2002

Communication in sport : coach-athlete interactions on a Division III female track and field team

Eilis Magee
Ithaca College

THE RELATIONSHIP OF SELECTED ICE HOCKEY SKILLS TO SUCCESS IN ICE HOCKEY

by

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An Abstract

of a project submitted in partial fulfillment
of the requirements for the degree of
Master of Science in the School
of Health, Physical Education
and Recreation at
Ithaca College

December 1975

Project Advisor: Dr. Victor Mancini

ABSTRACT

With an increasing interest in ice hockey, a test was needed to determine the relative abilities of players. The purpose of this study was to determine the relationship between selected ice hockey skill tests and ice hockey playing ability.

The battery was administered to 60 members of the St. Lawrence University Hockey School representing two age levels: 11-13 years and 14-16 years. The battery included tests of agility, speed, stickhandling, and the wrist shot. The data were collected from a series of testing procedures administered to each subject at the end of both the first and the second week of the hockey school. Each subject was given two trials for each of the four tests, his best score was tabulated.

Each subject received a subjective rating from five experienced coaches, and the mean rank was used as the criterion measure for the regression analysis.

Test-retest scores were compared to determine test reliability. Results of the reliability scores showed that all tests were significant at the .01 level of confidence.

Final multiple correlation coefficients of R = .71, for the 11-13 year old boys and R = .74, for the 14-16 year old boys were determined. All variables added significantly

to the regression equations at the .01 level.

Versions of the obtained regression equations to predict ability in hockey were as follows: (1) Ice hockey playing ability for 11-13 year old boys = .46 (shooting in number of scores) - 8.60 (speed in sec.) - 2.79 (agility in sec.) - 1.28 (stickhandling in sec.) + 208.99. (2) Ice hockey playing ability for 14-16 year old boys = .15 (shooting in number of scores) - 2.00 (stickhandling in sec.) - 1.62 (agility in sec.) + 1.13 (speed in sec.) + 134.24.

An ice hockey skill test battery including tests of stickhandling, agility, speed, and shooting was found to be a reliable and valid measure of ice hockey playing ability.

THE RELATIONSHIP OF SELECTED ICE HOCKEY SKILLS TO SUCCESS IN ICE HOCKEY

A Research Project Presented to the Faculty
of the School of Health, Physical
Education and Recreation
Ithaca College

In Partial Fulfillment of the
Requirements for the Degree
Master of Science

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by
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December 1975

Ithaca College
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Ithaca, New York

CERTIFICATE OF APPROVAL

MASTER OF SCIENCE RESEARCH PROJECT

This is to certify that the Research Project of

Allan G. MacCormack

submitted in partial fulfillment of the requirements for the degree of Master of Science in the School of Health, Physical Education, and Recreation at Ithaca College has been approved.

Research Project Advisor:

Candidate:

Chairman, Graduate Program in Physical Education:

Director of Graduat Studies:

Date: December 18 1975

ACKNOWLEDGMENTS

The investigator would like to take this opportunity to thank the following persons for their cooperation, assistance, and guidance in the completion of this project:

1. Dr. Victor H. Mancini, my research project advisor, for his guidance, assistance, and continuing support in the completion of this project.

2. Dr. Edward Burke for his valuable assistance in the statistical analysis of the data obtained from this study.

3. The instructors, counselors, and the 60 subjects at the St. Lawrence University Hockey School for their time and cooperation through the testing period.

4. My parents, who made it possible for me to reach this educational goal.

5. My wife, Shirley, for her assistance with the typing of the many rough drafts.

6. Appreciation is extended to Mrs. June Miles who typed the manuscript.

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INTRODUCTION

Ice hockey is a game of tremendous interest and popularity whose growth has created a problem of evaluating abilities of participants for physical educators and coaches. The evaluating of activity has been one of the greatest problems that confronts a coach or teacher, for in spite of the acknowledged importance of skill tests, few such tests have been developed in hockey. The common practice among hockey coaches is to eliminate and select players by a subjective rating rather than an objective means. Without any objective evaluation, the subject is left without definite knowledge of his standing and accomplishment. Skill tests can, and should, play an important role as a teaching aid, as practices, and as a supplement to instruction (2). Not only does this lack of objective measuring pertain to ice hockey, but it has only been within the last 20 years that sports have conferred with this problem. The American Association of Health, Physical Education and Recreation states, "One of the greatest problems that has confronted our profession for a long time is that of evaluating physical education" (1:6).

With an increasing interest in ice hockey, there is a definite need for an objective evaluational device. The author hopes that interested teachers and coaches of hockey

consider the points brought forth in this study.

Scope of Problem

Four tests developed by Edmond F. Enos (24) and H. H. Merrifield and G. A. Walford (16) were used to measure selected basic skills in ice hockey. Sixty members of the St. Lawrence University Hockey School ranging in age from 11-16 were selected as subjects. The objective ratings of the subjects on the four tests were then compared to the subjective rating made by five qualified coaches.

Statement of Problem

The purpose of this study was to determine the relationship between selected ice hockey skill tests and ice hockey playing ability.

Hypothesis

research hypothesis

It was hypothesized that the four ice hockey skills: skating agility, puck carrying, shooting accuracy, and skating speed could be used as an evaluational device to determine a player's success in ice hockey.

Assumptions

The following were the assumptions of the study:

1. Ice hockey skills can be measured.
2. All subjects gave their best effort.

3. The subjective ratings made by the four coaches of individual basic ice hockey skills were considered a valid measure.

4. The subjects, ranging in age from 11 to 16, assumingly represented different levels of hockey ability.

Definition of Terms

1. Wrist shot--A wrist shot was a forehand shot with the puck in contact with the stick throughout the shooting action. The body weight was not transferred during the act of shooting but remained on the leg adjacent to the puck or on both legs. Both arms were thrust forward in a co-ordinated movement with the wrist snap propelling the puck forward. Once the wrists have fully snapped the shooting action terminated.

2. Success--Success was determined by a rating assigned by each member of the hockey school staff to a player at the end of the hockey school. The rank of each hockey school member in relation to other members of that school was determined by the experts responsible for teaching at the ice hockey camp.

Delimitations of Study

1. The number of subjects was delimited to 60 members of the St. Lawrence University Hockey School from 11 to 16 years of age.

2. All players were tested except the goal tenders.

3. The battery of tests included measurements of shooting accuracy, puck carrying, forward skating speed, and agility but did not measure other essential skills such as passing, backhand shooting, and backward skating.

4. Motivation, a quality most effective in displaying one's skill level, was another factor not considered in this study.

5. The study was limited to two weeks of the hockey school.

Limitations of Study

1. The study applied to 60 members of the St. Lawrence Hockey School from 11 to 16 years of age.

2. The battery of tests did not measure all basic hockey skills but was intended to select only a few which might contribute significantly to ice hockey ability.

3. The temperature and ice surface conditions varied.

4. There might have been a motivational variance between the two tests.

5. Since the subjects were only at the school for two weeks, the testing was administered at the end of the first and last week.

Chapter 2

REVIEW OF RELATED LITERATURE

Hockey Skill Tests

In the search of related literature, it was found that relatively few tests have been devised to objectively rate a player in ice hockey.

The first published literature trying to develop an objective test was by Brown (7) who devised an ice hockey test for girls based on a skill test in 1935. Three test items were developed: dribbling and dodging, goal shooting, and speed skating and dribbling. The object of the skills test was to measure the speed and skill in handling the puck, the skill in shooting goals, and the speed in skating with the puck. The testing did not prove valuable because validity of the test items was not considered.

Merrifield and Walford (16) developed six tests for the purpose of measuring selected basic ice hockey skills. One day prior to the first test day, a hockey coach ranked each of his 15 hockey players on each of the test items and on overall ability.

Reliability was established by the test-retest method. The reliabilities for the forward skating speed, backward skating speed, skating agility, and puck carrying were considered sufficient to warrant additional statistical

treatment. Test items of shooting and passing with low reliability coefficients were not considered further. The tests used were significantly beyond the .01 level. Correlations among test items were computed. Four of these correlations were significant, three beyond the .01 level and one beyond the .05 level. The puck carrying test was found to have significant relationship to each of the three other tests and was determined the best single item for measuring overall ability.

Hache (25) tested 23 varsity ice hockey players on four items: (1) forward skating, (2) backward skating, (3) crossovers, and (4) ice hockey motor ability. Judges used a rating scale to grade the subjects on the selected skills. A multiple correlation of .06 was observed and two test items, crossovers and ice hockey motor ability, were shown to have a significant contribution to the multiple correlation squared. The coefficients of objectivity ranged from .63 to .99. A version of the obtained regression equation to evaluate basic ice hockey skills was as follows: basic ice hockey skills = 2.01 (ice hockey motor ability score) + 2.95 (crossovers score) + 8.99 (forward skating score) + 2.76 (reciprocal of the ponderal index score) + 1.13 (backward skating score) - 183.56.

Enos (24) developed a battery of seven tests to measure four skill areas: skating, stickhandling, shooting,

and passing. The battery was administered to 126 subjects representing four levels of hockey proficiency: bantam, senior high school, college, and professional. Coaches on each level evaluated the players subjectively on their play during five intersquad games. The reliability of the battery was substantiated by statistical significant correlations of the test-retest scores (.898-.978). The validity of the battery also was substantiated by statistical significant correlations between the subjects battery ranks and the subjects panel of coaches rank (.817-.922).

Doroschuk and Marcotte (9) adopted the Illinois Agility Run Test for use as an objective scoring means on ice to assist coaches in screening large numbers of players at initial work-outs. Twenty-seven undergraduate students in physical education between 18 and 25 were used as subjects. A biserial correlation between ranking on the agility test and the instructor's subjective evaluation was .83. The reliability coefficient on test-retest for the same group was .93. The main critiques of this study were that there was only one subjective coaches rating and the select nature and small sample tested does not lend credibility to validity or reliability.

Toner (32) used 94 pee-wee hockey players ranging in age from 12-13 to measure the hockey playing ability of elementary school boys. He foresaw the test as a means of

classifying players, equating teams, and grading skills.

The subjects were timed while they skated 30 feet, stopped and returned to the starting line. Each subject was given a ranking based on time and assigned to one of eight teams. The fastest eight skaters were distributed among the eight teams. The second fastest eight players were distributed in reverse order. In the third selection the team with the highest cumulative time score was given the player with the next lowest score and the remaining subjects were placed on the same basis.

Over the following year a double round-robin schedule of games were played. Five experienced coaches then subjectively ranked the 20 best players and the 20 poorest players. A single mean ranking for both groups was then constructed. The author reported a statistically significant difference between the means of these groups.

The administration of the study was weak in that the test only covered one facet of hockey, this being skating. No effort was made to determine whether this test was reliable, and its validity has to be classified as questionable.

Hockey Ability Tests

Cantrell (20) compared nine specific skills involving speed, endurance, agility, and stickhandling as performed by 18 boys in seventh grade to the over-all rating of the boys by competent judges to determine their degree of relationship.

It was found from the results that backward and forward skating for endurance showed the closest relationship to the subjective ratings. Six tests: 1) stop-and-go, 2) wrist shot for accuracy, 3) backward skating, 4) skating agility, 5) stickhandling ability, and 6) forward skating for endurance were significantly related to the criterion beyond the .05 level. Four tests: 1) stop-and-go, 2) backward skating, 3) skating agility, and 4) forward skating for endurance were significantly related to the criterion beyond the .01 level. The limited findings of the study indicated there was a significant relationship between ability and agility in skating, backward skating, forward skating for endurance, stickhandling ability, stops and starts, and wrist shot for accuracy.

MacGillivary (28) studied the total body reaction time, depth perception, and peripheral vision, and whether they relate to superior and inferior hockey players. It was found that simple movement time showed a fairly high significant correlation with hockey ability, but all other correlations between capacities and the criterion were low and not significant.

In a study by Olsen (17) concerning the relationship between simple reaction time and ice hockey ability, a correlation coefficient of .398 was determined. Within this study, judges' ratings were used to provide a mean rank for

each subject on "general hockey ability." This was then used as the criterion in a Pearson product-moment correlation. It was determined in this study that, with the exception of simple movement time, the measures employed in this study were not good predictors of hockey ability.

De Vincenzo, Kelly, and Leaman (23) constructed a battery of four tests to predict the potential abilities of secondary school hockey players. The tests were administered to 148 secondary school players at 12 schools during one of their practice sessions.

From a pilot study it was found that shooting for accuracy, forward speed skating, skating agility, and stickhandling were to be used to measure ability.

The scores achieved on the battery of tests at the start of the season and the rating assigned independently by that team's coach at the end of the season were correlated. Conclusions showed that the tests were not valid and there was no provision for reliability.

Sabasteanski (30) had 35 members of the Bowdoin College hockey team take the Edgen side-stepping test prior to the season. The results were correlated with the coach's ranking of his players at the conclusion of the season with the result showing a validity coefficient of correlation as low as .25.

Other Hockey Studies

The review of other studies was used in the assistance in the development of this study. By researching these studies the author was able to concentrate on certain hockey skills.

Alexander, Haddow, and Schultz (3) found that velocity increased with levels of proficiency, but accuracy showed no significant improvement. Results also showed that the slap shot was greater than that of the wrist shot for the standing and skating positions. Low positive correlations were found between dominant grip strength and velocity of shots, whereas accuracy was uncorrelated with dominant grip strength. A ballistic pendulum was the device used to measure the velocity of the two wrist shots and two slap shots taken for record.

Alexander, Drake, Reinchenbach, and Haddow (4) studied the effect of strength development of the major shoulder, arm and wrist muscles used in shooting. An experimental group was placed on a five-week isometric exercise training program. The experimental group showed statistically significant gains in the speed of both shots and in six of the eight strength measures. The controlled group showed a statistically significant gain in one of the strength measures and the skating wrist shot. The velocity of the slap shot was found to be greater than that of the wrist shot for both groups and tests.

Bissonette (19) used thirty 10 year old boys to determine if mental practice could improve speed while skating in a straight line and if physical practice with instruction could improve speed performance in a straight line. Conclusions found that in each of the treatments there was significant improvement.

Costello (21) used a group of high school boys to prove or disprove that passing decreased with the curved stick. An experimental group (without any previous experience with a curved blade) was tested for passing accuracy with the curved stick. They were then allowed time to practice and tested again. The same was done for the control group which used a straight blade. Results showed no difference in passing accuracy, but results also showed the proficiency of the boys to be poor.

Cotton (22) found that the velocity of wrist, sweep, and slap shots of 17 members of the University of Michigan hockey team was faster from a skating position than shots taken from a standing position.

Hebert (26) used boys aged 13 to 14, 15 to 16, and 17 to 18 as subjects to determine the comparative accuracy of the sweep and snap passes at different distances. Ten sweep passes and 10 snap passes were taken from a distance of 25 to 50 feet. A motor and pulley system was used to propel the target along the ice surface. A pass cutting

the central section was accorded the highest point value. Results showed that the 25 foot pass did not seem to effect passing accuracy except for the 17-18 year olds. The 50 foot pass had no effect, and the sweep and snap passes were equally effective at the two distances, except for the 17-18 year olds at 25 feet.

Jones (27) determined the difference between the front and side styles of starting in ice hockey with respect to time, speed, and acceleration. Sixteen University of British Columbia varsity hockey players did 10 trials with each style, skating 60 feet each trial. The initial 30 feet and the total of 60 feet of skating were timed. The front style was found to be superior to the side style in time, speed, and acceleration for both the first 30 feet and the total distance of 60 feet.

Thiffoult's (31) study was twofold: (1) to determine if there was any difference with a puck under control, between the skating front start, the skating side start lead-foot, the skating side start cross-over, and the running start and (2) which was to determine the fastest method. The subjects were drilled in each technique and were tested in random order. The F-ratio was significant, and further analysis (Newman-Keuls) revealed the side start lead-foot technique to be significantly faster than the three other methods.

Developed Skill Tests With the Use of Subjective Ratings

Kronquist and Brumbach (13) in a study of 71 boys in grades 10 and 11 on a volleyball test had principles related to the author's proposed test. The basis for their validity criterion was subjective ratings given to the students by three experienced volleyball teachers who worked individually. Each teacher used the same rating scale and then collaborated and discussed his discrepancies.

Schick (18) developed a battery of defensive softball skills consisting of a repeated throws test, a fielding test, and a target test. Validity correlations for all tests were based on comparisons between the individual's test scores and the judges' rating of individual performance. The persons who acted as judges for these ratings had taught and coached softball and had played competively.

Brady (5) in a study investigating volleyball playing ability used four experienced volleyball teachers' subjective ratings of players in actual game situations for his criterion. The reliability of the teachers' ratings were determined by correlating the ratings to one group of players by two judges against the ratings made for the same group by two other judges.

Clifton (8) constructed a single hit volley test to evaluate the volleying ability of college women students in volleyball. Validity was studied by the rating of five

experienced judges on the performance of the student in volleying in a game of volleyball during class meetings.

Also McDonald (29), Lochart and McPherson (15), Lehsten (14), Kelson (12), Broer and Miller (6), Dyer (10), and French and Cooper (11) used a subjective rating of experienced coaches and then correlated these with an objective scoring in devising sports skill tests.

Summary

In the literature reviewed it has been found that only in Enos's study has there been complete significance. In the studies by Doroschuk and Marcotte (9) and Merrifield and Walford (16) there was significance found, but in both cases the sample sizes were limited. In other studies where validity was indicated, the size, nature, and use of the sample categorized showed the results to be questionable. Another common weakness was that in all the tests, skills fundamental to the game of hockey were not tested.

In the area of criterion validity, skill tests in other sports have been developed that closely relate to this study. It is necessary that a subjective rating by experienced individuals be a part of the study.

Chapter 3

METHODS AND PROCEDURES

The purpose of this study was to determine the relationship between four selected ice hockey skills and a subjective coach's rating scale to predict success in ice hockey over a two week session at the St. Lawrence University Hockey School.

Selection of Subjects

Sixty boys aged from 11 to 16 years at the St. Lawrence University Hockey School were used as subjects.

Selection of Ice Hockey Tests

From a review of literature four tests were selected for the study. Two tests from Enos's (24) study, skating agility, and the wrist shot; and two tests from Merrifield and Walford's (16) study, skating speed and puck handling were used as the four tests in the study.

Description of Tests

Test One - Stickhandling (See Fig. 3-1.)

A. Layout

Seven pylons were placed on the ice in a straight

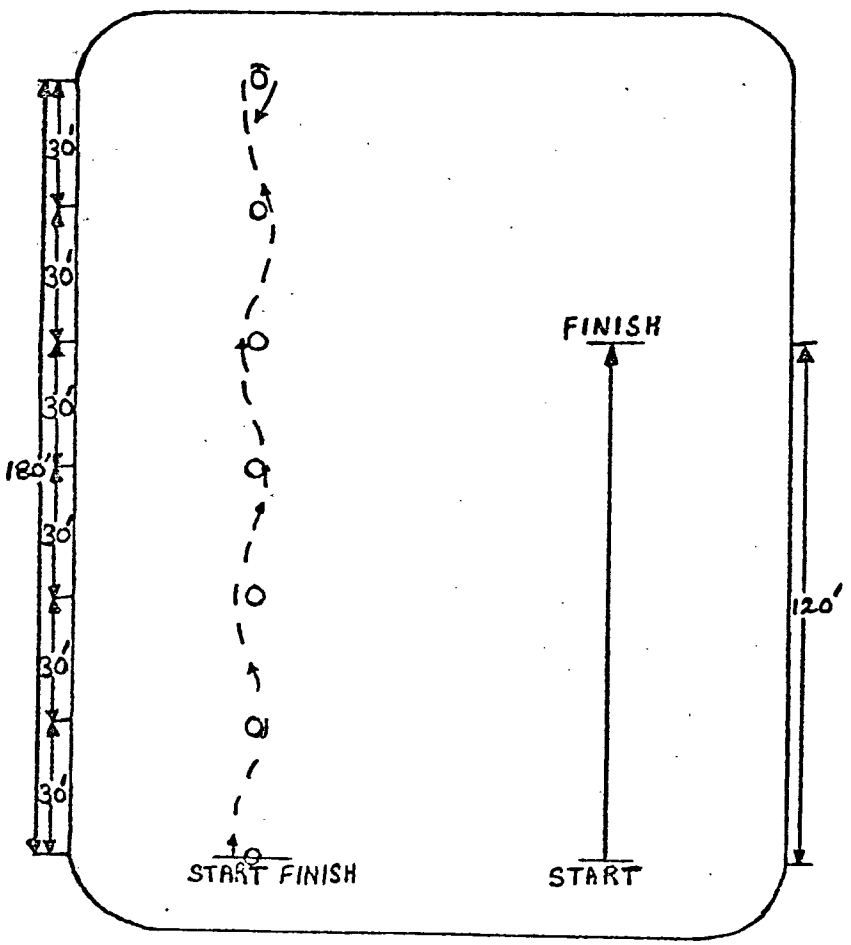

Figure 3-1

Ice Markings for Puck Carry and Speed Tests

line 30 feet apart. The first obstacle was situated at the 4 foot start-finish line.

B. Directions

The skater stood behind the start-finish line with the puck resting on the line to the left of the obstacle. When the signal was given, the skater moved through the zig-zag course passing to the left of the first obstacle, on the right of the second obstacle, etc., and skated around the farthest obstacle and repeated the sequence back through the course to the finish line. If two or more obstacles were knocked over, the skater had to repeat the test. The performer was required to maintain control over the puck throughout the test.

Achievement was measured in time to the nearest tenth of a second.

Test Two - Skating Agility (See Fig. 3-2.)

A. Layout

Seven (825x14) tires were placed over a 60 foot course: tires #1 and #7 were placed 20 feet from the boards and 60 feet from each other. The first tire was placed on the south blueline. On a line with the two tires, and between the 60 foot area, two tires 20 feet apart (tires #3 and #5) were placed. At equal distance (10 feet between tires #3 and #5) and the end (tires #1 and #7) three tires offset at 10 feet from the boards

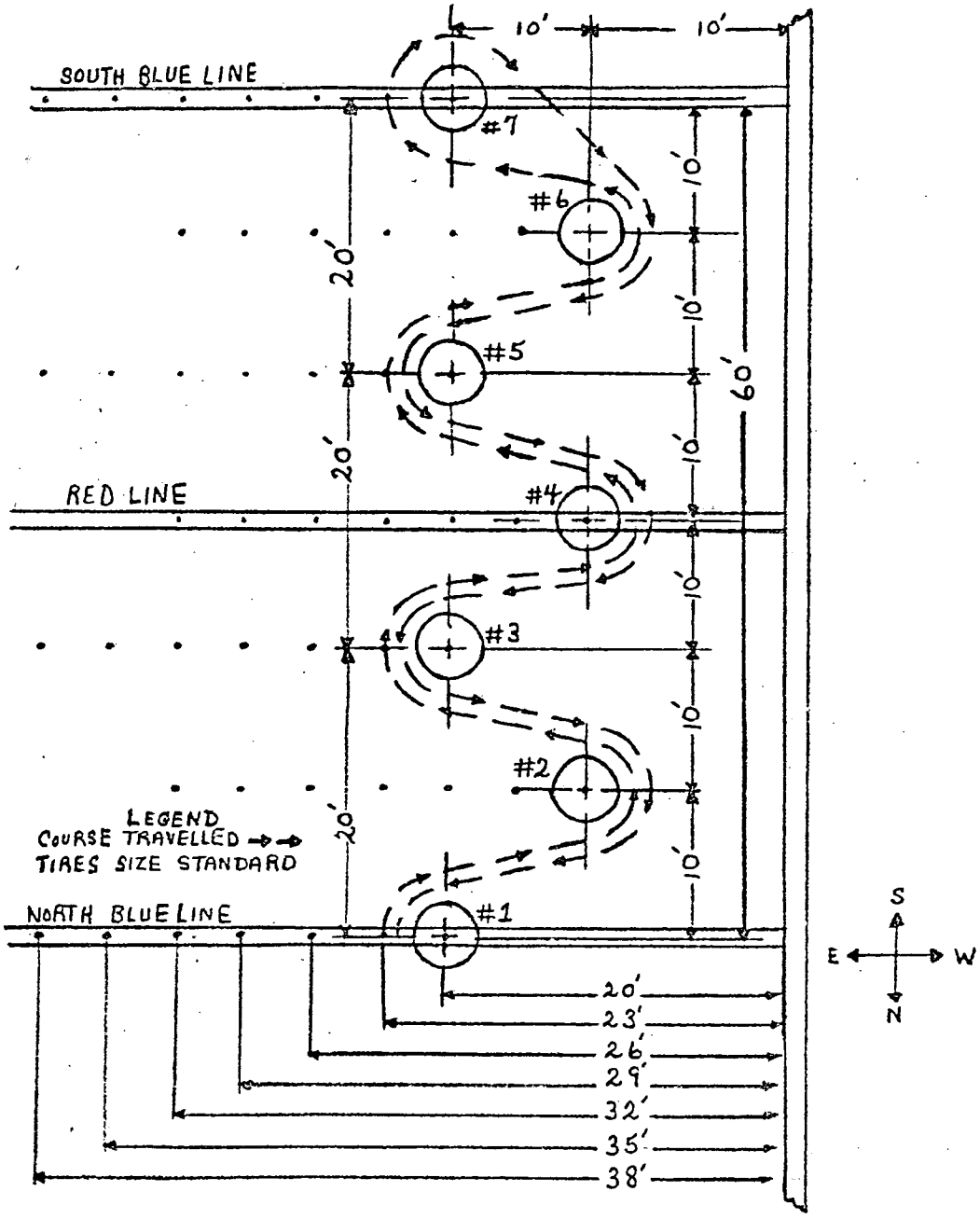

Figure 3-2

Ice Markings for the Skating Agility Test

(tires #2, #4, and #6) were situated. To give each subject a similar ice surface seven additional spots at three foot intervals were aligned to the left of each tire, facing the course. After each group of three subjects were tested the course was shifted 3 feet to the left and centered on these spots.

B. Directions

The starting line was the goal side of the south blue-line where the first tire was situated. The subjects began at the left side of the first and then skated to the right of the second, to the left of the third, to the right of the fourth, to the left of the fifth, to the right of the sixth, and to the left of the seventh tires at the end of the 60 foot course; the skater circled it and returned to the opposite side of the first tire following the same zig-zag, or weaving in-and-out pattern.

C. Scoring

Achievement was measured in time to the nearest tenth of a second.

Test Three - Wrist Shot (See Fig. 3-3.)

A. Layout

A standard net was placed on the goal line 30 feet from the side boards. At a point 30 feet in front of and perpendicular to its center point a line 15 feet across was marked parallel to the goal line to act as a restraining

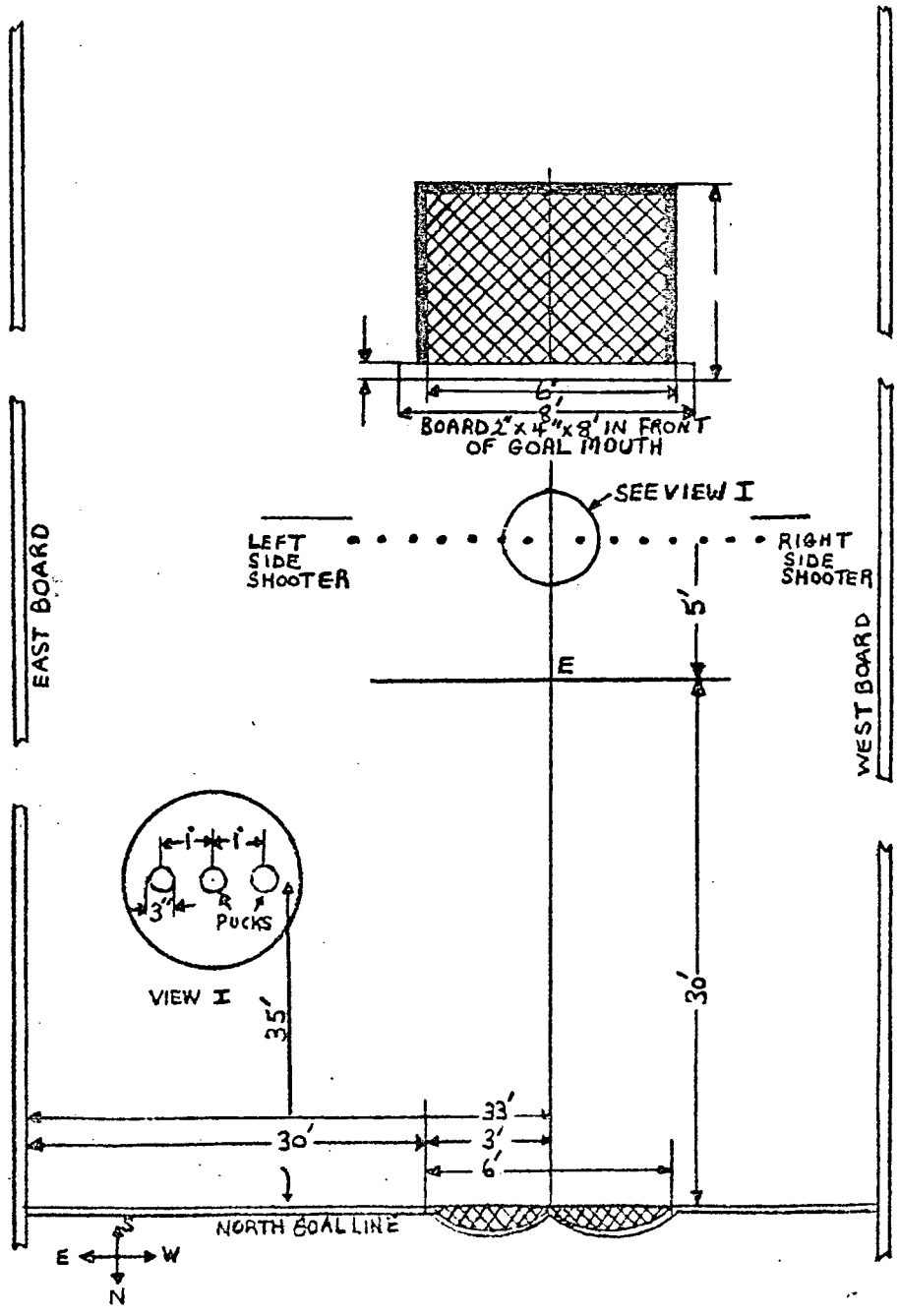

Figure 3-3

Ice Markings for the Shooting Test

line. Five feet further (35 feet from goal) and parallel to this line 15 spots were painted 1 foot apart. A puck on its flat edge was placed on each spot. On the ice surface across the goal mouth was laid a 2 inch x 4 inch x 8 foot timber. The timber was placed on its 2 inch side with the four inch side facing the shooter.

B. Directions

The subject assumed his natural wrist shot shooting position, aligned on the outer puck. On the starting command the subject executed a shot on goal, using a wrist shot. He realigned himself for repeated scoring attempts until commanded to halt. The command to halt occurred after a 10 second interval. While in the act of shooting, the subject remained behind the 15 foot restraining line. Wrist Shot Technique: A shot on goal that was performed by a player with his feet parallel or slightly staggered. The puck was located at the side of the shooter and released quickly. The blade of the hockey stick was in contact with the puck throughout the shooting action. The body weight was not transferred during the act of shooting but remained on the leg adjacent to the puck or on both legs. Both arms were thrust forward in a co-ordinated movement with the wrist snap propelling the puck forward and into the air. Once the wrists have been fully snapped the shooting action terminated.

C. Scoring

Achievement was measured in points, one for each

puck entering the net during the prescribed ten second interval.

Test Four - Forward Skating Speed (See Fig. 3-1.)

A. Layout

Two parallel lines 120 feet apart were painted on newly surfaced ice 5 feet from the boards. The line nearer to the end of the skating rink was designated as the starting line.

B. Directions

The skater stood facing the finish line in his natural position with both feet behind the starting line. At the signal the subject skated in a straight line for the finish line.

C. Scoring

Achievement was measured in time to the nearest tenth of a second.

Coaches' Rating Scale

The coaches' rating scale was in a modified form of Enos's (16) hockey battery tests. Each of the seven tests was given a value between 10 and 20 points according to the weight Enos used in his testing (Appendix A).

Methods of Data Collection

All testing during the study was administered by the

author. Eleven members of the St. Lawrence University Hockey School staff, all with college hockey experience helped with the administration of the test. The groups included dorm counsellors and instructors, but none of these participated in the subjective rating of the hockey players. All administrators were instructed by the author in a previous meeting as to how the testing was to be given.

The skills test was administered during two sessions, the final day of the first week and the final day of the second week. Testing time on both days was the same from 7:15 a.m. to 10:00 a.m.

At each testing session the subjects were given as much time as they desired for warm-up purposes.

Prior to the administration of the testing, the subjects were given the same instructions, and they were instructed to skate at their maximum speed. The subjects were also permitted to familiarize themselves with each test station with one trial.

The subjects were given adequate time between trials and tests to rest. Prior to each testing station each subject was asked if he felt fatigued. If so, he was given adequate time to rest until he felt he was ready to be tested.

Each subject was given two trials on each day, and his best score on each day was recorded (24).

Five experienced hockey coaches from the hockey school independently evaluated and ranked the subjects on a score

between 1-100 according to the coaches' rating scale. The five coaches received formal instruction prior to their two week rating period.

Scoring of Data

The data were collected from a series of testing procedures administered to each subject at the end of the first and the end of the second week of the hockey school. These data were recorded on data sheets which were constructed by the researcher.

The basis of the statistical analysis was the official test scores achieved by each subject (Appendix B). The criteria for the official test scores were test one, two, and four achievement measured in seconds and tenths of seconds. Each subject was given two trials on each day, and his lower score was tabulated as the official score.

In test three achievement was measured in the number of goals scored in the goal over a ten second period. The trial with the highest number of scores was forwarded as the official test score.

Each subject received a subjective rating from five experienced coaches, 3 college and 2 high achool coaches (Appendix C). The score recorded for each individual could be between 1-100 according to the subjective rating compiled on the coaches' rating scale. A mean rank drawn from the five experienced coaches' ratings was used as the main

criterion for the study (Appendix D).

The hockey school was divided into sessions according to age. Coaches subjective ratings were made for two groups: 11-13 year olds and 14-16 year olds.

Treatment of Data

Reliability

To test reliability, the official test scores achieved on the first day were compared with the official test scores on the second day. The Pearson product-moment correlation coefficient was used to determine test-retest reliability.

Validity

The four ice hockey items were used in a stepwise multiple regression equation in an attempt to predict the results of the scores on the coaches' rating scale. The .01 level was used for inclusion of variables in the regression equation. Means and standard deviations for each variable and the intercorrelation matrix were computed.

Chapter 4

ANALYSIS OF DATA

The results of the study are presented in this chapter. Results obtained included a correlation coefficient of test-retest scores of each skill for the whole group, means and standard deviations of both the 11-13 and 14-16 year old groups, a correlation coefficient matrix for each of the two groups, the number of variables in the study, the constructed regression equations, the multiple coefficients, and the standard error to estimate for each step.

Reliability

The Pearson product-moment correlation coefficient was used to compare the official test scores on the first day with the official test scores on the second day. These scores are recorded in Table 1. Reliability coefficients ranged between .47 and .88; all were significant beyond the .01 level.

Means and Standard Deviations

The means and standard deviations of the raw scores for the 11-13 year old group are recorded in Table 2. The means and standard deviations of the raw scores for the 14-16 year old group are recorded in Table 3.

Correlation Matrix

Table 4 shows the correlation matrix obtained from the variables for the 11-13 year old subjects, while Table 5 shows the correlation matrix obtained from the variables for the 14-16 year old subjects.

Multiple Stepwise Regression Analysis

Tables 6 and 7 show multiple regression equations for 11-13 year olds and 14-16 year olds, respectively. Included in these tables are the multiple correlation coefficients and the standard error of estimate for each step.

Table 1

Test-Retest Correlation Coefficients and Tests of Significance of Difference for Variables Employed in the Study

Variable	Test 1$\bar{x}$	Test 2$\bar{x}$	γ	Test of Significance
Stickhandling	22.37	22.39	.74*	1.35
Agility	19.81	19.55	.83*	1.00
Shooting	5.73	5.02	.47*	1.14
Speed	6.10	6.11	.88*	1.24

* P<.01

Table 2

Means and Standard Deviations of the Five Variables for Boys, 11-13 Years of Age

Variable	Mean	Standard Deviation
Stickhandling	22.827	1.461
Agility	19.748	0.961
Shooting	4.672	1.928
Speed	6.334	0.306
Subjective Rating	67.924	7.831

Table 3

Means and Standard Deviations of the Five Variables for Boys, 14-16 Years of Age

Variable	Mean	Standard Deviation
Stickhandling	21.961	2.401
Agility	19.603	1.907
Shooting	6.032	1.857
Speed	5.877	0.306
Subjective Rating	66.054	10.080

Table 4

Correlation Matrix for Boys,
11-13 Years of Age

Variable Number	1	2	3	4	5
Stickhandling	1.000	0.430	-0.490	0.790	-0.597
Agility		1.000	-0.426	0.453	-0.550
Shooting			1.000	-0.615	0.357
Speed				1.000	-0.611
Subjective Rating					1.000

Table 5

Correlation Matrix for Boys,
11-13 Years of Age

Variable Number	1	2	3	4	5
Stickhandling	1.000	0.819	-0.727	0.775	-0.721
Agility		1.000	-0.555	0.782	-0.686
Shooting			1.000	-0.526	0.526
Speed				1.000	-0.589
Subjective Rating					1.000

Table 6

Regression Equations for the Prediction of Success in Ice Hockey for Boys, 11-13 Years of Age*

Number of Variables Included	Regression Equation	R	S.E.
1	$\hat{Y}$ = -15.63(speed in sec.)+166.95	.61	3.90
2	$\hat{Y}$ = -2.80(agility in sec.)-11.66 (speed in sec.)+197.01	.68	1.31
3	$\hat{Y}$ = -1.30(stickhandling in sec.) -2.62(agility in sec.)-7.02 (speed in sec.)+193.71	.70	1.26
4	$\hat{Y}$ = -.46(shooting in number of scores)-8.60(speed in sec.)-2.79 (agility in sec.)-1.28 (stickhandling in sec.)+208.99	.71	.76

*All variables add significantly to the regression equation at the .01 level.

Table 7

Regression Equations for the Prediction of Success in Ice Hockey for Boys, 14-16 Years of Age*

Number of Variables Included	Regression Equation	R	S.E.
1	$\hat{Y}$ = -3.03(stickhandling in sec.)+132.57	.72	.53
2	$\hat{Y}$ = -1.52(agility in sec.)-2.04 (stickhandling in sec.)+140.64	.74	1.17
3	$\hat{Y}$ = 1.18(speed in sec.)-2.10 (stickhandling in sec.)-1.61 (agility in sec.)+136.71	.74	7.36
4	$\hat{Y}$ = .15(shooting in numbers of scores) -2.00(stickhandling in sec.)-1.62 (agility in sec.)+1.13(speed in sec.) +134.24	.74	1.05

*All variables add significantly to the regression equation at the .01 level.

Chapter 5

DISCUSSION OF RESULTS

The areas of discussion contained in this chapter are (1) reliability of the test, (2) the correlation matrix coefficient, and (3) the interpretation of the regression equations obtained.

Reliability

The Pearson product-moment correlation coefficient was used to compare the official test scores of the first day with the official test scores of the second day (the test-retest scores).

The results of each test item showed all were significant at the .01 level of confidence. It would appear that these tests are moderately reliable. Scores ranged from a r of .88 on speed to .47 on shooting.

Intercorrelation Coefficients

The intercorrelation matrix for the boys aged 11-13 showed the highest correlation of .790 between stickhandling and speed. Correlations between the subjective rating and stickhandling .597, agility .550, and speed .611 showed all to be closely related. The lowest correlation was .357 between shooting and the subjective rating from the coaches.

The intercorrelation matrix for the boys aged 14-16 showed high positive relationships. It was noted that stickhandling had high positive relationships with all the variables, while .819 on agility was the highest. Intercorrelations between the subjective rating and the other four variables showed stickhandling with a score of .721 to be highest, agility with a score of .686, speed with a score of .589, and the lowest score of .526 on shooting. As in the 11-13 year old group, the shooting was lowest of all variables.

Multiple Stepwise Regression Analysis

Final multiple regression equations of .71, for the 11-13 aged boys and .74, for the 14-16 aged boys, showed all variables add significantly to the regression equations at the .01 level. The close agreement between the multiple correlation coefficient of .71 for the 11-13 year old group and .74 for the 14-16 year old group showed that the subjective rating of both age groups varied little when the four variables were combined into one regression equation.

Ironically, speed, which seems to be the highest predictor for the boys 11-13, and stickhandling, which seems to be the highest predictor for the boys 14-16, reverse themselves in both equations. Speed is high in the 11-13 aged boys but is the third predictor for the 14-16 year old boys, and stickhandling, which is highest in the 14-16 year old boys, is third in the 11-13 year old boys. The agility test ranks

second in both regression equations and could be considered to have the highest positive relationship of the four predictor variables that were entered in the regression analysis.

Versions of the obtained regression equations to predict success in hockey may be observed as follows: (1) 11-13 year old boys = .46 (shooting in number of scores) - 8.60 (speed in sec.) - 2.79 (agility in sec.) - 1.28 (stickhandling in sec.) + 208.99 and (2) 14-16 year old boys = .15 (shooting in number of scores) - 2.00 (stickhandling in sec.) - 1.62 (agility in sec.) + 1.13 (speed in sec.) + 134.24.

In the final analysis, the results of the four tests correspond to those of Enos (24) and Merrifield and Walford (16). The reliability and validity of the tests show that the hypothesis can be accepted, and these tests may be used as an indicator of skill level.

The results of these tests would be highly useful in that they approximate the information gathered from five experienced coaches. These tests are easily administered and should not take a coach any more than an hour of ice time for completion. If time proved to be a factor for a coach, the third test of shooting for accuracy could be eliminated and the third regression equation could be used in each age level.

Chapter 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of the study was to determine the relation between selected ice hockey skill tests and ice hockey playing ability.

Four skill tests were selected from earlier studies: skating agility and the wrist shot tests from an investigation by Enos (24); speed and stickhandling tests from the research of Merrifield and Walford (16).

Sixty members of the St. Lawrence University Hockey School ranging in age from 11 to 16 years were selected as subjects. The data were collected from a series of testing procedures administered to each subject at the end of both the first and second week of the hockey school. Each subject was given two trials on each day for each of the four tests. The lower score in seconds was tabulated as the official score for test one (stickhandling), test two (agility), and test four (speed). The greater number of goals over a ten second period was used as the criterion for test three (shooting).

The tests were given at four different stations. All subjects followed the same test sequence, one through four.

Prior to each testing session, each subject was permitted one practice run through the tests.

Each subject received a subjective rating from five experienced coaches, three from the college level and two from the high school level. The score recorded for each individual could have ranged between 1-100 according to the subjective rating compiled on the coaches' rating scale. A mean rank drawn from the five experienced coaches' ratings was used as the criteria measure for the regression analysis. The hockey school was divided into sessions according to age. Coaches' subjective ratings were made for two groups: 11-13 year olds and 14-16 year olds.

The Pearson product-moment correlation coefficient was used as the reliability measurement to compare the official test scores on the first day with the official test scores on the second day. The results of each test showed all were significant at the .01 level of confidence with scores ranging from .88 on speed to .47 on shooting.

For the 11-13 year old boys, the highest intercorrelation coefficient between variables was R = .79, between stickhandling and speed. For the same group the highest correlation between the predictor variable and ice hockey playing ability was R = -.61, for speed. The lowest correlation coefficient between the predictor variable and ice hockey playing ability was R = .38, for shooting.

For the 14-16 year old boys, the highest intercorrelation coefficient between variables was R = .82, between stickhandling and agility. The highest correlation coefficient between the predictor variable and ice hockey playing ability was R = -.72, for stickhandling. The lowest was R = .526 for shooting.

Final multiple correlation coefficients of R = .71, for the 11-13 year old boys and R = .74, for the 14-16 year old boys were determined. All variables added significantly to the regression equations at the .01 level. The close agreement between multiple correlation coefficients showed that the subjective rating of both age groups varied little when the four variables were combined into one regression equation.

Versions of the obtained regression equations to predict ability in hockey may be observed as follows: (1) Ice hockey playing ability for 11-13 year old boys = .46 (shooting in number of scores) - 8.60 (speed in sec.) - 2.79 (agility in sec.) - 1.28 (stickhandling in sec.) + 208.99; (2) Ice hockey playing ability for 14-16 year old boys = .15 (shooting in number of scores) - 2.00 (stickhandling in sec.) - 1.62 (agility in sec.) + 1.13 (speed in sec.) + 134.24.

The results of the four tests are in substantial agreement with the research of Enos (24) and Merrifield and Walford (16). The hypothesis that the four ice hockey skills could be used as an evaluational device to determine a

player's ability in ice hockey was accepted.

Conclusions

1. An ice hockey skill test battery including tests of stickhandling, agility, speed, and shooting was found to be a reliable and valid measure of ice hockey playing ability.

2. It was possible to predict ice hockey playing ability for the 11-13 year olds utilizing the four variables with a multiple correlation coefficient of .71 and a standard error of estimate of .76.

3. It was possible to predict ice hockey playing ability for 14-16 year olds utilizing the four variables with a multiple correlation coefficient of .74 and a standard error of estimate of 1.05.

Recommendations

1. The same test items should be administered to a larger number of subjects to further test the validity of each item.

2. The same test items should be administered to ice hockey players at different age levels.

3. It is recommended that the shooting test be revised or a new test be developed.

4. A battery of tests should be constructed to measure goaltending ability.

5. More ice hockey tests should be developed to measure important skills such as endurance, reaction time, checking ability, and the backhand shot.

APPENDICES

Appendix A

Coaches' Ranking Scale

Subject's Name

_____

	Weighted Values	Coaches Score
1. Skating		
(A) Skating Agility	10	
(B) Starts-Stops-Turns	10	
(C) Forward Skating Speed	10	
2. Stickhandling	20	
3. Shooting		
(A) Wrist Shot	15	
(B) Slap Shot	15	
4. Forward Passing	20	
Total Value	100	

Appendix B-1

Test Scores for the 11-13 Year Old Group

Test One--Stickhandling

Subject Number	Day 1			Day 2		
	Trial 1	Trial 2	Official Score	Trial 1	Trial 2	Official Score
1	23.6	23.5	23.5	22.5	26.3	22.5
2	20.1	20.9	20.1	20.4	20.6	20.4
3	21.1	22.9	21.1	21.4	23.0	21.4
4	22.3	22.7	22.3	34.0	22.1	22.1
5	21.4	21.4	21.4	21.0	21.5	21.0
6	21.0	21.0	21.0	21.9	21.4	21.4
7	21.9	22.5	21.9	25.5	23.5	23.5
8	22.8	22.3	22.3	33.0	27.6	27.6
9	24.3	23.0	23.0	23.0	22.3	22.3
10	23.2	23.2	23.2	23.6	23.4	23.4
11	21.4	23.6	21.4	22.6	22.6	22.6
12	24.4	22.6	22.6	23.4	24.7	23.4
13	26.0	24.7	24.7	23.0	24.1	23.0
14	22.3	21.9	21.9	22.0	22.9	22.0
15	25.8	24.1	24.1	23.0	22.9	22.9
16	28.7	27.1	27.1	26.5	26.1	26.1
17	22.4	22.1	22.1	23.5	25.7	23.5
18	27.0	20.7	20.7	20.8	20.6	20.6
19	23.9	23.7	23.7	25.0	23.6	23.6
20	22.7	23.2	22.7	22.8	22.7	22.7
21	24.3	29.8	24.3	24.0	25.9	24.0
22	22.8	23.9	22.8	22.3	22.7	22.3
23	25.1	25.5	25.1	24.5	23.9	23.9
24	31.8	26.0	26.0	25.0	28.9	25.0
25	22.5	22.8	22.5	23.5	24.0	23.5
26	23.7	22.6	22.6	23.2	23.1	23.1
27	21.0	22.0	21.0	20.1	21.1	20.1
28	23.8	23.9	23.8	23.0	25.0	23.0
29	23.5	23.2	23.2	22.5	23.7	22.5

Appendix B-2

Test Scores for the 11-13 Year Old Group

Test Two--Agility

Subject Number	Day 1			Day 2		
	Trial 1	Trial 2	Official Score	Trial 1	Trial 2	Official Score
1	19.8	19.6	19.6	19.3	18.2	18.2
2	19.5	18.8	18.8	18.8	19.0	18.8
3	19.7	19.7	19.7	18.5	18.7	18.5
4	21.5	20.9	20.9	20.0	19.1	19.1
5	20.4	19.6	19.6	19.1	18.4	18.4
6	19.4	19.8	19.4	19.9	18.9	18.9
7	20.8	20.2	20.2	21.0	19.4	19.4
8	19.4	19.3	19.3	19.0	18.6	18.6
9	19.5	18.9	18.9	20.8	19.6	19.6
10	20.7	21.2	20.7	20.0	19.5	19.5
11	20.5	21.2	20.5	23.4	24.8	23.4
12	20.3	20.2	20.2	20.5	18.8	18.8
13	20.1	19.6	19.6	19.6	18.9	18.9
14	20.0	20.3	20.0	20.0	19.4	19.4
15	21.5	21.2	21.2	20.5	19.9	19.9
16	21.5	21.3	21.3	20.2	20.5	20.2
17	20.8	19.7	19.7	19.2	18.7	18.7
18	21.4	18.2	18.2	18.6	18.0	18.0
19	19.3	21.2	19.3	19.5	19.2	19.2
20	18.7	19.0	18.7	20.4	19.1	19.1
21	20.8	23.0	20.8	21.3	21.4	21.3
22	18.6	19.2	18.6	21.1	18.7	18.7
23	22.7	23.5	22.7	22.1	21.8	21.8
24	19.9	20.8	19.9	20.9	21.0	20.9
25	20.7	21.2	20.7	21.0	22.6	21.0
26	21.2	21.5	21.2	23.2	21.0	21.0
27	20.6	20.0	20.0	21.7	20.0	20.0
28	18.4	18.7	18.4	19.0	19.7	19.0
29	20.1	20.3	20.1	20.9	21.8	20.9

Appendix B-3

Test Scores for the 11-13 Year Old Group

Test Three--Wrist Shot

Subject Number	Day 1			Day 2		
	Trial 1	Trial 2	Official Score	Trial 1	Trial 2	Official Score
1	1	6	6	4	1	4
2	8	8	8	5	6	6
3	5	3	5	0	1	1
4	6	5	6	4	2	4
5	6	5	6	5	5	5
6	5	6	6	6	5	6
7	6	4	6	1	2	2
8	5	8	8	5	5	5
9	6	5	6	2	4	4
10	5	6	6	2	1	2
11	5	5	5	3	4	4
12	4	9	9	3	2	3
13	0	6	6	6	1	6
14	6	6	6	6	4	6
15	5	4	5	2	2	2
16	3	2	3	0	0	0
17	5	8	8	5	6	6
18	10	11	11	3	7	7
19	4	2	4	0	1	1
20	5	5	5	0	2	2
21	1	0	1	3	0	3
22	4	2	4	3	1	3
23	1	1	1	5	1	5
24	1	6	6	4	0	4
25	2	2	2	4	6	6
26	6	7	7	5	6	6
27	3	5	5	6	8	8
28	3	1	3	1	0	1
29	0	0	0	0	0	0

Appendix B-4

Test Scores for the 11-13 Year Old Group

Test Four--Speed

Subject Number	Day 1			Day 2		
	Trial 1	Trial 2	Official Score	Trial 1	Trial 2	Official Score
1	6.8	6.8	6.8	6.7	6.8	6.7
2	6.0	6.1	6.0	6.2	6.0	6.0
3	6.3	6.3	6.3	6.0	6.6	6.0
4	6.3	6.4	6.3	6.4	6.7	6.4
5	6.1	5.9	5.9	6.3	6.0	6.0
6	5.7	5.9	5.7	6.3	6.2	6.2
7	6.4	6.2	6.2	6.5	6.4	6.4
8	6.2	6.4	6.2	6.9	6.4	6.4
9	6.2	6.3	6.2	6.6	6.3	6.3
10	6.7	6.6	6.6	6.8	7.0	6.8
11	6.4	6.7	6.4	6.3	6.3	6.3
12	6.4	6.4	6.4	6.3	6.4	6.3
13	6.3	6.4	6.3	6.4	6.3	6.3
14	6.0	6.0	6.0	6.1	6.1	6.1
15	6.9	7.1	6.9	6.8	6.9	6.8
16	6.9	7.1	6.9	7.0	7.0	7.0
17	6.2	6.2	6.2	5.9	5.9	5.9
18	6.0	5.8	5.8	6.1	6.1	6.1
19	6.6	6.5	6.5	6.7	6.6	6.6
20	6.3	6.2	6.2	6.8	6.5	6.5
21	6.5	6.6	6.5	6.9	6.8	6.8
22	6.1	6.1	6.1	6.0	6.0	6.0
23	6.6	6.9	6.6	6.7	6.6	6.6
24	7.1	6.9	6.9	7.0	7.0	7.0
25	6.4	6.5	6.4	6.7	7.0	6.7
26	6.1	6.2	6.1	6.3	6.1	6.1
27	5.7	5.7	5.7	5.9	6.3	5.9
28	6.4	6.4	6.4	6.5	6.8	6.5
29	6.4	6.3	6.3	6.5	6.5	6.5

Appendix B-5

Test Scores for the 14-16 Year Old Group

Test One--Stickhandling

Subject Number	Day 1			Day 2		
	Trial 1	Trial 2	Official Score	Trial 1	Trial 2	Official Score
30	19.4	24.5	19.4	19.0	27.8	19.0
31	20.2	20.6	20.2	22.0	20.4	20.4
32	20.2	23.0	20.2	19.2	19.8	19.2
33	23.5	24.1	23.5	22.0	23.0	22.0
34	32.2	30.5	30.5	28.9	31.0	28.9
35	24.7	30.5	24.7	25.0	24.1	24.1
36	21.4	20.6	20.6	19.1	19.6	19.1
37	20.0	19.8	19.8	19.2	19.4	19.2
38	23.1	26.6	23.1	27.8	26.4	26.4
39	23.6	20.4	20.4	20.4	20.4	20.4
40	25.9	22.5	22.5	20.8	20.7	20.7
41	21.9	21.5	21.5	20.4	20.7	20.4
42	20.2	20.7	20.2	20.4	20.7	20.4
43	22.0	22.1	22.0	21.4	20.8	20.8
44	22.6	21.5	21.5	21.0	20.6	20.6
45	21.0	21.0	21.0	21.9	20.0	20.0
46	20.6	19.7	19.7	25.0	20.3	20.3
47	24.0	22.5	22.5	34.8	30.0	30.0
48	22.6	22.0	22.0	29.5	21.4	21.4
49	23.7	22.4	22.4	23.2	26.5	23,2
50	19.7	25.2	19.7	20.4	20.3	20.3
51	23.7	20.5	20.5	21.2	20.2	20.2
52	22.5	24.7	22.5	21.2	21.4	21.2
53	21.0	20.9	20.9	20.1	21.7	20.1
54	25.9	29.0	25.9	28.0	25.0	25.0
55	24.7	25.2	24.7	32.0	25.5	25.5
56	24.7	21.9	21.9	21.2	21.4	21.2
57	21.7	21.5	21.5	25.0	25.5	25.0
58	20.4	20.6	20.4	19.5	19.6	19.5
59	22.7	24.4	22.7	28.8	23.5	23.5
60	23.2	21.9	21.9	32.5	22.5	22.5

Appendix B-6

Test Scores for the 14-16 Year Old Group

Test Two--Agility

Subject Number	Day 1			Day 2		
	Trial 1	Trial 2	Official Score	Trial 1	Trial 2	Official Score
30	18.2	18.8	18.2	19.2	18.1	18.1
31	19.5	18.4	18.4	19.3	18.8	18.8
32	17.8	19.3	17.8	18.4	18.0	18.0
33	22.1	22.0	22.0	23.0	21.5	21.5
34	27.2	26.8	26.8	28.0	27.0	27.0
35	20.8	21.4	20.8	22.0	21.7	21.7
36	17.6	17.1	17.1	17.5	18.0	17.5
37	18.4	17.9	17.9	18.7	18.9	18.7
38	20.0	21.3	20.0	20.0	19.0	19.0
39	19.2	19.7	19.2	18.5	19.2	18.5
40	19.1	19.0	19.0	19.2	18.9	18.9
41	19.3	21.2	19.3	19.1	21.3	19.1
42	19.0	23.2	19.0	23.0	19.4	19.4
43	19.8	19.6	19.6	23.0	19.3	19.3
44	18.8	18.5	18.5	18.0	20.9	18.0
45	20.4	19.5	19.5	18.0	17.7	17.7
46	19.3	19.3	19.0	19.0	19.2	19.0
47	19.5	20.6	19.5	19.3	19.8	19.3
48	18.8	17.8	17.8	19.0	20.1	19.0
49	18.7	18.4	18.4	25.0	20.1	20.1
50	19.0	20.1	19.0	18.0	19.1	18.0
51	18.0	19.2	18.0	17.9	18.2	17.9
52	18.3	19.7	18.3	19.0	19.6	19.0
53	20.1	20.5	20.1	20.2	19.8	19.8
54	21.9	22.4	21.9	23.0	22.9	22.9
55	21.0	22.5	21.0	22.2	22.7	22.2
56	18.1	20.2	18.1	18.6	18.5	18.5
57	18.6	18.5	18.5	24.9	21.0	21.0
58	18.0	18.4	18.0	19.7	20.1	19.7
59	21.6	23.6	21.6	23.0	24.3	23.0
60	19.4	19.3	19.3	20.1	20.8	20.1

Appendix B-7

Test Scores for the 14-16 Year Old Group

Test Three--Wrist Shot

Subject Number	Day 1			Day 2		
	Trial 1	Trial 2	Official Score	Trial 1	Trial 2	Official Score
30	6	7	7	4	10	10
31	7	8	8	5	8	8
32	7	7	7	2	8	8
33	5	1	5	5	8	8
34	1	0	1	0	0	0
35	2	4	4	4	2	2
36	8	3	8	8	7	8
37	6	7	7	6	8	8
38	1	3	3	4	4	4
39	4	5	5	2	6	6
40	3	8	8	6	4	6
41	6	5	6	5	3	5
42	4	6	6	2	4	4
43	3	6	6	8	5	8
44	3	5	5	6	6	6
45	4	6	6	5	8	8
46	3	5	5	5	2	5
47	3	1	3	4	4	4
48	3	1	3	4	6	6
49	8	8	8	2	7	7
50	3	4	4	7	11	11
51	5	9	9	6	4	6
52	4	4	4	4	5	5
53	10	4	10	2	4	4
54	1	6	6	0	4	4
55	1	6	6	2	5	5
56	6	2	6	3	6	6
57	2	5	5	5	4	5
58	5	8	8	10	8	10
59	5	9	9	8	5	8
60	6	3	6	3	3	3

Appendix B-8

Test Scores for the 14-16 Year Old Group

Test Four--Speed

Subject Number	Day 1			Day 2		
	Trial 1	Trial 2	Official Score	Trial 1	Trial 2	Official Score
30	5.8	5.7	5.9	5.9	6.0	5.9
31	6.0	5.8	5.8	5.8	6.1	5.8
32	6.7	6.7	6.7	5.7	6.2	5.7
33	6.1	5.9	5.9	5.9	6.1	5.9
34	7.1	7.0	6.9	8.0	8.0	6.9
35	6.3	6.3	6.3	6.6	6.5	6.5
36	6.0	6.0	6.0	6.0	5.8	5.8
37	5.5	5.5	5.5	5.5	5.6	5.5
38	6.1	6.1	6.1	6.1	6.0	6.0
39	6.0	5.7	5.7	6.0	5.7	5.7
40	6.1	5.8	5.8	6.2	6.0	6.0
41	5.6	5.7	5.6	5.8	5.9	5.8
42	5.7	5.6	5.6	6.0	5.6	5.6
43	6.0	6.0	6.0	6.1	6.0	6.0
44	5.7	5.7	5.7	5.9	5.8	5.8
45	5.6	5.5	5.5	5.5	5.5	5.5
46	5.8	5.5	5.5	5.8	6.0	5.8
47	5.8	6.0	5.8	6.2	5.7	5.7
48	5.8	6.1	5.8	5.9	6.2	5.9
49	5.6	5.4	5.4	6.1	6.2	6.1
50	6.1	5.9	5.9	5.7	5.5	5.5
51	5.8	5.8	5.8	5.9	5.9	5.9
52	6.0	6.1	6.0	6.2	6.0	6.0
53	5.3	5.3	5.3	5.7	5.4	5.4
54	6.7	6.4	6.4	6.5	6.3	6.3
55	5.8	6.1	5.8	6.3	6.0	6.0
56	5.8	5.9	5.8	6.1	5.8	5.8
57	5.7	6.1	5.7	6.1	6.0	6.0
58	5.9	6.0	5.9	6.1	5.8	5.8
59	6.4	6.0	6.0	6.4	6.3	6.3
60	6.0	6.2	6.0	6.1	6.0	6.0

Appendix C

Names and Qualifications of Hockey Experts

1. Mr. Bernard MacKinnon
   Qualifications: Former varsity hockey player and freshman hockey coach at St. Lawrence University. Presently varsity hockey coach and director of a hockey school at St. Lawrence University.
2. Mr. Peter Bragdon
   Qualifications: Former Harvard University hockey player and presently varsity hockey coach at Kent High School.
3. Mr. Bill Cookly
   Qualifications: Former Brown University and Chicago Cougar hockey player. Presently varsity hockey coach at Canton High School.
4. Mr. Steve Warr
   Qualifications: Former All American at Clarkson University and Toronto Toro hockey player. Presently assistant varsity hockey coach at Clarkson University.
5. Mr. Terry Moran
   Qualifications: Former St. Lawrence University and Syracuse Blazer hockey player. Presently junior varsity and assistant varsity coach at Norwich University.

Appendix D-1

Coaches' Subjective Rating for the
11-13 Year Old Group

Subject's Name	Coach Number					Mean
	1	2	3	4	5	
Fiaca, Greg	67	65	60	71	61	64.8
Queenmilk, Tim	80	77	80	88	81	73.8
Morrison, Pat	81	73	81	85	78	80.4
Navano, Greg	74	72	78	80	70	74.8
Daugherty, Tom	79	76	72	81	79	77.4
Ostrom, Don	61	62	88	80	73	72.8
McPherson, John	80	83	72	85	77	79.4
Taylor, Matt	66	64	65	75	53	64.6
Darling, John	47	63	67	77	51	61.0
McLennon, Stan	65	69	70	74	46	64.8
Crime, Mike	45	47	56	65	41	50.8
Bradshaw, Mike	77	71	73	78	41	68.0
Pinkowski, Mike	49	58	73	70	48	59.6
Martin, Ken	58	72	80	81	53	68.8
Tripp, Scott	57	54	67	64	49	58.2
Wilkins, Greg	60	42	64	76	46	57.6
Garlach, Jeff	66	77	71	78	76	73.6
Bristol, Sai	75	78	76	85	77	78.2
Stafford, Rod	55	62	67	76	55	63.0
Walentynowicz, Dave	74	78	70	85	76	76.6
Collocan, Joe	48	60	69	75	47	59.8
Kucharski, Stan	72	66	72	78	70	71.6
Eyman, Ken	66	53	68	75	43	61.0
Howell, Steve	55	59	58	73	70	63.0
Rice, John	68	76	81	82	71	75.6
Summers, Terry	53	49	76	78	50	61.2
Yule, Rich	67	69	82	85	77	76.0
Longley, Bruce	63	72	75	75	68	70.6
Miller, Carter	54	60	65	67	68	62.8
Average Mean						67.9

Appendix D-2

Coaches' Subjective Rating for the 14-16 Year Old Group

Subject's Name	Coach Number					Mean
	1	2	3	4	5	
Smith, David	92	85	80	83	82	84.4
Leach, Mark	82	84	80	78	77	80.2
Silmser, Tom	74	72	57	61	49	62.6
Williams, Chris	67	58	55	57	41	55.6
Pribeish, John	63	54	31	31	30	41.8
White, Keil	71	66	43	58	52	58.0
Smith, Greg	87	81	77	64	78	77.4
Pike, John	90	86	88	81	78	84.6
Robinson, Charles	64	62	37	44	44	50.2
Clements, Bill	77	70	79	65	63	70.8
DeCelles, Norm	77	76	72	70	71	73.2
Casey, Dan	75	74	67	74	47	67.4
MacKinnon, Mike	86	87	66	64	58	72.2
Schmid, Ken	67	65	51	59	46	57.6
Beaumont, Phil	76	69	56	58	55	62.8
Stafford, Bob	78	80	69	67	64	71.6
Howell, John	81	77	68	77	69	74.4
Abrams,	74	74	59	58	52	63.4
Stevens, Ben	84	78	80	69	60	74.2
Maxwell, Scott	75	88	61	60	52	67.2
Wilkins, Tab	82	72	79	73	64	74.0
Callahan, Kevin	74	62	73	58	45	62.4
Paller, Gary	74	68	57	64	40	60.6
Summers, Jeff	79	76	61	55	65	52.3
Ruina, Bob	71	64	52	31	49	53.4
Kapper, David	72	70	55	48	39	56.8
Stafford, Rich	73	80	59	74	57	68.6
Tobin, Rich	78	73	67	58	56	66.4
Greenbaum, Jim	83	78	63	61	68	70.6
Robinson, Steve	74	55	53	60	60	60.4
Miller, Gus	78	71	60	76	78	72.6
Average Mean						66.05

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