings of satisfaction vary based on whether they perform well or poorly. (p. 472)

Complete Anxiety in Sport Tests

Competitive State Anxiety Inventory-2: CSAI-2 is a sport-specific measure of multidimensional A-state which contains nine-item subscales of cognitive A-state, somatic A-state, and state self-confidence. Internal consistency for each of the CSAI-2 subscales is sufficiently high with alpha coefficients ranging from .79 to .90. Correlational values are concurrent with four A-trait inventories and four A-state inventories to infer concurrent validity of the CSAI-2. Anti-social desirability instructions are given when administering the CSAI-2 to help reduce response bias (Martens, Burton, Vealey, Bump, and Smith, 1990).

The SCAT inventory was given the night before the first day of competition. The CSAI-2 inventory was given within thirty minutes of actual competition on two separate occasions. There were total scores for each of the CSAI-2 subscales and a total score for SCAT.

Sport History Questionnaire

The investigator devised a Sport History Questionnaire to gather information about the subjects' sport experience in general and field hockey experience in particular. Questions included: number of seasons playing field hockey and at what level, record of their high

school field hockey team for the past three seasons, whether field hockey camps were attended, whether they were involved in any other sport, at what age they first became involved in organized sport, and whether they had been selected to a select/travel team in any sport.

Subjects

Elite Subjects

The elite subjects in this investigation were 13 (of the original 16) regulars and one (of the original four) alternate (s) who had been selected to the Empire State Games Western Scholastic Field Hockey Team. These members of the selected group participated in the National High School Field Hockey Festival at Orlando, Florida during the Thanksgiving week, 1991 and had all but one of the tests administered at that time.

Nonelite Subjects

The nonelite subjects in this investigation were all members of the team which finished in fifth place (out of nine) in the Monroe County Field Hockey League. Fifteen members of this team were able to attend a team meeting four months following the conclusion of their season, and the entire battery of tests was given to them at this time.

Nonathlete Group

The nonathlete group was a physical education class composed of junior and senior girls from the high school where the investigator

coaches. Although all the girls in the class took the battery of tests, the only scores used were those of girls not members of a school athletic team this year (as determined by the absence of their names on a mandatory sport physical list kept on file in the Athletic Director's office).

Subjects' Ranking

Both coaches of the Empire State Games elite group, the coach of the nonelite group, and the physical education teacher of the nonathlete group were all asked to rank their players. This ranking was a subjective one based on the rater's perception of each player's general ability to play in a game situation. The players were ranked as belonging in the top or bottom half of the group they belonged to. The purpose of the ranking was to allow for comparisons within groups as well as among groups. (See Appendix B)

Procedures for Collecting Data

Elite Group

The elite group took the battery of tests during the course of the National High School Field Hockey Festival (with the exception of the Mahoney Inventory).

The CFIT - Level 2, Form A was given the night before the first day of competition during a team meeting in the dormitory. Each player received her own question booklet, a separate answer sheet, and

a pencil. The other coach administered the test. Answer sheets were hand-scored. Further analysis was done by computer.

The concentration exercise was given after the group finished the CFIT - Level 2, Form A. Answer sheets were checked for errors and hand-scored. Next, Vealey's TSCI was administered, with the distinction being made that "trait" means how you generally feel about sport (with field hockey being the particular sport). After the TSCI was completed, Vealey's COI was handed out. Each girl read the directions and then the investigator further explained the matrix format. Subjects were given until the conclusion of the Festival to return the COI. The TSCI was hand-scored and a final score for each subject was recorded. A final COI score was recorded after analysis by computer. The last test given at this time was the SCAT test. The SCAT test was hand-scored and a final score for each subject was recorded. (See Appendixes C, D, E)

Vealey's SSCI was given to the subjects as they arrived at the field thirty minutes prior to competition. This was done on two separate occasions: before the first game of the entire competition and before the third game of the competition (which was the first game on day two). The distinction was made that "state" means how you feel right now about sport (with field hockey being the particular sport). The CSAI-2 test was administered at these same times after the anti-social desirability instructions were given. Results were hand-scored and recorded for each subject. (See Appendixes F, G)

The CFIT - Level 3, Form A was administered to the subjects in the dormitory after completion of tournament play and on their final night at the Festival. Answer sheets were hand-scored. Further analysis was done by computer.

The Sport History Questionnaire was handed out at the beginning of the Festival and the subjects had the entire time at the Festival to complete this information. (See Appendix H)

Mahoney's PSIS-5 arrived three months after the Festival, so it was mailed to each of the subjects to be filled out and returned as quickly as possible.

Nonelite Group

The nonelite group had the entire battery of tests given at one time at one location. The investigator read the instructions for both the CFIT tests as written in the booklet, and administered all other tests. The session began with a brief introduction, after which the subjects read and signed a waiver (See Appendix I). The order of the tests was: CFIT - Level 2, Form A, concentration grid, Vealey's TSCI, SSCI, and COI, Mahoney's PSIS-5, CFIT - Level 3, Form A, CSAI-2 and SCAT, and the Sport History Questionnaire.

Nonathlete Group

The nonathlete group, a high school physical education class composed of junior and senior girls, had part of the battery of tests

given during one class period and the remainder of the tests given in another class period. During the first day of class, after a brief introduction and signing of the waiver, the following tests were given: CFIT - Level 2, Form A, the concentration grid, Vealey's TSCI and SSCI, Mahoney's PSIS-5, and CSAI-2 and SCAT. The inventories were completed on the basis of a hypothetical competitive situation (as if they were going to compete in physical education class that day). The Sport History Questionnaire was handed out as class ended so that it could be filled out and returned to the next class. (See Appendix J)

On the day that the second part of the tests was to be administered, the entire school was closed for a weather emergency and then remained closed for an entire week. It was almost two weeks between tests. During the final meeting with the class, the following tests were given: Vealey's COI and the CFIT - Level 3, Form A. Most of the girls had forgotten their Sport History Questionnaire, so extra copies were handed out, completed, and collected. Scores for each of the tests were hand-scored and recorded. Further analysis was done by computer.

CHAPTER IV

RESULTS

Means and standard deviations were computed from raw scores for each of the cognitive measures (See Appendix K). The statistical method included a series of multiple analyses of variance (MANOVAS) calculated for each of the cognitive categories. These categories included abstract visual reasoning, concentration, sport-confidence, psychological skills relevant to exceptional performance, and competitive anxiety.

The Culture Fair Intelligence Test (CFIT) was used to measure the four components of abstract visual reasoning: the order of information (Subtest 1), the classification of information (Subtest 2), the patterns of information (Subtest 3), and the conditions of information (Subtest 4). A concentration grid exercise was used to measure concentration. Vealey's Trait Sport-Confidence Inventory (VTSCI), Vealey's State Sport-Confidence Inventory (VSSCI), and Vealey's Competitive Orientation Inventory (VCOI) were used to measure sport-confidence. Mahoney's Psychological Skills Inventory (PSIS-5) was used to measure six themes of psychological skills relevant to exceptional performance: anxiety (MAHAX), concentration (MAHCC), confidence (MAHCF), mental preparation (MAHMP), motivation (MAHMV) and team motivation (MAHTM). The Competitive State Anxiety Inventory - 2 (with the cognitive subtest, somatic subtest, and self-

confidence subtest) and Sport Competitive Anxiety Test (SCAT) were used to measure competitive anxiety.

To determine if there were any subtests within an cognitive category that helped differentiate levels, a oneway analysis of variance (ANOVA) was done on each dependent measure. The Scheffé procedure was used for post hoc analysis at the .10 level of significance. The .05 level of significance was established for all other statistical analyses. In an effort to determine which parts of all the tests would account for membership in a particular group, a stepwise multiple regression technique was used.

Since comparisons between the top half of the elite group and bottom half of the nonelite group might provide additional insight into differences within the two field hockey groups, all analyses were repeated in a two group (high elite / low nonelite) design. This included the MANOVAS, ANOVAS, and stepwise multiple regression technique. Any significant result, whether multivariate or univariate, is presented.

Three Group Analyses

(Elite / Nonelite / Nonathlete)

Abstract Visual Reasoning: There were no significant multivariate main effects for any of the CFIT - Level 2, Form A subtests ($F [8,64] = 1.9003$, $p<.075$). However, post hoc univariate ANOVAs on

each CFIT - Level 2, Form A subtest were computed and results indicated:

-the elite group (M = 10.857) displayed significantly higher CFIT - Level 2, Form A

-Subtest 1 (serial information), F (2,35) = 4.6161, p<.017 than did the nonathlete group (M = 9.000) [See Table 1]

Since the CFIT - Level 3, Form A had been given to all groups in case further differentiation was needed, a multivariate analysis of variance MANOVA was performed for each of the subtests. There were no significant main effects for any of the CFIT-Level 3, Form A subtests, nor were there any significant univariate analysis of variance (F [8,60] = 2.0130, p<.060).

Concentration: A oneway analysis of variance ANOVA on the concentration grid scores was computed and no significant main effects were found (F [2,35] = 1.5860, p<.2191).

Sport-Confidence: A significant multivariate main effect for sport-confidence was obtained, F (6,60) = 5.6701, p.<.000. Post hoc univariate ANOVAs for each of the Vealey sport-confidence instruments were computed. The results indicated:

-the elite group (M = 86,962) displayed significantly higher VSSCI, F (2,33) = 101.5146, p<.003 than the nonathlete group (M = 58.333)

Table 1

Abstract Visual Reasoning (Three Groups)

Univariate F-test (df = 2,35)

Variable	Hypothesis Mean Square	Error Mean Square	F test	Sig.
CFIT - 1 (order)	9.63409	2.08707	4.61607	.017
CFIT - 2 (classif.)	5.89453	3.23084	1.82446	.176
CFIT - 3 (patterns)	4.29929	1.50771	2.85154	.071
CFIT - 4 (conditions)	4.08634	3.27401	1.24811	.300

-the nonelite group (M = 88.000) displayed significantly higher VSSCI, F (2,33) = 10.5146, p<.003 than the nonathlete group (M = 58.333)

-the elite group (M = 88.000) displayed significantly higher VTSCI, F (2,35) = 5.7092, p<.0071 than the nonathlete group (M = 58.333) [See Table 2]

Psychological Skills for Exceptional Athletic Performance: A significant multivariate main effect for psychological skills was obtained, F (12,56) = 5.42095, p<.000. Post hoc univariate ANOVAs for each of the Mahoney Psychological skills themes were computed. The results indicated:

-the elite group (M = 18.000) displayed significantly higher MAHMV (Mahoney Motivation theme), F (2,34 = 13.1393, P<.0001 than the nonathlete group (M = 9,44)

-the elite group (M = 9,2143) displayed significantly higher MAHMP (Mahoney mental preparation theme), F (2,35) = 7.5855, p<.0018 than the nonathlete group (M = 12.444)

-the nonelite group (M = 10.6000) displayed significantly higher MAHMP, F (2,35) = 7.5855, p<.0018 than the nonathlete group (M = 12.444)

-the elite group (M = 19.4667) displayed significantly higher MAHTM (Mahoney team motivation theme), F (2,35) = 10.7784, p<.002 than the nonathlete group (M = 15.444)

Table 2

Sport-Confidence (Three Groups)

Univariate F-test (df = 2,32)

Variable	Hypothesis Mean Square	Error Mean Square	F test	Sig.
VTSCI	1574.82282	280.22560	5.61984	.008
VSSCI	2843.50604	278.14784	10.22300	.000
VCOI	510.46374	628.89423	.81168	.453

-the nonelite group (M = 19.4667) displayed significantly higher MAHTM, F (2,35) = 10.7784, p<.0002 than the nonathlete group (M = 15.444) [See Table 3]

Competitive Anxiety: A significant multivariate main effect for competitive anxiety was obtained, F (8,64) = 2.2653, p<.034. Post hoc univariate ANOVAs for each of the CSAI-2 subscales and SCAT were computed. The results indicated

-the elite group (M = 24.7143) displayed significantly higher CSAI-2C1 (cognitive subscale), F (2,35) = 4.051, p<.0262 than the nonathlete group (M = 18.000) [See Table 4]

Multiple Regression Analysis: A stepwise multiple regression technique using all tests given found that three items (MAHMV, MAHMP, MAHTM) accounted for 67% of the behavioral variance (R square = .67496) [See Table 5]

Two Group Analyses

(High Elite / Low Nonelite)

Abstract Visual Reasoning: There were no significant multivariate main effects for any of the CFIT - Level 2, Form A subtests and no significant univariate analyses of variance (F [4,9] = 1.1266, p<.403).

Table 3

Psychological Skills Relevant to Exceptional Performance (Three Groups)

Univariate F-test (df = 2,32)

Variable	Hypothesis Mean Square	Error Mean Square	F test	Sig.
MAHAX (anxiety)	221.67094	27.86843	7.95420	.002
MAHCC (concent.)	163.26358	11.40743	14.31204	.000
MAHCF (confid.)	128.14286	42.71861	2.99970	.064
MAHMP (ment.prep.)	28.77015	3.98026	7.22821	.002
MAHMV (motivat.)	201.52885	15.45196	13.04229	.000
MAHTM (team mot.)	87.52610	7.87636	11.11250	.000

Table 4

Competitive Anxiety (Three Groups)

Univariate F-test (df = 2,35)

Variable	Hypothesis Mean Square	Error Mean Square	F test	Sig.
CSAI2C1 (cognit.)	124.05213	30.62259	4.05100	.026
CSAI2S1 (somatic)	3.28571	34.08367	.09640	.908
CSAI2SC1 (self conf.)	31.69478	32.74526	.96792	.390
SCAT	11.54804	25.70703	.44922	.642

Table 5

Stepwise Multiple Regression (Three Groups)

	Step 1	Step 2	Step 3
Variables:	MAHMV	MAHMP	MAHTM
Multiple R:	.65579	.77528	.82156
R Square:	.43005	.60106	.67496
Adjusted R Square:	.41167	.57447	.64133
Standard Error:	.62894	.53489	.49107
df	1,31	2,30	3,29

Sport-Confidence: Although there were no significant multivariate main effects for sport-confidence measures ($F [3,7] = 2.8203$, $p<.117$), when post hoc univariate ANOVAs were computed results indicated:

-the high elite group ($M = 91.250$) displayed significantly higher VTSCI, $F (1,12) = 9.3981$, $p<.02$ than the low nonelite group ($M = 69,167$) [See Table 6]

Psychological Skills for Exceptional Performance: A significant multivariate main effect for psychological skills was obtained, $F (1,10) = 14.7266$, $p<.005$. Post hoc univariate ANOVAs for each of the Mahoney psychological skills themes were computed. The results indicated:

-the high elite group ($M = 20.50$) displayed significantly higher MAHMV (Mahoney motivation theme, $F (1,11) = 85.7287$, $p<.000$ than the low nonelite group ($M = 18.333$) [See Table 7]

Competitive Anxiety: There were no significant multivariate main effects for any of the competitive anxiety subtests and no significant univariate analyses of variance ($F [4,9] = .1653$, $p<.951$).

Multiple Regression Technique: A stepwise multiple regression technique found that four items (MAHMV, VTSCI, VSSCI, and CFIT - Level 2, Form A, Subtest 1) accounted for 99% of the behavioral variance (R square = .99918). This finding seems to be unusually high. [See Table 8]

Table 6

Sport-Confidence (High Elite/Low Nonelite)

Univariate F-test (df = 1,9)

Variable	Hypothesis Mean Square	Error Mean Square	F test	Sig.
VTSCI	1330.01894	166.87037	7.97037	.020
VSSCI	92.80303	186.75926	.49691	.499
VCOI	1700.00303	614.40370	2.76692	.131

Table 7

Psychological Skills Relevant to Exceptional Performance (High Elite/Low Nonelite)

Univariate F-Test (df = 1,10)

Variable	Hypothesis Mean Square	Error Mean Square	F test	Sig.
MAHAX (anxiety)	.33333	44.33333	.00752	.933
MAHCC (concent.)	4.08333	11.08333	.36842	.557
MAHCF (confid.)	96.33333	31.43333	3.06469	.111
MAHMP (ment.prep.)	.33333	3.33333	.00000	.758
MAHMV (motivat.)	243.00000	3.36667	72.17822	.000
MAHTM (team mot.)	14.08333	7.28333	1.93364	.195

Table 8

Stepwise Multiple Regression (High Elite / Low Nonelite)

	Step 1	Step 2	Step 3	Step 4
Variables:	MAHMV	VTSCI	VSSCI	CFIT - 1
Multiple R:	.92892	.96760	.99294	.99959
R Square:	.86289	.93625	.98592	.99918
Adjusted R Square:	.84330	.91500	.97748	.99837
Standard Error:	.20863	.15366	.07910	.02130
df	1,7	2,6	3,5	4,4

CHAPTER V

DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

Discussion and Conclusions

The results of this investigation indicated that there are cognitive differences among, and between, the three levels of high school age elite field hockey players, nonelite field hockey players, and physical education class nonathletes. Even though the three groups were intact groups that had been selected for the investigation on the basis of their level of play, there were significant differences among, and between, the groups on how they thought and what they thought. Since most studies about the elite and nonelite in sport have dealt with the Olympic, pre-Olympic, or collegiate level, this investigation revealed that there are cognitive differences already significant at an earlier stage.

The battery of tests covered a wide range of cognitive skills. Some of the instruments were general while some of the instruments were more sport-specific. For each, the investigator hypothesized a progression through each level where the elite group would score higher than the nonelite group and the nonelite group would, in turn, score higher than the nonathlete group. This was not always the case. Most of the time, the differences were between the elite group and nonathlete group, and often the nonelite group had a similar advantage over the nonathlete group. This would initially indicate an

athlete-nonathlete dichotomy. Comparison of scores between the high elite group and low nonelite group provided additional insight into areas where the cognitive advantage between athletes might begin to take place.

Abstract Visual Reasoning: Originally, the investigator had hypothesized that the elite group had a greater ability to reason in an abstract visual way than either the nonelite group or the nonathlete group, and that part of its better "game sense" came from an ability to "see" patterns and relationships at a higher level as the game unfolded. There was some difficulty finding an instrument to test for abstract visual reasoning of the high school age student, but eventually the Culture Fair Intelligence Test (CFIT or Cattell's Test of "g") seemed particularly appropriate because it had levels for different ages and further, it was subdivided into four components of abstract visual reasoning. Since the four components corresponded with the generally accepted differences between experts and novices and what they do with information, the investigator anticipated part of the elites' advantage would be confirmed with those differences in how they thought.

At Level 2 (for high school age), only Subtest 1 (order of information) came through with any significance, and then it was only between the elite and nonathlete groups. This indicates that the elite group is able to handle the temporal order of information better than the nonathlete group. When Level 3 (for adults or for further

differentiation) was given, none of the Subtests showed statistical significance. When the high elite/low nonelite comparisons were completed, Subtest 1 (order of information) again came through as significant as part of the multiple regression analysis. Although this was a general intelligence test, the timing component reappearing at the different levels suggests that it is an area to be stressed. In sport, it could occur at various times: when learning the sport skill, when performing the sport skill, or when using the sport skill within the context of the game.

Although Subtest 4 (conditions) did not come through significantly, the visual "if ... then" component might better work if tied in with the sequencing component and be thought of as the order in which the game "shows" itself. While the visual cues may provide declarative knowledge, the sequencing of conditions may be more important as knowledge is transformed into procedural knowledge (and eventually automized with experience).

The fact that none of the other subtests on this general intelligence test were significant may point to just how sport-specific an advantage might be.

Concentration: Concentration is often noted as an area of advantage for the elite. However, results of both the concentration grid exercise and concentration theme of the Mahoney PSIS-5 were not significant. The lack of significance may come from the choice of instruments or the nature of the instruments.

The concentration grid exercise was a single task exercise, and for the elite in an open-skill sport such as field hockey the greater advantage may come from being able to handle more than one task at a time and by being able to distinguish which task receives top priority. Theories of information-processing ability stress individual differences in the areas of memory, perception, and attentional resources (Lohman, 1989). A multi-task, multi-strategy activity such as field hockey would call for the ability to shift attention appropriately and quickly. The question remains why concentration, the ability to sustain attention over time, was not coming through as being partly responsible for the elite's usual consistency over time.

Mahoney's PSIS-5 is a self-report inventory. Although it is sport-specific, questions about concentration are quite general. At the high school age, the subjects may have had some difficulty defining the finer points of this ability.

Sport-confidence: The results of this investigation confirmed Vealey's idea of confidence specific to sport. In contrast to Mahoney's PSIS-5 instrument with very general questions about concentration, Vealey's SSCI and TSCI are very specific as sport confidence is broken down into thirteen different components with an accompanying question about each. When done this way, both the elite and nonelite groups were significantly different from the nonathlete group on state sport-confidence and the elite group was significantly different from the nonathlete group on trait sport-confidence.

The one aspect of the original Vealey model which was expected to be significant but was not was that the elite group would be more performance-oriented than outcome-oriented than either the nonelite group or the nonathlete group. The results of this investigation confirmed Vealey's more recent study (1988) where she found age and gender differences on the Competitive Orientation Inventory (COI). This may be partly because the subjects were coming from a background where winning is emphasized or where winning is the norm.

For the SSCI and TSCI instruments, the subjects were instructed to compare themselves to the most successful athlete they knew (to prevent the ceiling effect). Thomas, French, and Humphries (1986) had called for studies which included questionnaire or interview to gain insight into the process of becoming skilled in sport. As part of this investigation, the elite athletes were queried at a later date about whom they compared themselves to for the purpose of the Vealey inventories. The replies provided a closer view into where subjects look for comparison. In most cases, the subjects compared themselves to another female. Many times it was another female in the same sport. If a peer, it included fellow teammates or opponents within the same high school league. If someone older, it often included staff members at a field hockey camp which the subject attended, and particularly the person who specialized in the position the subject played. It would appear that role models are sport-specific as well.

Also, as part of this investigation, subjects included their own high school field hockey team's record for the past year on the Sport History Questionnaire. The fourteen members of the elite group had a combined win-loss-tie record of 176-51-24 and only two players came from a program with a losing record. This may help confirm Heyman's (1982) observation that a very important relationship exists between the history and selection of the athlete and their later performance.

Other Psychological Skills for Exceptional Performance: Two of the six themes of Mahoney's PSIS-5 which have been specifically cited as areas of advantage for the elite are concentration and self-confidence. The results of this investigation did not replicate those findings, but revealed three other themes as being significant. Both the elite group and the nonelite group differed significantly from the nonathlete group on themes of motivation, mental preparation, and team motivation. A multiple regression analysis on the entire battery of tests showed motivation accounting for .67 of the difference.

In reviewing the PSIS-5 and the statements which comprise these themes, the investigator noted that most were general statements that dealt with interpersonal relationships among the subject, fellow teammates, the coach, and the sport. Replies on the Sport History Questionnaire showed that all subjects from all groups had had early experiences with sport. One of the first noticeable differences among the groups was that subjects from the nonathlete group had but brief early experiences with sport, while many from the elite and nonelite

groups were still involved with the original activity as well as other sports. Reasons given by subjects in the nonathlete group for not continuing participation included those with social dimensions (did not feel comfortable with the other people, did not feel part of the group) and those with a satisfaction factor (did not like the sport, found the sport too boring, found the sport took up too much time). The results of this investigation pointed to emotional as well as non-emotional factors influencing the development of competence.

This "early nurturing" was one of the common factors Bloom (1986) found among his study of 120 experts and their path to the top in their field. Not only did family and friends expose them to the activity, but the "first" teacher was enthusiastic, full of praise, and able to keep the activity fun. It was only after the child felt comfortable in the activity that they entered the next stage where precision and accuracy were emphasized.

Sport Anxiety: Results of the CSAI-2 showed that the elite group had significantly more cognitive anxiety than the nonelite group or nonathlete group. This runs counter to the notion that the more skilled performer has less cognitive and somatic A-state and greater self-confidence before competition than the less skilled performer. What may account for this discrepancy during this particular investigation was the timing of the administration of the test.

The elite group was asked to complete the CSAI-2 thirty minutes before its first-ever appearance in the National High School Field Hockey Festival. Moreover, its uncertainty could have been compounded by the fact that the group had not played together as a team since its final game at the Empire State Games the first week in August of that year (it was now late November).

Meanwhile, the nonelite group had the test administered four months after its final contest and were instructed to think back on its last competition (a 0-1 loss in Sectionals). The nonathlete group was told to imagine how they would feel if they were to play in physical education class that day (a hypothetical situation). It would seem the elite group had a much more immediate cause for anxiety. Interestingly, many members of the elite group reacted specifically to this particular test. They commented how they really hadn't thought that much about how anxious they were or could be until they took the test and saw statements in writing.

High Elite/Low Nonelite Comparison: The investigator had anticipated greater differences between the elite and nonelite groups. Rankings within each of the two groups allowed for comparisons between the top half of the elite group and the lower half of the nonelite group.

The only area where the high elite group differed significantly from the low nonelite group was Mahoney's PSIS-5 motivation theme. The most surprising result of the whole investigation came with a multiple

regression analysis of the entire battery of tests and the results between the high elite group and low nonelite group. Four items came through to account for 99% of the difference: Mahoney's motivation theme, Vealey's state sport-confidence, Vealey's trait sport-confidence, and the Culture Fair Intelligence Test - Level 2, Form A, Subtest 1 (order of information). It seemed particularly significant that four cognitive items came through so strongly in an investigation whose groups were selected by differences in skill level.

Complex, Interactive Nature of Cognitive Factors: The results of this investigation seemed to confirm many of the points that Lohman (1989) made in his suggestions for future directions in his review of literature on human intelligence. First, he called for the inclusion of affect and volition, in addition to cognition, in a theory of intelligence. The elites' feelings of confidence in sport would confirm the influence of affect, the elites' choice to take an interest in sport and give it a place of importance would confirm the influence of volition, and the elites' use of sequencing information would confirm the influence of cognition.

Next, Lohman cited the shift of achievement, particularly the acquisition, organization, and use of knowledge in a particular domain. Recent research (Anshel, 1990; Franks & Goodman, 1986; Franks, Wilson & Goodman, 1987; Overdorf, 1990) has stressed the importance of timing in skilled performance and knowing the key factors of performance (including time-data pairing) that have critical influence on the results.

Finally, Lohman noted the renewed emphasis on the contextual foundation of the concept of "intelligence" in the culture and life history of the participant. The replies of the Sport History Questionnaire showed the influence of sport-specific role models, team record history, early participation comfort and satisfaction, and interpersonal relationships. All of this points to a complex, interactive relationship among a wide range of mental component of skilled performance.

Implications

Physical educators and coaches are in a position to impact the acquisition of skilled performance. The results of this investigation include a number of implications.

1. The importance of the mental aspects of performance should be acknowledged.
2. The mental aspects of skilled performance should be included when presenting, practicing, performing, and evaluating skills.
3. Early influences can have long-term effects on what is thought about sport and how a person feels about sport.
4. Early exposure to sport should provide many opportunities for success and fun.
5. Interpersonal skills are critical as teacher/coach nurtures the growth of talent and desire.
6. It is the responsibility of the teacher/coach to "know" a specific sport thoroughly. This includes its hierarchy of skills,

progression of skills, developmentally appropriate tasks, common vocabulary, models to provide scaffolding of new knowledge to previous knowledge, "schema" to account for conditions and constraints of knowledge, sport-specific strategies, cues, and rehearsal to help view, store, and retrieve information.

7. Information should be presented so participants share the reasons why something is done a particular way.
8. It is the responsibility of the teacher/coach to help participants gain a sense of "ownership" of a specific sport. This includes matching: sport to person, position within sport to person, task demands to task performances, and social demands. It also means providing opportunities: to practice, to compete, to lead and follow, to experiment, to reflect, to be successful, and to have fun.
9. It is the responsibility of the teacher/coach to help participants learn to observe a skill so they know what needs to occur, at what time, to add to the quality of the skill.
10. The influence of interpersonal relationships should not be underestimated and positive experiences should be encouraged to increase the likelihood of sustained interest.
11. Rank-ordering of participant's various mental skills by participant and teacher/coach helps both reach agreement on mutual goals. Concrete, practical suggestions by the

teacher/coach are perceived by participants as being most helpful (Orlick & Partinton, 1987).

12. It is important to expose participants to sport-specific role models, to expose participants to a higher level of play, and to provide opportunities at sport-specific camps/clinics.
13. Participants should be encouraged to have a vested interest in the sport and to help pass on the heritage of the sport.

APPENDIX A

Exercise 82
Evaluating Your Concentration

Directions: Ask a friend to time you for one minute. During that time period, beginning with number 00, put a slash through as many consecutive numbers as possible.

84	27	51	78	59	52	13	85	61	55
28	60	92	04	97	90	31	57	29	33
32	96	65	39	80	77	49	86	18	70
76	87	71	95	98	81	01	46	88	00
48	82	89	47	35	17	10	42	62	34
44	67	93	11	07	43	72	94	69	56
53	79	05	22	54	74	58	14	91	02
06	68	99	75	26	15	41	66	20	40
50	09	64	08	38	30	36	45	83	24
03	73	21	23	16	37	25	19	12	63

APPENDIX B

PLAYER RANKING SHEET -

RATER: _____

DATE: _____

GAME: _____

PLAYER	REASON(S)

GRETCHEN 1
ANGELA 5
MARY 18
TERRI 4
CARRIE 22
AMEY 19
MALEVA 21
TRISTA 20
SHAWN 23
AUBREY 24
SHERRY 6
JULIE 7
ELLEN 25 (26)
JEANETTE 17

Appendix C

NAME _____

DATE _____

Trait Sport-Confidence Inventory

Think about *how self-confident* you are when you compete in sport.

Answer the questions below based on how confident you *generally feel* when you compete in your sport. Compare your self-confidence to the *most self-confident athlete* you know.

Please answer as you *really* feel, not how you would like to feel. Your answers will be kept completely confidential.

When you compete, how confident do you *generally feel*? (circle number)

1. Compare your confidence in *your ability to execute the skills necessary to be successful* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
2. Compare your confidence in *your ability to make critical decisions during competition* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
3. Compare your confidence in *your ability to perform under pressure* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
4. Compare your confidence in *your ability to execute successful strategy* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
5. Compare your confidence in *your ability to concentrate well enough to be successful* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
6. Compare your confidence in *your ability to adapt to different game situations and still be successful* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
7. Compare your confidence in *your ability to achieve your competitive goals* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
8. Compare your confidence in *your ability to be successful* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
9. Compare your confidence in *your ability to consistently be successful* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
10. Compare your confidence in *your ability to think and respond successfully during competition* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
11. Compare your confidence in *your ability to meet the challenge of competition* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
12. Compare your confidence in *your ability to be successful even when the odds are against you* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9
13. Compare your confidence in *your ability to bounce back from performing poorly and be successful* to the most confident athlete you know.	Low				Medium				High
	1	2	3	4	5	6	7	8	9

APPENDIX J

NAME _____

DATE _____

Competitive Orientation Inventory

When you compete in sport, you focus on two major goals. These goals are:

1. To perform well
2. To win

Think about how satisfied you are when you perform well and lose.
Think about how satisfied you are when you perform poorly and win.

Below is a matrix containing 16 boxes. Each box represents a situation in which you either win or lose and either perform well or poorly.

Write a number from 0 to 10 in each box below (see the example box on the right).

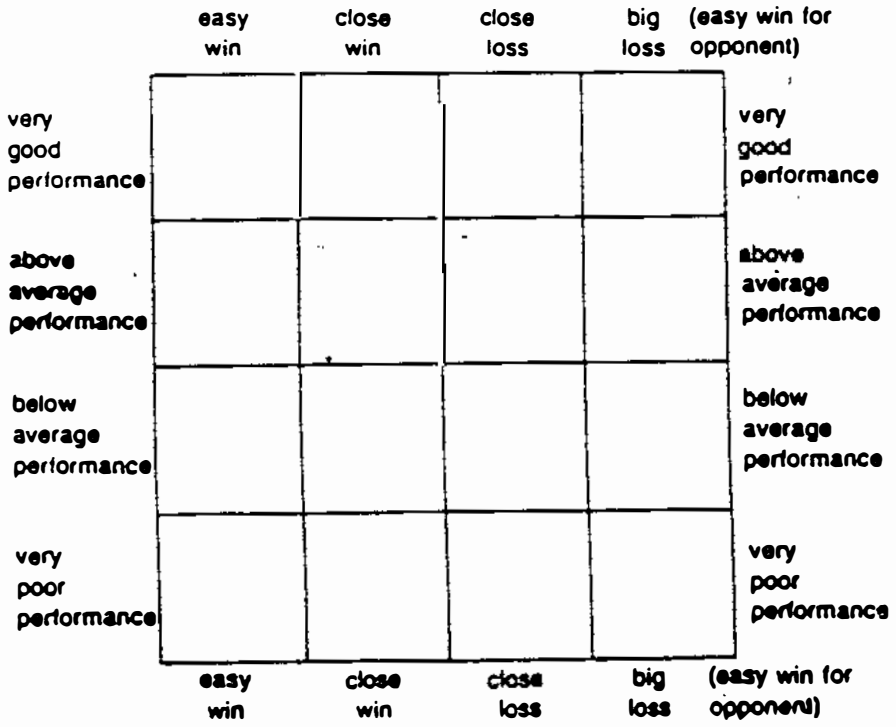
8	6	10	2
3	7	4	8
9	5	0	7
6	2	7	1

Select your numbers for each box based on the scale below:

0 1 2 3 4 5 6 7 8 9 10

very dissatisfied in this situation — very satisfied in this situation

*There are no right or wrong answers—we are interested in how *you* feel.



APPENDIX E

Table 25

Sport Competition Anxiety Test for Children

ILLINOIS COMPETITION QUESTIONNAIRE

Form C

Directions: We want to know how you feel about *competition*. You know what competition is. We all compete. We try to do better than our brother or sister or friend at something. We try to score more points in a game. We try to get the best grade in class or win a prize that we want. We all compete in sports and games. Below are some sentences about how boys and girls feel when they compete in sports and games. Read each statement below and decide if *you* HARDLY-EVER, or SOMETIMES, or OFTEN feel this way when you compete in sports and games. Mark A if your choice is HARDLY-EVER, mark B if you choose SOMETIMES, and mark C if you choose OFTEN. There are no right or wrong answers. Do not spend too much time on any one statement. *Remember* choose the word which describes how you *usually* feel when competing in *sports and games*.

	Hardly-Ever	Sometimes	Often
1. Competing against others is fun.	A ☐	B ☐	C ☐
2. Before I compete I feel uneasy.	A ☐	B ☐	C ☐
3. Before I compete I worry about not performing well.	A ☐	B ☐	C ☐
4. I am a good sportsman when I compete.	A ☐	B ☐	C ☐
5. When I compete I worry about making mistakes.	A ☐	B ☐	C ☐
6. Before I compete I am calm.	A ☐	B ☐	C ☐
7. Setting a goal is important when competing.	A ☐	B ☐	C ☐
8. Before I compete I get a funny feeling in my stomach	A ☐	B ☐	C ☐
9. Just before competing I notice my heart beats faster than usual.	A ☐	B ☐	C ☐
10. I like rough games.	A ☐	B ☐	C ☐
11. Before I compete I feel relaxed.	A ☐	B ☐	C ☐
12. Before I compete I am nervous.	A ☐	B ☐	C ☐
13. Team sports are more exciting than individual sports.	A ☐	B ☐	C ☐
14. I get nervous wanting to start the game.	A ☐	B ☐	C ☐
15. Before I compete I usually get up tight.	A ☐	B ☐	C ☐

APPENDIX F

Think about how confident you feel right now about performing successfully in the upcoming competition.

Answer the questions below based on how confident you feel right now about competing in the upcoming contest. Compare your self-confidence to the most self-confident athlete you know.

Please answer as you really feel, not how you would like to feel. Your answers will be kept completely confidential.

Name

How confident are you right now about competing in the upcoming contest? (circle number)

1.	Compare the confidence you feel right now in your ability to execute the skills necessary to be successful to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
2.	Compare the confidence you feel right now in your ability to make critical decisions during competition to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
3.	Compare the confidence you feel right now in your ability to perform under pressure to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
4.	Compare the confidence you feel right now in your ability to execute successful strategy to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
5.	Compare the confidence you feel right now in your ability to concentrate well enough to be successful to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
6.	Compare the confidence you feel right now in your ability to adapt to different competitive situations and still be successful to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
7.	Compare the confidence you feel right now in your ability to achieve your competitive goals to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
8.	Compare the confidence you feel right now in your ability to be successful to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
9.	Compare the confidence you feel right now in your ability to think and respond successfully during competition to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
10.	Compare the confidence you feel right now in your ability to meet the challenge of competition to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
11.	Compare the confidence you feel right now in your ability to be successful based on your preparation for this event to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
12.	Compare the confidence you feel right now in your ability to perform consistently enough to be successful to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High
13.	Compare the confidence you feel right now in your ability to bounce back from performing poorly and be successful to the most confident athlete you know.	Low	1	2	3	4	5	6	7	8	9	High

APPENDIX G

CSAI-2

Name: _____ Sex: M F Date: _____

Directions: A number of statements that athletes have used to describe their feelings before competition are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel right now—at this moment. There are no right or wrong answers. Do not spend too much time on any one statement, but choose the answer which describes your feelings right now.

	Not at all	Somewhat	Moderately so	Very much so
1. I am concerned about this competition.	1	2	3	4
2. I feel nervous.	1	2	3	4
3. I feel at ease.	1	2	3	4
4. I have self-doubts.	1	2	3	4
5. I feel jittery.	1	2	3	4
6. I feel comfortable.	1	2	3	4
7. I am concerned I may not do as well in this competition as I could.	1	2	3	4
8. My body feels tense.				
9. I feel self-confident.	1	2	3	4
10. I am concerned about losing.	1	2	3	4
11. I feel tense in my stomach.	1	2	3	4
12. I feel secure.	1	2	3	4
13. I am concerned about losing.	1	2	3	4
14. My body feels relaxed.	1	2	3	4
15. I'm confident I can meet the challenge.	1	2	3	4
16. I'm concerned about performing poorly.	1	2	3	4
17. My heart is racing.	1	2	3	4
18. I'm confident about performing well.	1	2	3	4
19. I'm worried about reaching my goal.	1	2	3	4
20. I feel my stomach sinking.	1	2	3	4
21. I feel mentally relaxed.	1	2	3	4
22. I'm concerned that others will be disappointed with my performance.	1	2	3	4
23. My hands are clammy.	1	2	3	4
24. I'm confident because I mentally picture myself reaching my goal.	1	2	3	4
25. I'm concerned I won't be able to concentrate.	1	2	3	4
26. My body feels right.	1	2	3	4
27. I'm confident of coming through under pressure.	1	2	3	4

Cognitive score: _____

Somatic score: _____

Self-confidence score: _____

APPENDIX H

SPORT HISTORY QUESTIONNAIRE

Name _____ Phone Number _____

Birthdate _____ Grade in School _____

How many seasons have you played field hockey? _____

Seasons played at each level? Varsity _____ J.V. _____ Modified _____

Position(s) played most often? _____

Position you prefer to play? _____

Side of the field played most often? Right _____ Center _____ Left ____

School team's record for the past three seasons ?

Year	Win	Loss	Tie
____	____	____	____
____	____	____	____
____	____	____	____

Field hockey camps attended? (where? when?) _____

_____

Summer field hockey league participation? (when?) _____

Team honors/accomplishments? _____

Individual field hockey honors/accomplishments? _____

_____

What do you think distinguishes you from another player? _____

_____

What do you think others think distinguishes you from another player? _____

_____

Have there been any significant occasions that have prompted you to play or understand the game of field hockey better? (particular game, particular drill, particular comment, particular teammate, particular opponent, particular praise, particular decision, etc.) Briefly describe. (Use back of sheet if needed.)

_____

_____

_____

Do you play on any other sport teams? _____

Which ones, and for how many seasons? _____

_____

_____

Have you ever been on a travel/select team? _____

Which sport(s), and when? _____

Earliest organized sport you were involved in? _____ What age? ____

Are you still involved? _____ If not, when did you stop? _____

Why did you stop? _____

Earliest influence for participating in sport? _____

Current influence for participating in sport? _____

APPENDIX I

March, 1991

As part of my coursework for completion of a Masters Degree in Physical Education at the State University College at Brockport, I'm writing a thesis. In the final standings of the Monroe County Field Hockey League your team finished exactly in the middle (fifth out of nine) and therefore meet the qualifications for this study.

Each of you will take a number of paper-and-pencil tests that should involve approximately 90 minutes of your time. You will not need to study for any of these tests. Results of the tests will remain confidential and your scores will be assigned a number so you remain anonymous. Your participation in this project is voluntary. You will receive no compensation. Out of this original group, fourteen (14) of you will have your entire battery of tests randomly selected to represent the group.

Thank you,

Linda B. Adams

I have read the above explanation of the study I am about to take part in and agree with the conditions. Signed _____

Date _____

APPENDIX J

Fbrr, 199L

As part of my coursework !or cOmpLetiOn of a :ste D ree in Physical Education at the State Universsity Collegf at Brockport, I'm riti a thesis. or p r of this study, a control group is needed that includes high school junior or senior fem les who a r not memb r of a school athletic team.

You have been r ndomLy selected to b part of this control group. This will involve appr ximtely ninety (90) minutes of your time to take a number of paper-and-pencil tests. You wiLL not need to study for any of these tests. Results of the tests wiLL r min confident i L and your scor s wiLl b ass ned a numb r so you r min anonymous. tour p r icip tion in this project is voluntary. You will receive no compen s tion.

Thank you,

Linda B. Adams

I have read the above explanation of the study I am about to take p r in and a re with the cond.itions. 3 ned

Date _____

APPENDIX K

MEANS AND STANDARD DEVIATIONS

Three group Analyses (Elite/Nonelite/Nonathlete)

Variables:	Elite	Nonelite	Nonathlete
CFIT	10.857 (M)	10.333 (M)	9.000 (M)
Subtest 1	.949 (SD)	1.234 (SD)	2.236 (SD)
(Order)	14 (n)	15 (n)	9 (n)
CFIT	8.714 (M)	9.333 (M)	7.889 (M)
Subtest 2	1.637 (SD)	1.718 (SD)	2.147 (SD)
(Classif.)	14 (n)	15 (n)	9 (n)
CFIT	10.357 (M)	10.667 (M)	9.444 (M)
Subtest 3	1.008 (SD)	1.447 (SD)	1.130 (SD)
(Patterns)	14 (n)	15 (n)	9 (n)
CFIT	5.714 (M)	6.467 (M)	5.333 (M)
Subtest 4	1.858 (SD)	1.407 (SD)	2.291 (SD)
(Conditions)	14 (n)	15 (n)	9 (n)
VTSCI	87.712 (M)	76.308 (M)	63.444 (M)
(trait	14.417 (SD)	15.649 (SD)	21.019 (SD)
sport-conf.)	13 (n)	13 (n)	9 (n)
VSSCI	86.962 (M)	88.000 (M)	58.333 (M)
(state	14.505 (SD)	14.059 (SD)	22.372 (SD)
sport-conf.)	13 (n)	13 (n)	9 (n)
VCOI	70.769 (M)	58.769 (M)	68.333 (M)
(competit.	25.629 (M)	23.735 (SD)	26.177 (SD)
orient.)	13 (n)	13 (n)	9 (n)

PSIS-5	23.000 (M)	24.692 (M)	15.889 (M)
MAXAX	5.023 (SD)	5.851 (SD)	4.755 (SD)
(anxiety)	14 (n)	13 (n)	9 (n)
PSIS-5	16.643 (N)	14.538 (M)	9.000 (M)
MAHCC	2.678 (SD)	3.886 (SD)	3.571 (SD)
(concent.)	14 (n)	13 (n)	9 (n)
PSIS-5	22.143 (M)	20.000 (M)	15.333 (M)
MAXCF	6.769 (SD)	7.461 (SD)	4.272 (SD)
(self-conf.)	14 (n)	13 (n)	9 (n)
PSIS-5	18.000 (M)	14.154 (M)	9.444 (M)
MAHMV	3.573 (SD)	4.580 (SD)	3.395 (SD)
(motiv.)	14 (n)	13 (n)	9 (n)
PSIS-5	9.214 (M)	10.692 (M)	12.444 (M)
MAHMP	1.847 (SD)	2.016 (SD)	2.186 (SD)
(ment. prep.)	14 (n)	13 (n)	9 (n)
PSIS-5	21.071 (M)	19.308 (M)	15.444 (M)
MAHTM	1.900 (SD)	2.720 (SD)	3.941 (SD)
(team motiv.)	14 (n)	13 (n)	9 (n)
CSAI-2	24.714 (M)	21.733 (M)	18.000 (M)
comp. anx.	5.823 (SD)	4.399 (SD)	6.708 (SD)
(cognit.)	14 (n)	15 (n)	9 (n)
CSAI-2	18.929 (M)	18.000 (M)	18.667 (M)
comp. anx.	5.255 (SD)	3.684 (SD)	8.972 (SD)
(somatic)	14 (n)	15 (n)	9 (n)
CSAI-2	22.071 (M)	22.400 (M)	19.222 (M)
comp. anx.	3.626 (SD)	5.565 (SD)	8.228 (SD)
(self-conf.)	14 (n)	15 (n)	9 (n)
SCAT	21.286 (M)	19.667 (M)	21.222 (M)
compet.	4.565 (SD)	4.995 (SD)	5.911 (SD)
anx.	14 (n)	15 (n)	9 (n)

Two Group Analyses (High Elite/Low Nonelite)

Variables	High Elite	Low Nonelite
CFIT Subtest 1 (order)	11.167 (M) .753 (SD) 6 (n)	10.125 (M) 1.126 (SD) 8 (n)
CFIT Subtest 2 (classif.)	8.500 (M) 1.643 (SD) 6 (n)	9.000 (M) 1.852 (SD) 8 (n)
CFIT Subtest 3 (patterns)	10.500 (M) 1.049 (SD) 6 (n)	10.500 (M) 1.069 (SD) 8 (n)
CFIT Subtest 4 (conditions)	5.500 (M) 2.429 (SD) 6 (n)	6.875 (M) 1.126 (SD) 8 (n)
VTSCI (trait sport-conf.)	91.250 (M) 11.478 (SD) 5 (n)	69.167 (M) 13.963 (SD) 6 (n)
VSSCI (state sport-conf.)	87.000 (M) 12.981 (SD) 5 (n)	81.167 (M) 14.190 (SD) 6 (n)
VCOI (competit. orient.)	69.800 (M) 31.011 (SD) 5 (n)	44.833 (M) 18.346 (SD) 6 (n)
PSIS-5 MAHAX (anxiety)	25.000 (M) 5.441 (SD) 6 (n)	24.667 (M) 7.685 (SD) 6 (n)
PSIS-5 MAHCC (concent.)	16.000 (M) 2.191 (SD) 6 (n)	14.833 (M) 4.167 (SD) 6 (n)

PSIS-5	23.167	(M)	17.500	(M)
MAHCF	5.345	(SD)	5.857	(SD)
(self-conf.)	6	(n)	6	(n)
PSIS-5	20.167	(M)	11.167	(M)
MAHMV	1.941	(SD)	1.722	(SD)
(motiv.)	6	(n)	6	(n)
PSIS-5	10.000	(M)	10.333	(M)
MAHMP	2.000	(SD)	1.633	(SD)
(ment. prep.)	6	(n)	6	(n)
PSIS-5	20.500	(M)	18.333	(M)
MAHTM	2.665	(SD)	2.733	(SD)
(team motiv.)	6	(n)	6	(n)
CSAI-2	23.000	(M)	22.750	(M)
comp. anx.	5.727	(SD)	3.845	(SD)
(cognit.)	6	(n)	8	(n)
CSAI-2	17.667	(M)	17.125	(M)
comp. anx.	2.422	(SD)	2.588	(SD)
(somatic)	6	(n)	8	(n)
CSAI-2	20.500	(M)	20.750	(M)
comp. anx	2.739	(SD)	2.964	(SD)
(self-conf.)	6	(n)	8	(n)
SCAT	21.500	(M)	19.750	(M)
compet.	4.370	(SD)	3.240	(SD)
anx.	6	(n)	8	(n)

References

Alexander, P. & Judy, J. (1988). The interaction of domain-specific knowledge in academic performance. Review of Educational Research, Winter 1988, Vol. 58, No. 4, 375-404.

Allard, F. & Burnett, N. (1985). Skill in sport. Canadian Journal of Psychology, 39(2), 294-312.

Anshel, M. H. (1990). An information processing approach to teaching motor skills. Journal of Physical Education, Recreation, & Dance, May/June 1990, 70-75.

Arnold, P. J. (1988). Education, movement and the curriculum. New York: The Falmer Press.

Barton, K., Dielman, T. E., & Cattell, R. B. (1972). Personality and IQ measures as predictors of school achievement. Journal of Educational Psychology, 63(4), 398-404.

Bjorklund, D. F. (1989). Children's thinking: Developmental function and individual differences (p. 203). Pacific Grove, California, Brooks/Cole Publishing Company.

Bloom, B. S. (1981). All our children learning: A primer for parents, teachers, and other educators. New York: McGraw-Hill Book Company.

Bump, L. (1989). Sport psychology workbook. Champaign, IL: Human Kinetics Publishers, Inc.

Cattell, R. B. & Cattell, A. K. S. (1990). Culture Fair Intelligence Tests Bulletin. Champaign, IL: Institute for Personality and Ability Testing, Inc.

Chapman, N. L. (1980). An investigation of the prediction of success in women's field hockey. Abstracts of Research Papers, 1980, REF GV 203 A 47.

Chase, W.G., & Simon, H. A. (1973a). The mind's eye in chess. In W. G. Chase (Ed.), Visual information processing. New York: Academic Press.

Chase, W. G, . & Simon, H. A. (1973b). Perception in chess. Cognitive Psychology, 4, 80-81.

Chi, M., Glaser, R., & Rees, E. (1982). Expertise in problem solving. In R. J. Sternberg (Ed.), Advances in the psychology of human intelligence, Vol. 1 (7-75). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

de Groot, A. (1966). Perceptions and memory versus thought: Some old ideas and recent findings. In B. Kleinmutz (Ed.), Problem solving. New York: Wiley, 1966.

Franks, I. M. & Goodman, D. (1986). A systematic approach to analyzing sports performance. Journal of Sport Science, 4, 49-59.

Franks, I. M., Wilson, G. E., & Goodman, D. (1987). Analyzing a team sport with the aid of a computer. Canadian Journal of Sport Sciences, 12: 2, 120-125.

Gill, D. (1986). Competitiveness among females and males in physical activity classes. Sex Roles, 15, 243-257.

Gill, D. & Dzewaltowski, D. A. (1988). Competitive orientations among intercollegiate athletes: Is winning the only thing: The Sport Psychologist, 1988, 2, 212-221.

Glass, A. L., & Holyoak, K. J. (1986). Cognition (Second Ed.). New York: Random House.

Gould, D., Weiss, M., & Weiss, M., & Weinberg, R. (1981). Psychological characteristics of successful and nonsuccessful Big Ten wrestlers. Journal of Sport Psychology, 3, 69-81.

Gould, P. & Greenwalt, N. J. (1981). Some methodological perspectives on the analysis of team games. Journal of Sport Psychology, 4, 283-304.

Griffin, N. & Keough, J. (1982). A model for movement confidence. In J. A. S. Kelso and J. E. Clark (Eds.), The development of movement control and co-ordination (213-236). John Wiley & Sons, Ltd.

Heyman, S. R. (1982). Comparison of successful and unsuccessful competitors: A reconsideration of methodological questions and data. Journal of Sport Psychology, 1982, 4, 295-300.

Highlen, P. S., & Bennett, B. B. (1979). Psychological characteristics of successful and nonsuccessful elite wrestlers: An exploratory study. Journal of Sport Psychology, 1, 123-137.

Highlen, P. S. & Bennett, B. B. (1983). Elite divers and wrestlers: A comparison between open- and closed-skill athletes. Journal of Sport Psychology, 1983, 5, 390-409.

Hunt, E. & Lansman, M. (1982). Individual differences in attention. In R. J. Sternberg (Ed.), Advances in the psychology of human intelligence, Vol. 1 (207-245). Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Jewett, A. E. & Bain, L. L. (1985). The curriculum process in physical education. Dubuque: Wm. C. Brown Publishers.

Lohman, D. F. (1989). Human intelligence: An introduction to advances in theory and research. Review of Educational Research, Winter 1989, Vol. 59, No. 4, pp. 333-373.

Mahoney, M. J., & Avener, M. (1977). Psychology of the elite athlete: An exploratory. Cognitive Theory and Research, Vol. 1, No. 2, 135-141.

Mahoney, M. J., Gabriel, T. J., & Perkins, T. S. (1987). Psychological skills and exceptional athletic performance. The Sport Psychologist, 1987, 1, 181-199.

Martens, R. (1977). Sport Competitive Anxiety Test. Champaign, IL: Human Kinetics Press.

Martens, R. (1989). Coaches guide to sport psychology. Champaign, IL: Human Kinetics Press.

Martens, R., Vealey, R. & Burton, D. (1990). Competitive anxiety in sport. Champaign, IL: Human Kinetics Books

Martens, R., Burton, D., Vealey, R. S., Bump, L., & Smith, D. (1990). Development and validation of the competitive state anxiety inventory-2. In Competitive anxiety in sport (pp. 127-173). Champaign, IL: Human Kinetics Books.

Meyers, A. W., Cooke, C. J., Cullen, J., & Liles, L. (1979). Psychological aspects of athletic competitors: A replication across sports. Cognitive Therapy and Research, Vol. 3, No. 4, 1979, pp. 361-366.

Orlick, T. & Partington, J. (1987). Mental links to excellence. The Sports Psychologist, 2, 119-130.

Overdorf, V. G. (1990). Timing - in life and in sports - is everything. Journal of Physical Education, Recreation, & Dance, Sept. 1990, 66-69.

Prawat, R. S. (1989). Promoting access to knowledge, strategy, and disposition in students: A research synthesis. Review of Educational Research, Spring 1989, Vol. 89, No. 1, 1-41.

Salokun, S. O., & Toriola, A. L. (1985). Personality characteristics of sprinters, basketball, soccer, and field hockey players. Journal of Sports Medicine, 25, 222-226.

Shakeshaft, N. B. (1981). Personality characteristics of teachers of exceptional children and teachers of normal children. Unpublished master's thesis, State University of New York at Brockport, Brockport, NY.

Singer, R. N. & Gerson, R. F. (1981). Task classification and strategy utilization in motor skills. Research Quarterly for Exercise and Sport, Vol. 52, 100-116.

Smith, D. (1982, May). Changes in cognitive and somatic competitive anxiety as the time to compete nears. Paper presented at the meeting of the North American Society for Psychology of Sport and Physical Activity Conference (NASPSPA), University of Maryland.

Starks, J. L. (1987). Skill in field hockey: The nature of the cognitive advantage. Journal of Sport Psychology, 9, 146-160.

Straub, W. F., & Williams, J. M. (1984). Cognitive sport psychology. Lansing, NY: Sport Science Associates.

Thomas, J. R., French, K. E., & Humphries, C. A. (1986). Knowledge development and sport skill performance: Directions for motor behavior research. Journal of Sport Psychology, 8, 259-272.

Vealey, R. S. (1986). conceptualization of sport-confidence and competitive orientation: Preliminary investigation and instrument development. Journal of Sport Psychology, 1986, 8, 221-246.

Vealey, R. S. (1988). Sport-confidence and competitive orientation: An addendum on scoring procedures and gender differences. Journal of Sport & Exercise Psychology, 1988, 10, 471-478.

Vickers, J. (1986). The resequencing task: Determining the expert-novice differences in the organization of a movement sequence. Research Quarterly for Exercise and Sport, Vol. 57, No. 3, 260-264.

Williams, L. R. T., & Parkin, W. A. (1980). Personality factor profiles of three hockey groups. International Journal of Sport Psychology, 1192, 113-120.

Woltz, D. J. (1988). An investigation of the role of working memory in procedural skill acquisition. Journal of Experimental Psychology: General, 1988, Vol. 117, No. 3, 319-331.

Yazdy-Ugav, O. (1988). Speed of information processing in sport: Closed vs. open skills. International Journal of Sport Psychology, 19 (4), 281-295.

VITAE

Degrees

B. S. Health and Physical Education

State University of New York

College at Brockport

Brockport, New York

Experience and Abilities

Member of Brockport College field hockey team

(1965 - 1967)

Former member of Red Jackets Field Hockey Club

Former member of Finger Lakes Field Hockey Association

Selected to Mid-East Third Team – 1969 - 1971

Selected to Mid-East First Team – 1970

Varsity field hockey coach at Eastridge H. S.

Rochester, New York, 1970 - present

Modified field hockey coach at Eastridge Junior H. S.,

Rochester, New York, 1987 - present

Selector for Empire State Games Western Scholastic

Field Hockey, 1978 - 1989

Coach of Empire State Games Western Scholastic

Field Hockey, 1988 - present