

University of Windsor

Scholarship at UWindor

Electronic Theses and Dissertations

Theses, Dissertations, and Major Papers

1-1-1980

The effects of hi-speed hockey on skill, fitness, and selected psychological variables.

Gregory Kenneth Reeds
University of Windsor

Follow this and additional works at: <https://scholar.uwindsor.ca/etd>

Recommended Citation

Reeds, Gregory Kenneth, "The effects of hi-speed hockey on skill, fitness, and selected psychological variables." (1980). *Electronic Theses and Dissertations*. 6750.
<https://scholar.uwindsor.ca/etd/6750>

This online database contains the full-text of PhD dissertations and Masters' theses of University of Windsor students from 1954 forward. These documents are made available for personal study and research purposes only, in accordance with the Canadian Copyright Act and the Creative Commons license—CC BY-NC-ND (Attribution, Non-Commercial, No Derivative Works). Under this license, works must always be attributed to the copyright holder (original author), cannot be used for any commercial purposes, and may not be altered. Any other use would require the permission of the copyright holder. Students may inquire about withdrawing their dissertation and/or thesis from this database. For additional inquiries, please contact the repository administrator via email (scholarship@uwindsor.ca) or by telephone at 519-253-3000ext. 3208.

THE EFFECTS OF HI-SPEED HOCKEY ON SKILL, FITNESS,
AND SELECTED PSYCHOLOGICAL VARIABLES

by

Gregory Kenneth Reeds

A Thesis
submitted to the Faculty of Graduate Studies
through the Faculty of
Human Kinetics in Partial Fulfillment
of the requirements for the Degree
of Master of Human Kinetics at
The University of Windsor.

Windsor, Ontario, Canada

1980

UMI Number: EC54733

INFORMATION TO USERS

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleed-through, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

UMI[®]

UMI Microform EC54733
Copyright 2010 by ProQuest LLC
All rights reserved. This microform edition is protected against
unauthorized copying under Title 17, United States Code.

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

AS of 1980

© Gregory Kenneth Reeds 1980
All Rights Reserved

747961

ABSTRACT

THE EFFECTS OF HI-SPEED HOCKEY ON SKILL, FITNESS AND SELECTED PSYCHOLOGICAL VARIABLES

by

Gregory Kenneth Reeds

In an experiment to determine the psycho-physiological effects of participation in a modified hockey environment, two groups were formed. An experimental group (n=24) played the modified game (Hi-Speed Hockey), while a control group (n=24) played in the conventional intramural league at the University of Windsor. Skill, fitness, attitude and selected psychological variables were assessed for a ten week period during the hockey season.

Modifications to the traditional game consisted of reducing the number of players on the ice to three skaters and one goaltender. A maximum of three substitutes were allowed per team. There were no whistles or stoppages in play. Each game lasted twenty-four minutes (3 x 8 minute periods). It was hypothesized that as skill, fitness and internality increase, competitiveness and aggression decrease in the Hi-Speed participant.

A stepwise discriminant analysis was used to analyze group separation. Based on the outcomes of participation in the experimental programme, the discriminating variables

classified the groups with 64% accuracy. Statistical analysis showed that Hi-Speed subjects received significantly more playing time ($p < .01$) than did their intramural counterparts with concurrent significant differences in competitive attitude, aggression ($p < .01$) perceived utility, internality and commitment ($p < .05$).

The results of the study indicate that participation in the modified game of Hi-Speed Hockey produces a shift toward a recreational rather than a competitive orientation. The psychological outcomes which accompany this shift should form the basis for constructive alterations to existing hockey programmes at many levels.

DEDICATION

I would like to dedicate this thesis
to my parents and to my sisters.

ACKNOWLEDGMENTS

I would like to express my appreciation to the members of my committee, whose careful reading of both the proposal and the final draft helped to formulate many important ideas. To Dr. C. G. Eaves, Dr. P. J. Galasso and Dr. V. B. Cervin, I acknowledge your support and guidance. Appreciation is also extended to Mr. J. K. Tyler for his creative input during the planning stages of this experiment.

I feel especially fortunate to have had as my advisor, Dr. James Duthie. As time went on, I came to realize that his friendship and counsel has given me a most vital learning experience.

TABLE OF CONTENTS

ABSTRACT.	iv
DEDICATION.	vi
ACKNOWLEDGMENTS	vii
LIST OF TABLES.	x
LIST OF ILLUSTRATIONS	xi
LIST OF APPENDICES.	xii
CHAPTER I INTRODUCTION AND IMPORTANCE TO THE STUDY.	1
I. The Problem and Its Conceptual Background	1
II. Hi-Speed Hockey: Game Description	4
III. The Problem.	6
IV. Delimitations.	9
V. Limitations and Assumptions.	10
CHAPTER II REVIEW OF LITERATURE.	11
CHAPTER III INSTRUMENTS.	24
I. Selection and Construction	24
II. Skill-Fitness Instruments.	25
III. Psychological Instruments.	27
CHAPTER IV METHODOLOGY AND RESEARCH DESIGN	31
I. Research Design.	31
II. Selection of the Sample.	32
III. Collection of the Data	33
IV. Analysis of the Data	34
CHAPTER V RESULTS AND INTERPRETATIONS.	44
I. Demographic Information and Reasons For Playing Hockey	44
II. Ice-Time and Game Duration	46

III. Skill, Fitness and Psychological Variables.	51
IV. Analysis of Group Separation	64
CHAPTER VI SUMMARY AND CONCLUSIONS	73
I. Summary.	73
II. Conclusions.	74
III. Recommendations.	77
REFERENCES.	79
BIBLIOGRAPHY.	83
APPENDIX.	85
VITA AUCTORIS	134

LIST OF TABLES

TABLE		PAGE
1	Skill, Fitness and Psychological Instruments.	26
2	Intercorrelation Coefficients Attitude Scale.	41
3	Intercorrelation Coefficients Commitment Scale.	41
4	Correlation Matrix For Attitude and Commitment Variables.	42
5	Demographic Information	45
6	Reasons For Playing Hockey	47
7	Ice Time For Each Playing Condition.	48
8	Psycho-Physiological Differences Between Groups.	52
9	Test-Retest Sensitization.	58
10	Psycho-Physiological Changes in Intramural Hockey.	59
11	Psycho-Physiological Changes in Hi-Speed Hockey.	61
12	Changes In Attitude.	63
13	Discriminating Variables Used In The Analysis.	66
14	Stepwise Discriminant Analysis Of Two Groups and Nine Variables.	69
15	Classification Results From Discriminant Analysis.	71

LIST OF ILLUSTRATIONS

FIGURE		PAGE
1	Change in Skill.	53
2	Change in Commitment.	53
3	Change in Body Weight.	55
4	Change in Anaerobic Fitness.	55
5	Change in Attitude	56
6	Change in Internality.	56

LIST OF APPENDICES

APPENDIX		PAGE
A	Calculations for AN30	85
B	Hi-Speed Information Package	87
C	General Information Questionnaire.	91
D	Commitment To Hockey Scale	94
E	Attitude Scale	96
F	Locus of Control Scale . . . . .	.101
G	Hi-Speed Hockey Rules. . . . .	.104
H	Modified Hockey Environment Interview Schedule . . . . .	.107
I	Pilot Study Information. . . . .	.109
J	Hermiston HOckey Skills Test . . . . .	.111
K	Windsor Minor Hockey Association Proposal.	.113
L	Research Memorandum. . . . .	.116
M	AN30 Performance Norms . . . . .	.118
N	Intramural Hockey Final Standings. . . . .	.120
O	Hi-Speed Hockey Final Standings. . . . .	.122
P	SPSS Subprogramme T-Test . . . . .	.124
Q	SPSS Subprogramme Pearson Corr . . . . .	.126
R	SPSS Subprogramme Discriminant . . . . .	.128
S	Items Used in the Discriminant Analysis. . . . .	.130
T	Items Used in the Calculation of Construct Validity . . . . .	.132

CHAPTER I

INTRODUCTION AND IMPORTANCE OF THE STUDY

To many observers the countenance of professional ice-hockey on this continent is clear: it is a streamlined industry designed and promoted to capture its share of the ever increasing "sport" dollar. Hockey, from this perspective is big business, conducted under the guise of sport. When viewed beneath this mask, however, North American ice-hockey creates difficulties for many youngsters who are learning the game.

These problems arise from the trends of the past decade which have shifted the emphasis of hockey from one of speed, excitement and fun to undesired levels of aggression and competition. The professional leagues, which provide the role models for on ice behaviours have strongly influenced hockey participation at all levels. The subsequent lack of skilled young players who enjoy playing hockey has led to this investigation into the nature of the present game and its esteemed position in the mainstream of Canadian society.

The impetus for this research was provided by the ongoing assesement of the state of minor hockey across Canada. Minor hockey, the cornerstone of the professional farm system, has registered a large scale exodus away from participation in the traditional game. Boys (and their parents) throughout the 1970's have expressed disgust with the way ice-hockey conducts itself. There is a marked drop-out from organized

hockey at age 15. Proulx and Soucie (1977) have quoted figures that state that while 35 percent of the players registered in the C.A.H.A. were between ages twelve to 15 only 11% were over 15 years of age. These figures are astonishing if we consider that the majority of youngsters give up an activity that they have enjoyed for quite a few years.

It seems unfortunate to arrive at such disastrous outcomes considering that so much energy has been spent instructing minor hockey players all over Canada. In order to capture the virtues of hockey participation hockey programmes should not be eliminated but carefully examined. Windsor Minor Hockey Association, the forum for many studies which preface this current one did not offer juvenile level hockey (age 16-18) in 1978-79 because the on-ice behaviour has become too violent and difficult to control.

The play and success of the European teams--Soviets, Czechoslovakians, and Swedes has revealed the basis of this problem. It is evident that hockey programmes must change or remain as second rate. The results of a joint survey by the Ministry of Culture and Recreation and the Ontario Hockey Council ("Examination into the Quality of Minor Hockey", 1979) may provide the initial steps needed to turn ice hockey around in Ontario. To do this however, the Ministry will need more than surveys and expression of public concern; hockey programmes will need facts and clear-cut alternatives.

Having led the way in cleaning up abuses and remedying defects in Windsor Minor Hockey in the early 1970's (Duthie,

1974a, 1974b; Duthie and Tyler, 1979a, 1979b), a University of Windsor research team has developed a modified form of hockey, evolved and pilot tested, to provide positive outcomes from participation. The new game is called "Hi-Speed" Hockey. It is designed specifically, as a treatment aimed to streamline the traditional game form.

Hi-Speed hockey emerges as an alternative for those attracted to hockey but who turn away from the regular game where enjoyment and recreation are too often sacrificed for aggressive competition. The new game provides a "release" from the conventional tedium of "hi-pressure" hockey and returns its participants to the open environment of a frozen pond.

The experimental game attempts to provide hockey players with a more attractive competitive situation while still maintaining the basic "hockey" environment and its essential structure. Participants test the fundamental skills of skating, shooting and stickhandling in a game that gives players significantly more playing time than would be possible in an equivalent session of regular hockey. It is hoped this will provide a viable alternative game both for the developing and longtime player and especially the ones who might otherwise stay away from the game all together.

II. HI-SPEED HOCKEY: GAME DESCRIPTION

The professional model of sport on this continent has so altered the desired outcomes of participation in amateur and minor sport programmes, that corrective measures have to be implemented to save the virtues of sport participation. The norms of behaviour in hockey have become the ones that optimize a child's chances of becoming a professional player i.e. tough, belligerent, and often violent displays. The new game form introduces a large range of innovative behaviours that create constructive outcomes. The "open" environment concept nurtured by Hi-Speed leads the individual toward initiating, rather than following type behaviour. The participant in Hi-Speed cannot anticipate what will occur by simply reconstructing the events he has previously experienced in hockey. Hi-Speed is an entirely novel stimulus. How then does this new game operate?

Hi-Speed was designed to emphasize the skill, fitness, and recreational components of hockey and to reduce the aggressive play that has taken the "fun" out of playing hockey. Experimentally, Hi-Speed or the "treatment" group will play this alternative form of hockey to be offered in conjunction with the existing competitive leagues already in progress (control group). The location for this research will be the Intramural programme at the University of Windsor. The experiment could have taken place at any level of participation or for any age group but it was felt that the

existing competitive structure of intramural hockey provided an ideal field setting for the documentation of the factors under examination.

Hi-Speed is played on a regular ice surface with nets positioned at opposite ends of the arena. An extended crease area protects the goaltender. Each team is made up of a goalie and six skaters. The goalie remains on the ice with 3 skaters on any given shift. Player changes are made during the play only to speed up the game. Initially four or six teams will play in an Experimental league, scheduled for a 10 week period. Playoffs will follow a "seeded" or handicapped format so that run-away winners will be balanced out. Each game lasts 24 minutes (2x12 or 3x8 minute periods). The centre red line has been removed to allow fast breaks and longer passes. The puck is advanced after a goal or an offside without a face-off. Whistles are blown to indicate an infraction of the rules and the end of the period of play. The game therefore, is a modified hockey situation, causing the participants by its physical properties to accentuate skill (passing) and constant movement (skating). Pilot testing revealed a preference for a non-contact game.

The origin of Hi-Speed can be found in its attempt to alter the ongoing repertoire of undesired behaviours displayed throughout hockey. This is brought about, in part by the many new tactical considerations when maximizing positioning on the ice. Players and coaches must decide what formations provide for optimal control and movement of the puck for both

offensive and defensive situations. These have to be envisaged and carried out. It is evident that being caught "out-of-the-play" is a very large concern in such a game. Players have to be both adventurous and conservative; to think ahead and plan. New decision making processes occur on every shift creating constructive arousal and the opportunity for enjoyment.

This research is designed to accurately assess the state of hockey as viewed by a specific group of players; those who elect to play hockey as a form of recreation.

III. THE PROBLEM

Statement of the Problem: The central focus of this study was to determine the effects of a modified hockey environment (Hi-Speed Hockey) on a set of variables characterizing participation among intramural ice-hockey players. The purpose of this research therefore, is to investigate the present state (condition) of ice-hockey and its outcomes through the development of an alternative form of hockey, designed specifically to reduce the negative aspects found throughout most levels of hockey in Canada today.

The Variables under Investigation: The dependent variables selected for the analysis are those considered to be the most salient measures reflecting participation in ice-hockey at the intramural level. It is imperative that these factors reflect both the state of hockey in general and to display the treatment effect outlined in this experiment. The

following variables will be examined in the study: skill, fitness, attitude, commitment, and locus of control. Within the attitude scale a raw score of "Feelings About Playing Hockey" will be further analyzed according to five (5) distinct concepts clearly indicating a participant's competitive attitude toward the game.

Skill-Environment: measured by the emphasis placed on the perceived degree of skill required to play recreational hockey and the extent to which competitiveness is determined by the skill level.

Winning: assessed by the importance placed on winning as an antecedent to success and enjoyment in hockey.

Competition: determined by the directional response locating an individual toward either the competitive or recreational end of the continuum.

Aggression: indicated by extent to which aggression and hostility is felt toward opponents.

Perceived Utility: assessed by a measure of the perceived utility of playing hockey and if the present game form is a desired form of physical activity.

Experimentally, two groups were formed. Hi-Speed participants made up the experimental group and Intramural participants made up the control group. Demographic information was collected to monitor group homogeneity and to control for such factors as age and number of years in hockey. Descriptive information on reasons for playing hockey also assessed group differences.

In order to delineate the problem more specifically , the following comparisons were made which led to the formulation of the experimental hypotheses:

- A. A comparison between the control group and the experimental group at Time 1 (before treatment).
- B. A comparison between the control group and the experimental group at Time 2 (after treatment).
- C. A comparison of the control group (Time 1-Time 2 no treatment).
- D. A comparison of the experimental group (Time 1-Time 2 treatment).

Experimental Hypotheses (Ho): Experimentally, the following hypotheses were drawn to analyze the above comparisons.

- A. There will be no difference between groups at Time 1.
- B. There will be no significant changes within the control group (Time 1-Time 2 no treatment).
- C. There will be no significant changes within the experimental group Time 1 and the experimental group Time 2.
- D. There will be no significant difference between the control group Time 2 and the experimental group Time 2 (treatment effect).

Directional Hypotheses: In order to analyze the experimental effects or changes for both groups, the following directional hypotheses were formulated.

- A. There will be no significant difference between groups at Time 1.
- B. There will be no significant difference for the control group between Time 1 and Time 2 (i.e. no treatment).
- C. There will be a significant increase on all variables for the experimental group between Time 1 and Time 2 (treatment).
- D. There will be a significant difference between the experimental group Time 2 and the control group Time 2

(i.e. treatment effect).

- E. The variables selected are not affected by participation in an intensive experimental hockey programme among intramural ice-hockey players.

Research Objectives:

- A. To assess and evaluate why people elect to play recreational hockey. The age group 18-25 was selected for this study in an attempt to determine the most important factors which contribute to continued participation in hockey. The behavioural outcomes may then be applied to all levels of active participation which will initiate constructive directions for change.
- B. To develop reliable and valid scales to measure attitudes about playing hockey.
- C. To develop and run a new experimental game designed as an alternative to the present form and which builds fitness, skill and recreation. Hi-Speed is one of the most innovative hockey development programmes offered in Canada.
- D. To determine statistical significance of difference between a control group and an experimental group who elected to participate in the modified game. An analysis of the treatment will indicate if the variables selected can be altered by making the game more attractive.
- E. To provide substantive evidence that changes in the present game are necessary.
- (i) Provide an alternative game form, that could be used at many levels which would attract those who might otherwise stay out of hockey or which would be used as a skill development "practice" game.
- (ii) Promote skill, fitness, and recreation-positive outcomes of hockey participation.
- (iii) The findings of this research could be used by hockey administrators (C.A.H.A., OHC, OMHA) to re-evaluate existing goals and objectives in hockey today.

IV. DELIMITATIONS

1. The experimental group of subjects was made up of twenty-four intramural hockey players who selected to play Hi-Speed Hockey. These subjects also played or have played regular

intramural hockey. The effect on the variables therefore, is due to the "additional" treatment of Hi-Speed participation.

V. LIMITATIONS AND ASSUMPTIONS

1. The treatment effect of the additional hockey experience included only a ten week period. The effect could be heightened by a longer test-retest period.
2. The study was limited to a cross section of the participants who played in the University of Windsor's Intramural Hockey League governed by its rules and regulations in 1979-80.
3. It was assumed that subjects in the experimental group had previously played various levels of hockey making the Hi-Speed experiment a novel or different game. Had these players not been very familiar with the regular game as a participant a shift or experimental effect could not be explained.

CHAPTER II

REVIEW OF LITERATURE

The review of literature examines the contemporary psychological research associated with participation in competitive and non-competitive sport environments. Particular attention has been given to the attitude and personality variables characteristic of the recreational participant. There are a number of psychological variables which provide strong evidence in support of the concept under investigation and will be presented within the theoretical framework of this review. These "target" concepts include: attitude change, professionalization of attitude, locus of control and commitment. This chapter therefore, is designed to integrate the current research to provide an understanding of the interactive effects of competition when individuals are placed in a predominantly non-competitive setting. Perhaps the most important aspect of this review is to assess how individuals perceive themselves and to define the effects upon them as a result of their participation in sport. This in turn will help to explain the methodology and research design selected for use in this study and will provide the theoretical rationale for the Hi-Speed Hockey experiment.

Two of the most common conditions which arise out of game playing and which remain largely unresolved among the participants are competition and recreation. When the limits of competition are not clearly defined, individuals invariably

differ in their interpretation of the competitive event. This standoff surfaces commonly in an intramural or recreational situation where we find some players are very competitive while others are playing just for recreation. A basic problem centres around resolving the differential effects of participation in a competitive and non-competitive environment.

The research in support of this thesis clearly documents two ends of a continuum. The literature examines from its widest base a developmental approach to the study of both competitive and recreational sport. These studies recognize and identify the attitudinal, perceptual, behavioural and environmental forces which operate to change ones own expectations about competition. At the other end, the research attempts to replicate the societal effects of competition through narrow and precise experimental conditions. Typical of the macro-analysis are the studies which examine the stable or normative hockey environment. Experimental studies on the other hand, examine the novel or modified hockey environment where a very specific experiment is designed to monitor a very specific effect.

A very definite theoretical shift parallels the overall framework of the literature. Studies which investigate the stable or normative hockey environment are linked with the effects of competition on aggression and institutionalized rule violation (Vaz, 1979; Pooley, 1978; Mantel and Vander Velden, 1971). Research which investigates experimental

situations seeks not only to examine the effects of the normative environment, but attempts to manipulate or modify the situation to bring about a set of desired outcomes from participation (Watson, 1977; Duthie, 1974a, 1974b; Tyler and Duthie, 1979a, 1979b; Proulx and Soucie, 1978; Shea, 1975). The over-riding theme of the present research states that if the traditional competitive environment is changed, a new range of attitudinal and personality responses will emerge from the participant.

In a study to determine if university intramural participation encourages a shift from a competitive to a recreational orientation Loy, Birrell, and Rose (1976) examined attitudes held toward recreational activities. Attitudinal dimensions were assessed for this special class of leisure pursuits termed by the researchers "agonetic". Agonetic activities are games and sports pursued as a form of competitive physical recreation. The specific focus of the report examined the attitudinal changes associated with the "professionalization of attitude toward play" in the context of agonetic activities. In support of the hypothesis, Loy, (et al) cite the findings of Petrie (1971), Maloney and Petrie, (1974) and Mantel and Vander Velden (1971) who administered "Webb's professionalization of play scale" (Webb, 1969) to various groups of recreational participants. The self report scale measures the emphasis placed on either skill and competition (professional orientation) or the emphasis placed on fairness (recreational orientation). The results of Petrie's

study (1971) showed that professionalization of attitude toward play increased with age, having gathered data on grade school children, high school students and university undergraduates. Mantel and Vander Velden (1971) on data secured from adolescent aged subjects found that attitudes toward play were directly related to sport participation. Maloney and Petrie (1974) extended this finding and developed an index of sport professionalization based on the level of an individual's participation and determined that participation in intramural sporting activities appeared to lessen the professionalization of attitude toward play.

To gather conclusive evidence on the effects of intramural participation Loy (et al, 1976) replicated the previous studies and administered the professionalization of play scale to intramural participants at the University of Massachusetts. Responses to the scale showed that the intramural participants showed a preference for a play orientation whereas their intercollegiate counterparts stressed a professional orientation toward sport involvement.

An examination of the relationship between competitive behaviours, games and culturally defined sports is a natural extension of Loy's research and has been investigated by Ionotto, Marshall and Chambers (1977). Ionotto (et al, 1977) has developed an Athletic Apperception Test (AAT) which allows subjects to describe and explain their own competitiveness. According to Ionotto (et al, 1977) the concept of "competition" should explore the cultural milieu in which such behaviours

occur and in terms of whether those behaviours are to be expected (ie. normal) or not. Data was collected from one hundred hockey players aged nine to sixteen. The findings of the study are strikingly relevant. Competitiveness was found to be a function of happiness, elation, satisfaction, accomplishment, pride and confidence. Competitiveness was found not to be associated with aggression, frustration or hostility but as a product of being aggressed against. The implications indicate that the competitive environment should provide for constructive arousal and increased opportunity for self initiated behaviours.

Some researches have attempted to elicit and measure this shift in attitude when monitored in response to a particular environmental condition (Duke et al 1975; DiFebo, 1975). This disposition or orientation toward environmental conditions is termed locus of control and stems from J.B. Rotter's (1966) work on generalized expectancies of reinforcement. Locus of control describes the degree to which an individual believes that reinforcements are contingent upon his own behaviour. An internal orientation indicates a belief that rewards are contingent upon ones own actions and behaviours whereas an external orientation is a belief that destiny is controlled by luck, chance or powerful others. According to Anshel (1979) the shifting of locus of control from an external to an increasingly internal position should be one of the more significant concerns of modern society. Anshel has stated that athletic environments play a large

role in the facilitation of internalizing an individuals perception. It is desirable therefore, for children, students and athletes to feel responsible for their own behaviour.

The observation that locus of control may be amenable to environmental forces provides for the formulation of the central hypothesis underlying this present study. It can now be postulated that movement away from a predominantly competitive or professional play environment toward an essentially recreational setting where the opportunity for individual control increases, a parallel shift occurs toward a more internal perception of performance.

Experimentally this hypothesis has received notable investigation for both adult and child populations. Duke (et al, 1977) sought to determine if children aged six to fourteen would experience increased self-confidence and a sense of self-directedness along with greater internal locus of control as a result of participation in a sports fitness camp. It was hypothesized that the locus of control of the participants would change in terms of a significant movement toward the internal end of the continuum. It was shown that children became more internally controlled as a result of participating in the camp programme. The increased levels of physical fitness and skills, the group experience with peers and the reinforcement from camp leaders, were situations which promoted increased feelings of self-esteem and internality. The "social climate" of the sports camp described by Duke (et al, 1977) bears a strong relationship to the

initial research leading to the development of Hi-Speed Hockey. While researchers focused on the relationship between environment and ones locus of control, the structure of minor hockey became the forum for critical evaluation. Having studied the effects of competition on social development Duthie (1974a, 1974b; Duthie and Moriarty, 1976) set out to drastically change the competitive structure of minor hockey. To counter act the negative effects attributed to competitive, all-star hockey, Duthie formed "no-standing" leagues which were implemented by the Windsor Minor Hockey Association in the early 1970's. To de-emphasize competition a house league (HL) and a pioneer league (PL) provided an alternative to the All-Star or Travel team (TT) concept. All situations directly observable in house league hockey provide for increased feelings of self-esteem and internality. There is very little pressure from outside the individual to perform, therefore, any reinforcements from the activity have as their origin an internal orientation. The same is true of the pioneer league which provides essentially the same "social climate" with a greater skill level. Subsequent studies (Tyler and Duthie, 1979a, 1979b; Tyler, 1979a, 1979b) sought to determine which environment would contribute increased feelings of personal control. Tyler, (1979b) isolated the differential effects on locus of control between the HL exposure and participation in either the TT or PL level. The three groups of subjects aged 10 to 12 were administered the Nowicki-Strickland (1973) locus of control scale before

and after their first season of hockey in the new competitive structure. The results of the study showed that while all groups shifted toward a more internal orientation HL and PL subjects were significantly more internal than the TT group at the retest. This finding supports the proposition that a less competitive environment which provides for self control produces development toward internality.

In an attempt to isolate which of the critical components were responsible for the increased feelings of control in the children Tyler and Duthie (1979b) examined the effects of each play experience on social norms, notably aggression and violence. Having documented the competitive environment of "travel teams" this study illustrated how conformity or acceptance of social norms is affected by the competitive environment. Story-pictures or cartoons were presented for rating by the HL and TT participants to determine humour judgements and ratings of aggression. The results of this follow-up study indicate that in children, a competitive environment not only renders a loss of personal control but showed that aggressive behaviours occur in response to the group experience and the role requirements of TT hockey.

The experimental findings of Duthie and Tyler support the theoretical literature which surrounds their field investigations. Vaz (1979) has documented the institutionalization of not only aggressive behaviours but of rule violation. This suggests that there is a normative way children break the adult rules of the game. Further, Vaz has stated that

such acts as elbowing, tripping, grabbing plus a range of illegitimate tactics are normative in minor hockey. These acts are situationally expected and reinforced. In turn, the individual learns to play within these constraints only to find that play has been removed and replaced by the survival demands of competition.

During the socialization process into hockey, self-reinforcing behaviours decrease and the child becomes more dependent upon external stimuli which motivate the play. Several researchers (Suttie et al, 1976; Duquin, 1978) have suggested that this phenomenon is not exclusive to children, but in fact, is just as apparent in adult play. According to Suttie (et al 1976) play, as arousal seeking behaviour in adults is caused by the same factors that cause play in children. The outcomes of pleasure, competence and adaptation are similar. It makes great sense therefore to make practical application of such profound logic.

To counter act the onset of "professionalization" in adult recreational play, structured competition is replaced by an open-environment; the number of rules are decreased to facilitate activity; and stoppages in play are limited to place the participant firmly in control of his own environment. Duquin (1978) has stated that an adult participant who is aware of the functions and effects of the athletic process is more likely to identify, within that process, factors that are personally rewarding. Mumford (1968) suggests an optimum environment would be characterized by

variety and providing for purposeful growth as opposed to an environment that magnifies authoritarian power and minimizes or destroys human initiative, and self direction. The recreational environment offered to adults requires non-structuredness so that participants can experience opportunities to be stimulated and motivated (Suttie et al, 1976). During the act of playing, the individual experiences feelings of enjoyment, is more apt to accept and persist in the game and increases the likelihood of becoming committed to the physical activity.

Several processes operate to facilitate a change in both the structure and function of adult play. The literature on effective arousal (Maddi, 1960; Peek, 1960; Csikszentmihalyi, 1975) sheds an interesting light on the initial hypothesis underlying the development of Hi-Speed Hockey. Maddi has proposed that constructive arousal occurs during both environmental regularity and change when the situation is perceived as being non-threatening and will not produce anxiety. The theoretical implication suggests that if a novel event is presented whereby arousal or stimulation is produced in a non-threatening manner, the event is likely to be accepted. The acceptance of Hi-Speed is based on the psychological premise that an adult organism will seek a release from a conventional or traditional environment when a state of boredom is replaced by arousal. It is necessary therefore, to substantiate that a shift toward acceptance of a new game could actually occur.

Hansen (1979) has outlined an "eight-point plan" to re-establish hockey accountability. The over-riding assumption of his plan is to eliminate the professionalization of attitude which he states permeates the entire structure of ice-hockey in Canada. An alternative lies in the refocusing of hockey as a sport, to eliminate the dysfunctional aspects that characterize the typical hockey environment. The goals and objectives of the Hi-Speed Hockey programme implement many of the alternatives proposed by Hansen. Most notable of these include: a de-emphasis on winning which reduces unrealistic expectancies; gains in physical fitness; increments in skill; more social interaction resulting in respect for others and greater self-esteem; modified rules, and players playing all positions. These characteristics are intensified in the Hi-Speed situation.

Watson (1977) has developed a model which applies the positive aspects of competition to make a competitive situation more attractive to the participant. Based largely upon Festinger's (1954) social comparison theory, several aspects of the model are especially relevant. The first assumption states that all humans possess a "unidirectional drive" upwards to improve ones ability. This drive may be satisfied by competitive situations which provide a means of evaluating ones ability relative to previous stages of development (Festinger, 1954). Accordingly, under these conditions, Watson has determined that if the criterion is defined by the participant relative to his or her "own" capability and

not some externally defined level, the outcome of any competitive experience will be meaningful.

The psychological dimensions of a modified hockey environment may constitute a viable alternative to the presently existing elitist-type of hockey which predominates in our society. Two concepts emerge: no-contact hockey and three-man half court hockey. Proulx and Soucie (1978) have researched the revival of hockey programmes through no-contact leagues. The elimination of body contact has restored participation at many levels of hockey. Specifically, university intramural leagues, mens leagues and minor hockey associations have implemented the no-contact concept. The removal of excessive roughness and fear of injury has provided renewed incentive for many participants who may stay away from the regular game.

Shea (1975) has devised a three-on-three game played on half the ice, which is the predecessor of the Hi-Speed game. Shea has theorized that by reducing the number of individuals on the ice, the game develops a player's hockey sense and creativity. The action is continuous and always around the key area--the goal. Once the players develop individual skills and instincts, it becomes easy for them to learn team patterns (Shea, 1975). The next progression in accordance with the research is to maximize these same principles by extending the game to cover the entire ice surface.

The theoretical background to the Hi-Speed experiment

has therefore, been revealed throughout the literature. The cumulative findings of the previous research has led to the gradual evolution of Hi-Speed Hockey, a new game. This present study attempts to measure or quantify the observable effects of participation in this modified game situation.

CHAPTER III

INSTRUMENTS

I. SELECTION AND CONSTRUCTION

The research instruments have been designed and selected to yield information about a specific group of individuals: namely those who elected to participate in Hi-Speed Hockey. The research will provide scientific data regarding the underlying factors influencing participation in Intramural or what has come to be called "recreational" Hockey. A number of key concepts have been identified for the analysis and it has been the purpose of this research to select the most precise and reliable instruments for the measurement of these variables. A large component of the overall validity in any research of this nature therefore, rests upon the selection and construction of these instruments. It must now be determined how these instruments measure the variables which have been isolated and further, to analyze the effects that participation in the modified game has on these variables.

The research instruments can be divided into two areas: (1) Skill-Fitness Instruments and (2) Psychological Instruments. Their selection and inclusion in the study was based on the following criteria:

- (1) Reliability and Validity
- (2) Specificity and Adaptability
- (3) Administration.

The types of measures obtained and the approximate time of administration for each instrument is summarized in Table 1.

II. SKILL-FITNESS INSTRUMENTS

Hermiston (Standardized) Hockey Skills Test

The Hermiston Hockey Skills Test was constructed to yield ratings of overall skating and puck handling ability. Each subject skates through an obstacle course which is marked out on the ice by pylons. The test calls upon the combined skating, (both forward and backward) puck control, speed and agility of the individual. Average times of performance on the test have been calculated for various levels of hockey proficiency. The test is a valid measure of skating ($r=.7$) and puck control and has produced significant correlations to hockey ability for all ages and levels. This performance variable provides an objective measure of skill, distinguishing intramural participants as a whole as well as distinguishing the two groups in the experiment.

Wingate Thirty-Second Anaerobic Test (AN30)

The AN30 was selected for its precision in measuring anaerobic leg power, which is the essential fitness component in hockey. The nature of Hi-Speed Hockey closely mimics the anaerobic principles of interval training or "speed-play" (Fartlek). The players skate all-out for approximately sixty-second shifts which is followed by a short recovery period. The step-like progression provides ideal anaerobic training maximizing lactic acid build-up and recovery. The

TABLE I
 SKILL, FITNESS AND PSYCHOLOGICAL INSTRUMENTS

<u>Measurement</u>	<u>Instrument</u>	<u>Time of Testing</u>
Hockey Skill	Hermiston Standardized Hockey Skill Test	2 minutes per S _s
Hockey Fitness	Wingate 30 Second Anaerobic Test	2 minutes per S _s
Demographics	General Information Questionnaire Part I	2 minutes per S _s
Reasons for Playing	General Information Questionnaire Part II	2-5 minutes per S _s
Attitude	Competitive Attitude Scale	5-10 minutes per S _s
Commitment	Modified Positive Addiction Scale	5 minutes per S _s
Locus of Control	Velecha-Ostrom I-E Scale	5-10 minutes per S _s

Wingate test developed by Dr. Oded Bar-Or at the Wingate Fitness Institute in Tel Aviv, Israel is an exhaustive test which consists of a thirty second maximal sprint on a bicycle ergometer. The resistance for the test was set according to the subjects body weight multiplied by a constant 0.075 to produce the work load on the bicycle ergometer. After the subject overcame the initial flywheel inertia the resistance was set. The electronically triggered counter and timer was activated. The number of revolutions was recorded at five second intervals for a total of 30 seconds. Total power output for the 30 seconds was calculated (see Appendix A). Green (1979) has produced an analysis of the metabolic requirements for performance in ice-hockey. The Wingate Thirty-Second Test will provide data on the anaerobic fitness levels of the Hi-Speed and the control group participants.

III. PSYCHOLOGICAL INSTRUMENTS

General Information Questionnaire: (GIQ) Part I

The general information questionnaire (GIQ) was designed to produce demographic information about the population. The data obtained from this instrument was used to determine the homogeneity of the groups and to determine between subjects variance on such factors as age, total hockey experience, levels of hockey played and average hours of hockey played per week. These variables are expected to be predictors of the construct commitment to hockey (CH) and must also be considered to correlate with fitness and attitude. Part I

of the questionnaire consisted of 12 items.

General Information Questionnaire (GIQ) Part II

The general information questionnaire Part II produced descriptive data on the subjects reasons for playing hockey. The questionnaire asked two open-ended questions.

- (1) Please give three reasons for your beginning to play hockey.
- (2) Please give three reasons for why you are presently playing hockey.

Attitudes About Playing Hockey

The Attitudes About Playing Hockey Scale is a 30 item summated-rating scale constructed to reflect the attitudes of intramural ice-hockey players toward the recreational versus the competitive aspects of playing hockey. Within the scale five concepts combine to produce an overall competitive or recreational attitude.

- (1) skill
- (2) fitness
- (3) competition/recreation
- (4) aggression/violence
- (5) utility or state of the present game.

A firmly favourable response (from a recreational point of view) was given a weight of 5 and so on down to the firmly unfavourable response which go a weight of 1. All the weights were added so the respondents general attitude score could range from 30-150. Items 22, 25, 26, 28, 30, 35, 36, 38 were scored with reversed weighting. Ratings of specific items

from the scale were used to analyze group differences.

Commitment to Hockey (CH)

This modified scale stems from the work of Glasser (1976) who developed the term "positive addiction" (PA) to describe the psychological effects or propensity for running. Glasser's initial hypothesis was re-named "commitment" in a survey of runners attitudes by Carmack and Martens (1979). The Carmack-Martens study produced a 12 item "Commitment to Running Scale" (CR) and provided substantial support for its reliability and concurrent validity. A commitment to hockey scale (CH) was then adopted for this present study to acquire data on the degree of commitment among intramural ice-hockey players.

Internal-External Locus of Control

The Valecha-Ostrom Abbreviated Measure of Internal-External Locus of Control consisted of 11 paired items whose psychometric properties (distributional characteristics, scale reliability, and item-test correlations) were found to be similar to the full 29 item Rotter I-E Scale. The items retained the forced-choice feature used by Rotter in which the respondent is required to indicate which of two statements one internal, and one external, is closest to his views. The respondent was asked to indicate if the statement was much closer or slightly closer to his own opinion. The scoring of the test was done as follows:

- 1- internal response-much closer

- 2- internal response-slightly closer
- 3- external response-slightly closer
- 4- external response-much closer.

The total score on the scale was obtained by summing the values on all 11 scale items. Thus, the theoretical range of scores was from 11 (internal)-44 (external).

CHAPTER IV
METHODOLOGY AND RESEARCH DESIGN

I. RESEARCH DESIGN

The research design selected for this experiment is the "three-group, before-after" design as outlined by Kerlinger (1973 p. 339).

	Y _b		X		Y _a	
R	Y _b	~	X		Y _a	(Control 1)
			X		Y _a	(Control 2)

The strengths of this design include: (1) a control group, (2) randomization, (3) pre-test-post-test, (4) avoids possible interactive effects due to sensitization of the pre-test. This design is ideally suited to study change and the effects of an experimental treatment.

In this design subjects (teams) are assigned to the experimental group (top line) and the control group (bottom line) and are pre tested on the measures Y, the dependent variables. Analysis of difference can be performed at Time 1. The experimental manipulation X is performed, after which the two groups are again measured on Y. The measures produced by the second control group at Time 2 should indicate that the scores of the first control group at Time 2 were not unduly sensitized by the administration of the pre test.

Delineation of the Variables

Independent Variable: type of hockey participation.

- (1) Control group: non-contact, highly competitive

Intramural hockey.

- (2) Experimental group: open environment, non competitive, emphasis on fitness, skill development and recreation.

Dependent Variables: skill, fitness, attitude, commitment, locus of control.

II. SELECTION OF THE SAMPLE

Control of as many variables as possible was attempted in selecting the sample. Demographic factors such as age, weight, and number of years in hockey have been documented. A skill factor has also been introduced which helps to substantiate the homogeneity of the sample. Uncontrolled variables therefore, have been considered in assessing the sources of variance to be explained by the treatment effect.

The element of randomness was also considered for the selection of teams into both the experimental and control groups. Practical considerations prevented the assignment of subjects to groups at random. As is true of any experiment where volunteers are used, the initial likeness of the two groups on the pre test could be affected by an uncontrolled variable characteristic to only one group of volunteers. However, the choice of teams for both the experimental league and the control group were selected at random. The selection difficulty of using volunteers therefore, disappears. While external validity or representativeness is somewhat decreased by the use of volunteers, the homogeneity or matching of like

subjects by use of a pre-test design thereby restores the principles of random selection.

The research design used in this experiment has also taken into account any pre-test, post-test sensitization effect that could alter variance to be explained by the treatment effect. A second control group, selected at random was tested at time 2.

III. COLLECTION OF THE DATA

Several research techniques have been used in the collection of data for this study. These included qualitative informative from two sources: (1) video-taped interviews, (2) the open-ended questionnaire. Quantitative data was secured from both the skill-fitness tests and the paper and pencil psychological scales.

The intramural ice-hockey programme at the University of Windsor was then selected for the investigation. After an initial presentation to the captains of all teams in the intramural league, a follow up letter describing the experimental game and its rules was sent to the teams who expressed interest in taking part in the ten week programme (see Appendix B). Of these, four were selected at random. Data was likewise collected at random from four teams who participated in the regular intramural league. Incentives to participate were minimized (i.e. ice-time was made available for the experimental group and a fitness and skill test for the control group).

A pilot study preceded the formation of the experimental league. Data was collected from the teams that took part. The teams invited were the University of Windsor Lancers and the Essex 73's, a Jr. B hockey club. This pilot session was designed to: (1) test and modify the rules of the game (2) attain feedback from the players about the game (3) pre-test the scales for ease of administration and for the calculation of reliability.

Data was collected at the arena and in the physiology laboratory. The hockey skills test was performed on the ice. The control group was tested prior to practice games at the start of the season. The experimental group had skill testing before the first game of the Hi-Speed season.

The bicycle ergometer was stationed both at the arena and in the lab. Paper and pencil tests were administered in the dressing room before games. The investigator was present to control test situations and provided consistent instructions outlining how to complete each test.

IV. ANALYSIS OF THE DATA

The analysis of the data involved statistical procedures for two distinct areas within the thesis.

1. To determine the significance of difference between the mean responses and scores attained from the control and experimental groups for both the pre-test and post-test.

2. To determine statistical reliability and validity for the tests and measurements selected and constructed for

this experiment.

The statistical analyses were performed by an SPSS programme on the University of Windsor IBM S/370 computer.

Analysis of Differences

The SPSS sub-programme CONDESCRIPTIVE produced a CODE BOOK of mean, variance, standard deviation and standard error for all variables tested on each group. To determine the significance of difference between the mean responses and scores, the groups were compared on all variables by the use of a t-test.

The SPSS sub-programme T-TEST provided a test of statistical significance between the means of the two groups for both the pre-test and post-test. The sub-programme provides for the two computational formulae used to calculate a t-value. A t-test for independent samples compared the differences between groups and a t-test for paired samples compared each group pre to post. The probability of any difference occurring by chance is reported for a two-tailed test unless otherwise indicated.

An SPSS sub-programme DISCRIMINANT was used to analyze the significance of group separation and to classify group membership. The analysis was performed on post test data only as it was hypothesized that a discriminant function would not separate the groups before treatment.

The sub-programme produced group means, standard deviations, a total covariance matrix, separate and pooled group matrices, a stepwise discriminant function and classification results

for predicted group membership. As a statistical procedure discriminant analysis will determine the significance with which the discriminating variables actually discriminate between the groups and further will provide the degree to which the variables successfully classify group membership. No single variable is likely to discriminate perfectly between the two groups, but by mathematically combining them, a single dimension along which the groups cluster at different points may be found.

Measures of Relations

An SPSS sub-programme PEARSON CORR was used to produce a measure of reliability and validity for the scales constructed for use in this experiment. Pearson correlation coefficients were calculated to determine test-retest reliability of both the commitment to hockey scale and the attitude scale. A correlation matrix assessing construct validity was produced for the items of the attitude scale.

Reliability and Validity of the Tests and Measurements

Skill-Fitness Instruments

Hermiston Hockey Skills Test

The Hermiston Standardized Hockey Skills Test was developed by Dr. R.T. Hermiston, an exercise physiologist and an active designer of hockey programs at the University of Windsor and in the nearby community of LaSalle. The test was constructed to yield an overall rating of hockey

ability. Results of the Hermiston test when compared to two other predictive measures, indicated that the Hermiston Hockey Ability Test was the best predictor ($r=.7$) with the results of the other two tests showing a coefficient of correlation of approximately 0.5 (Hermiston et al, 1979). It was therefore concluded that a hockey players ability correlated significantly with performance on the Hermiston test.

Wingate Thirty-Second Anaerobic Test (AN30)

An example of raw data collected from this test is summarized in Appendix A . Two components are associated with performance on the AN30: total AN30 power and peak power. Total AN30 power was used in this study. The total AN30 power relative to body weight is significantly related to oxygen debt relative to body weight ($r=0.63$). The relationship between peak power/kg. and oxygen debt/kg. during the first minute of recovery after the AN30 yielded a correlation coefficient of $r=0.85$. Validation of the AN30 when compared to the Margaria Stair-Climb test produced a correlation of $r=0.84$ (Jacobs, 1979).

Psychological Instruments

Attitudes About Playing Hockey

A list of 50 original items drawn from interviews and related literature was reduced to produce a 30 item summated rating scale according to the Likert technique of attitude

scale construction (Murphy and Likert, 1966).

Reliability of the scale was calculated by the test-retest method of correlating scores from the control group subjects (no treatment). An SPSS sub-programme PEARSON CORR was used to perform the analysis. The subsequent reliability of the scale produced a test-retest reliability coefficient of $r=0.93$ which is significant at the 99% level of confidence ($p<.01$).

Validity, as defined as the accuracy with which an instrument actually measures what it is intended to measure, was calculated using the method of construct validity (Magnusson, 1966). The concept of construct validity is especially useful when external criteria are not available. An SPSS sub-programme PEARSON CORR produced an intercorrelation matrix between single items on different parts of the test. The underlying variables of the test must have a high intercorrelation if the test is to be regarded as measuring a unitary variable. Table 2 reports the intercorrelation coefficients for ratings of the variable "competitive attitude toward playing hockey".

When interpreting the coefficients several factors must be considered which limit the magnitude of the correlation. The items correlated measure essentially the same concept but are worded differently. The correlation therefore, indicates the degree to which the items measure similar but not identical constructs. Further, as an expression of construct validity, the correlated items are only subsets

of the overall raw score and as such the validity is limited by the degree to which these measures are indicators of the overall attitude.

The items which measured the social aspects of playing hockey produced a correlation coefficient of $r=.37$. Concepts such as companionship and a sense of belonging to a team were felt to contribute to the recreational aspects of attitude. The fitness components produced a correlation coefficient of $r=.47$. An emphasis placed on playing to increase personal fitness as opposed to playing for competitive reasons would also lead to an overall "recreational" orientation. The recreational component in itself was measured by ratings of relaxation and a change from everyday life. These items produced a correlation coefficient of $r=.40$.

Commitment to Hockey (CH)

Reliability of the Carmack and Martens Scale (Commitment to Running, 1979) was calculated using the analysis of variance procedure outlined by Kerlinger (1973 pp. 448-449). The reliability coefficient thereby attained was .93. Internal consistency was assessed also by calculating a correlation matrix among the 12 items of the scale; from this matrix, a mean inter-item correlation coefficient of .30 was produced. The Kuder-Richardson formula 20 was then applied obtaining a reliability coefficient of .97.

The modified scale used in this present study (Commit-

ment to Hockey) was constructed by replacing the word "running" with the phrase "playing hockey". The 12 item scale was pilot tested and data was collected from twenty-five (25) subjects. The subsequent reliability of this scale was calculated according to the test-retest procedure to produce a reliability coefficient of $r=.77$ which is significant at the 99% level of confidence.

An SPSS sub-programme PEARSON CORR produced an inter-correlation matrix between single items of the test as a measure of construct validity. Table 3 reports the inter-correlation coefficients produced by the items of the commitment to hockey scale. The items which measured commitment produced a correlation coefficient of .50. Enjoyment was determined by ratings of how playing hockey contributed to overall enjoyment of life and produced a correlation coefficient of .60. Drudgery, a measure of feelings derived from playing hockey produced a correlation coefficient of .71.

The intercorrelation matrix produced for items from both the commitment scale and the attitude scale is shown in Table 4. The correlation coefficients for each item are reported with their corresponding level of significance. All items were correlated as independent measurements. Variables shown numerically as 1,2,3,7,8,9 pertain to the attitude scale. Variables 4,5,6,10,11,12 pertain to the commitment scale. Low or negative correlations within the matrix indicate that those items are measuring different

TABLE 2

INTERCORRELATION COEFFICIENTS BASED ON ITEMS IN THE ATTITUDE SCALE
(n=30)

Variable	Social	Fitness	Recreation
Social	0.37		
Fitness		0.47	
Recreation			0.40

TABLE 3

INTERCORRELATION COEFFICIENTS BASED ON ITEMS IN THE COMMITMENT SCALE
(n=30)

Variable	Commitment	Enjoyment	Drudgery
Commitment	0.50		
Enjoyment		0.60	
Drudgery			0.71

TABLE 4

CORRELATION MATRIX FOR ATTITUDE AND COMMITMENT VARIABLES

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12
V1	1.0000 P=0.0											
V2	0.3185 P=0.043	1.0000 P=0.0										
V3	0.3844 P=0.018	0.3390 P=0.033	1.0000 P=0.0									
V4	0.2286 P=0.112	0.1547 P=0.207	0.3147 P=0.045	1.0000 P=0.0								
V5	0.4170 P=0.011	0.1222 P=0.260	-0.0588 P=0.379	0.4708 P=0.004	1.0000 P=0.0							
V6	0.3268 P=0.039	0.0902 P=0.318	0.4184 P=0.011	0.4423 P=0.007	0.0951 P=0.309	1.0000 P=0.0						
V7	0.3667 P=0.023	0.0555 P=0.385	0.3009 P=0.053	0.1021 P=0.296	0.0142 P=0.470	0.2171 P=0.125	1.0000 P=0.0					
V8	0.5801 P=0.000	0.4686 P=0.005	0.4155 P=0.011	0.2358 P=0.105	0.2104 P=0.132	0.1480 P=0.218	0.5180 P=0.002	1.0000 P=0.0				
V9	0.3329 P=0.036	0.3336 P=0.036	0.4012 P=0.014	0.0927 P=0.313	-0.0423 P=0.412	0.3909 P=0.016	0.0355 P=0.426	0.2687 P=0.076	1.0000 P=0.0			
V10	0.4102 P=0.012	0.1260 P=0.254	0.3273 P=0.039	0.5035 P=0.002	0.4533 P=0.006	0.5602 P=0.001	0.1293 P=0.248	0.2240 P=0.117	0.3129 P=0.046	1.0000 P=0.0		
V11	0.4314 P=0.009	0.2973 P=0.055	0.1751 P=0.177	0.5021 P=0.002	0.5959 P=0.000	0.2676 P=0.076	0.3380 P=0.034	-0.1203 P=0.263	0.3331 P=0.036	1.0000 P=0.0		
V12	0.2228 P=0.118	0.0114 P=0.476	0.2937 P=0.058	0.7084 P=0.000	0.3459 P=0.031	0.7137 P=0.000	0.1287 P=0.249	0.2433 P=0.098	0.2761 P=0.070	0.6020 P=0.000	0.1809 P=0.169	1.0000 P=0.0

concepts, thereby contributing an additional test of construct validity.

Locus of Control

The abbreviated measure of internal-external locus of control developed by Valecha and Ostrom (1974) has produced similar scale-reliability to the full 29 item Rotter I-E scale. The abbreviated scale was pre-tested along with the Rotter scale to produce a correlation coefficient $r=.69$. Split-half and test-retest reliability coefficients obtained on the original Rotter scale averaged about $r=.70$. A four part differentiated response ("much closer", "slightly closer") further improved the reliability of the scale.

CHAPTER V
RESULTS AND INTERPRETATIONS

The results reported in this chapter have been organized according to the variables and the type of analysis selected for their interpretation. The chapter, therefore, is divided into four sections. Section one reports the demographic information describing the characteristics of the sample used in this experiment. This section also documents the subjects reasons for playing hockey, information secured from the open-ended "general information questionnaire". Section two reports the ice-time differences and duration of play between the two game conditions. Section three reports the psycho-physiological changes associated with participation in ten weeks of the experimental programme. Section four deals with the differences between the experimental and control groups using a stepwise discriminant analysis. Group separation was examined for nine psychological variables which were entered into the analysis.

I. DEMOGRAPHIC INFORMATION AND REASONS FOR
PLAYING HOCKEY

The demographic information for both the control and experimental groups is reported in Table 5. The demographic information was collected to control for variance on such factors as age and number of years in hockey. The level of significance derived from the analysis produced no signif-

TABLE 5
 DEMOGRAPHIC INFORMATION OF HI-SPEED AND CONTROL GROUP SUBJECTS
 (n=44)

Variable	Hi-Speed (n=25)		Intramural (n=19)		t-value	Level of Significance
	\bar{x}	S.D.	\bar{x}	S.D.		
Age	24.6	3.31	24.7	2.41	-0.12	0.908
Height (cm)	176.2	7.5	177.7	4.63	-0.82	0.415
Weight (kg)	74.9	10.05	76.2	8.38	-0.46	0.649
Years in Hockey	8.9	3.52	7.3	4.01	1.40	0.171

icant differences between the groups. The average age for a university intramural hockey player is 24.6 years. The experimental group subjects had played an average of 8.9 years of hockey or 1.6 years more than their control group counterparts.

The results of the most frequently expressed reasons for playing hockey appear in Table 6. Subjects were asked to give three reasons for why they began to play hockey and for why they are presently playing. The responses were subsequently classified into five general categories and the very specific or infrequent responses were listed as miscellaneous. The reasons for beginning to play hockey show that Hi-Speed subjects felt that the social aspects (affiliation, friendship) of playing hockey were important whereas the control group subjects expressed personal achievement (goal orientation, success) more frequently than did the experimental group. The reasons for presently playing indicate that Hi-Speed subjects stressed enjoyment while the control group felt that fitness was the most important factor.

II. ICE-TIME AND GAME DURATION

Total playing time and game duration for each playing condition is reported in Table 7. Actual playing time is expressed as a percentage of the total game played. Hi-Speed subjects averaged 56.2% of the total game time (24 minutes) while their intramural counterparts averaged only

TABLE 6
REASONS FOR PLAYING HOCKEY

Beginning	Hi-Speed (%)	Intramural (%)
Influenced by Others	28.1	30.4
Enjoyment	22.8	26.3
Social Aspects	15.8	8.8
Fitness	14.0	12.3
Personal Achievement	8.8	14.0
Miscellaneous	10.5	8.8
Present	Hi-Speed (%)	Intramural (%)
Enjoyment	35.1	21.8
Fitness	26.3	27.3
Social Aspects	21.5	21.8
Personal Achievement	17.5	21.8
Influenced by Others	0.0	2.0
Miscellaneous	0.0	5.5

TABLE 7
 ICE TIME FOR EACH PLAYING CONDITION
 (n=14)

Variable	Hi-Speed (\bar{x} min)	Intramural (\bar{x} min)
Time on the Bench	8.2	26.5
Time for Whistles	1.0	6.54
Time Between Periods	2.0	1.76
Time Puck in Play	21.0	38.7
Total Playing Time	11.8	12.2
Percentage of Total Game Played	56.2*	31.5*
Total Game Time	24	47
Pre Game Warm-up	6	6
Total Ice Time Alloted for 1 Game	30	53

*Ice Time Difference Between Groups Significant ($p < .01$)

31.5% of the total game time (53 minutes). The actual playing time derived from a one hour game was very similar to a study by Montgomery and Vartzbedian (1979) who reported that participants average 29% of the total ice-time allotted for one game. Actual playing time increased significantly ($p < .01$) in the experimental situation when total non-playing time was held constant.

Hi-Speed participants averaged 8.2 minutes per game on the bench or 34.1% of the total game. Participants in the regular intramural game of 53 minutes in duration averaged 26.5 minutes or 56.3% of the total game time sitting on the bench. The initial goal of the experimental programme therefore, has been satisfied the game was designed to increase actual playing time and to limit many of the needless stoppages in play. It must be stated, however, that while actual playing time varied significantly between the two game conditions, the introduction of this new variable (actual playing time) has not sacrificed the basic criterion of experimental control. Actual playing time was systematically controlled throughout the experiment.

Data on the ice-time was collected for both groups. This contribution to experimental control was essential to monitor treatment effect incurred through Hi-Speed participation. Variability between the two test conditions on ice-time alone would confound the results of the experiment. Experimental subjects played ten games of Hi-Speed Hockey or the equivalent total playing time of five intramural

games over the test-retest period. The intramural subjects played ten games in this same period or the equivalent playing time derived from the Hi-Speed programme. The total ice-time allotted for Hi-Speed which provided the same amount of actual playing time was thereby reduced by half. In an attempt to maximize ice-time utilization it is fair to calculate that in one hour of Hi-Speed Hockey four teams or twenty-four players are provided with hockey. In the same one hour of allotted ice-time, two teams or approximately twenty-four intramural players are also serviced with hockey but receive significantly less playing time. Hi-Speed Hockey has provided significantly more playing time to the same number of participants in one-hour of ice-time.

By playing more the participant greatly increases the number of opportunities to handle the puck, an activity deemed fundamental to both skill acquisition and mastery of the hockey playing environment. It is felt that the increased playing time and reduced time on the bench will initiate feelings of greater overall contribution and enjoyment. This in turn will produce subsequent changes in the selected psycho-physiological attributes of the experimental participants. The findings of the study, therefore, are based on a controlled treatment administered to a sampling of subjects who receive a fixed total amount of ice-time but whose treatment is based upon the conditions of the game in the modified hockey environment.

III. SKILL, FITNESS AND PSYCHOLOGICAL VARIABLES

The psycho-physiological differences between the experimental and control groups pre and post are summarized in Table 8. The levels of significance reported in Table 5 indicate that pre to post differential effects for all variables analyzed produced no significant differences. As hypothesized scores showed that the two groups were very similar on all measures at the pre-test. When retested the difference between the Hi-Speed and control group subjects showed that experimental group subjects did not change significantly more than did their control group counterparts. Significant pre to post changes did occur however, when the scores of the experimental group were subjected to a correlated test of significance to determine the magnitude of the treatment effect among experimental group subjects only.

These pre to post directional changes and their standard deviations for each group are summarized graphically for all variables. Figure 1 shows that the control group improved performance on the skill test slightly over the ten week period while the experimental group hardly changed at all. The Hi-Speed participants began the experiment with a lower mean performance score on the test. Figure 2 illustrates pre to post differences in commitment to hockey scores between the two groups.

The control group began the experiment with a higher mean commitment score (50.5) than did the experimental group (47.1) however, over the same test re-test period commitment

TABLE 8
 PSYCHO-PHYSIOLOGICAL DIFFERENCES BETWEEN GROUPS PRE AND POST
 (n=38)

Variable	Hi-Speed (n=19)		Intramural (n=19)		t-value	Level of Significance
	\bar{x}	S.D.	\bar{x}	S.D.		
Skill Pre	41.5	3.67	42.1	4.75	-0.31	.763
Skill Post	40.0	2.49	39.8	5.28	0.06	.945
Fitness Pre	42.6	7.87	40.0	7.00	-1.10	.283
Fitness Post	45.9	5.0	44.2	1.32	1.17	.256
Attitude Pre	107.2	7.71	108.6	6.33	-0.60	.554
Attitude Post	109.0	8.05	107.2	7.95	0.63	.534
Commitment Pre	47.1	6.25	50.5	5.45	-1.80	.080
Commitment Post	48.8	6.04	49.9	6.45	-0.52	.610
Internality Pre	23.4	3.45	23.5	4.75	-0.13	.900
Internality Post	23.3	4.31	24.9	3.63	-1.19	.242

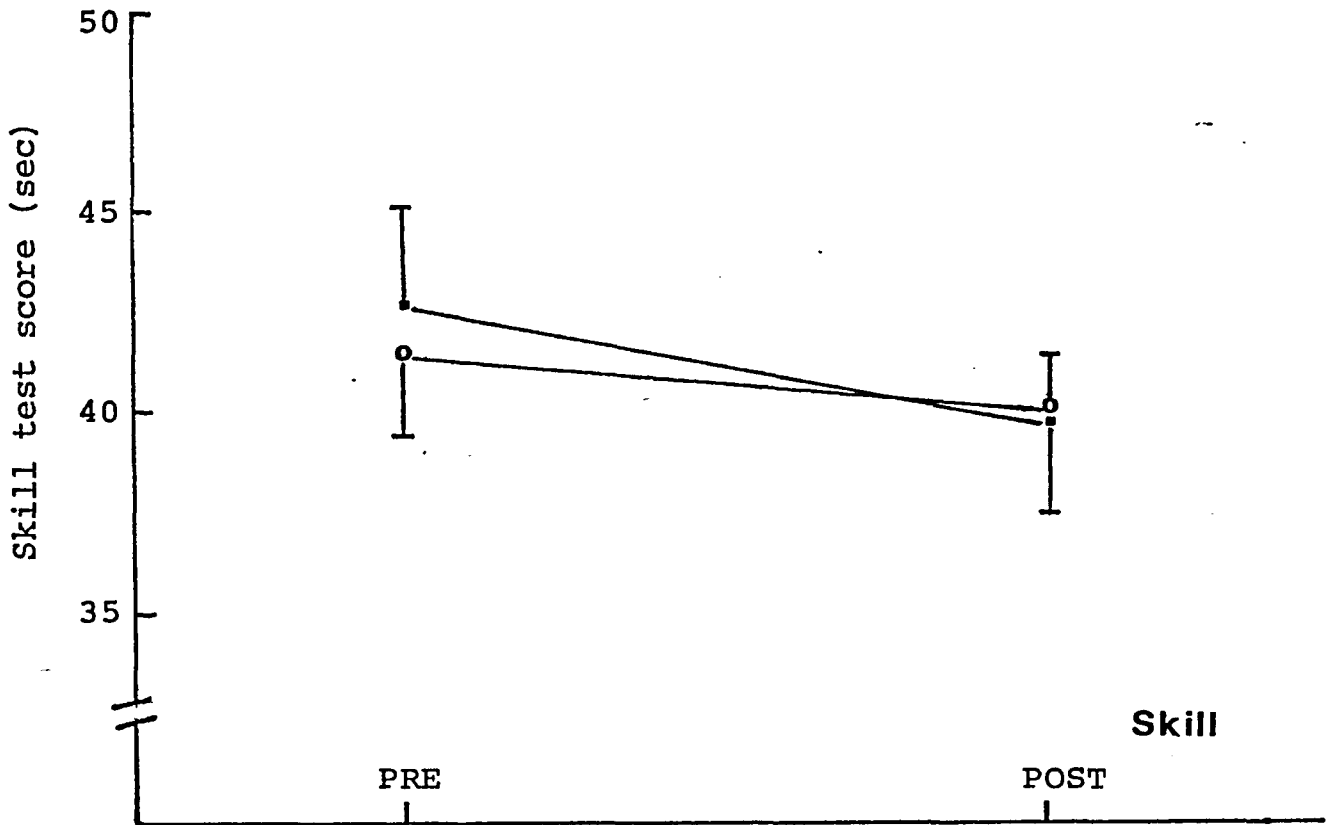


Fig. 1. Change in skill.

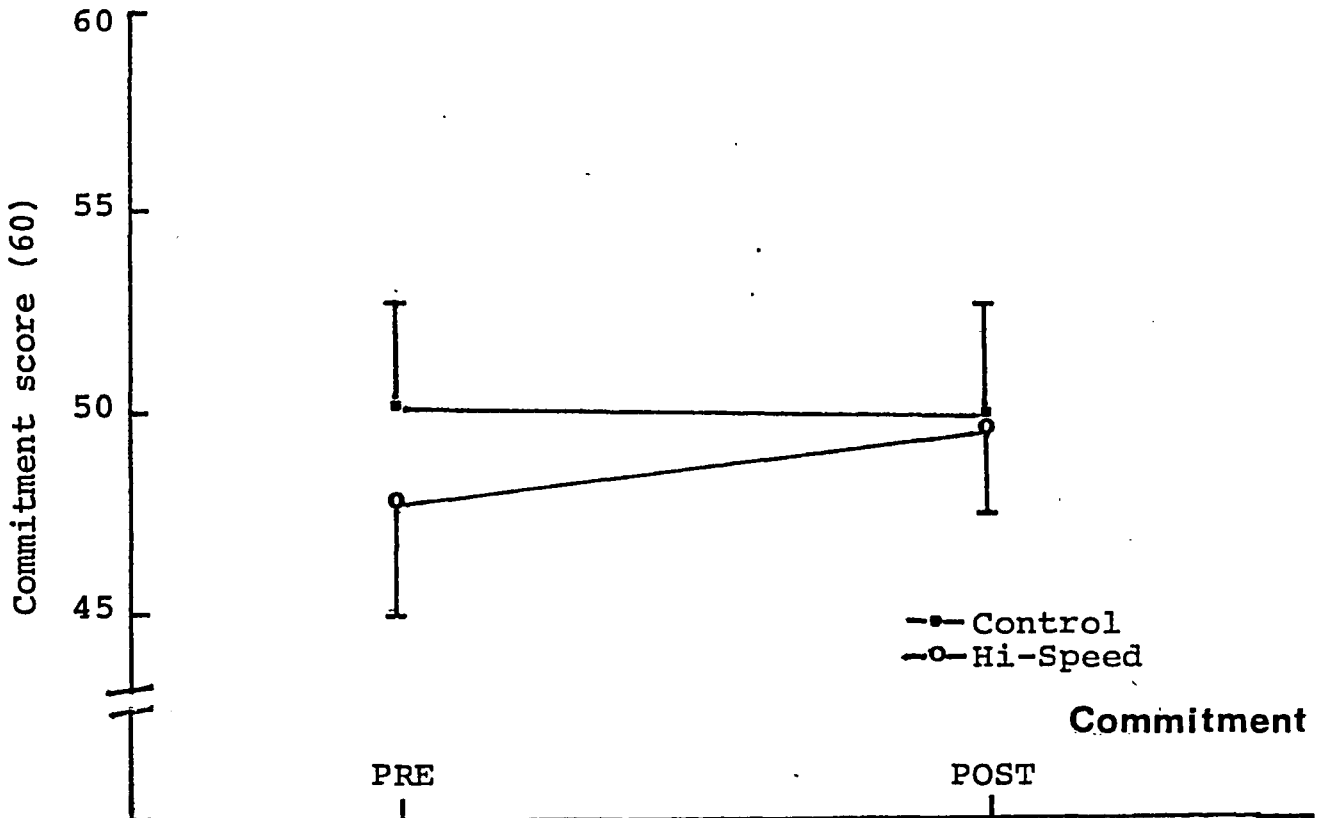


Fig. 2. Change in commitment.

among control group subjects actually decreased (49.9) while commitment scores for the experimental group increased (48.8). Figure 3 reports changes in body weight. The control group started the experiment heavier than the experimental group and showed a gain in body weight while their experimental counterparts maintained the same weight over the test-retest period. Figure 4 illustrates the pre and post differences in anaerobic fitness. The control group began the experiment less fit than the experimental group and did not increase fitness as much as the experimental group when retested at the end of the experiment. Figure 5 illustrates the differential effects in competitive attitudes toward hockey. A higher score indicates a more recreational orientation. Control group subjects began the experiment with a higher mean attitude score (108.6) than did the experimental group and became more competitive (107.2) over the ten week period. The experimental group began with a mean attitude score (107.2) and increased to a more recreational score (108.9) at the completion of the experiment. The differential change toward a more recreational attitude among the Hi-Speed subjects with a concurrent increase in competitive attitude among intramural subjects supports the hypothesis that Hi-Speed Hockey can foster a more recreational orientation toward playing hockey. Figure 6 reports pre to post changes in locus of control. A decrease in the mean value indicates a shift toward internality. Control group subjects became more external (controlled by others

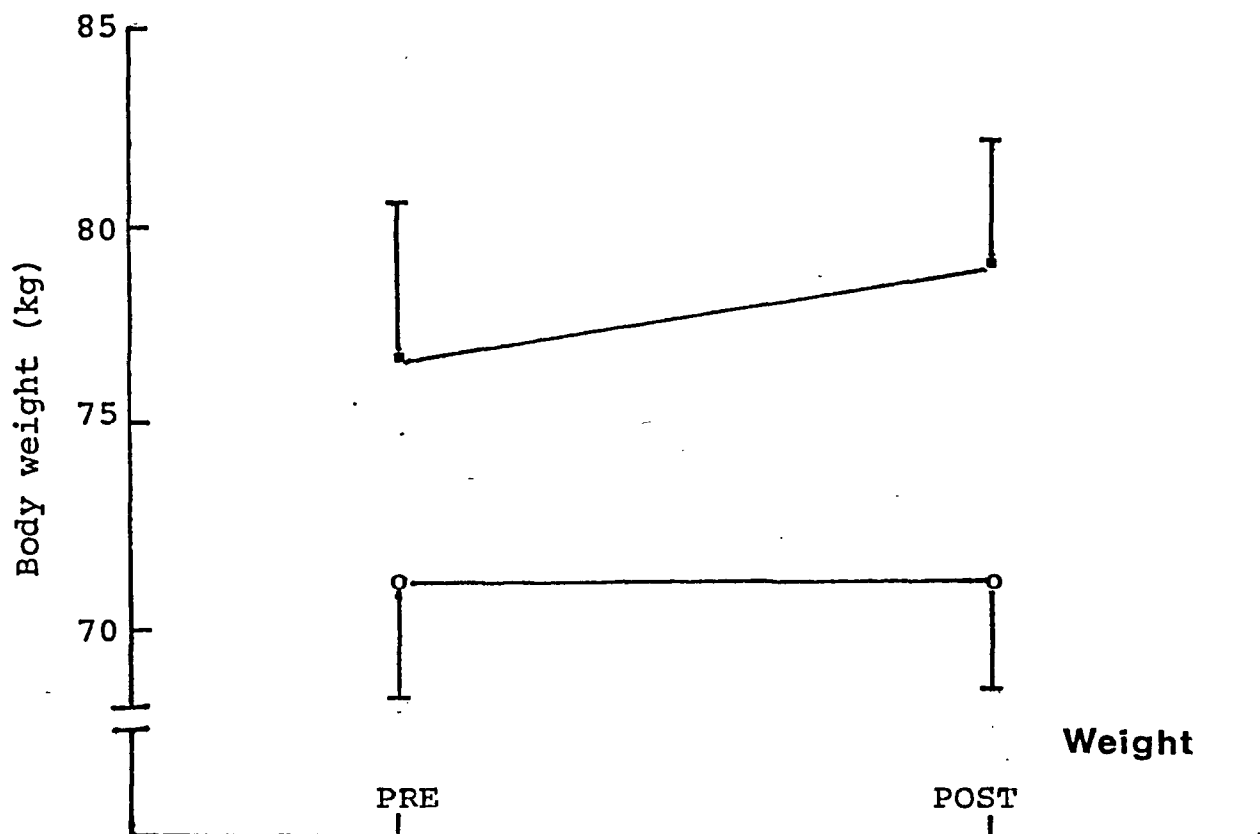


Fig. 3. Change in body weight.

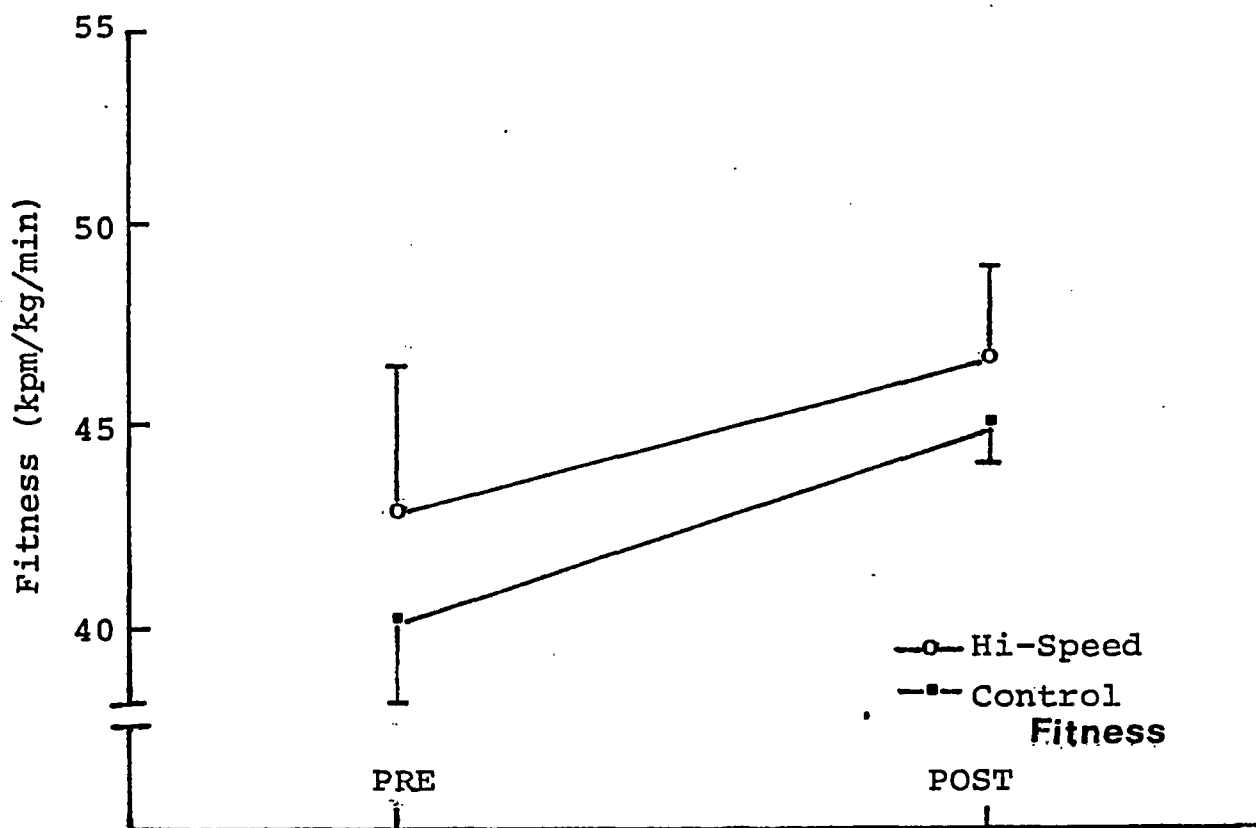


Fig. 4. Change in anaerobic fitness.

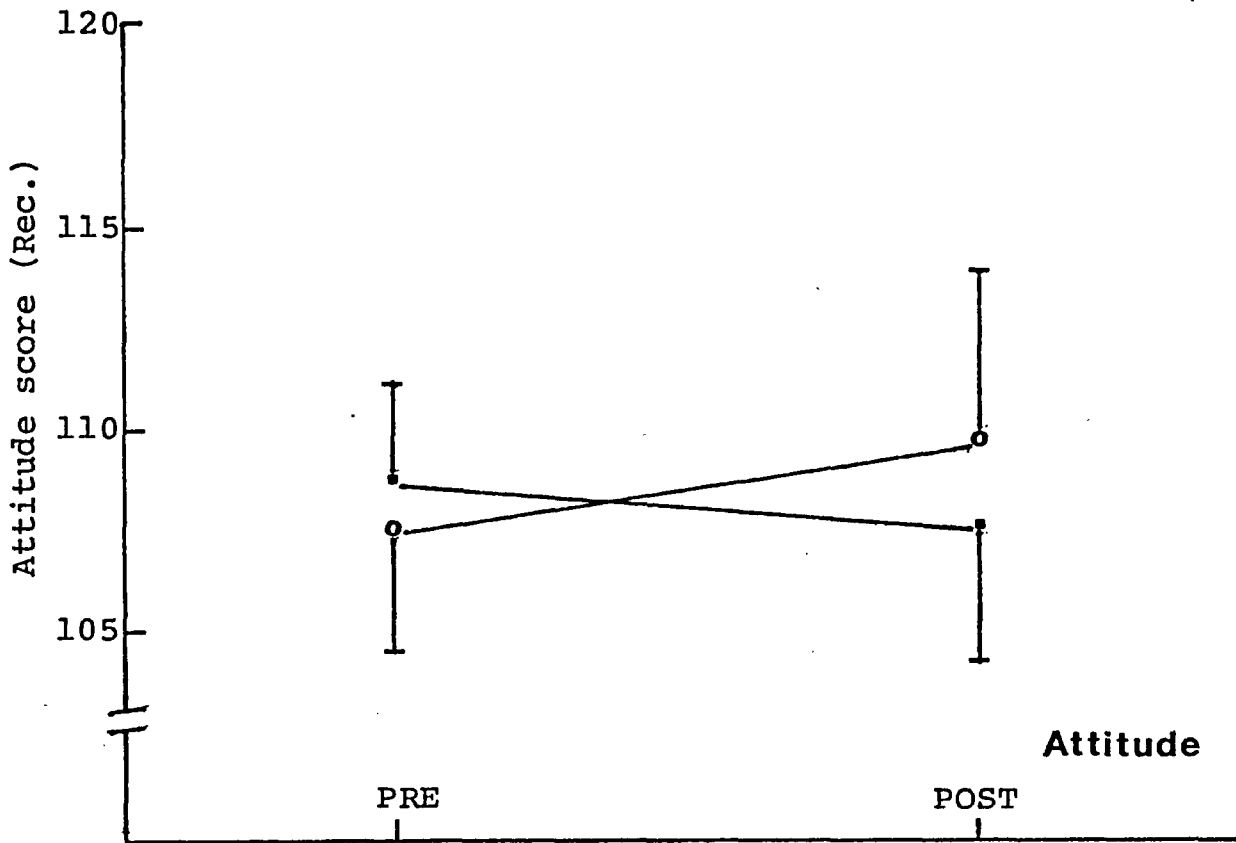


Fig. 5. Change in competitive attitude.

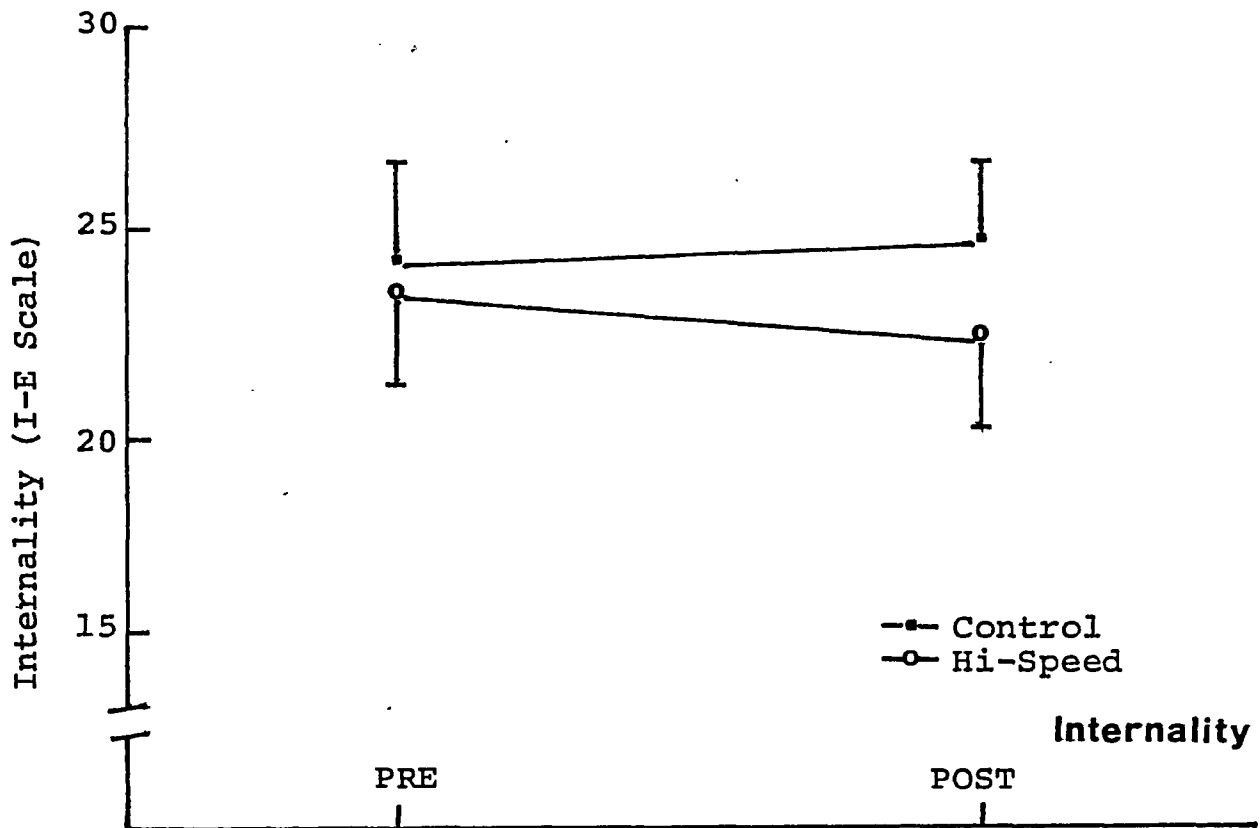


Fig. 6. Change in internality.

luck, chance) during this experiment while their Hi-Speed counterparts demonstrated a shift toward a more internal orientation (self control).

Table 9 reports the mean standard deviation and level of significance for a second control group tested at time two only. This group was included as a control for a test-retest sensitization effect in accordance with the design of the experiment. There were no significant differences between control group one and the second control group tested at time two only. The scores from the three psychological scales were analyzed using a t-test for independent samples and the two tailed probability is summarized in Table 6. The attitude score for the second control group while not significantly different is somewhat lower (103.5) than the score reported for control group one (107.2) indicating a more competitive orientation. Subjects composing the two teams which made up the second control group were tested before a game which was to determine their eligibility for the intramural playoffs. The two teams which made up control group one were already assured of a playoff position when tested which accounts for a lower competitive attitude score for this group.

The psycho-physiological changes associated with ten weeks of intramural hockey are reported in Table 10. Pre to post scores on all variables for control group subjects produced no significant differences. The level of significance is reported for a two-tailed test; reflecting the

TABLE 9.
 TEST-RETEST CONTROL GROUP SENSITIZATION
 (n=19)

Variable	Control 1		Control 2		t-value	Level of Significance
	\bar{x}	S.D.	\bar{x}	S.D.		
Attitude	107.2	7.95	103.5	11.73	1.09	.284
Commitment	49.9	6.45	48.5	4.87	0.71	.486
Internality	24.9	3.63	24.9	1.83	0.04	.966

TABLE 10

PSYCHO-PHYSIOLOGICAL CHANGES ASSOCIATED WITH TEN WEEKS
OF INTRAMURAL HOCKEY
(n=19)

Variable	Pre \bar{x}	S.D.	Post \bar{x}	S.D.	Mean Diff.	t-value	Level of Significance
Skill (sec)	42.1	4.51	39.8	5.28	-2.3	0.70	0.533
Fitness (kpm/kg/min) (n=5)	39.6	7.00	43.6	1.81	4.0	-1.03	0.492
Weight (kg)	76.2	8.38	78.9	8.08	2.7	-0.54	0.625
Attitude	108.6	6.33	107.2	7.95	-1.4	0.53	0.601
Commitment	50.5	5.25	49.9	6.45	-0.6	0.28	0.781
Internality	23.4	4.78	24.9	3.63	1.5	-1.03	0.311

initial hypothesis that no directional change was expected for the control group. On the variable skill, control group subjects improved performance slightly over the ten week period. Anaerobic fitness as expected, increased as a function of active participation in hockey but did not increase significantly. Pre to post body weight changes showed that control group subjects gained 2.7 kg. Test-retest scores on the competitive attitude scale produced a decrease in recreational attitude or conversely, a shift toward a more competitive orientation toward playing hockey. This finding supports the underlying position that regular intramural hockey at the university level increases the competitive attitudes of its participants. Scores on the commitment to hockey scale produced a marginal decrease. The most prominent psychological change among control group subjects was a shift toward a more external frame of reference over the ten week experiment. A change in locus of control especially toward externality among subjects whose average age was 24.7 years suggests that a series of significant events took place to alter the score of the control group subjects during the test-retest period. The increase in externality over this short period of time indicates that a shift toward an external orientation can occur. The increase noted may reflect the demands placed upon the subjects by a large university residence to secure the intramural hockey championship.

Table 11 reports the results of the treatment effect

TABLE 11
 PSYCHO-PHYSIOLOGICAL CHANGES ASSOCIATED WITH TEN WEEKS OF
 HI-SPEED HOCKEY
 (n=24)

Variable	Pre \bar{x}	S.D.	Post \bar{x}	S.D.	Mean Diff.	t-value	Level of Significance
Skill (sec)	41.3	2.98	41.5	3.96	0.2	-0.13	0.453
Fitness (kpm/kg/min)	42.6	6.67	46.7	3.88	4.2	-2.54*	0.013
Weight (kg)	71.2	14.57	71.1	17.57	-0.1	0.07	0.474
Attitude	106.7	7.86	107.1	6.63	0.4	-0.27	0.395
Commitment	47.1	6.99	47.8	6.15	0.7	-0.61	0.275
Internality	23.2	3.49	22.3	3.50	-0.9	1.47	0.083

* Significant at $p < .01$

measured for the experimental group. Pre to post changes associated with the ten weeks of Hi-Speed Hockey are given. Levels of significance are reported for a one tailed test reflecting the initial hypothesis that Hi-Speed subjects would produce directional change on all variables. Pre to post treatment effects among experimental subjects produced one significant difference. Hi-Speed subjects incurred an anaerobic fitness increment significant at the 99% level of confidence ($p < .01$). The three psychological variables; attitude, commitment, and locus of control all produced directional change in accordance with the experimental hypotheses. Hi-Speed subjects showed a decrease in competitive attitude over the ten week period marking a shift or emphasis toward the recreational aspects of playing hockey. This change was accompanied by an increased score on the commitment to hockey scale reflecting heightened or renewed enjoyment and dedication to playing hockey. On the locus of control variable, experimental group subjects produced a notable shift toward a more internal frame of reference, a finding in compliance with the basic premise underlying the experiment. The initial experimental hypothesis stated that internality would increase among Hi-Speed subjects as a function of increased feelings of personal control stemming from participation in the modified hockey environment.

Group responses to the six concepts which collectively contribute to the overall score on the attitude scale are reported in Table 12. Levels of significance were calculated

TABLE 12

CHANGES IN ATTITUDE ASSOCIATED WITH TEN WEEKS
OF HI-SPEED HOCKEY
(n=50)

Item	Hi-Speed (n=20)		Intramural (n=30)		t-value	Level of Significance
	\bar{x}	S.D.	\bar{x}	S.D.		
Aggression	3.50	0.95	2.83	0.95	2.44**	.009
Competition	2.85	1.09	2.63	1.03	0.70	.243
Skill Environment	3.15	1.39	2.53	1.17	1.64*	.055
Winning	3.85	0.86	3.53	1.25	1.05	.149
Team Aggression	2.95	1.25	2.76	0.90	0.57	.286
Utility	2.70	1.03	2.53	0.97	0.57	.285

** Significant $p < .01$

* Significant $p < .05$

for a one-tailed directional test. The analysis produced two significant differences between the control and experimental groups. Control group subjects scored significantly higher ($p < .01$) than did the experimental group on the aggression variable. Hi-Speed subjects felt less hostile toward their opponents by rating this action less acceptable than did their intramural counterparts. Control and experimental group subjects differed significantly ($p < .05$) on rating the emphasis placed on hockey skill. Control group subjects felt that recreational hockey did not require the same degree of skill as would a more competitive hockey environment.

Control group subjects showed a preference for a competitive hockey environment over a recreational one and felt that winning was an indicator of success in hockey.

Control group subjects rated an aggressive team as having a better chance of winning and felt that the present game was more likely to continue in its present form without changes.

IV. ANALYSIS OF GROUP SEPARATION

The selection of discriminant analysis as a statistical procedure was based on its ability to distinguish between the two groups involved in the experiment. In order to determine if the groups showed systematic differences as a result of the experiment, a set of discriminating variables on which the groups were expected to differ was entered into

the analysis. These variables and the group means are reported in Table 13. The discriminant analysis was performed on data collected at time two, so that the groups would be distinguished on the basis of the experimental effect. It is hypothesized that the discriminant function would not distinguish or separate the groups on any Time one variable. However, it is implicit that the discriminating variables would classify the two groups on any of the variables after the treatment effect.

The mathematical objective of discriminant analysis is to force the groups to be as statistically distinct as possible by maximizing the F ratio (Nie, Hull, et al, 1975). This group separation indicates which psychological attributes best represents a players inclusion into one of the two game conditions. We would expect therefore, that members of the Hi-Speed group would differ from the control group on a set of psychological variables measured after the experimental manipulation.

The variables were entered into the analysis in a stepwise fashion. The stepwise method selects the variables on the basis of their discriminating power. At each step a variable is removed indicating it to be the best group discriminator and all remaining variables are re-entered. The next best discriminator is selected at each step. Five stepwise criteria are available in the SPSS sub-programme DISCRIMINANT. The criterion used for this analysis was Rao's V which is a generalized distance measure. When Rao's

TABLE 13
 DISCRIMINATING VARIABLES USED IN THE ANALYSIS

Variable	Hi-Speed \bar{x}	Control \bar{x}	Total \bar{x}
Competitive Attitude	108.8	104.9	106.4
Commitment to Hockey	48.8	49.4	49.1
Internality	24.8	24.9	24.8
Aggression	3.5	2.8	3.1
Competitive Environment	2.9	2.6	2.7
Skill Environment	3.2	2.5	2.8
Winning	3.9	3.5	3.7
Team Aggression	3.0	2.8	2.8
Perceived Utility	2.7	2.5	2.6

V is used the variable selected at each step is the one which contributes to the largest increase in V when added to the previous variables (Nie, Hull, 1975). All variables were included in the analysis regardless of their negative or positive contribution to group separation by selecting a minimum inclusion value of 0.0.

When interpreting the step-wise method the step at which each variable is entered into the analysis provides an indication of the importance of that variable in discriminating between the groups. In this analysis, (Table 14) aggression appears to be the most important variable in discriminating between the groups. Whereas preference for a competitive environment appears to be the least important variable. This means that there is significantly more variation between groups on the aggression variable ($p < .014$).

Another measure of the importance of each variable in discriminating between the groups is the F value. The larger the F value, the more important that variable is in discriminating between the groups. However, it is important to note that the column of F values is only approximately related to the order of entry into the analysis. This is due in part to a situation termed Multicollinearity. Multicollinearity arises when some or all of the variables are highly intercorrelated which may affect entrance order. For example utility may be highly correlated with other variables and is entered ahead of the other variables on the basis of its discriminating power. The stepwise discriminant

analysis included two groups and nine psychological variables and the results are found in Table 14. The variable which produced the most significant group separation was aggression. Hi-Speed subjects felt less hostile toward an opponent while control group subjects felt significantly more hostile ($p < .01$). Experimental group responses indicate that hockey can be enjoyed as a game if the need for aggression toward an opponent were removed.

On the variable "skill environment" Hi-Speed subjects assessed the skill requirements of a recreational game to be as important as those found in a competitive game, whereas their control group counterparts significantly differed ($p < .01$) rating a competitive environment to be more skill-full.

The perceived utility of playing hockey was measured by determining if the state of the present game would lead to its ultimate decline. Control group subjects felt that the present game was less likely to decline in popularity and significantly differed ($p < .05$) from the Hi-Speed subjects on this item. If the present game form is rated as being acceptable by control group subjects it would follow that they are more likely to accept the normative conditions that characterize the game. Conversely, Hi-Speed subjects are more likely to reject the unacceptable aspects of the present game and are more likely to accept an alternative game form.

Hi-Speed subjects differed significantly ($p < .05$) from

TABLE 14

A STEPWISE DISCRIMINANT ANALYSIS OF 2 GROUPS AND 9 VARIABLES
(n=50)

Step Number	Item Entered	F To Remove	Wilk's lambda	Sig. of lambda	Rao's V	Sig. of Rao's V
1	Aggression	4.966	.890	.019	5.93**	.014
2	Skill Environment	2.305	.847	.020	8.65**	.013
3	Utility	0.256	.831	.035	9.77*	.021
4	Internality	0.809	.821	.059	10.45*	.033
5	Commitment	0.605	.815	.097	10.92*	.053
6	Team Aggression	0.297	.810	.148	11.28	.080
7	Attitude	0.245	.807	.216	11.51	.118
8	Winning	0.161	.803	.293	11.76	.162
9	Competitive Environment	0.918	.803	.391	11.77	.226

** Increase in V significant $p < .01$

* Increase in V significant $p < .05$

the control group at Time two when measured on the locus of control variable. Hi-Speed subjects became more internal over the experimental period whereas the control group shifted toward a more external orientation.

Step five entered the commitment scores for each group which produced the last discriminating variable that separated the groups significantly ($p < .05$). The control group scored higher on the commitment scale than did their Hi-Speed counterparts at Time two however, as hypothesized the experimental group increased their commitment to hockey over the ten week period whereas the control group actually became less committed to playing.

Steps six through nine failed to separate the groups at the 95% confidence level which indicates that responses on the treatment effect failed to distinguish between the control and experimental group on those variables.

A second feature of discriminant analysis was used to predict which group a particular subject should belong to based on the data used in the analysis. In this experiment each subject was classified into either the control or experimental group and the classification results are reported in Table 15. In the analysis using two groups and nine variables 64% of all cases were correctly classified. This indicates that nearly two-thirds of the subjects were correctly classified as responding in accordance with actual group membership.

In attempting to assess which of the nine variables

TABLE 15
 CLASSIFICATION RESULTS FROM DISCRIMINANT ANALYSIS
 (n=50)

Actual Group	N of Cases	Predicted Group Membership	
		Group 1	Group 2
Group 1 Hi-Speed	20	13 (65.0%)	7 (35.0%)
Group 2 Intramural	30	11 (36.7%)	19 (63.3%)

Percent of "Grouped" Cases Correctly Classified: 64.0%

contributed most significantly to the percentage of cases correctly classified the value of Wilks' Lambda was examined. In a stepwise selection of variables the value of Wilks' Lambda is the overall multivariate F ratio for a test of differences among group centroids. The variable which maximizes the F ratio also minimizes Wilks' Lambda. It can be seen from the values in Table 14, the first five variables reduce the value of Lambda considerably but the remaining four show very small reduction or group discrimination. In order to significantly predict the effects of Hi-Speed Hockey on its participants the number of variables or predicted outcomes therefore, could be reduced to those items which produced significant group differences.

CHAPTER VI
SUMMARY AND CONCLUSIONS

I. SUMMARY

This study was an exploration into the psychology of playing hockey, an area of research which emerged from an ongoing assessment of the effects of athletic competition on the participant. Specifically, this investigation gathered scientific information on a number of people who participated in intramural ice-hockey, a voluntary, self-rewarding activity, selected as a means of recreation. The data was collected from two groups of subjects. A control group consisted of four intramural teams at the University of Windsor. An experimental group of twenty-four individuals in addition to playing the regular game took part in an experimental league, designed to emphasize skill, fitness and recreation. The experiment sought to determine if positive changes among these variables would produce a concurrent reduction of aggression and a shift away from the competitive attitude which predominates throughout hockey. The positive behavioural outcomes derived from participation in the modified game (Hi-Speed Hockey) as a treatment effect, could therefore, be applied to hockey programmes at many levels.

A number of standardized instruments were used in the study but it was also necessary to construct new and specific ways of measuring the attributes which characterize intra-

mural hockey participants. Subsequent reliability and validity indices were calculated for these instruments which produced important information for the analysis and interpretation of the experimental findings.

The variables selected for inclusion in the research were those which provided an accurate and objective assessment of the hockey environment which typifies an intramural participant.

II. CONCLUSIONS

On the basis of the results obtained from the study, it is expedient to consider the usefulness of the topic. The investigation examined two hockey environments; an existing competitive intramural league and an experimental recreational league. Previous work in the area of competition theory has suggested that intramural participation does not increase competitiveness (professionalization of attitude). The evidence from this present study indicates that the modified hockey environment provides a more effective outlet for recreational participants than does the regular league. Positive changes in the variables assessed occurred in the experimental group. Control group subjects in fact, became more competitive during the period of the experiment.

The discriminant analysis was useful in identifying those variables which separate the two groups, one which received a treatment and one which received no treatment. Five variables produced significant differences and predicted

group membership with 64% accuracy. The identification of these variables creates not only an ideal starting point for further investigative research, but the results themselves must be carefully assessed.

1. Aggression, measured by ratings of hostility toward an opponent was found to be significantly higher among the intramural participants. The emphasis placed on winning, even in an intramural environment was sufficient to elicit responses of aggression, a behavioural norm in hockey.

2. Aggressive behaviour in hockey has in many instances replaced the skillful requirements of the game. Players who lack ability, have found success by substituting aggression for skill. It was hypothesized that this substitution would not take place at the recreational level. Ideally, as the normative components of a competitive hockey environment are reduced (aggression, hostility, retaliation), the skill demands required for performance should increase. Control group subjects, however, felt that hockey skill was not an essential requirement for participation in recreational hockey. The experimental group rated the skill requirements of a recreational setting to be as important as those found in a more competitive environment. Mean ratings of the experimental group suggests that in competitive or recreational hockey skill should not be sacrificed to meet the demands of the situation.

3. The perceived utility of existing hockey programmes was viewed differently by the two groups. Control group subjects felt that the present condition of hockey would

not lead to a decline in the games's popularity. The experimental group revealed rejection of hockey's present state, an indication that changes to the game are required.

4. Internality describes the degree to which an individual believes that events and rewards are a consequence of ones own behaviour. It was hypothesized that feelings of personal control could be strengthened by placing subjects in a specific environmental condition. A significant change in I-E orientation did occur during the experiment. Hi-Speed subjects became significantly more internal when compared with the control group subjects who actually shifted to an increasingly external disposition. The increase in internality appears to be related to the performance outcomes provided by the Hi-Speed environment.

5. Commitment, as a predictor of psychological identification and involvement reflects the degree to which an individual exhibits active membership in a group or organization. Highly committed individuals are more likely to display regular attendance and will comply with an organizations goals. Hi-Speed subjects attended 74% of the experimental games and became significantly more committed to hockey than did their intramural counterparts.

These conclusions are supportive of the literature which suggests that movement away from a competitive environment increases a play or recreational orientation among adult participants. However, in terms of the experimental situation these conclusions produce new theoretical

implications. Existing recreational and intramural environments should be revised so that actual playing conditions reflect these research findings.

There is reason to believe that the results of this experiment should be used to modify existing hockey programmes, an area where this research makes its greatest practical contributions.

III. RECOMMENDATIONS

Although studies of this kind may create useful and necessary information, they too often fail to bring about the theoretical and practical impact that is actually embodied in the research. Having designed an experiment to determine the psychological effects of participation in a modified athletic environment, an effective strategy must be developed whereby this information will provide answers to specific questions posed by the research problem. The following recommendations therefore, reflect the changes that occurred among the experimental participants. The effects of the experimental manipulation as measured by the dependent variables represents possible solutions to similar and related problems.

Hi-Speed extends hockey participation from its highly competitive base in the traditional game (professional, varsity, or travel team) to three groups of people. These include players who elect not to participate because they do not enjoy the regular game or who are not good enough to perform in the elite

elite stream; those players who would play, but no hockey programme is offered, and those who would like to play but are limited by factors such as time and commitment. It is important to assess the relative contribution Hi-Speed makes to each sector.

It has been shown that active participation in a modified athletic environment can be an effective means of altering normative behaviour. The active participant is exposed to a variety of novel situations which require changes in behaviour. This research has examined these effects and has attempted to identify the many situations which require the participant to choose between the available alternatives. Based upon the research findings, it is suggested that Hi-Speed Hockey be offered as an alternative to regular hockey, when the modified game could attract players who would otherwise elect not to play.

The desired changes in the dependent variables under investigation give rise to several other specific applications. Hi-Speed, designed in part to curb violence and limit undesired anti-social behaviours lends itself well to juvenile level hockey. The modified game successfully intervenes between aggressive urges that so often surface at this level of hockey.

In the analysis of commitment to hockey, it was shown that Hi-Speed subjects became more committed to playing hockey over the ten week period. It is assumed that when time is viewed as a limiting factor to participation, Hi-Speed which provides an intensive game in a short period of time, becomes an attractive alternative.

REFERENCES

- Anshel, M.H. "Effect of Age, Sex, and Type of Feedback on Motor Performance and Locus of Control". The Research Quarterly. 50(1979): 305-317.
- Carmack, M. and R. Martens. "Measuring Commitment to Running". Journal of Sport Psychology. 1(1979): 25-42.
- Csikszentmihalyi, M. Beyond Boredom and Anxiety. San Fransisco: Jossey-Bass Publishers, 1975.
- DiFebo, J.E. "Modification of General Expectancy and Sport Expectancy Within a Sport Setting". in Landers, D.M. ed. Psychology of Sport and Motor Behaviour. University Park: The Pennsylvania State University Press, 1975.
- Duguin, M.E. "The Dynamics of Athletic Persistence". in Straub, W.F. ed. Sport Psychology. Ithica: Mouvement Publications, 1978.
- Duke, M. Johnson, T.C. and S. Nowicki Jr. "Effects of Sports Fitness Camp Experience on Locus of Control Orientation in Children". Research Quarterly. 48(1977): 281-283.
- Duthie, J.H. "No Wins, No Loses". Sports Illustrated. Vol. 40-4, January 28, 1974a.
- Duthie, J.H. "No Win Hockey". Time. 103, January, 1974b.
- Duthie, J.H. and D. Moriarty. "Retreading Sports Organizations". in Craig, T.T. ed. The Humanistic and Mental Health Aspects of Sports, Exercise and Recreation. American Medical Association, 1976, 66-68.
- Festinger, L. "A Theory of Social Comparison Processes". Human Relations. 7(1954): 117-140.
- Green, H.J. "Metabolic Aspects of Intermittant Work with Specific Regard to Ice-Hockey". Canadian Journal of Applied Sport Sciences. 4(1979): 29-34.

- Hansen, H. "How To Get Hockey Back On Course". Coaching Review. 2(1979): 26-29.
- Hermiston, R.T. Gratto, J. and T. Teno. "Three Hockey Skills Tests as Predictors of Hockey Playing Ability". Canadian Journal of Applied Sport Sciences. 4(1979): 95-97.
- Ionotto, R. Marshall, J. and D. Chambers. "How Hockey Players Aged 9 to 16 Perceive the Game of Hockey". Recreation Research Review. 5(1977): 31-36.
- Jacobs, I. "The Effects of Thermal Dehydration on Performance of the Wingate Test of Anaerobic Power". Masters Thesis (MHK) University of Windsor, 1979.
- Loy, J. Birrell, S. and D. Rose. "Attitudes Held Toward Agonetic Activities as a Function of Selected Social Identities". Quest. Learning How to Play. 26(1976): 81-93.
- Maddi, S.R. "Surprise and affective arousal during environmental regularity and change". Phd Thesis. Harvard University, 1960.
- Maloney, T. and B.M. Petrie. "Professionalization of Attitudes Toward Play Among Canadian School Pupils as a Function of Sex, Grade and Athletic Participation". Journal of Leisure Research. 4(1974): 184-185.
- Mantel, R.C. and L. Vander Velden. "Relationship Between the Professionalization of Attitude Toward Play and Participation in Organized Sport". Third International Symposium on the Sociology of Sport. Waterloo, Ontario, Canada, August 22-28, 1971.
- Margarita, R. et al. "Energy utilization in Intermittant Exercise". Journal of Applied Physiology. 26(1969): 752-756.
- Ministry of Culture and Recreation. "Examination Into the Quality of Minor Hockey". Ontario Hockey Council Survey, 1979.

- Montgomery, D.L. and B. Vartzbedian. "Duration and Intensity of Play In Adult Recreational Hockey Games". in Terands, J. and Gros, H.J. eds. Science in Skiing, Skating and Hockey. Del Mar: Academic Publishers, 1979.
- Mumford, L. The Urban Prospect. New York: Harcourt Brace Jovanovich, 1968.
- Nie, N.H. Hull, C.H. et al. Statistical Package For The Social Sciences. New York: McGraw-Hill, 1975.
- Nowicki, S. and Strickland, B.R. "A Locus of Control Scale for Children". Journal of Consulting and Clinical Psychology. 40(1973): 148-154.
- Peek, H. "The Effect of Arousal Motivation on Attitude". Journal of Abnormal Psychology. 1(1960).
- Petrie, B.M. "Achievement Orientation in the Motivations of Canadian University Students Toward Physical Activity". Journal of the Canadian Association of Health, Physical Education and Recreation. 37(1971): 7-13.
- Pooley, J.C. "Violence in Sports". The Nova Scotia Medical Bulletin. 57(1978): 69-73.
- Proulx, R. and D. Soucie. "A Descriptive Analysis of No-Contact Hockey Leagues". Canadian Journal of Applied Sport Sciences. 3(1978): 119-123.
- Rotter, J.B. "Generalized Expectations for Internal Versus External Control of Reinforcements". Psychological Monographs. 80(1966). No. 609.
- Shea, S.A. "Three-Man Half-Court Hockey". Scholastic Coach. 45(1975): 44.
- Suttie, S.J. and H.L. Shearer. "Play Behavior: From Concepts to the Play Environment". Quest. 26(1976): 96-101.
- Tyler, J.K. "Epistemic Incongruity Judgements of Minor Hockey League Players". Masters Thesis (MHK), University of Windsor, 1978. (1979a).

- Tyler, J.K. "Effects of Differing Competitive Processes on Windsor Minor Hockey Players". Paper submitted to the Department of Psychology, University of Windsor (Psychology 630c), 1979b.
- Tyler, J.K. and J.H. Duthie. "The Effect of Ice Hockey on Social Development". Journal of Sport Behavior. 2(1979a): 49-60.
- Tyler, J.K. and J.H. Duthie. "Effects of Organized Play Experiences on Social Norms". in Schwartzman, H.B. ed. Play and Culture. 1978 Proceedings of the Association for the Anthropological Study of Play. West Point: Leisure Press, 1979b.
- Valecha, G.K. and T.M. Ostrom. "An Abbreviated Measure of Internal-External Locus of Control". Journal of Personality Assessment. 38(1974): 83-90.
- Vaz, E. "Institutional Rule Violation and Control in Organized Minor League Hockey". Canadian Journal of Applied Sport Sciences. 4(1979): 83-90.
- Watson, G.G. "Introducing Children to Attractive Competitive Situations". University of Western Australia, November, 1977.
- Weeb, H. "Professionalization of Attitudes Toward Play Among Adolescents". in Kenyan, G.S. ed. Aspects of Contemporary Sport Sociology. Chicago: Athletic Institute, 1969, 161-187.

BIBLIOGRAPHY

- Anderson, B.F. The Psychology Experiment. California: Brooks/Cole Publishing Company, 1971.
- Cattell, R.B. ed. Handbook of Multivariate Experimental Psychology. Chicago: Rand McNally and Company, 1966.
- Fatheringham, A.S. and L.G. Reeds. "An Application of Discriminant Analysis To Agricultural Land Use Prediction". Economic Geography. 55(1979): 114-122.
- Ferguson, G. Statistical Analysis in Psychology and Education. New York: McGraw-Hill Book Company, 1971.
- Fishbein, M. Attitude Theory and Measurement. New York: John Wiley and Sons, Inc., 1967.
- Glasser, W. Positive Addiction. New York: Harper and Row, Publishers, 1976.
- Kerlinger, F.N. Foundations of Behaviour of Research. New York: Holt, Rinehart and Winston, Inc., 1973.
- Lefcourt, H.M. Locus of Control. New York: John Wiley and Sons, 1976.
- Leonard, G. The Ultimate Athlete. New York: Viking Press, 1975.
- Magnusson, D. Test Theory. Massachusetts: Addison-Wesley Publishing Company, 1966.
- Murphy, G. and R. Likert. Public Opinion and the Individual. New York: Russell and Russell, 1966.
- Nogradi, G. "Organizational Commitment: Turning Employees On". Recreation Research Review. 7(1979) No 3.

0110, 7.

Orlick, T. "An Analysis of Early Sports Participation".
Phd Thesis. University of Alberta, 1972.

Phares, E.J. Locus of Control in Personality. Morristown:
General Learning Press, 1976.

Sherif, C.W. Sherif, M. and R.E. Nebergall. Attitude and
Attitude Change. Philadelphia: WB Saunders Company, 1965.

Smoll, F.L. and Smith, R.E. Psychological Perspectives in
Youth Sports. New York: John Wiley and Sons, 1978.

Watson, G.G. "Principles for the Design of Childrens Sport
Environments". Sport Coach, August, 1977.

APPENDIX A
CALCULATIONS FOR AN30

CALCULATIONS FOR AN30

Example: Subject #1 Weight: 82.7kg.

Resistance= 82.7 kg. x 0.075 kiloponds (kp) kg.

Work load = 6.2 kp.

Test Results:

TIME	REVOLUTIONS
0- 5	13.5
5-10	12.0
10-15	11.0
15-20	9.5
20-25	8.0
25-30	<u>7.0</u>
	61.0

TOTAL AN30 POWER

$$= \frac{\# \text{ revs.} \times \text{resistance} \times \text{fly wheel distance/rev}}{\text{body wt. (kg)}}$$

$$= 61 \times 6.2 \times 6 \times 2 \text{ (60sec.)}$$

$$= \frac{4538}{82.7}$$

$$= 55 \text{ kpm/kg/min.}$$

APPENDIX B
HI-SPEED INFORMATION PACKAGE

University of Windsor
Intramural Hockey Notice

To: Intramural Hockey Captains Date: January, 1980
Subject: Hi-Speed Hockey League

General Information

1. As a captain of Intramural hockey this experimental league provides your team with free practice time and an opportunity to play an enjoyable recreational alternative to the competitive league.
2. The league will run for 10 consecutive weeks beginning in JANUARY and culminating in MARCH.
3. I have ice-time available at either South Windsor Arena or Adie Knox Arena which are closest to the campus. I will meet with you to mutually agree upon the best available time for all teams.
4. You need 1 goalie and 6 skaters.. List your players on the Intramural registration form.

Game Description

A University of Windsor Research Team is launching an alternative form of hockey to be offered in conjunction with the Intramural programme already in progress. Hi-Speed or 3 on 3 was designed to emphasize the skill and fitness components of hockey and eliminate the dirty, violent play that we feel has taken the "fun" out of playing hockey. This is a wide open game that provides the participant with

the opportunity to skate, pass and shoot; something like the good old days of "pond" hockey. You have the freedom to move anywhere on the ice, creating your own plays with precision passes and tactful strategies. You will be on the ice and skating more than in a regular game which will provide a great invigorating work-out. You will feel "fitter" every time out.

Hi-Speed attempts to recapture the essence of the game of hockey as it was intended to be played. With the onset of violence in amateur hockey and the recent decline in Canadian supremacy in International hockey (especially against Russia, Czech., Sweden) we have tried to develop a game that could be implemented to redirect the development of skillful Canadian hockey players.

You will be taking part in one of Canada's most innovative hockey development programmes. CBC Radio has taped a show for provincial broadcast which talks about the Hi-Speed league here at the University of Windsor. The media has been contacted and will be present for the first game which indicates the interest is there.

A hockey skills test like the one on NHL Showdown will be administered at the first meeting at the ice as well as a practice game to get used to 3 on 3. A fourth year Human Kinetics student, studying the Advanced Analysis of Coaching will be assigned to each team to help you understand the rules and goals of the new game. As Captain, you should work closely with your "coach" to decide what formations and

player alignments make best use of the "open" ice.

Each team will play 1 game a week for 10 weeks which is free ice-time for you. The league will run from JAN. 22-MAR. 21. Playoffs will be scheduled and a combined system of points and goals will be tallied for the league standings. Each participant will be awarded an intramural shield and prizes for M.V.P., scoring, and league champion have been allocated.

I am looking forward to the opening game and I am confident that your team will enjoy the experience.

Thank you for you participation in this pioneering hockey experiment.

Sincerely,

Greg Reeds

Greg Reeds
Hi-Speed Convenor.

APPENDIX C
GENERAL INFORMATION QUESTIONNAIRE

General Information Sheet

Part I

Name: _____

Birthdate: _____
 (month) (day) (year)

Height: _____

Weight: _____

Levels of hockey played: (please circle)

Minor Junior University Intramural Industrial
 Recreational Casual

Total hockey experience in years:

2 years 4 years 6 years 8 years 10 years 12 years
 or over

Average hours of hockey per week (presently): _____

Did you play last semester: _____

If so, how many hours per week? _____

Do you participate in any other sports? _____

If so, how many hours? _____

Do you do any fitness training? _____

(Specify strength of aerobic) _____

If so, how many hours? _____

Feelings About Playing Hockey

PART II

A. Please give three reasons for you beginning to play hockey.

1. _____

2. _____

3. _____

B. Please give three reasons why you are presently playing hockey.

- 1. _____
- 1 2. _____
- 3. _____

APPENDIX D
COMMITMENT TO HOCKEY SCALE

Feelings About Playing Hockey

In the following the word "hockey" is to be understood to represent actively playing some form of hockey.

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. I look forward to hockey.	1	2	3	4	5
2. I wish there was a more enjoyable way to stay fit.	1	2	3	4	5
3. Hockey is drudgery.	1	2	3	4	5
4. I do not enjoy hockey.	1	2	3	4	5
5. Hockey is vitally important to me.	1	2	3	4	5
6. Life is so much richer as a result of playing hockey.	1	2	3	4	5
7. Hockey is pleasant.	1	2	3	4	5
8. I dread the thought of hockey.	1	2	3	4	5
9. I would arrange or change my schedule to meet the need to play hockey.	1	2	3	4	5
10. I have to force myself to play hockey.	1	2	3	4	5
11. To miss a day's hockey is sheer relief.	1	2	3	4	5
12. Hockey is the high point of my day.	1	2	3	4	5

APPENDIX E
ATTITUDE SCALE

Feelings About Playing Hockey

In the following the work "hockey" is to be understood to represent actively playing some form of hockey.

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
1. I look forward to hockey.					
2. I wish there was a more enjoyable way to stay fit.					
3. Hockey is drudgery.					
4. I do not enjoy hockey.					
5. Hockey is vitally important to me.					
6. Life is so much richer as a result of playing hockey.					
7. Hockey is pleasant.					
8. I dread the thought of hockey.					
9. I would arrange or change my schedule to meet the need to play hockey.					
10. I have to force myself to play hockey.					
11. To miss a day's hockey is sheer relief.					
12. Hockey is the high point of my day.					

Feelings About Playing Hockey (con't)

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
13. Hockey gets me in shape and increases my present fitness.					
14. Hockey enhances my self-respect.					
15. Hockey is a good game to help me lose weight.					
16. I play hockey for relaxation—a change from everyday life.					
17. I enjoy the companionship of other players.					
18. I feel better as a result of playing hockey.					
19. Hockey provides a sense of belonging to a team.					
20. Skating is a good way to increase my leg strength.					
21. Playing hockey allows me to meet a challenge.					
22. Winning and losing shows my success in hockey.					

Feelings About Playing Hockey (con't)

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
23. Hockey feels invigorating because I sweat.					
24. Hockey gives me a sense of identity.					
25. I like to compare my skills to other players.					
26. Hockey gives me a chance to show off.					
27. I play hockey for fun and relaxation.					
28. I feel the referee interferes too much with the game.					
29. Coaches play a large role in my enjoyment of hockey.					
30. I generally feel a little hostile toward my opponents.					
31. My teammates help me attain my satisfaction.					
32. Penalties are fair and promote the rules of the game.					
33. Hockey helps me get along with people.					

Feelings About Playing Hockey (con't)

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
-------------------	----------	-----------	-------	----------------

- 34. I prefer a competitive hockey environment over a recreational one.

--	--	--	--	--
- 35. Recreational hockey does not require the same degree of skill as competitive hockey.

--	--	--	--	--
- 36. An aggressive team improves chances of a victory.

--	--	--	--	--
- 37. There should be a ban on body checking.

--	--	--	--	--
- 38. Violence in hockey began as a result of the example shown by the professional leagues.

--	--	--	--	--
- 39. Other people quit hockey because they are bored with the game.

--	--	--	--	--
- 40. Hockey programs at all levels should emphasize skill development.

--	--	--	--	--
- 41. Parents play an important role in the enjoyment of a child's hockey experience.

--	--	--	--	--
- 42. The state of hockey will lead to its ultimate decline.

--	--	--	--	--

APPENDIX F
LOCUS OF CONTROL SCALE

In each item 1-11 choose A or B and indicate this by circling the answer opposite the item number.

- A. 1. Many of the unhappy things in people's lives are partly due to bad luck.
- B. People's misfortunes result from the mistakes they make.
- A. 2. In the long run, people get the respect they deserve in this world.
- B. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.
- A. 3. Without the right breaks, one cannot be an effective leader.
- B. Capable people who fail to become leaders have not taken advantage of their opportunities.
- A. 4. Becoming a success is a matter of hard work: luck has little or nothing to do with it.
- B. Getting a good job depends mainly on being in the right place at the right time.
- A. 5. What happens to me is my own doing.
- B. Sometimes I feel that I don't have enough control over the direction my life is taking.
- A. 6. When I make plans, I am almost certain that I can make them work.
- B. It is not always wise to plan too far ahead, because many things turn out to be a matter of good or bad fortune anyway.
- A. 7. In my case, getting what I want has little or nothing to do with luck.
- B. Many times we might just as well decide what to do by flipping a coin.
- A. 8. Who gets to be boss often depends on who was lucky enough to be in the right place first.
- B. Getting people to do the right thing depends upon ability; luck has little or nothing to do with it.

- A. 9. Most people don't realize the extent to which their lives are controlled by accidental happenings.
- B. There is really no such thing as "luck".
- A. 10. In the long run, the bad things that happen to us are balanced by the good ones.
- A. 11. Many times I feel that I have little influence over the things that happen to me.
- B. It is impossible for me to believe that chance or luck plays an important role in my life.

APPENDIX G
HI-SPEED HOCKEY RULES

Hi-Speed Hockey

Rules

1. Full ice surface, 3 skaters and 1 goalie.
3 players as alternates for changes
total 6 players and one goalie
1 additional player may be named to play if one of the
regulars cannot make it.
It is important that the same 6 players play each game.
2. 3 x 8-min. periods Total 24 minutes
1 x 5-min. overtime for ties
1 x 5-min. warmups
3. To speed up the game:
 - (i) player changes on the "fly" only
 - (ii) no freezing the puck along the boards (penalty)
 - (iii) after a goal, offside, or icing (referee call),
the puck will be advanced from the defensive end.
The opposition to be on the other side of centre
ice.
 - (iv) no centre red line for offside.
4. Body checking-
Clean hip or shoulder checks only will be permitted.
No high sticking or elbowing will be tolerated.
A well delivered body check is a hockey skill, not an
intimidation tactic.
It has been observed that the wide-open style of the
game limits an indiscriminate use of the body.

5. Penalties-

- Served regardless of scoring -- 1 min. running time.
- All infractions of basic CAHA hockey rules will be strictly enforced by a qualified referee.
- 3 penalties per team produces a "technical foul" situation. -- a penalty shot taken at the end of the game.

J.H. Duthie:pb/1979/12/10

APPENDIX H
MODIFIED HOCKEY ENVIRONMENT INTERVIEW SCHEDULE

Interview Schedule - Hi-Speed

1. How do you feel.....?
2. Is it more strenuous than ordinary hockey?
3. What is the main demand after skating?
4. What skills did you find demanded?
5. Do you think youngsters could handle this?
6. If kids played this at Pee Wee or Bantam level, what effect would this have on them?
7. Is this a way to push the need for skills?
8. Would Hi-Speed cut down on fighting and aggression?
9. Does Hi-Speed have spectator appeal?
10. Does it appeal to you personally?
11. Occasionally or as a regular game?
12. Would you like to take part in a Hi-Speed tournament at the end of the season?

J.H. Duthie:pb/1979/12/20

APPENDIX I
PILOT STUDY INFORMATION

Hi-Speed Hockey Pilot Study

Adie Knox Arena

Thursday, December 20

A group of interested individuals are being invited to join in two Hi-Speed Hockey games to be held in Adie Knox Arena, at 2100 hours on Thursday, December 20.

The purpose of these will be to provide a number of hockey players, officials and coaches with a first experience of this newly evolved game. As a result of this experience and the ensuing debriefing discussions it is hoped to have indications of:

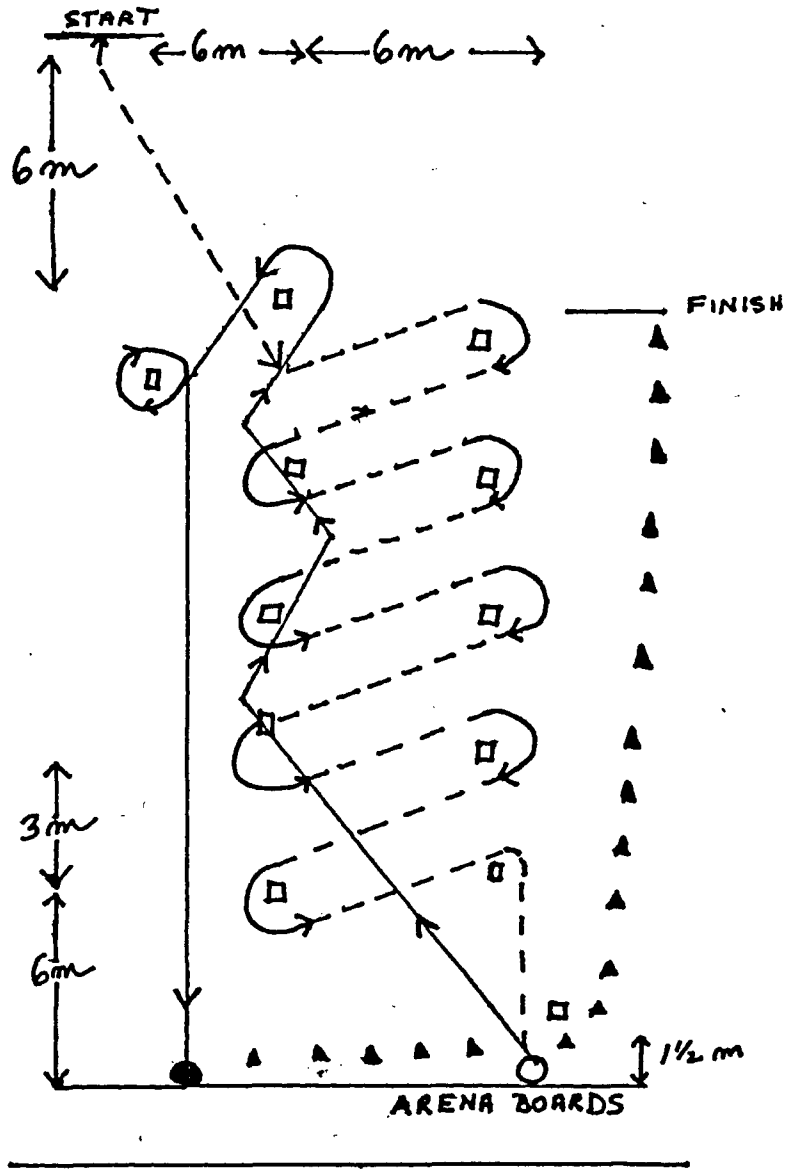
1. Agreed upon rules and procedures
2. A clear picture of the function of the coach
3. Ways to improve skill learning and facilitate physical fitness increments in children.

To attempt this a series of games have been arranged, each lasting for an ice time of 40 minutes of which the first 10 minutes will be a warmup, briefing and experimental session for both teams, who will then play 3 eight minute periods according to the rules of Hi-Speed Hockey which follow, along with a description of the game.

Please confirm that you are interested in taking part.

J.H. Duthie:pb/1979/12/10

APPENDIX J
HERMISTON HOCKEY SKILLS TEST



- NO PUCK
- > WITH PUCK
- ▲▲▲ BACKWARD (NO PUCK)

APPENDIX K
WINDSOR MINOR HOCKEY ASSOCIATION PROPOSAL

TO: Windsor Minor Hockey Association Executive

FROM: Hi-Speed Hockey Research Team

SUBJECT: Running an experimental Juvenile Hi-Speed Hockey League in the 1979-80 season.

We all come to love and appreciate the games with which we grew up and especially those which seem to capture the essence of our culture. For the British this would be either Rugby or Soccer: for the Canadian there is only one possible choice: Hockey. As you will have noted, nearly 40 Juveniles expressed an interest in Hi-Speed Hockey during registration. Your help is needed to supply this need.

This has established for us our heroes, our folklore and our values. Canada is hockey and in a very real sense hockey stands for Canada. We seek ways of reinforcing these values through minor hockey but change becomes necessary in any sport when it no longer provides the outcomes desired or when better ways of achieving these is envisaged. Juvenile hockey, played in the years when boys are growing most rapidly into men presents a particular challenge. To improve oneself in hockey means hard work, hard knocks and above all, the ability to measure up to the demands of sustained competition. Skills are often disrupted by this development, bad temper and violence occur and evoke a response. Tempers run high at an age when controlling one's behaviour is difficult. All across Canada (and across Europe and South America) these common problems are reported at this age.

Hi-Speed Hockey has been designed to cope with this situation. Indeed by altering the on and off ice situation we believe the problems mentioned above will be obviated for the form of the game itself will dictate other responses. What are these new behaviours? We think that each participant will discover in each session:

1. Increased and increasing skill demands;
2. A strenuous workout;
3. More demands on thinking & heads up play;
4. Better relations with other players;
- and 5. Better relations with officials and the coach.

Above all more fun in opportunities to express vitality and desire to play hockey well.

These are large claims and there is no way they can be checked without trial.

So as the next step in the process we wish to describe the game itself to your executive and our proposal for running a Juvenile experimental section in the coming season. During this session we will show the June 1st, Sports Scene, T.V.

tape to help in communicating the strengths which this approach may provide.

Hi-Speed Hockey Research Team

J.H. Duthie, K. Tyler, G. Reeds

APPENDIX L
RESEARCH MEMORANDUM

UNIVERSITY OF WINDSOR

MEMORANDUM

TO: C. Eaves
K. Tyler
G. Reeds

DATE: June 14, 1979

FROM: J.H. Duthie

SUBJECT: Hi Speed Hockey Collaboration

We spoke briefly. To recap areas of mutual interest: it was suggested that we consider in September 1979.

1. Involving a group of 10-12 students in a joint special project (425c) to act as coaches, officials and data collectors working with a special juvenile league (sponsored by WMH) engaged in Hi Speed Hockey.
2. Contrasting the (a) physiological, (b) skill, (c) biomechanic and (d) psychological effects of such participation with a control group (those involved in pioneer and House League hockey at a Juvenile level).
3. To promote the experimental effect (movements in a, b, c, d dimensions) students acting as coaches and officials would have instructional sessions on techniques of:
 - a) Improving skating, stickhandling and similar skills
 - b) Arranging dressing room and on-ice warmup and drills
 - c) Handing adolescent hockey players to promote positive interpersonal relations.
 - d) Coaching Hi Speed Hockey and be expected to apply these to their teams. (There will undoubtedly be a good deal of public and media interest in this experiment and this is to be carefully fostered. For example, it would be useful to have a team of volunteers work this game up on a specific skill level during the summer to provide:
 - a) A learning experience for ourselves
 - b) A demonstration squad
 - c) Media content during summer to keep pot boiling - also, we can take photographs, film, TV tape to provide informational material for class use in fall.)

This will be a 2 x 2 by variables design with the first condition being Pre/Pose and the second H.S. Hockey versus League Hockey.

Please consider this a first communication with the aim of stimulating thinking and discussion.

JHD:pb

APPENDIX M
AN30 PERFORMANCE NORMS



מכון ווינגייט לחינוך גופני ולספורט

WINGATE INSTITUTE FOR PHYSICAL EDUCATION & SPORT

Department of Research and Sports Medicine

January 1977

Values Representing the Overall Mechanical Power Output in 30 Seconds (expressed as $\frac{\text{Kpm}}{\text{min. x kg body weight}}$) For Non-Athletes

Age yr.	Males	Females
	$\frac{\text{Kpm}}{\text{min. kg}}$	$\frac{\text{Kpm}}{\text{min. kg}}$
9-10	35.0 \pm 4.0	
10-11	38.0 \pm 5.0	34.0 \pm 6.0
11-12	37.5 \pm 5.0	
13-14	43.5 \pm 6.0	36.0 \pm 6.0
19-22	43.5 \pm 6.0	
30-40	43.0 \pm 6.5	35.0 \pm 6.5

Top Israeli male athletes in anaerobic events (sprinters, jumpers) have reached 52-64 kpm/min. x kg. Our top female 100 m hurdler (12.92 sec.) reached 57.5 kpm/min. kg.

10-12 yr olds (♂; ♀) (בנות וילדים) 41-42 \pm ~4 $\frac{\text{Kpm}}{\text{min. kg}}$

APPENDIX N
INTRAMURAL HOCKEY FINAL STANDINGS

FINAL STANDINGS 1979-80

UNIVERSITY OF WINDSOR INTRAMURAL HOCKEY LEAGUE (BLUE DIVISION)

TEAM	GP	WIN	LOSS	TIE	PTS
Cody Hall*	10	9	0	1	19
Commerce B	10	8	0	2	18
69ers**	10	7	1	2	16
Huron Hall*	10	6	2	2	14
Law Weasels	10	4	4	2	10
HK Blades	10	3	5	2	8
Biolcgy**	10	3	5	2	8
Bedrockers	10	1	4	5	7
HK Hacks	10	3	7	0	6
Engineering II	10	1	9	0	2
My Scrovos	10	0	8	2	2

* Formed Control group pre/post

** Formed Control group post only

APPENDIX O
HI-SPEED HOCKEY FINAL STANDINGS

FINAL STANDINGS 1980

HI-SPEED HOCKEY LEAGUE

TEAM	GP	WIN	LOSS	TIE	PTS	GF	GA
Huron Hall	10	10	0	0	20	64	21
Cody Hall	10	4	5	1	9	46	51
Human Kinetics	8	2	5	1	5	32	40
Geology	10	2	8	0	4	36	63

APPENDIX P
SPSS SUBPROGRAMME T-TEST

```
//HK997 JOB (XXXXXXXXXX,2,25),'REEDS',CLASS=B
// EXEC SPSS
//GO.SYSIN DD.*
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF373I STEP /GO / START 80192.2332
IEF374I STEP /GO / STOP 80192.2333 CPU OMIN 01.23SEC MAIN 214K LCS OK
IEF375I JOB /HK997 / START 80192.2332
IEF376I JOB /HK997 / STOP 80192.2333 CPU OMIN 01.23SEC
```

SPSS BATCH SYSTEM

07.

SPSS FOR OS/360, VERSION 4, RELEASE 8.1, APRIL 1, 1980

ORDER FROM MCGRAW-HILL: SPSS, 2ND ED. (PRINCIPAL TEXT) ORDER FROM SPSS INC.:
 SPSS PRIMER (BRIEF INTRO TO SPSS)
 SPSS UPDATE (USE W/SPSS.2ND FOR REL. 7 & 8)

S
S
K

DEFAULT SPACE ALLOCATION.. WORKSPACE 71680 BYTES TRANSSPACE 10240 BYTES
 ALLOWS FOR.. 102 TRANSFORMATIONS
 409 RECCDE VALUES + LAG VARIABLES
 1641 IF/COMPUTE OPERATIONS

- 1 RUN NAME HI-SPEED HOCKEY
- 2 VARIABLE LIST V1 TO V12
- 3 INPUT MEDIUM CARD
- 4 N OF CASES 17
- 5 INPUT FORMAT FIXED (4F3.1, 2F3.0, 4F2.0, 2F3.1)

ACCORDING TO YOUR INPUT FORMAT, VARIABLES ARE TO BE READ AS FOLLOWS

VARIABLE	FORMAT	RECORD	COLUMNS
V1	F 3. 1	1	1- 3
V2	F 3. 1	1	4- 6
V3	F 3. 1	1	7- 9
V4	F 3. 1	1	10- 12
V5	F 3. 0	1	13- 15
V6	F 3. 0	1	16- 18
V7	F 2. 0	1	19- 20
V8	F 2. 0	1	21- 22
V9	F 2. 0	1	23- 24
V10	F 2. 0	1	25- 26
V11	F 3. 1	1	27- 29
V12	F 3. 1	1	30- 32

THE INPUT FORMAT PROVIDES FOR 12 VARIABLES. 12 WILL BE READ
 IT PROVIDES FOR 1 RECORDS ('CARDS') PER CASE. A MAXIMUM OF 32 'COLUMNS' ARE USED. C

- 6 MISSING VALUES V1 TO V4(99.9)/V5 TO V6(999)/V7 TO V10(99)/V11 TO V12
- 7 VAR LABELS V1, SK PRE / V2, SK POST / V3, FIT PRE / V4, FIT POST / V5, ATT PRE / V6, ATT POST / V7, COM PRE / V8, COM POST / V9, LC PRE / V10, LC POST / V11, WT PRE / V12, WT POST /
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19 VALUE LABELS V1, (1)SK / V2, (1)SK / V3, (1)FIT / V4, (1)FIT / V5, (1)ATT / V6, (1)ATT / V7, (1)COM / V8, (1)COM / V9, (1)LC / V10, (1)LC / V11, (1)WT / V12, (1)WT /
- 20
- 21
- 22
- 23
- 24
- 25
- 26
- 27
- 28
- 29
- 30
- 31
- 32 READ INPUT DATA

HI-SPEED HOCKEY

07

33 T-TEST

PAIRS=V1.V2/V3.V4/V5.V6/V7.V8/V9.V10/V11.V12

***** T-TEST PROBLEM REQUIRES 336 BYTES OF WORKSPACE *****

APPENDIX Q
SPSS SUBPROGRAMME PEARSON CORR

```

//HK997 JOB (XXXXXXXXXX,2,25), 'RFFDS', CLASS=B
// EXEC SPSS
//GO,SYSIN DD *
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF373I STEP /GO / START 80199.2144
IEF374I STEP /GO / STOP 80199.2145 CPU OMIN 01.91SEC MAIN 214K LCS OK
IEF375I JOB /HK997 / START 80199.2144
IEF376I JOB /HK997 / STOP 80199.2145 CPU OMIN 01.91SEC
  
```

JOB641

07/17/80

SPSS BATCH SYSTEM

SPSS FOR OS/360, VERSION H, RELEASE 8.1, APRIL 1, 1980

ORDER FROM MCGRAW-HILL: SPSS, 2ND ED. (PRINCIPAL TEXT) ORDER FROM SPSS INC.: SPSS S
 SPSS PRIMER (BRIEF INTRO TO SPSS) SPSS P
 SPSS UPDATE (USE W/SPSS,2ND FOR REL. 7 & 8) KEYWOP

DEFAULT SPACE ALLOCATION.. ALLOWS FOR.. 102 TRANSFORMATIONS
 WORKSPACE 71680 BYTES 409 RECODE VALUES + LAG VARIABLES
 TRANSPACE 10240 BYTES 1641 IF/COMPUTE OPERATIONS

- 1 RUN NAME HI-SPEED HOCKEY
- 2 VARIABLE LIST V1 TO V12
- 3 INPUT MEDIUM CARD
- 4 N OF CASES 30
- 5 INPUT FORMAT FIXED (12F1.0)

ACCORDING TO YOUR INPUT FORMAT, VARIABLES ARE TO BE READ AS FOLLOWS

VARIABLE	FORMAT	RECORD	COLUMNS
V1	F 1.0	1	1- 1
V2	F 1.0	1	2- 2
V3	F 1.0	1	3- 3
V4	F 1.0	1	4- 4
V5	F 1.0	1	5- 5
V6	F 1.0	1	6- 6
V7	F 1.0	1	7- 7
V8	F 1.0	1	8- 8
V9	F 1.0	1	9- 9
V10	F 1.0	1	10- 10
V11	F 1.0	1	11- 11
V12	F 1.0	1	12- 12

THE INPUT FORMAT PROVIDES FOR 12 VARIABLES. 12 WILL BE READ
 IT PROVIDES FOR 1 RECORDS ('CARDS') PER CASE. A MAXIMUM OF 12 'COLUMNS' ARE USED ON A R

- 6 VAR LABELS
 - V1, SOCIAL /
 - V2, FITNESS /
 - V3, RECREATION /
 - V4, COMMITMENT /
 - V5, ENJOYMENT /
 - V6, DRUDGERY /
 - V7, SOCIAL /
 - V8, FITNESS /
 - V9, RECREATION /
 - V10, COMMITMENT /
 - V11, ENJOYMENT /
 - V12, DRUDGERY /
- 18 VALUE LABELS
 - V1, (1)SOC /
 - V2, (1)FIT /
 - V3, (1)REC /
 - V4, (1)COM /
 - V5, (1)ENJ /
 - V6, (1)DRUD /
 - V7, (1)SOC /
 - V8, (1)FIT /
 - V9, (1)REC /
 - V10, (1)COM /
 - V11, (1)ENJ /
 - V12, (1)DRUD /
- 31 READ INPUT DATA

HI-SPEED HOCKEY

07/17/80

- 32 PEARSON CORR V1 TO V12 WITH V1 TO V12
- 33 STATISTICS ALL

***** PEARSON CORR PROBLEM REQUIRES 6912 BYTES WORKSPACE *****

APPENDIX R
SPSS SUBPROGRAMME DISCRIMINANT

```
//HK997 JOB (XXXXXXXXXX,2,25),*REEDS*,CLASS=B
// EXEC SPSS
//GO.SYSIN DD *
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF373I STEP /GO / START 80188.1224
IEF374I STEP /GJ / STOP 80188.1227 CPU OMIN 03.30SEC MAIN 214K LCS OK
IEF375I JOB /HK997 / START 80188.1224
IEF376I JOB /HK997 / STOP 80188.1227 CPU OMIN 03.30SEC
```

SPSS BATCH SYSTEM

07/06/80

SPSS FOR OS/360, VERSION 4, RELEASE 3.1, APRIL 1, 1980

ORDER FROM MCGRAW-HILL: SPSS, 2ND ED. (PRINCIPAL TEXT) ORDER FROM SPSS INC.: SPSS
 SPSS PRIMER (BRIEF INTRO TO SPSS) SPSS
 SPSS UPDATE (USE #/SPSS,2ND FOR REL. 7 & 8) KEYWORD

DEFAULT SPACE ALLOCATION.. ALLOWS FOR.. 102 TRANSFORMATIONS
 WORKSPACE 71680 BYTES 409 RECODE VALUES + LAG VARIABLES
 TRANSSPACE 10240 BYTES 1641 IF/COMPUTE OPERATIONS

- 1 RUN NAME HI-SPEED HUCKEY
- 2 VARIABLE LIST V1 TO V13
- 3 INPUT MEDIUM CARD
- 4 N OF CASES 50
- 5 INPUT FORMAT FIXED (1F1.0, 3F3.1, 1F3.0, 2F2.0, 6F1.0)

ACCORDING TO YOUR INPUT FORMAT, VARIABLES ARE TO BE READ AS FOLLOWS

VARIABLE	FORMAT	RECORD	COLUMNS
V1	F 1. 0	1	1- 1
V2	F 3. 1	1	2- 4
V3	F 3. 1	1	5- 7
V4	F 3. 1	1	8- 10
V5	F 3. 0	1	11- 13
V6	F 2. 0	1	14- 15
V7	F 2. 0	1	16- 17
V8	F 1. 0	1	18- 18
V9	F 1. 0	1	19- 19
V10	F 1. 0	1	20- 20
V11	F 1. 0	1	21- 21
V12	F 1. 0	1	22- 22
V13	F 1. 0	1	23- 23

THE INPUT FORMAT PROVIDES FOR 13 VARIABLES. 13 WILL BE READ
 IT PROVIDES FOR 1 RECORDS ('CARDS') PER CASE. A MAXIMUM OF 23 'COLUMNS' ARE USED ON A F

- 5 VAR LABELS V1, GROUP /
- 7 V2, SKILL /
- 8 V3, FITNESS //
- 9 V4, ICE TIME //
- 10 V5, ATTITUDE /
- 11 V6, COMMITMENT /
- 12 V7, LOCUS OF CONTROL /
- 13 V8, AGGRESSION /
- 14 V9, COMPETITION /
- 15 V10, SKILL ENVIRONMENT /
- 16 V11, WINNING /
- 17 V12, TEAM AGGRESSION /
- 18 V13, UTILITY /
- 19 VALUE LABELS
- 20 V1, (1) HS (2) INT /
- 21 V2, (1) SK /
- 22 V3, (1) FIT /
- 23 V4, (1) ICE TIME /
- 24 V5, (1) ATT /
- 25 V6, (1) CUM /
- 26 V7, (1) LC /
- 27 V8, (1) AGG /
- 28 V9, (1) CUMP /
- 29 V10, (1) SK ENVIR /
- 30 V11, (1) WIN /
- 31 V12, (1) TEAM AGG /
- 32 V13, (1) UTIL /
- 33 READ INPUT DATA

APPENDIX S
ITEMS USED IN THE DISCRIMINANT ANALYSIS

ITEMS USED IN THE DISCRIMINANT ANALYSIS

Aggression: I generally feel a little hostile towards my opponents.

Skill Environment: Recreational hockey does not require the same degree of skill as competitive hockey.

Utility: The state of hockey will lead to its ultimate decline.

Team Aggression: The aggressive team improves its chances of victory.

Winning: Winning and losing shows my success in hockey.

Competitive Environment: I prefer a competitive environment over a recreational one.

APPENDIX T
ITEMS USED IN THE CALCULATION OF CONSTRUCT VALIDITY

ITEMS USED IN THE CALCULATION OF CONSTRUCT VALIDITY

Social: I enjoy the companionship of other players.

Hockey provides a sense of belonging to a team.

Fitness: Hockey gets one in shape and increases my present fitness.

Skating is a good way to increase my leg strength.

Recreation: I play hockey for relaxation--a change from everyday life.

I play hockey for fun and relaxation.

Commitment: I have to force myself to play hockey.

To miss a day's hockey is sheer relief.

Enjoyment: Hockey is vitally important to me.

Life is so much richer as a result of playing hockey.

Drudgery: Hockey is drudgery.

I do not enjoy hockey.

VITA AUCTORIS

GREGORY KENNETH REEDS

BIRTHDATE: April 7, 1955

BIRTHPLACE: Hamilton, Ontario, Canada

EDUCATION: 1973 Ontario Secondary School Honours
Graduation Diploma
Hillfield Collège
Hamilton, Ontario

1973-1977 Bachelor of Physical Education
(Honours)
School of Physical Education and Athletics
McMaster University
Hamilton, Ontario

1977-1978 Bachelor of Education
Faculty of Education
University of Toronto
Toronto, Ontario

1978 Ontario Teachers Certificate

1978-1980 Master of Human Kinetics
Faculty of Human Kinetics
University of Windsor
Windsor, Ontario