HODGES, CAROLYN V. Construction of an Objective Knowledge Test and Skill Tests in Lacrosse for College Women. (1967) Directed by: Dr. Gail M. Hennis. pp. 123.

The purposes of this study were to construct and standardize an objective knowledge test in lacrosse appropriate for college women; to devise skill tests which would objectively measure selected lacrosse playing skills of college women who had had little or no previous experience in lacrosse; and to establish a battery of lacrosse tests which would effectively measure skills and knowledges in lacrosse.

One hundred thirty-five subjects, who were freshman college women enrolled in five beginning lacrosse classes taught by the writer at Lynchburg College during the spring of 1967, participated in this study.

A seventy item, four-choice, multiple-choice knowledge test was constructed. From the items which met selection criteria, as determined by an item analysis, forty items were chosen for the final test. The reliability coefficient of the Revised Lacrosse Knowledge Test was fairly low (.68); however, the items possessed adequate discriminating power and degrees of difficulty.

Three lacrosse skill tests were developed: the Wall Volley Test, the Pick-Up, Dodge, Turn, Run Test, and the Shooting Accuracy Test. The test-retest method of establishing reliability was used. Averaged Judges' Ratings were used as the criterion for determining validity.

The Wall Volley Test yielded reliability coefficients of .85 for the best of three scores and .88 for the sum of scores. The Pick-Up, Dodge, Turn, Run Test produced a reliability coefficient of .83 when the best of three scores was used, and .63 when the sum of scores was used. Neither test was a valid measure of lacrosse playing ability as determined by the Judges' Ratings. It is suggested that each test be accepted on the basis of face validity to measure their respective skills. The reliability coefficients obtained for the Shooting Accuracy Test were too low to warrant additional statistical computations.

Several batteries of tests were analyzed. The skill test battery, which consisted of the Wall Volley Test (sum of scores) and the Pick-Up, Dodge, Turn, Run Test (best scores), had a multiple correlation coefficient of .50 when the first administrations of both tests were used. The skill test battery is an acceptable measure of lacrosse playing ability until a better measure is produced. The battery of tests, which consisted of the Wall Volley Test (sum of scores), the Pick-Up, Dodge, Turn, Run Test (best scores), and the Revised Lacrosse Knowledge Test, had a validity coefficient of .52 when the first administrations of the skill tests and scores on the revised knowledge test were combined. The skill and knowledge test battery is an acceptable measure of lacrosse playing ability until a better measure is produced. An intercorrelation coefficient of .31 between the Revised

Lacrosse Knowledge Test scores and the Judges' Ratings indicated that a relationship greater than chance existed between lacrosse knowledges and playing ability for the subjects who participated in this study.

CONSTRUCTION OF AN OBJECTIVE KNOWLEDGE TEST AND SKILL TESTS IN LACROSSE FOR COLLEGE WOMEN

by

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APPROVAL SHEET

This thesis has been approved by the following committee of the Faculty of the Graduate School at The University of North Carolina at Greensboro, Greensboro, North Carolina.

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

An emphasis on tests and measurements in physical education began shortly after the middle of the nineteenth century. Anthropometry, strength, and cardiovascular efficiency were the first areas of this field to be explored. After 1925, when physical education was recognized as an integral part of the educative process, a movement was begun to measure the concomitant (attitudes and appreciations), associated (knowledges and understandings), and technical (skills and fitness) learnings of physical education (5:6-8). It was with the areas of skill and knowledge testing that this writer was concerned.

If skill and knowledge tests are to be used successfully in physical education, care must be taken to provide sound evaluating instruments. If the attainment of objectives is to be evaluated accurately on the basis of students' progress and achievement, skillfully constructed standardized or teacher-made tests must be used.

The process of providing acceptable measures of skills and knowledges in any area of instruction is continual. Many aspects of physical education have been explored and appropriate measuring instruments constructed. However, adequate

measuring devices have not been produced in the areas of dance and several sports. Lacrosse is one of the sports in which limited experimentation has been conducted in the area of skill and knowledge assessment.

Lacrosse has been a popular sport for girls and women in the Northeastern states for many years. Recently participation in the sport has begun to encompass a larger geographical area since more schools and colleges are offering lacrosse in their physical education instructional, interscholastic, and intercollegiate programs.

The writer became interested in lacrosse while an undergraduate physical education major at Lynchburg College, Lynchburg, Virginia. This interest continued as a result of teaching lacrosse. The existing need for statistically sound measuring instruments became apparent during the first year of teaching. A survey of literature revealed that no attempts to standardize lacrosse knowledge tests, and only a few attempts to validate lacrosse skill tests, had been made. Therefore, it became the intent of this study to devise and standardize a lacrosse knowledge test and to supplement existing skill tests with new or revised tests. It is the hope of the writer that the results of this study will help to fulfill the need for sound measuring devices in lacrosse, foster interest in the sport, and encourage future experimentation in the area of lacrosse evaluating techniques.

Statement of the Problem

The purpose of this study was threefold:

1. To construct and standardize, on the basis of sound criteria, a valid and reliable knowledge test in lacrosse appropriate for college women.

2. To review existing skill tests in lacrosse; improve previously constructed tests; or if necessary, devise skill tests which objectively measure achievement in selected lacrosse playing skills of college women who have had little or no previous experience in lacrosse.

3. To establish a battery of lacrosse tests which would provide a suitable measure of lacrosse playing ability.

CHAPTER II

REVIEW OF LITERATURE

A review of literature was undertaken to determine the extent of research completed on lacrosse knowledge and skill testing. Preliminary readings revealed that no lacrosse knowledge tests had been published and that a limited number of lacrosse skill tests had been statistically analyzed. Therefore, a more extensive review was made to determine what knowledge tests had been published in individual and team sports. The order of presentation is chronological. Emphasis was placed on the types of test items used in the studies and the methods employed to establish reliability and validity coefficients. Appendix A presents a summary of the published knowledge tests in team and individual sports. Dates of publication, levels of instruction, types of questions, and indications of statistical analysis can be readily determined from this table.

Lacrosse skill tests are discussed in the second section of Chapter II. Emphasis was placed on skills evaluated and methods employed in the statistical analyses.

I. PREVIOUS STUDIES ON KNOWLEDGE TESTS IN INDIVIDUAL AND TEAM SPORTS

The first knowledge test to appear in the physical education literature was a basketball test by Bliss (3) in 1929. His test consisted of thirty true-false items regarding techniques. No statistical analysis was indicated or data reported.

In 1930, Knighton (25) published a soccer test, consisting of twenty-five true-false, five multiple-choice, and five completion items, designed for beginning players. The test was not statistically analyzed.

Rodgers and Heath (32), in 1931, constructed an objective knowledge test on playground baseball for fifth and sixth grade boys. The test, which was composed of one hundred true-false statements on rules and strategy, had a reliability coefficient of .89, P.E. .0242 according to Spearman's formula. Scores made on odd-numbered statements were correlated with the scores made on the even-numbered statements. In 1932, the same authors (18) conducted a similar study on soccer. On this one hundred item true-false test, the scores made on the odd-numbered statements were correlated with the scores made on the even-numbered statements. The reliability coefficient of the soccer knowledge test was $+.903 \pm .0181$, as determined by Spearman's formula. This test which was designed for fifth and sixth grade boys was assumed to possess curricular validity.

A written-practical basketball test published by Schleman (33) in 1932, was an attempt to provide a practical training technique for officiating basketball for use with large groups. It was used as a supplement to individual practice in officiating. No statistical analysis was reported.

In 1932, Hemphill (19) devised a series of knowledge tests in health and physical education activities for high school boys. On the basis of odd-even calculations, the coefficients of reliability were reported as follows: baseball, .773; basketball, .666; football, .780; self-defense, .877; health, .808; minor sports, .847; recreation, .730.

A golf knowledge test for college women was reported by Murphy (29) in 1933. The test, which accompanied the article, was composed of fifty true-false, ten completion, and thirty matching items. The reliability coefficient was found to be .76 for the half-test and .86 on the whole test following the application of Spearman's formula. Sigma scores were included for grading purposes.

Grisier (17) published a field hockey test in 1934, which was an attempt to provide a standardized test for USFHA officiating examinations. The test was validated by comparing the performances on the test of rated officials with the performances of non-rated officials and players. After discarding items for low validity, each test was scored as two equal halves (alternate items). The

reliability coefficient (product-moment correlation) for each form of the test was: Form A, .88; Form B, .88; and Form C, .92.

An ice hockey test for girls which accompanied twelve lesson plans and three skill tests was published in 1935 by Brown (12). The test questions, twelve true-false and six short-answer, were included in the article. No statistical data were reported.

In 1935, Wagner (45) constructed a knowledge test in tennis suitable for use with beginning groups of college women. The knowledge test was accompanied by several skill tests to provide objective methods of grading in beginning tennis. The knowledge test covered rules, court positioning, strategy, and knowledge of efficient form in strokes. Ten sample multiple-choice items were included in the article. No attempt was made to validate the test or determine its reliability.

In 1935, Snell (41) reported the results of a three-year testing project conducted by the Department of Physical Education for Women at the University of Minnesota. The study included examinations on the following activities: archery, baseball, basketball, fundamentals, golf, hockey, riding, soccer, tennis, volleyball, and hygiene. Expert opinion was the criterion used for ascertaining validity. The reliability of each test was determined by the correlation of chance halves, odd-numbered versus even-numbered

items, corrected by the Spearman-Brown prophecy formula. The reliabilities varied from a .51 for the riding test to a .92 for the hockey test. The tests were used as pretests for classifying students in service classes at the University of Minnesota and as post-tests for grading at the end of the term. Snell (39) published Part II of the preceding project in March 1936 which included the volleyball, soccer, and basketball tests. Each test was composed of forty-five best answer multiple-choice items. Part III of this project was published by Snell (40) in May 1936. The tests included in this article were golf and baseball, which had forty-five best-answer, multiple-choice items each.

In 1937, Scott (38) reported a teaching device which was designed for use in the training of basketball officials. It can be utilized as a written test (twenty-five situation questions) or as a decision chart while watching a game. This technique allows many people to officiate the same game. No statistical analysis accompanied the report.

According to Goll (48), in 1937 Phillips published a book, Fundamental Handball, in which he included a fifty-item, true-false test on handball, that covered rules, terminology, and fundamental techniques. No evidence of statistical analysis was presented.

Schwartz (34) reported a summary of her master's thesis in 1937. Her study dealt with skill and knowledge tests in basketball for senior high school girls. Her knowledge test consisted of fifty true-false, fifteen completion, twenty

best-answer multiple-choice, and fifteen pictorial items covering rules, team play, strategy, fundamental techniques, and player positioning. The validity of the test was established on the basis of "the opinion of experts". The scores on the test ranged from 100 to 33, with a mean of 69.9 and a standard deviation of 9.48. The reliability coefficient of the test was not established. Norms in the form of T-Scales were constructed for each skill test and for the knowledge test.

A "Comprehensive Tennis Knowledge Test" for college men and women was devised by Hewitt (21) in 1937. The test battery was composed of thirty true-false, fifteen multiple-choice, five diagrammatic, ten completion, twenty-five yes-no, and fifteen matching items. The questions covered rules, playing situations, fundamentals, history, and equipment. This test correlated highly with the Dyer Tennis Playing Ability Test ($r = .939 \pm .080$). It also correlated highly with months of playing experience ($r = .886 \pm .043$). A reliability coefficient of .947 was obtained by correlating odd against even items and stepping up this coefficient by means of the Spearman-Brown prophecy formula. This degree of reliability warranted the formation of parallel forms, A and B, of fifty questions each. A correlation coefficient of $.808 \pm .084$ was reported as a result of correlation of scores on this test with scores on the Minnesota Tennis Knowledge Test. It was assumed that the test possessed face

validity since it measured tennis essentials. The test was used as a supplement to skill tests in the classification of students into beginning, intermediate, and advanced classes. It was also used as a grading device.

Rodgers (31) presented a paper before the Test and Measurement Section of the American Association for Health, Physical Education, and Recreation in April 1938, which reported the results of a ten-year plan at the State Teacher's College, Lacrosse, Wisconsin, to develop objective knowledge tests in soccer, volleyball, and softball. These tests consisted of one hundred true-false statements. Scores on chance halves of the soccer test were correlated and the reliability coefficient determined by Spearman's formula was .903 .02. Validity was assumed on the basis of the choice of material for the questions and significant increases in scores at successive age levels. Reliability coefficients of the softball and volleyball tests were not reported.

A research project by Deitz and Frech (13), in 1940, indicated an attempt to devise a comprehensive field hockey knowledge test suitable for high school girls in grades nine through twelve inclusive. The test was a combination of seventy-seven true-false and completion items. A total of one hundred seventy-two subjects was tested. The range of scores, the median score, and the average score for each grade level was given. No additional statistical computations were reported.

The results of an extensive testing project, by the Research Committee of the Central Association of Physical Education for College Women were reported by Scott (35, 36, 37), in 1940 and 1941. The long term project included knowledge tests for three activities, namely: swimming, tennis, and badminton. The knowledge test in swimming (35) was published in 1940. The purpose of this phase of the project was to provide college swimming instructors with achievement examination for grading and classification purposes. An elementary swimming test consisting of thirty multiple-choice plus twenty-six true-false items and an intermediate test including twenty-two multiple-choice and thirty-six true-false items were constructed. Individual questions were based on material commonly covered in beginning and intermediate college swimming classes as revealed by a questionnaire. The items to be retained were based on the Swineford technique (an index of discrimination calculated by the formula $\text{Means}_{\text{rights}} - \text{Means}_{\text{wrongs}}$) and the difficulty rating (percentage passing the item). The reliability coefficient calculated by the odd-even method and corrected to actual length by the Spearman-Brown prophecy formula was found to be .888 for the revised elementary swimming test and .867 for the revised intermediate swimming test.

The tennis test (36) was similar in purpose, design, and statistical procedure to the swimming test. Again the Swineford technique and a difficulty rating were used to

determine the validity of the individual items. The revised Elementary Tennis Examination, which includes twenty-five multiple-choice and forty-one true-false items, yielded a reliability coefficient of .87. The revised Intermediate Tennis Examination, which included twenty-one multiple-choice and thirty true-false items, possessed a reliability coefficient of .78. The reliabilities of the final batteries were ascertained by correlating odd-even items and correcting by the Spearman-Brown formula. In this phase of the study, the committee found that a student's knowledge of tennis was not directly related to skill.

The final phase of the CAPECW Research committee project (37) was the construction and validation of a badminton examination. The final form of the badminton test contained forty-seven multiple-choice and thirty-three true-false items. The Swineford technique and a difficulty rating were used on this test to determine the validity of the individual items. The reliability coefficients computed by the odd-even method and corrected to actual length by the Spearman-Brown prophecy formula were .79 for the multiple-choice items, and .72 for the true-false items, based upon one hundred papers selected at random. A grading plan based on the achievement of the entire group was suggested by the committee.

French (15) reported a summary of her doctoral dissertation in 1943. This study included knowledge tests in sixteen physical education activities. The purpose of these

tests was to provide (1) a partial determiner of the technique requirement for women students majoring in physical education at the State University of Iowa and, (2) an indication of the student's ability to retain information and apply this knowledge in specific situations. Course outlines were consulted in the preparation of the items for each test. The tests were composed of multiple-choice items. The index of discrimination (Swineford's technique, $M_R - M_W$), and the difficulty rating served as guides in the selection of test items to be retained. The reliabilities were calculated by the odd-even method and corrected to actual length by the Spearman-Brown prophecy formula. The tests included in the study were as follows: badminton, basketball, body mechanics, canoeing, field hockey, folk dancing, golf, recreational sports, rhythms, soccer, softball, stunts and tumbling, swimming, tennis, track and field, and volleyball. The reliability coefficients for the full length form of the tests ranged from .884 on the volleyball test to .702 on the body mechanics test. The reliability coefficients for the subsequent short form of the tests ranged from .878 on the field hockey test to .619 on the stunts and tumbling test. The reliabilities on the full-length forms were computed on the total number of cases; for the short forms, they were computed only on those subjects who had received their instruction at the State University of Iowa. The results of the tests by French compared favorably with those reported by Snell and Scott.

In 1946, Phillips (30) reported the results of her doctoral dissertation. The purpose of this study was to construct a badminton test for beginning, intermediate, and physical education major students. The curricular validity of the examination was established by analysis of course content and badminton textbooks, supplemented by the judgment of four experts whose opinions were used to formulate a table of specificiations. The validity of individual items was ascertained by the Votaw Curve and difference-between-means methods. The reliability coefficients for the test ranged from .921 for the heterogeneous group (all groups) to .873 for the beginning group. The Kuder-Richardson formula, as adapted by Froelich, was used to determine these test reliabilities. The test in its revised form contained forty-five multiple-choice and fifty-five true-false items.

Fisher (49) completed a study in 1950 in which she devised knowledge tests in ten physical education activities. The purpose of the study was to initiate a unified testing program for measuring achievement in both knowledge and skill for women enrolled in physical education service classes at Ball State College. Multiple-choice questions were constructed from information contained in the course outlines. True-false items were also included in some of the tests. The questions were evaluated for face validity by the instructors of the activity courses. As the basis for test revision, the degree of difficulty and the index of

discrimination were computed using the Flanagan technique. No attempt was made to determine reliability coefficients for the knowledge tests. The final forms of the basketball and volleyball tests were considered satisfactory for use in measuring knowledge in college service classes. The recreational sports (badminton, archery, and table tennis), soccer, softball, tennis, stunts and tumbling, and swimming, (beginning, intermediate, and advanced), tests needed further study.

A tennis test which was a part of a long term project undertaken by the Women's Physical Education Department of the University of Washington, was reported by Broer and Miller (11) in 1950. The one hundred twenty-eight item revised test included multiple true-false, multiple-choice, true-false, short answer, and identification questions. Curricular validity was determined by the upper and lower thirds method. The reliability of the revised test was computed by the split-halves method and corrected to actual length by the Spearman-Brown prediction formula. The reliability coefficients were .82 for the beginning classes, .92 for the intermediate classes, and .86 for the combined groups.

Kelly and Brown (24), in 1952, published a field hockey knowledge test designed for use with physical education major students. The final form of the test was composed of eighty-eight multiple-choice questions. The test indicated increasing difficulty through expert, major, service, and lay groups. Critical ratios of the difference between means ranged from

5.97 to 38.47. A validity coefficient of .60 was reported for the combined major and expert group with quality of field hockey participation. The correlation was .52 for the major group. The reliability coefficient for the total group was .94 and for the physical education major group, .88.

In 1953, Miller (28) published a summary of her doctoral dissertation. The purpose of this study was to determine achievement levels (knowledge and skill) of women physical education major students in tennis. The judgment of experts and analyses of textbooks and courses of study were used to establish curricular validity. Validity of the individual items was ascertained through the use of the Votaw formula. The reliability coefficient determined by Froelich's variation of the Kuder-Richardson formula #20 was .90 when tests were corrected for guessing and .788 when the papers were scored by the number right. The one hundred-item revised form of the test included true-false, five-choice multiple-choice, and five-response multiple response questions. Norms in the form of T-scores and percentile ranks were reported.

A beginning badminton knowledge test, developed by the badminton committee of the Women's Physical Education Department at the University of Washington, was reported by Fox (14) in 1953. The reliability of the examination, calculated by the split halves method and corrected by the Spearman-Brown formula, was .90 ± .012. To assure

curricular validity, the selection of test items was determined on the basis of the course content outline. In addition, the percentage of test questions dealing with each area corresponded with the relative emphasis placed on these areas in the course of study. The upper-lower thirds method was used to determine the item validity. Item difficulty was determined by computing the percentage of the entire group that missed each question. The final one hundred six-item examination included multiple true-false, true-false, completion, and identification items.

A golf knowledge test, prepared for men enrolled in the required physical education program at the University of Florida, was reported by Waglow and Rehling (43) in 1953. The final form of the test included one hundred true-false items. Curricular validity was achieved by a survey of prominent books on golf. As a basis for test revision, the difficulty rating was obtained by determining the ratio of the correct responses to the number taking the test. The index of discrimination was calculated by the Flanagan technique. The reliability coefficient, established by the odd-even method and corrected by the Spearman-Brown prophecy formula, was found to be .82.

In 1955, Hennis (49) completed a doctoral dissertation involving the construction and evaluation of knowledge tests in selected physical education activities for college women. The activities included in this study were badminton,

basketball, bowling, field hockey, softball, tennis, and volleyball. The tests consisted of four-option, multiple-choice questions. The items ranged in number from thirty-two to thirty-seven for each test. The tests were administered to large numbers of women enrolled in colleges and universities throughout the United States. Reliability coefficients determined by Angoff's equation C, ranged from .81 on the softball test to .72 on the badminton test. Curricular validity in each case was established by an analysis of course content. In addition, a table of specifications for each test was formed based on course content as reported by staff members of ninety-seven institutions. The Flanagan and Aschenbrenner techniques were used to calculate the difficulty ratings and indices of discrimination of all items, as well as to detect the presence of nonfunctioning distractors. Percentile norms, for the revised tests, were established.

A volleyball test reported by Langston (26) in 1955, included one hundred true-false and multiple-choice items. Curricular validity was achieved through the use of a table of specifications designed from a review of textbooks and the opinion of nineteen experts. Item validity was established on the basis of a difficulty rating (proportion of correct responses to total number of cases). The reliability coefficient of the revised test, calculated by Froelich's adaptation of the Kuder-Richardson formula, was .823.

National norms have been established in the form of T-scores and percentile ranks.

A softball knowledge test was published in 1955 by Waglow and Stephens (44). The one-hundred-item test, consisting of true-false and completion statements, plus fair-or-foul-ball and ball-in-play-or-dead situation problems, was designed for use on the college level. The reliability coefficient of the first revised test was .83 calculated by the odd-even method, corrected to actual length by the Spearman-Brown formula. The reliability coefficient of the second revision, obtained in the same manner, was .78. Item validity was determined by the calculation of difficulty ratings and indices of discrimination. The difficulty rating was obtained by dividing the number of correct responses by the number who took the test. The Flanagan technique was used to find the indices of discrimination. T-scores are presented.

Goll (48) completed a Master's thesis in 1956, for which she constructed and evaluated a badminton and a swimming knowledge test for high school girls. The revised badminton test was composed of fifty-five multiple-choice items. The revised swimming test for all levels of ability consisted of sixty multiple-choice questions. Curricular validity, for each test, was established by consulting the course outline and objectives, and judged by a review of textbooks. Difficulty ratings and indices of discrimination

were computed for all items by the Flanagan method. The reliability coefficients, calculated by the odd-even method, corrected by the Spearman-Brown prophecy formula, were .85 ± .02 for the badminton test and .68 ± .03 for the swimming test.

Gershon (16) presented a summary of his doctoral dissertation in 1957. The purpose of the study was to develop a knowledge test on apparatus gymnastics for male physical education major students. Both the Flanagan index and the Votaw curve were utilized in determining the validity of the test items. The final test consisted of fifty-five multiple-choice questions and forty-five true-false statements. The reliability, ascertained by the Froelich adaptation of the Kuder-Richardson formula, was .72. The raw scores were not corrected for chance success. National norms were formulated.

In 1957, Winn (56) devised a soccer knowledge test for college men. A one-hundred item test and two duplicate form tests of sixty-five items each, were developed. Multiple-choice and true-false type items were used. The reliability coefficients of the revised tests, as determined by the Spearman-Brown prophecy formula, were .935 ± .007 for the one-hundred item test, .811 ± .029 for Form A and .810 ± .029 for Form B. The correlation coefficient between the one-hundred item test and Form A was .885 ± .043, while that between the one-hundred item test and Form B was .908 ± .046.

The correlation coefficient between Form A and Form B was .777 ± .033. Norms in the form of T-scores were developed for each of the revised tests.

Bradley (46) completed a research study, in 1959, on baseball knowledge testing. The curricular validity of the test was established by the judgment of thirty-three baseball instructors. The final test contained eighty, four-option, multiple-choice questions. The reliability coefficient reported was .847.

In 1960, Ley (51) completed a doctoral dissertation on the construction of objective knowledge tests to measure "high levels of achievement" in selected physical education activities. High Levels of achievement was defined as the ability to make generalizations, demonstrate understanding, and make application and interpretation of skills, techniques, and strategies of play. From thirty-six to fifty-five relevant multiple-choice items were constructed for the following activities: archery, badminton, basketball, bowling, golf, soccer, softball, and volleyball. Practical use of skills, techniques, and problems of play were emphasized. The tests were further characterized by an extensive use of diagrams and pictures. Test results were obtained from women in required and major physical education classes if fifteen colleges and universities. Each test was subjected to an item-analysis. In addition to the dissertation, the author published a manual which contained the revised tests. Data

sheets were included for each test, which indicated how each item functioned with regard to the index of discrimination, the degree of difficulty, level of relevance, and effectiveness of each distractor. The correct answer to each question was indicated. A lack of significant difference between required and major group results was reported.

In 1964, Hewitt (22) published a revision of his original (1937) Comprehensive Tennis Knowledge Test. The odd-even method, stepped up by the Spearman-Brown prophecy formula, yielded a reliability coefficient of .95. Validity was established by comparison of the Hewitt test with the Minnesota Tennis Knowledge Test (r = .81) and with Scott's Achievement Examinations for Elementary and Intermediate Tennis (r = .86). Item validity was determined by an item analysis and Holzinger's Index of Discrimination. This study indicated that a relationship exists between tennis knowledge and playing experience. A correlation of .89 was obtained when test results were compared with the number of months of playing experience.

A study, which was completed by McCutcheon (54) in 1965, involved the construction of an objective basketball knowledge test for college women enrolled in required physical education classes. Fifty four-choice, multiple-choice items were constructed. The questions covered rules, etiquette, procedure, techniques, skills, strategy, terminology, history, equipment, and safety. The reliability of

the examination, calculated by a Kuder-Richardson formula was .852. The Flanagan method was used for the item analysis. Time did not permit revision and readministration of the test; however, specific revision indications were made.

In 1966, Hooks (23) reported the results of a doctoral dissertation which involved the construction and standardization of objective knowledge tests in selected physical education activities for college men. It represents the first study of this type designed for college men. Tests were developed for use in badminton, softball, tennis, and volleyball service courses. The preliminary forms of the tests were administered to one hundred eighty-five students at Campbell College. As a result of item analysis, each final test contained fifty best-answer, multiple-choice questions. The final tests were administered to freshman and sophomore men enrolled in eighty-nine colleges and universities throughout the United States. Curricular validity for these tests was established by an analysis of textbooks and reference books in each activity, and by the opinion of experts. The reliability coefficients for the final forms of the tests were .85 for badminton, .81 for tennis, .77 for softball, and .73 for volleyball, determined by the odd-even method stepped up by the Spearman-Brown prophecy formula. National percentile norms and American Association for Health, Physical Education, and Recreation district percentile norms were developed for each test.

II. PREVIOUS STUDIES ON SKILL TESTING IN LACROSSE

A perusal of the literature was made for published objective skill tests in lacrosse. A limited number of studies, employing methods of evaluation other than the subjective opinion, was found.

The first battery of skill tests in lacrosse was reported in 1954 by Waglow and Moore (42). These tests were not subjected to full statistical analysis. The four skill tests included in this battery were designed to measure six different lacrosse skills, namely: shooting, throwing, scooping, cradling, weaving, and dodging. The purpose of the goal shooting test was to measure the student's ability to score a goal from twenty yards in front of the goal. The test which was designed to measure throwing accuracy from different angles utilized a stationary wall target, placed forty yards from the throwing line. The purpose of the scoop and weave combination test was to determine the student's time in picking up a stationary ball and cradling as he ran around barriers. The dodging test was designed to measure the student's time in cradling the ball and executing dodges around barriers. These tests were administered to college men.

In 1963, Lutze (53) constructed a series of skill tests for women lacrosse players at the beginning level. The battery consisted of three skill tests which measured the following individual lacrosse skills: goal-shooting,

throwing, catching, picking up, dodging and pivoting. One test consisted of goal-shooting at a wall target. The shot used for the test was the long, bouncing shot. Alternate scoring methods were developed for this test. The overarm throw was used for the second test which consisted of throwing and catching a ball continuously against a wall for three trials of thirty seconds each. The pick up, pivot, and dodge test was administered by picking up a stationary ball, dodging three standards, running between two lines and using a pivot for change of direction. In addition to the skill tests, a rating scale was constructed for the purpose of subjectively rating the general playing ability of the subjects. A five-point scale including the following categories was used: excellent, good, average, fair, and poor. Each of these categories was defined for the judges. Correlations were computed between judges one and two, two and three, and one and three. The coefficients of correlation were .84, .82, and .75 respectively as determined by the Pearson Product-Moment method of correlation. Reliability for each test was computed by correlating the sum of the trials of each test against the sum of the trials of the retest. The reliability coefficients were .79 to .77 for the Goal Shooting Tests, .88 for the Pass and Catch Test, and .82 for the Pick-Up, Pivot, and Dodge Test, when the number of trials was increased by the Spearman-Brown prophecy formula. Validity coefficients were computed by

correlating the criterion with the sum of the trials of the test. The validity coefficients were .28 to .11 for the Goal Shooting Tests, .57 for the Pass and Catch Test, and .20 for the Pick-Up, Pivot, and Dodge Test. The author indicated that the reasons for poor statistical results were possibly due to an insufficient number of subjects, a lack of motivation, and disagreement among the judges.

In 1965, McGowan (27) devised a Skill Test for the Overarm Pass. Experiments were conducted to determine the speed of a "good pass" as well as the optimal area in which to catch a pass. The test utilized a rectangular wall target measuring seven feet by eight feet, divided into fifty-six square blocks. The passes from a release point located thirty feet from the wall were timed. If the speed of the pass fell within the established limits, the point value of the block was doubled. The test consisted of ten trials. Extensive experimentation was not conducted; therefore, no statistical data was reported.

Wilke (55) completed a study in 1967 in which she devised three lacrosse skills tests which were designed to measure selected lacrosse skills of college women who had little or no previous experience in playing lacrosse. The Passing Test was designed to measure the subject's ability to pass ahead of the intended receiver. The ball was thrown from behind a release line located twenty-four feet from the target. The purpose of the Catching Test was to

measure the subject's ability to catch on the left and the right. The test utilized a throwing machine designed by a graduate student at the University of North Carolina at Greensboro. The purpose of the Pick-Up, Run, Dodge Test was to measure speed and cradling ability when dodging obstacles and running. Reliability of the tests was established by the test-retest method. Reliability of the Passing and Catching Tests was also calculated by the odd-even method stepped up by the Spearman-Brown prophecy formula. The difference between the results of the first and second administrations of each test were tested for significance. The Passing Test had a reliability coefficient of .78 when the number of trials was stepped-up to twelve. A reliability coefficient of .82 was obtained on the Catching Test when practice was allowed and the number of trials increased to twelve. The Pick-Up, Run, Dodge Test had a reliability coefficient of .78 when the best of three trials was used. Validity was determined by correlating the sum of the judges' ratings with the score of the first and second administrations of the Passing and Catching Tests and with the best score of the three trials on the Pick-Up, Run, Dodge Test. The validity coefficients were: .17 on the first administration of the Passing Test, .40 on the second administration of the Catching Test, and .45 on the first administration of the Pick-Up, Run, Dodge Test. None of the tests were shown to be statistically valid measures of

general lacrosse playing ability when compared with the judges' ratings.

At the present time, the division for Girls and Women's Sports is conducting a lacrosse skill testing project under the direction of Mushier (50). The results are to be included as a part of the AAHPER Sports Skills Tests Project. The study is expected to be published in 1967. Tests included in the test manual are designed to measure ability at all levels in the following individual lacrosse skills: throwing for accuracy, throwing for distance, catching and throwing, shooting, cradling, picking up a moving ball, and dodging. No statistical data has been reported to date.

CHAPTER III

PROCEDURE

I. LACROSSE KNOWLEDGE TEST

A survey of literature revealed no published knowledge tests in lacrosse. Therefore it was one of the purposes of this study to construct a lacrosse knowledge test which would be a reliable and valid measure of knowledges attained upon the completion of a beginning course in lacrosse on the college level.

Test Construction

Prior to the construction of the Lacrosse Knowledge Test, an analysis of textbooks and source material on lacrosse (2, 4, 7, 8, 57, 60) was made in order to complete an outline of course content and to determine the areas of emphasis for the test items. The textbook analysis, supplemented by the writer's teaching experience, and suggestions on test construction by Barrow and McGee (1:498), served as the basis for the construction of a Table of Specifications; i.e., a table indicating the approximate percentage of items allocated to each area. The areas included rules and scoring, techniques and skills, basic strategy and tactics, terminology, history, and safety. The percentages allocated to each area

reflected as closely as possible the relative emphasis placed on the various areas during the instructional phase of the course.

The multiple-choice type item was chosen for use in this study, since according to Scott and French (6:100), it is preferred for the following reasons:

1. It can be adjusted to test for various depths of understanding.
2. It can be made completely objective in scoring and adapts easily to answer sheets.
3. It makes possible the detection of nonfunctional responses.
4. It tests the student's ability to eliminate incorrect responses as well as to select the correct response directly.
5. It does not require correction for guessing.
6. It seems to have fewer disadvantages than the other commonly used forms: alternate response, . . ., matching forms, and recall. . . .

The test items were derived from textbook and source material statements and personal thoughts. Each statement or idea was placed on an individual index card. On the reverse side of each card, the information was written as a direct question with as many responses as possible. The correct response was listed first. The distractors were then rearranged. The order of arrangement was determined by logical order, i.e., alphabetical, numerical, ascending or descending order, or grouping of similar concepts. Items and distractors were prepared on the basis of rules for construction suggested by Scott and French (6:101) and Wood (10:43-57). The items were examined by the writer's thesis advisor and suggested revisions were made. The preliminary form of

the test, consisting of seventy, 4-choice, multiple-choice items was completed and typed for duplication. The order of occurrence of items was determined by random selection. Answer sheets and a scoring key were also prepared.

Selection of Subjects

The subjects selected to participate in this study were one hundred thirty-five college freshman women enrolled in five beginning lacrosse classes taught by the writer at Lynchburg College in the spring of 1967. With few exceptions, the subjects had little or no previous experience in lacrosse.

The textbook used in this course was an activities manual by Vannier and Poindexter (8). Supplementary mimeographed sheets presenting material inadequately covered in the textbook were compiled by the writer and distributed to the students. An effort was made to avoid keying the material to the test questions.

Administration of the Test

The test was administered on May 25, 1967, at 2:00 p.m. during the regular final examination period. All subjects were tested simultaneously in an auditorium with seating capacity of two hundred.

Answer sheets were distributed and requested information secured including name, course, class hour, and date. The test booklets were distributed and the directions were read to the subjects. The subjects were instructed to make

complete erasures if an answer was changed. It was requested that no marks be made on the test booklet. The subjects were instructed to place the answer sheet inside the test booklet upon completion of the test.

Treatment of the Data

The answer sheets were hand scored as soon as possible after the administration of the test. All items were checked for the possibility of multiple answers. Such items were scored as incorrect.

The range, mean, and standard deviation of the scores were computed. The following raw score formula was used in the computation of the standard deviation (9:92):

$$\sqrt{\frac{N\Sigma X^2 - (\Sigma X)^2}{N(N-1)}}$$

The Flanagan technique of item-analysis, which utilizes the extreme 29% of the cases, was used to determine the difficulty rating, the index of discrimination, and the existence of non-functional distractors. This technique gives double weight to the extreme 9% of the scores at each end of the distribution in the computation of the index of discrimination. This computation requires the subsequent use of Flanagan's Table of Product Moment Correlation Coefficients Corresponding to Various Proportions of Successes in the 29% Scoring Highest and Lowest (59). The mean and standard

deviation of the difficulty ratings and indices of discrimination for the total test were also computed.

On the basis of the item-analysis, items were discarded which fell outside of the range of ten to ninety per cent difficulty rating and which had an index of discrimination below .20. Items with fewer than two functioning distractors were also discarded. A distractor was considered as non-functioning if it were selected by fewer than three per cent of the subjects. The best of the remaining items were selected for inclusion in a forty-item form of the test on the basis of content corresponding to the Table of Specifications. A new key was constructed and the tests were rescored on the basis of the forty-item revised test. The mean and standard deviation of the revised test were determined and the mean and standard deviation of the difficulty ratings and the indices of discrimination were computed.

The reliability coefficients of the original test and the revised form of the test were determined by a Kuder-Richardson formula:

$$r_{tt} = \frac{n\,\sigma_t^{\,2} - M(n - M)}{(n - 1)\,\sigma_t^{\,2}}$$

According to Barrow and McGee (1:521), this formula provides the lower limit of the real reliability coefficient. With the use of this formula the test does not have to be split

into corresponding halves and only one administration of the test is required.

Ebel's Test Analysis (58:4) was completed for the purpose of judging the quality of the Revised Lacrosse Knowledge Test.

II. LACROSSE SKILL TESTS

A survey of the literature indicated that several attempts have been made to measure lacrosse playing skills (27, 42, 50, 53, 55). Eighteen skill tests were reviewed. Of these tests, only six had been subjected to a statistical analysis (53, 55).

Lutze (53) conducted a survey in her study which indicated that the following individual lacrosse skills were most essential to playing the game: holding the crosse, catching on the right and left, catching on the run, picking up a stationary ball, cradling, marking, passing, pivoting, dodging, body checking, cutting, and footwork. Shooting for the goal was added to this list by the writer because of its relationship to team success. From this list, the skills which could be objectively measured include: catching, picking up a stationary ball, passing, pivoting, dodging, and shooting.

It was the purpose of this study to analyze existing skill tests in lacrosse; improve previously constructed tests; and, if necessary, construct skill tests which

objectively measure achievement in selected lacrosse playing skills of college women who have had little or no previous experience in the sport.

Pilot Study

As a preliminary step to a pilot study, all of the available lacrosse skill tests were reviewed. Twelve of the tests were eliminated because they did not meet the following criteria: practicality, feasibility, objectivity, game-like situations, encouragement of good form, suitable difficulty, and involvement of only the performer (6:10-17). The remaining six tests were subjected to additional analysis.

The pilot study was conducted in two parts; the first at Sweet Briar College, Sweet Briar, Virginia, the second, at Lynchburg College, Lynchburg, Virginia. Through the cooperation of Miss Judith A. McMoran, a member of the Physical Education Department of Sweet Briar College, a Fall section of beginning lacrosse was made available for the purpose of experimentation with the selected skill tests. With a few exceptions, these students had had little or no previous experience in lacrosse. Twenty-one students participated in this portion of the pilot study. The second group of subjects used in the pilot study was the Lynchburg College Women's Lacrosse Team. Fifteen students participated in this phase of the study.

The tests selected for administration were: Lutze's Passing and Catching Test (53:24-27); Wilke's Pick-Up, Run,

Dodge Test (55:51-52); Mushier's Lacrosse Throw for Accuracy Test (50:3), Run and Cradle for Speed Test (50:7), Lacrosse Shot for Goal for Accuracy Test (50:6), and Lacrosse Repeated Catch and Throw Test (50L9). The Pick-Up, Run, Dodge Test and the Run and Cradle for Speed Tests were administered out-of-doors at Sweet Briar College. The remaining tests were administered two days later in the gymnasium.

Lutze's Passing and Catching Test was designed to measure the ability to pass accurately and catch on both sides of the body. The test involved the use of a wall target twelve feet high and fifteen feet long. A restraining line, located twelve feet from the wall, was divided into three parts: two passing zones (one located on each end of the line) and a neutral zone in the center. The test involved throwing the ball from the right passing zone to the left half of the target; catching the ball on the left; throwing it to the right half of the target; and catching the ball on the right. This process was repeated as many times as possible within a period of thirty seconds. Three trials were allowed. The following observations were made during the administration of the test: (1) the regulation lacrosse ball produced an unpredictable rebound from the brick wall; (2) the indoor type ball failed to rebound sufficiently; and (3) the test appeared to be too difficult for the subjects' level of ability. A total of eighteen subjects participated in the test. An insufficient number of scores was available for a

statistical analysis since impromptu experimentation was done with the two different types of balls. It was assumed that a different type rebound surface was used in the original study. Lutze obtained a reliability coefficient of .88 when the number of trials was raised to nine. Since nine trials seemed impractical and the degree of difficulty of the test appeared to be too high for beginning players, the test was not selected for further use in the writer's study.

Wilke's Pick-Up, Run, Dodge Test consisted of picking up a stationary ball, dodging three obstacles, turning at a restraining line, dodging the obstacles again, and running across the finish line with the ball. The distance between the starting line and the restraining line was seventy-five feet. The ball was positioned thirty feet from the starting line and fifteen feet from the first obstacle. The obstacles were placed six feet apart. A subjective evaluation of this test indicated the possibility of improved performance by making several minor adjustments in the indicated distances between various points on the test course. The test was administered in its original form to nineteen subjects at Sweet Briar College. The scores ranged from 12.9 to 20.5 with a mean score of 15.16. Additional statistical computations were not made since the basic value of the test had been demonstrated by Wilke. However, several changes were suggested on the basis of subjective judgment. It was observed during the test that the subjects could not gain full body and ball control or continue at top speed after

the ball pick-up, before dodging the first obstacle. It was also felt that the distance between obstacles could be increased slightly for beginning players. This test was subjected to additional experimentation at Lynchburg College. The group of varsity players experimented with various distances between obstacles, the starting line and the ball, the ball and the first obstacle, and the last obstacle and the restraining line. The following changes were made: the distance between the ball and the first obstacle was increased to twenty feet; the distance between the obstacles was increased to six feet, six inches; and the distance between the last obstacle and the turning line was decreased to twelve feet. It was believed that these changes produced a test that was more suitable for measuring the playing ability of beginning lacrosse players than the original test. This revised test, the Pick-Up, Dodge, Turn, Run Test, was selected for use in the experimental study for the purpose of the development of a battery of lacrosse skill tests. A complete description of the test and directions for administration can be found in Appendix C.

Mushier's Lacrosse Throw for Accuracy Test involved the use of a wall target which consisted of three concentric squares, the largest of which (four feet by four feet) was located seven feet above the floor. Each square was assigned a numerical value. The test consisted of throwing twenty balls at the target from behind a restraining line located twenty feet from the wall. Twenty Sweet Briar

College students participated in the test. A statistical analysis of this test was not made. On the basis of subjective judgment, it was concluded that the test was not gamelike since the subject was not required to run prior to the release of the ball. In addition, it was believed that the target was higher than the desired height for receiving a pass.

An adaptation of Mushier's Run and Cradle for Speed Test was administered to nineteen students at Sweet Briar College in an attempt to measure objectively the ability to cradle. The test consisted of two administrations: (1) a timed run through a simple obstacle course while carrying, by any means, a lacrosse stick; and (2) a timed run through the same obstacle course while cradling a lacrosse stick and ball. Scores for the test were obtained by subtracting the time of the first trial from the time of the second trial. During the second administration of the test, it was questionable whether methods used to carry the ball through the obstacle course could be classified as cradling. Therefore, the use of a subjective judgment was necessary to determine whether or not the subject had cradled. In addition, it was difficult to motivate the subjects to run at top speed during the first administration of the test. As a result, several negative scores were obtained. It was decided that the use of methods necessary to force the subject to cradle would change the test so that it would be measuring skills

other than cradling. Scores obtained on this test were not subjected to a statistical analysis.

Mushier's Lacrosse Shot for Goal for Accuracy was also administered at Sweet Briar College. Scores were obtained for eighteen subjects. This test involved the use of a goal-size wall target which was divided into nine equal squares. Each square was assigned a numerical value. Five shots each were taken from the right, center, and left shooting areas. In the original study, ten shots were taken from each angle. For the purposes of this study, the number was reduced to five because of a time factor. The center of the right and left shooting lines was positioned at a forty-five degree angle measured from the center of the goal line. Floor markings consisted of three shooting lines placed ten yards from the target and three restraining lines located five yards behind the shooting lines. The subject stood behind the restraining line with a ball in her crosse, ran forward, and released the ball before crossing the shooting line. Scores on each hit were announced by the scorer and recorded by the subject. Subjects were highly motivated during this test to score as high as possible. The quality of each performance was known immediately. Angle shots were considered important since few shots during an actual game situation are taken from directly in front of the goal. The possibility of the use of long bouncing shots also made the test more gamelike. It was observed, however, that rebound

shots off the floor bounced higher than comparable shots off the ground. For beginners, it was believed that the shooting lines should be moved closer to the target for the measurement of that degree of accuracy. Difficulty was also experienced in the reading of the scores of hits. Sums of scores ranged from 2 to 24 on the right, 5 to 21 in the center, and 4 to 20 on the left. Mean scores were 11.28, 10.39, and 13.17 respectively. On the basis of the face validity of the test and the students' reaction to the test, it was revised and included for use in the development of a battery of skill tests for beginning lacrosse players. The Shooting Accuracy Test, which was a modification of the Lacrosse Shot for Goal for Accuracy Test described by Mushier (50:6), was designed to measure the player's ability to shoot accurately. For the purpose of the present study, a target was constructed which could be superimposed upon the front of a regulation lacrosse goal for use out-of-doors; or which could be secured to a gymnasium wall if it became necessary to administer the test indoors. The target was constructed of 1" x 6" white pine finish lumber and 2" x 2" strips of lumber. Outside dimensions of the goal-target were 6'4" x 6'4" with a target area of 6' x 6', the size of a regulation goal. A complete description of the test and directions for administration can be found in Appendix C.

Markings for Mushier's Lacrosse Repeated Catch and Throw test consisted of a wall line ten feet high, fifteen

feet long, parallel to and ten feet from the wall. The test was characterized by repeated wall volleys thrown from behind the restraining line for a period of thirty seconds. Three trials completed the test. This test could not be administered in the Sweet Briar Gymnasium since the composition of the brick and the edges of the bricks as a result of the recessed mortar caused the regulation ball to rebound at unpredictable angles. Insufficient rebound resulted when the indoor ball was used. An informal experiment was conducted by the writer and varsity lacrosse players at Lynchburg College to evaluate this test. It was discovered that on this particular gymnasium wall, which was a fairly smooth painted brick surface, the wall line was too high. Further experimentation revealed that better results were obtained under these circumstances when the wall line was placed six feet above the floor and when the restraining line was placed ten feet, six inches from the wall. It was also believed that three trials of sixty seconds each would provide more consistent scores. On the basis of the face validity of the test and the successful use of wall volley tests for the measurement of skill in other sports, the test was revised and included in the experimental study for the purpose of establishing a battery of skill tests which would measure lacrosse playing skills. A complete description of the Wall Volley Test and directions for administration can be found in Appendix C.

Development of the Rating Scale

The criterion for determining the validity of the skill tests was a subjective rating scale, designed to measure lacrosse playing ability. Prior to constructing the scale, the rating scales developed by Lutze (53:62) and Wilke (55:54) were reviewed. Wilke's rating scale, which was a revision of Lutze's scale, consisted of five categories: very good, good, average, fair, and poor with numerical values of 5, 4, 3, 2, and 1 respectively. Each category was defined with regard to levels of performance of each playing skill. The following skills were included in each category: cradling, passing, catching, body control, player awareness, dodging, and changing direction. During the rating session, each player was observed in a game situation and assigned a rating of one to five.

Since neither Wilke's nor Lutze's rating scales had proven too successful according to the judges who used them, a different type of scale was devised. For this rating scale, eight skills were selected which were considered essential to playing the game. These skills were cradling, picking up a ball, catching, passing, evading opponents, shifting from offense to defense, field positioning, and body control. Each of these skills was defined in terms of five categories: excellent, good, average, fair, and poor. Additional discrimination was made possible through the use of a three point span within each category. For example,

for a good performance on catching, a judge could give the player a rating of G-, G, or G+. Each time a player performed one of the selected skills, a rating was to be given. A final rating was to be assigned to each skill observed and a composite score determined for each subject. A complete description of the rating scale and instructions for its use are provided in Appendix D.

Selection of Subjects

Subjects used in this study were college freshman women enrolled in five beginning lacrosse classes taught by the writer at Lynchburg College, Lynchburg, Virginia, during the spring semester of 1967. One hundred thirty-five subjects participated in the study. With a few exceptions, these students had had little or no previous experience in lacrosse. The classes met at 8:00 a.m., 10:20 a.m., 11:20 a.m., 12:05 p.m., and 1:00 p.m. for forty-five minute periods twice a week.

Administration of the Tests

Prior to the administration of the tests all classes had participated in twelve activity classes. Two lessons were taught indoors because of inclement weather. All tests were practiced before the day of testing. The Wall Volley and Pick-Up, Dodge, Turn, Run Tests were administered during the week of May 15-18. Four stations of the Wall Volley Test were set up in the gymnasium and two stations of the Pick-Up,

Dodge, Turn, Run Test were marked on the lacrosse field. The tests were explained and demonstrated for the administrators, scorers, and linesmen. Three physical education major students at Lynchburg College assisted in the administration of the tests. Additional linesmen and scorers were volunteers from the classes tested. The personnel required for the administration of each test is indicated in Appendix C under the directions for the test.

For testing purposes, the classes were divided into two groups. One group took the Wall Volley Test during the first half of the period and the Pick-Up, Dodge, Turn, Run Test during the second half of the period. The second group took the Pick-Up, Dodge, Turn, Run Test first, and then the Wall Volley Test. The same procedure was followed two days later during the re-testing process. Subjects recorded their scores after each trial.

On May 23, 1967, the Shooting Accuracy Test was administered in the gymnasium due to inclement weather. The target was attached to the gymnasium wall. The test was explained and demonstrated for the administrator, linesmen, and scorer. Because of the time consuming nature of the test, only five trials from each angle were possible within a class period. The test was re-administered two days later to fifty students between 12:30 p.m. and 1:30 p.m., and to eighty-four students between 3:30 p.m. and 5:00 p.m. Ten trials from each angle were taken. Initially the subjects

were divided into three groups for this test. Each individual was allowed to progress to another shooting line as soon as she had completed ten trials from any one angle.

Selection of the Judges

Five judges were selected to evaluate the playing ability of the subjects. Judge I taught lacrosse and coached the Lynchburg College Women's Lacrosse Team for two years. Judge II was a junior physical education major student at Lynchburg College. She has played lacrosse for three years and played on the Virginia Women's Lacrosse Team in the National Tournament in 1965. Judge III played lacrosse at Sweet Briar College for four years, taught lacrosse and coached the Sweet Briar College Lacrosse Team for one year. Judge IV has taught lacrosse and coached the Sweet Briar College Lacrosse Team for several years. Judge V, the writer, has taught lacrosse three years and has coached the Lynchburg College Women's Lacrosse Team for two years.

Prior to the rating session, the judges were given the rating scale and instructions. The scale was discussed with each judge individually. On Monday, May 10, 1967, the judges met for a few minutes before the first class and discussed the rating scale, instructions, and rating sheet. All subjects were rated that day.

It was observed during the first class that the judges experienced difficulty in observing the players and recording the ratings. In order to alleviate this problem,

student scorers were provided for the remaining rating sessions. The scorers received a ten-minute briefing on the technique of scoring the ratings given verbally by the judges. This technique made it possible for the judges to make more evaluations, since they were not required to look at the rating sheets. An analysis of the completed rating sheets revealed that the skill areas least frequently evaluated were shifting from offense to defense, field positioning, and body control.

Treatment of the Data

All the data were collected, organized, and subjected to statistical analyses. On the Wall Volley Test and the Pick-Up, Dodge, Turn, Run Test, the best trial and the sum of the three trials were analyzed. The sum of scores for each trial (right, center, and left) of the Shooting Accuracy Test were used. The range, mean, and standard deviation of the scores on each administration of the tests were determined. All correlation coefficients were computed by using the Pearson Product-Moment Formula for raw scores. The test-retest method was used to obtain scores for determining test reliability.

Judges' ratings were used as the criterion for establishing the validity coefficients of the tests. Since some judges failed to assign ratings to all eight skill areas, it became necessary to accept a judge's overall rating when she assigned values to a minimum of four skills.

In addition, judges' ratings were averaged only if a minimum of three of the five judges presented ratings for each subject. Intercorrelations among judges' scores were calculated.

Following an analysis of each of the individual tests, an attempt was made to establish a battery of tests which would be an acceptable measure of lacrosse playing ability. Multiple correlations were computed on two combinations of tests: (1) the Wall Volley Test and the Pick-Up, Dodge, Turn, Run Test; and (2) the Wall Volley Test, the Pick-Up, Dodge, Turn, Run Test, and the Revised Lacrosse Knowledge Test. The Doolittle Method of Multiple Correlation as presented by Scott and French (6:92) was used.

CHAPTER IV

ANALYSIS OF DATA

I. LACROSSE KNOWLEDGE TEST

Prior to the construction of the knowledge test, a survey of textbooks and source materials served as the basis for the construction of a course outline and the establishment of a Table of Specifications for the test items. (See Table I, page 50.) A preliminary test of seventy, four-choice, multiple-choice items was constructed.

The test was administered to one hundred thirty-five college freshman women enrolled in five lacrosse classes taught by the writer. One paper was eliminated because, in the opinion of the writer, the student's language difficulty as a result of her foreign background rendered her paper inappropriate to a statistical analysis of items.

The scores on the original test ranged from 66 to 22. The mean score was 49.63 and the standard deviation of scores was 6.51.

The difficulty ratings of the items on the original form of the test ranged from .15 to 1.00, with a mean rating of .71 and a standard deviation of .22. The indices of discrimination of the items on the preliminary test ranged from .00 to .66, with a mean index of .33, and a standard deviation of .15.

TABLE I

TABLE OF SPECIFICATIONS - APPROXIMATE PERCENTAGES

Content	70-Item Test	60-Item Test	40-Item Test
RULES	16	15	17.5
SKILLS AND TECHNIQUES	42	40	40.0
BASIC STRATEGY AND TACTICS	33	32	35.0
TERMINOLOGY AND EQUIPMENT	7	9	5.0
HISTORY	1	2	0.0
SAFETY	1	2	2.5
	100%	100%	100.0%

The reliability coefficient of the original test, as determined by the Kuder-Richardson formula, was .67.

As a result of the item-analysis, fifteen items were eliminated because of a high difficulty rating coefficient and/or the presence of two or more non-functioning distractors. Seven additional items were eliminated on the basis of low indices of discrimination. Eight others, satisfactory in every respect, were omitted so that the percentages for subject content areas could approximate those percentages indicated in the Table of Specifications. Three items with difficulty ratings higher than .90 were retained so that the standards of the Table of Specifications could be met.

The Revised Lacrosse Knowledge Test consisted of forty items. Scores on the final form of the test ranged from 9 to 37, with a mean score of 26.22, and a standard deviation value of 5.21. The difficulty ratings of the revised test ranged from .15 to .96, with a mean rating of .65, and a standard deviation value of .18. The indices of discrimination on the final form of the test ranged from .21 to .66, with a mean index of .39. The standard deviation of the indices of discrimination of the revised test was .12. The reliability coefficient of the revised form of the test was .68 as determined by the Kuder-Richardson formula. These data appear in Table II, page 52.

Curricular validity of the Revised Lacrosse Knowledge Test was established by an analysis of course content and

TABLE II

A COMPARISON OF THE SCORES, DIFFICULTY RATINGS, INDICES OF DISCRIMINATION, AND RELIABILITY COEFFICIENTS OF THE ORIGINAL AND REVISED LACROSSE KNOWLEDGE TESTS

	Original Test	Revised Test
NUMBER OF SUBJECTS	134	134
SCORES		
Number of Items	70	40
Range	22 - 66	9 - 37
Mean	49.63	26.22
Standard Deviation	6.51	5.21
DIFFICULTY RATING		
Number of Items	70	40
Range	.15 - 1.00	.15 - .96
Mean	.71	.65
Standard Deviation	.22	.18
INDEX OF DISCRIMINATION		
Number of Items	70	40
Range	.00 - .66	.21 - .66
Mean	.33	.39
Standard Deviation	.15	.12
RELIABILITY COEFFICIENT	.67	.68

lacrosse textbooks. Statistical validity of the test could not be determined since an external criterion of achievement was not available.

Ebel's Test Analysis Report (58:4) was completed to aid in judging the quality of the Revised Lacrosse Knowledge Test. This analysis was designed to answer the following questions (58:2):

1. Is the test fair to the course, in view of the things the course is supposed to teach?

2. Is the test fair to the students, in view of the instruction given them?

3. Is the test administered under conditions which give each student a good and an equal chance to demonstrate his achievements?

4. Does the test emphasize important, long-run achievements more than incidental, quickly forgotten information?

5. Are the questions individually effective in distinguishing between good and poor students?

6. Is the test of appropriate difficulty, neither too hard nor too easy?

7. Does the test as a whole distinguish clearly between students at different levels of ability?

8. Are the scores reasonably reliable, so that they would agree closely with those from another equivalent test?

9. . . .

10. Is the length of the test appropriate for the time available - long enough to give reliable scores but short enough so most students have time to attempt all items?

The test is believed to meet adequately the criteria set forth in the first three questions as indicated by the

Table of Specifications, observation, and the writer's subjective opinion. Results of the test analysis revealed that overall emphasis was placed on important achievements rather than simple recall of facts, even though the test contained some items of the latter type.

As indicated by Table II (page 52), the discriminating power of the test was increased slightly by the exclusion of items with indices below .20. On the basis of Ebel's test analysis, forty-five per cent of the items were highly discriminating (.40 and up) and fifty-five per cent were moderately discriminating (.21 to .40). Therefore, the individual items of the Revised Lacrosse Knowledge Test differentiate effectively between high and low levels of achievement as reflected by Ebel's criteria.

Table II reveals that the difficulty of the test was increased slightly by the elimination of very easy items and those items with two or more non-functioning distractors. Barrow and McGee (1:519) suggest that the mean difficulty rating of an entire test should be about fifty per cent of the number of items. Since the mean score of the revised test was 26.22, the test is considered moderately easy. The mean score compares more favorably with Ebel's standard of difficulty (58:6), which was 25.0 for this test. On the basis of these criteria, the Revised Lacrosse Knowledge Test is considered appropriately difficult. The difficulty of the test could be increased and the quality of the test

improved by the addition of more difficult items in the areas of safety, equipment, terminology, history, and rules.

The standard deviation of the revised test (5.21) compared favorably with Ebel's standard of variability (58:6), which was 5.0 for this test. On the basis of this standard of comparison, the Revised Lacrosse Knowledge Test discriminates fairly well between students of high and low levels of ability. A higher standard deviation value would indicate a more effective test. Greater variability in scores could be obtained by the addition of items with high degrees of difficulty.

The reliability coefficient of the Revised Lacrosse Knowledge Test was .68 as determined by a Kuder-Richardson formula. The minimum standard for acceptable reliability was set at somewhat below .70 by Ebel (58:7). The reliability of a knowledge test is influenced by several factors, including the standard deviation, length of the test, discriminating power, and difficulty level (1:519). The reliability of the revised test would be expected to increase upon the addition of a combination of items of comparable quality and items with higher degrees of difficulty and discriminating power.

Sufficient time was allotted for the test. One hundred per cent of the subjects finished the test within the time limit.

II. LACROSSE SKILL TESTS

The purpose of this portion of the study was to analyze existing lacrosse skill tests; improve previously constructed tests; and if necessary, construct skill tests which objectively measure achievement in selected lacrosse skills of college women who have had little or no previous experience in lacrosse. Following a pilot study, three tests were selected for revision and administration. These tests, the Wall Volley Test, the Pick-Up, Dodge, Turn, Run Test, and the Shooting Accuracy Test, were administered to one hundred thirty-five Lynchburg College freshmen during May 1967. Judges rated performance of playing ability during that same month.

Judges' Ratings

A subjective rating scale was designed for use as the criterion for determining the validity of the skill tests. The subjective ratings of the five judges were intercorrelated to determine the amount of agreement which existed among them. A correlation coefficient of .57 was found between Judges I and II, .37 between Judges I and III, .59 between Judges I and IV, .43 between Judges I and V, .30 between Judges II and III, .40 between Judges II and IV, .36 between Judges II and V, .48 between Judges III and IV, .57 between Judges III and V, and .50 between Judges IV and V (Table III, page 57). These coefficients indicate a lack

TABLE III

INTERCORRELATION COEFFICIENTS OF JUDGES' RATINGS

Judges	Number of Subjects	r
Judge I - Judge II	56	.57
Judge I - Judge III	39	.37
Judge I - Judge IV	66	.59
Judge I - Judge V	78	.43
Judge II - Judge III	36	.30
Judge II - Judge IV	56	.40
Judge II - Judge V	67	.36
Judge III - Judge IV	49	.48
Judge III - Judge V	52	.57
Judge IV - Judge V	97	.50

of agreement among the judges. The reliability of the Judges' Ratings could not be computed since only one rating session was held. Therefore, it was impossible to disregard the scores of judges who were inconsistent in their ratings. Factors that may have influenced these results include: (1) lack of an organized practice session, (2) the length of the rating scale, (3) the complicated nature of the rating scale, and (4) the design of the rating sheet.

Since at least two of the judges were apparently inconsistent in their ratings; and because the rating scale was evidently too complicated for efficient handling and scoring, the Judges' Ratings cannot be considered a good criterion for measurement of lacrosse playing ability for the purposes of this study. As a result, the validity coefficients obtained for each skill test (Table IV, page 59) may be misleading. In addition, lower validity coefficients appear to result when subjective ratings rather than a previously validated test are used as the criterion (6:22).

Despite its apparent weaknesses, the Judges' Rating Scale used in this study, produced somewhat better results than the ones designed by Lutze (53:62) and Wilke (55:54) when results on similar tests were compared. It is believed that the Rating Scale could be improved by decreasing the number of skills to be evaluated, and by revising the rating sheet into a simpler, more efficient form.

TABLE IV

CORRELATION COEFFICIENTS FOR RELIABILITY AND VALIDITY OF WALL VOLLEY TEST, PICK-UP, DODGE, TURN, RUN TEST, AND SHOOTING ACCURACY TEST

Test	N	Reliability	Validity
WALL VOLLEY TEST			
Test-Retest			
Best Scores	129	.85	
Sum of Scores	129	.88	
Judges' Ratings (Average)			
Best Scores			
1st. Adm.	93		.36
2nd. Adm.	92		.40
Sum of Scores			
1st. Adm.	93		.37
2nd. Adm.	92		.37
PICK-UP, DODGE, TURN, RUN TEST			
Test-Retest			
Best Scores	126	.83	
Sum of Scores	126	.63	
Judges' Ratings (Average)			
Best Scores			
1st. Adm.	94		.47
2nd. Adm.	90		.47
Sum of Scores			
1st. Adm.	94		.47
2nd. Adm.	90		.42
SHOOTING ACCURACY TEST			
Test-Retest			
Sum of Scores	125	.09	
Right-Right	125	.10	
Center-Center	125	.17	
Left-Left	125	-.02	

Wall Volley Test

The Wall Volley Test was administered to one hundred thirty-three subjects in the gymnasium of Lynchburg College. The test consisted of three trials of sixty seconds each. No practice trials were allowed. The trials were not consecutive. Subjects were required to wait until each person in the group finished a trial before the next one was administered. Results of the statistical analysis of the test are summarized in Tables IV and V, pages 59 and 61.

Using the best of three trials, the scores on the first administration of the Wall Volley Test ranged from 36 to 5 with a mean score of 23.35 and a standard deviation of 6.51. Scores ranged from 40 to 8 on the second administration with a mean score of 25.04 and a standard deviation of 6.65. When the sum of scores was used on the first administration of the test, a range of 102 to 8 was obtained, with a mean score of 63.53 and a standard deviation of 19.29. On the second administration of the test, the sum of scores ranged from 107 to 15, with a mean score of 67.61 and a standard deviation of 19.17.

Reliability coefficients were obtained by the test-retest method. Correlation of the best scores of the three trials of the Wall Volley Test yielded a reliability coefficient of .85. A reliability coefficient of .88 was obtained when the sums of scores were correlated. These coefficients meet the arbitrary standards for acceptable reliability as

TABLE V

RANGES, MEANS, AND STANDARD DEVIATIONS OF THE WALL VOLLEY TEST AND THE PICK-UP, DODGE, TURN, RUN, TEST

Test	Range	M	SD
WALL VOLLEY TEST			
Best Scores			
1st. Adm.	36 - 5	23.35	6.51
2nd. Adm.	40 - 8	25.04	6.65
Sum of Scores			
1st. Adm.	102 - 8	63.53	19.29
2nd. Adm.	107 - 15	67.61	19.71
PICK-UP, DODGE, TURN, RUN TEST			
Best Scores			
1st. Adm.	12.5 - 27.0	14.74	1.59
2nd. Adm.	12.0 - 19.3	14.18	1.10
Sum of Scores			
1st. Adm.	38.5 - 104.9	47.98	7.27
2nd. Adm.	37.2 - 75.0	45.72	5.95

presented by Barrow and McGee (1:42). Therefore the Wall Volley Test is considered a reliable measure of the ability to catch and throw in lacrosse.

To establish the validity of the Wall Volley test as a measure of lacrosse playing ability, the scores were correlated with the averaged Judges' Ratings. When the best scores of the trials of the first administration were correlated with the Judges' Ratings, a coefficient of .36 was obtained. Correlation of the best scores of the second administration with the Judges' Ratings yielded a coefficient of .40. Correlating the sum of scores with the Judges' Ratings resulted in a coefficient of .37 on both the first and second administrations of the test. The obtained coefficients were too low to accept the test as a valid measure of playing ability in lacrosse (1:42). However, it is recommended that the test be accepted at face validity, as a measure of throwing and catching ability, since it appears to measure these skills.

Pick-Up, Dodge, Turn, Run Test

The Pick-Up, Dodge, Turn, Run Test was administered to one hundred thirty-three subjects. The test consisted of three timed trials. No practice trials were given. The trials were not consecutive. Subjects were required to wait until each person on the testing group had completed a trial before the next trial was begun. Tables IV and V present a summary of the statistical analysis of this test.

On the best of three trials of the first administration of this test, the times ranged from 12.5 to 27.0 seconds, with a mean time of 14.74 seconds and a standard deviation of 1.59. For the second administration, the best of three trials ranged from 12.0 to 19.3 seconds, with a mean time of 14.18 seconds and a standard deviation of 1.10. When the three times were totaled, a greater variance of scores resulted. The sum of scores ranged from 38.5 to 104.9 seconds for the first administration. The mean and standard deviation of this administration were 47.98 and 7.27 respectively. On the second administration, the sum of scores ranged from 37.2 to 75.0 seconds with a mean time of 45.72 seconds and a standard deviation of 5.95.

The test-retest method of establishing reliability was used. Correlation of the best scores of the first and second administrations of the Pick-Up, Dodge, Turn, Run Test yielded a reliability coefficient of .83. When the sum of scores of the first and second administrations of the test were correlated, a coefficient of .63 was obtained. The lower reliability coefficient is assumed to be the result of the greater variance in scores produced when the trials were totaled. The reliability coefficient of .83 obtained by correlating the best scores of each administration of the Pick-Up, Dodge, Turn, Run Test meets the standards for acceptable reliability as presented by Barrow and McGee (1:42). Therefore, this test is considered a reliable

measure of the ability to control the ball while performing the following skills: picking up a stationary ball, dodging, and running. Since cradling is the method usually employed to control the ball while running, this test can also be considered a reliable measure of the ability to cradle.

In order to establish the validity of the Pick-Up, Dodge, Turn, Run Test, the scores were correlated with the averaged Judges' Ratings. Correlation of the Judges' Ratings with the best scores of both the first and second administrations of the test produced coefficients of .47. When the sum of the scores of the first administration of the test were correlated with the Judges' Ratings, a coefficient of .47 resulted. A correlation coefficient of .42 was obtained when the sum of scores of the second administration were correlated with the Judges' Ratings. These correlation coefficients are too low to recommend the test as a valid measure of lacrosse playing ability (1:42). It is suggested that the test could be accepted on the basis of face validity as a measure of the skills involved.

When compared with the results obtained by Wilke (55: 24), the Pick-Up, Dodge, Turn, Run Test seems to have been improved by its revisions. Wilke's Pick-Up, Run, Dodge Test yielded reliability coefficients of .62 for the sum of scores and .78 for the best of three scores for the group used in her study. The validity of Wilke's test was determined by correlating the sum of the Judges' Ratings with the best of

three trials on the first and second administrations of the test. The rating scale used by the judges was designed by Wilke. The validity coefficients thus obtained were .45 and .38 respectively for the group used in this study.

Shooting Accuracy Test

The Shooting Accuracy Test was administered to one hundred twenty-five subjects. The test consisted of ten shots taken from each of the three angles, for a total of thirty trials.

The test-retest method of establishing reliability was used. The sum of the five trials of the first administration was correlated with the sum of the first five trials of the second administration. The correlation coefficients thus obtained were: .10 on the right, .17 in the center, and -.02 on the left. A reliability coefficient of .90 was obtained when the total of the fifteen scores obtained on the first administration was correlated with the total of the first fifteen scores (five each from the right, center, and left) on the second administration of the test (Table IV, page 59).

Application of the Spearman-Brown Prophecy Formula to the trials taken from the right shooting area produced a coefficient of .42 when the number of trials was raised to twenty. Additional computations were not made.

The Shooting Accuracy Test is not considered a reliable measure of shooting ability under the conditions stated in this study.

III. FORMATION OF TEST BATTERIES

In an attempt to establish a battery of lacrosse skill tests which would be a valid measure of lacrosse playing ability, the Wall Volley Test and the Pick-Up, Dodge, Turn, Run Test were combined. The Doolittle Method of Multiple Correlation was used. The multiple correlation coefficients are summarized in Table VI, page 67. When the best scores of the first administrations of both tests were used, a coefficient of .49 was obtained. The combination of the best scores of the second administration of the tests produced a coefficient of .49. When the sum of scores of the first administrations of both tests was used in the multiple correlation, a coefficient of .50 was obtained. The combination of the sum of scores of the second administrations of the tests produced a coefficient of .47. When the sum of scores of the Wall Volley Test (First Administration) and the best scores of the Pick-Up, Dodge, Turn, Run Test (First Administration) were combined in a battery of tests (Battery II), a multiple correlation coefficient of .50 was obtained. The Wall Volley Test (sum of scores) and the Pick-Up, Dodge, Turn, Run Test (best scores) is considered the best battery of skill tests for the following reasons: it possesses one

TABLE VI

MULTIPLE CORRELATION COEFFICIENTS

BATTERY I[a]	
Best Scores - First Administration	.49
Best Scores - Second Administration	.49
Sum of Scores - First Administration	.50
Sum of Scores - Second Administration	.47
BATTERY II[b]	
Sum of Scores - Best Scores - First Administration	.50
BATTERY III[c]	.56
BATTERY IV[d]	.52

[a]Wall Volley Test and Pick-Up, Dodge, Turn, Run Test

[b]Wall Volley Test (Sum of Scores - First Administration) and Pick-Up, Dodge, Turn, Run Test (Best Scores - First Administration)

[c]Wall Volley Test (Sum of Scores - First Administration), Pick-Up, Dodge, Turn, Run Test (Sum of Scores - First Administration), and Revised Lacrosse Knowledge Test

[d]Wall Volley Test (Sum of Scores - First Administration), Pick-Up, Dodge, Turn, Run Test (Best Scores - First Administration), and Revised Lacrosse Knowledge Test

of the highest multiple correlation coefficients and its individual tests have the highest reliability coefficients when administered separately. Since the multiple correlation coefficient is dependent upon the relationship of the individual tests to the criterion, which was low, and until better measures are produced, the combination of tests used in Battery II is considered an acceptable measure of lacrosse playing ability.

A third combination tests was analyzed. This battery included the following tests: the Wall Volley Test, the Pick-Up, Dodge, Turn, Run Test, and the Revised Lacrosse Knowledge Test. The sum of trials of the first administration of each of the skill tests, and the scores on the Revised Knowledge Test were used in computing the multiple correlation coefficient. The Doolittle Method of Multiple Correlation was used. An intercorrelation coefficient of .31 was obtained between the Revised Lacrosse Knowledge Test scores and the averaged Judges' Ratings. A greater-than-chance relationship exists between lacrosse playing ability and knowledges for the group that participated in this study. A multiple correlation coefficient of .56 was obtained for Battery III (Table VI, page 67). This battery is unsatisfactory, however, because of the low reliability coefficient obtained on the Pick-Up, Dodge, Turn, Run Test (sum of scores).

Battery IV, which included the Wall Volley Test (Sum of Scores-First Administration), the Pick-Up, Dodge, Turn, Run Test (Best Scores-First Administration), and the Revised Lacrosse Knowledge Test, yielded a multiple correlation coefficient of .52. Since the multiple correlation coefficient is dependent upon the relationship of the individual tests to the criterion, which was low, Battery IV is considered an acceptable measure of lacrosse playing ability. Battery IV is considered a better measure of lacrosse playing ability than Battery III since its individual tests have the highest reliability coefficients. The addition of the knowledge test to the skill test battery provides a better measure of lacrosse playing ability than the previously described skill test battery. Until a better measure of lacrosse playing ability is developed, Battery IV, consisting of the Wall Volley Test, the Pick-Up, Dodge, Turn, Run Test, and the Revised Lacrosse Knowledge Test, may be used as an indicator of lacrosse playing ability.

CHAPTER V

SUMMARY AND CONCLUSIONS

One of the purposes of this study was to construct and standardize, on the basis of sound criteria, a knowledge test in lacrosse for college women. An additional purpose was to review available lacrosse skill tests; revise existing tests; and if necessary, devise tests which would be valid and reliable measures of selected lacrosse playing skills. A third purpose of the study was to devise a battery of tests which would be an acceptable measure of lacrosse playing skills and knowledges.

A review of literature was undertaken to determine what knowledge tests had been published on individual and team sports. The survey revealed that no lacrosse knowledge tests have been published. An additional survey revealed that a limited number of statistically analyzed lacrosse skill tests are available.

Prior to the construction of the knowledge test, a survey of textbooks and source material served as the basis for the construction of a course outline and the establishment of a Table of Specifications for the test items. A preliminary test of seventy, four-choice, multiple-choice items was constructed.

On the basis of an item analysis, a revised knowledge test was developed which consisted of forty, four-choice, multiple-choice items. The reliability coefficient of the Revised Lacrosse Knowledge Test was .68. The test, as judged by Ebel's criteria (58:2) had a high discriminating power and an adequate difficulty level.

A pilot study was undertaken to review and analyze existing skill tests. As a result of this analysis, three skill tests were selected to be revised on the basis of practicality, feasibility, game-likeness, previously obtained reliability coefficients, and face validity. The revised tests, the Wall Volley Test, the Pick-Up, Dodge, Turn, Run Test, and the Shooting Accuracy Test, were prepared for administration to the experimental group.

The subjects who participated in the experimental phase of the study were one hundred thirty-five college freshman women enrolled in five lacrosse classes taught by the writer at Lynchburg College, Lynchburg, Virginia, in the spring of 1967. With a few exceptions, these subjects had had little or no previous experience in lacrosse.

Skill tests were administered to the subjects upon the completion of twelve lacrosse classes. The tests administered were: the Wall Volley Test, the Pick-Up, Dodge, Turn, Run Test, and the Shooting Accuracy Test. The test-retest method was used to determine the reliability coefficients of each test. Averaged Judges' Ratings of

performance in a game situation were used as the criterion for determining the validity of the tests. All correlation coefficients were obtained by using the Pearson Product-Moment Formula for raw scores.

The Wall Volley Test produced reliability coefficients of .85 when the best of three trials was used and .88 when the sum of scores was used. Correlation of the best scores of the first and second administrations of the Wall Volley Test with the Judges' Ratings yielded coefficients of .36 and .40 respectively. The sum of trials on both the first and second administrations of the Wall Volley Test produced validity coefficients of .37.

Reliability coefficients obtained on the Pick-Up, Dodge, Turn, Run Test were: .83 when the best scores of the two administrations were correlated, and .63 when the sum of scores was used. Correlation of the Judges' Ratings with the best trials of each administration of the Pick-Up, Dodge, Turn, Run Test produced validity coefficients of .47. When the sum of scores of the first and second administrations of the Pick-Up, Dodge, Turn, Run Test were correlated with the Judges' Ratings, validity coefficients of .47 and .42 respectively were obtained.

The reliability coefficient of the Shooting Accuracy Test was computed on the basis of the total of five trials from each angle on the first administration with the total of the first five trials from each angle on the second

administration. When these figures were correlated, the following reliability coefficients were obtained: .10 on the right, .17 in the center, and -.02 on the left. A reliability coefficient of .09 was obtained when the total of the fifteen scores of the first administration was correlated with the total of the first fifteen scores (five from each angle) on the second administration of the test. Application of the Spearman-Brown Prophecy Formula to the second administration of the trials taken from the right shooting area produced a reliability coefficient of .42 when the number of trials was raised to twenty.

A battery of skill tests including the Wall Volley Test and the Pick-Up, Dodge, Turn, Run Test, was analyzed in an attempt to establish an acceptable measure of lacrosse playing ability. The Doolittle Method of Multiple Correlation was used in this analysis.

Several combinations of tests were correlated. The best combination was Battery II which consisted of the Wall Volley Test (Sum of Scores-First Administration) and the Pick-Up, Dodge, Turn, Run Test (Best Scores-First Administration). Battery II yielded a multiple correlation coefficient of .50.

Two batteries of tests including the Wall Volley Test, the Pick-Up, Dodge, Turn, Run Test, and the Revised Lacrosse Knowledge Test were analyzed in an attempt to establish an acceptable measure of lacrosse playing ability.

Battery IV, which used the sum of scores of the Wall Volley Test, the best scores of the Pick-Up, Dodge, Turn, Run Test, and the scores of the Revised Lacrosse Knowledge Test was considered the better battery on the basis of the reliability coefficients of its individual skill tests. The multiple correlation coefficient of Battery IV was .52. An inter-correlation coefficient of .31 was obtained between scores on the Revised Lacrosse Knowledge Test and the Judges' Ratings.

CONCLUSIONS

On the basis of the analysis of data, the following conclusions were drawn:

1. The Revised Lacrosse Knowledge Test is considered to possess curricular validity on the basis of an analysis of lacrosse textbooks and course content.

2. Individual items of the Revised Lacrosse Knowledge Test discriminate effectively between high and low levels of achievement.

3. On the basis of the criteria used in this study, the difficulty level of the test is adequately high; however, it is considered a moderately easy test. The difficulty level of the test could be increased and the test improved by the addition of items with higher degrees of difficulty in the areas of safety, equipment, terminology, history, and rules.

4. The reliability coefficient of the Revised Lacrosse Knowledge Test is fairly low. With the addition of more difficult items and items of comparable quality, the reliability of the test would be expected to increase.

5. The Revised Lacrosse Knowledge Test is considered an acceptable measure of understanding in the areas of lacrosse skills, techniques, strategy, and rules, on the basis of the evaluation criteria used in this study. The test could be improved by the suggestions made in (3) and (4) above.

6. The Judges' Ratings cannot be considered a good criterion for determining validity under the conditions stated in this study.

7. The Rating Scale designed for use in this study may have merit if revisions are made to improve its effectiveness in handling and scoring.

8. The Wall Volley Test is a reliable measure of throwing and catching ability in lacrosse.

9. The composition of the rebound surface used in the local situation may necessitate changes in the specified dimensions of the Wall Volley Test for optimal results.

10. The Pick-Up, Dodge, Turn, Run Test possessed a sufficiently high reliability coefficient to be an acceptable measure of the lacrosse playing skills specified in its title.

11. Neither the Wall Volley Test nor the Pick-Up, Dodge, Turn, Run Test is a valid measure of lacrosse playing ability when correlated with the Judges' Ratings.

12. Both tests are recommended as valid measures of their respective skills on the basis of face validity.

13. The Shooting Accuracy Test is not a reliable measure of shooting ability for beginning lacrosse players.

14. The Shooting Accuracy Test is recommended as a teaching device. It may be of value as a testing device for use with advanced players.

15. The combination of the Wall Volley Test (sum of scores) and the Pick-Up, Dodge, Turn, Run Test (best scores) as a battery of lacrosse skill tests is considered to be an acceptable measure of lacrosse playing skills until a better measure is produced.

16. The combination of the Wall Volley Test (sum of scores), the Pick-Up, Dodge, Turn, Run Test (best of scores), and the Revised Lacrosse Knowledge Test into a battery of tests provides an acceptable measure of lacrosse playing skills until a better measure is made available. This battery of tests provides a better measure of lacrosse playing ability than the skill test battery.

Suggestions for Further Study

On the basis of her experience with this particular study, the writer offers the following suggestions for future consideration:

1. Increase the length of the knowledge test in order to improve its reliability by: (a) constructing additional items of comparable quality; and (b) devising more difficult items in the areas of safety, equipment, terminology, history, and rules.

2. Revise the Judges' Rating Scale into a shorter, more practical, and more efficient form by decreasing the number of skills to be evaluated or by combining some of the specified skills.

3. Revise the Judges' Rating Sheet into a more efficient, less confusing form by: (a) eliminating the blanks for each category under individual skills; (b) providing more space for each skill evaluated so that notations can be made regarding the quality of each performance; and (c) making the final evaluations on the basis of the notations.

4. Revise the Shooting Accuracy Test for beginners by: (a) changing the angles of the side shooting areas to sixty degrees measured from the center of the goal line; and (b) decreasing the distance between the goal line and the shooting line.

5. Allow shooting practice from the specified angles prior to the administration of the Shooting Accuracy Test.

6. Administer the Shooting Accuracy Test as described in this study to advanced lacrosse players.

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APPENDICES

APPENDIX A

TABLE VII

SURVEY OF PHYSICAL EDUCATION KNOWLEDGE TESTS

SPORT	AUTHOR	DATE	LEVEL	TYPE	ITEM-ANALYSIS COMPLETED	RELIABILITY COMPUTED
Archery	Snell (41)	1935	college women	M-C	yes	yes
	Fisher (47)	1950	college women	M-C	yes	---
	Ley (51)	1960	college women	M-C	yes	---
Badminton	Scott (37)	1941	college women	M-C, T-F	yes	yes
	French (15)	1943	college women	M-C	yes	yes
	Phillips (30)	1946	college women (beginning, intermediate, & majors)	M-C, T-F	yes	yes
	Fisher (47)	1950	college women	M-C	yes	---
	Fox (14)	1953	college women	T-F, multiple T-F, completion, identification	yes	yes
	Hennis (20)	1956	college women	M-C	yes	yes
	Goll (48)	1956	high school girls	M-C	yes	yes
	Ley (51)	1960	college women	M-C	yes	---
	Hooks (23)	1966	college men	M-C	yes	yes

TABLE VII (continued)

SPORT	AUTHOR	DATE	LEVEL	TYPE	ITEM-ANALYSIS COMPLETED	RELIABILITY COMPUTED
Baseball	Hemphill (19)	1932	high school boys	T-F	yes	yes
	Snell (40)	1936	college women	M-C	yes	yes
	Bradley (46)	1959	college men majors	M-C	yes	yes
Basketball	Bliss (3)	1929	college men	T-F	---	---
	Schleman (33)	1932	officials	situation	---	---
	Hemphill (19)	1932	high school boys	T-F	yes	yes
	Snell (39)	1936	college women	M-C	yes	yes
	Scott (38)	1937	officials	situation	---	---
	Schwartz (34)	1937	high school girls	T-F, M-C, completion, pictorial	---	---
	French (15)	1943	college women	M-C	yes	yes
	Fisher (47)	1950	college women	M-C	yes	---
	Hennis (20)	1956	college women	M-C	yes	yes
	Ley (51)	1960	college women	M-C	yes	---
	McCutcheon (54)	1965	college women	M-C	yes	yes
Bowling	Hennis (20)	1956	college women	M-C	yes	yes
	Ley (51)	1960	college women	M-C	yes	---

TABLE VII (continued)

SPORT	AUTHOR	DATE	LEVEL	TYPE	ITEM-ANALYSIS COMPLETED	RELIABILITY COMPUTED
Canoeing	French (15)	1943	college women	M-C	yes	yes
Field Hockey	Grisier (17)	1934	officials	situation	yes	yes
	Snell (41)	1935	college women	M-C	yes	yes
	Deitz & Frech (13)	1940	high school girls	T-F, completion	---	---
	French (15)	1943	college women	M-C	yes	yes
	Kelly & Brown (24)	1952	physical education majors	M-C	yes	yes
	Hennis (20)	1956	college women	M-C	yes	yes
Football	Hemphill (19)	1932	high school boys	T-F	yes	yes
Golf	Murphy (29)	1933	college women	T-F completion, matching	---	yes
	Snell (40)	1936	college women	M-C	yes	yes
	French (15)	1943	college women	M-C	yes	yes
	Waglow & Rehling (43)	1953	college students	T-F	yes	yes
	Ley (51)	1960	college women	M-C	yes	---

TABLE VII (continued)

SPORT	AUTHOR	DATE	LEVEL	TYPE	ITEM-ANALYSIS COMPLETED	RELIABILITY COMPUTED
Gymnastics	Gershon (16)	1957	college men	M-C, T-F	yes	yes
Handball	Phillips (48)	1937	not indicated	T-F	---	---
Ice Hockey	Brown (12)	1935	high school girls	T-F, short-answer	---	---
Recreational Sports	French (15)	1943	college women	M-C	yes	yes
Riding	Snell (41)	1935	college women	M-C	yes	yes
Soccer	Knighton (25)	1930	beginners	T-F, M-C, completion	---	---
	Heath & Rodgers (18)	1932	5th & 6th grade boys	T-F	---	yes
	Snell (39)	1936	college women	M-C	yes	yes
	French (15)	1943	college women	M-C	yes	yes
	Fisher (47)	1950	college women	M-C	---	---
	Winn (56)	1957	college men	M-C, T-F	yes	yes
	Ley (51)	1960	college women	M-C	yes	---

TABLE VII (continued)

SPORT	AUTHOR	DATE	LEVEL	TYPE	ITEM-ANALYSIS COMPLETED	RELIABILITY COMPUTED
Softball	Rodgers & Heath (32)	1931	5th & 6th grade boys	T-F	---	yes
	French (15)	1943	college women	M-C	yes	yes
	Fisher (47)	1950	college women	M-C	yes	---
	Waglow & Stephens (44)	1955	college students	T-F, situations, completion	yes	yes
	Hennis (20)	1956	college women	M-C	yes	yes
	Ley (51)	1960	college women	M-C	yes	---
	Hooks (23)	1966	college men	M-C	yes	yes
Stunts & Tumbling	French (15)	1943	college women	M-C	yes	yes
	Fisher (47)	1950	college women	M-C	yes	---
Swimming	Scott (35)	1940	college women (elementary & intermediate)	T-F, M-C	yes	yes
	French (15)	1943	college women	M-C	yes	yes
	Fisher (47)	1950	college women (intermediate & advanced)	M-C	yes	---
	Goll (48)	1956	high school girls	M-C	yes	yes

TABLE VII (continued)

SPORT	AUTHOR	DATE	LEVEL	TYPE	ITEM-ANALYSIS COMPLETED	RELIABILITY COMPUTED
Table Tennis	Fisher (47)	1950	college women	M-C	yes	---
Tennis	Wagner (45)	1935	college women (beginning)	M-C	---	---
	Snell (41)	1935	college women	M-C	yes	yes
	Hewitt (21)	1937	college students	M-C, T-F, completion, diagrammatic, yes-no, matching	yes	yes
	Scott (36)	1941	college women (elementary & intermediate)	T-F, M-C	yes	yes
	French (15)	1943	college women	M-C	yes	yes
	Fisher (47)	1950	college women	M-C	yes	---
	Broer & Miller (11)	1950	college women	M-C, T-F, multiple T-F, identification, short-answer	yes	yes
	Miller (28)	1953	college women	T-F, M-C, multiple response	yes	yes
	Hennis (20)	1956	college women	M-C	yes	yes

TABLE VII (continued)

SPORT	AUTHOR	DATE	LEVEL	TYPE	ITEM-ANALYSIS COMPLETED	RELIABILITY COMPUTED
Tennis (cont.)	Hewitt (22)	1964	college students	T-F, M-C, diagrammatic, yes-no, matching	yes	yes
	Hooks (23)	1966	college men	M-C	yes	yes
Track & Field	French (15)	1943	college women	M-C	yes	yes
Volley-ball	Snell (39)	1936	college women	M-C	yes	yes
	Rodgers (31)	1939	5th & 6th grade boys	T-F	---	---
	French (15)	1943	college women	M-C	yes	yes
	Fisher (47)	1950	college women	M-C	yes	---
	Langston (26)	1955	college men	M-C, T-F	yes	yes
	Hennis (20)	1956	college women	M-C	yes	yes
	Ley (51)	1960	college women	M-C	yes	---
	Hooks (23)	1966	college men	M-C	yes	yes

APPENDIX B

TABLE VIII

DIFFICULTY RATINGS AND INDICES OF DISCRIMINATION OF THE ORIGINAL AND REVISED LACROSSE KNOWLEDGE TESTS

Item # O.T.*	Item # R.T.**	D.R.	I.D.	Item # O.T.	Item # R.T.	D.R.	I.D.
1.		.94	.28	36.	18	.82	.46
2.		1.00	.00	37.	19	.15	.27
3.		.96	.37	38.		.46	.10
4.		.99	.21	39.		.94	.46
5.		.60	.12	40.		.23	-.02
6.	1	.67	.50	41.		.18	.36
7.		.97	.33	42.	20	.59	.39
8.		.85	.27	43.	21	.72	.46
9.	2	.54	.28	44.	22	.78	.27
10.	3	.59	.34	45.		.46	.13
11.	4	.91	.21	46.	23	.54	.32
12.		.99	.21	47.	24	.55	.50
13.		.99	.21	48.	25	.76	.54
14.	5	.96	.37	49.		.95	.37
15.		.99	.21	50.	26	.33	.32
16.		.90	.24	51.	27	.81	.50
17.		.87	.26	52.	28	.45	.50
18.	6	.83	.65	53.	29	.96	.37
19.	7	.47	.30	54.	30	.76	.41
20.	8	.85	.51	55.		.91	.25
21.	9	.73	.42	56.		.86	.47
22.	10	.81	.23	57.		.91	.25
23.	11	.49	.43	58.	31	.54	.28
24.		.96	.37	59.		.24	.00
25.	12	.65	.42	60.	32	.73	.25
26.	13	.65	.37	61.		.82	.23
27.	14	.73	.24	62.	33	.74	.23
28.		.64	.14	63.	34	.35	.31
29.	15	.64	.27	64.	35	.40	.44
30.	16	.85	.40	65.	36	.58	.27
31.	17	.59	.38	66.	37	.67	.62
32.		.45	.02	67.	38	.41	.43
33.		.86	.51	68.	39	.63	.66
34.		.82	.29	69.		.73	.08
35.		.87	.60	70.	40	.86	.52

*Original Test
**Revised Test

APPENDIX C

WALL VOLLEY TEST

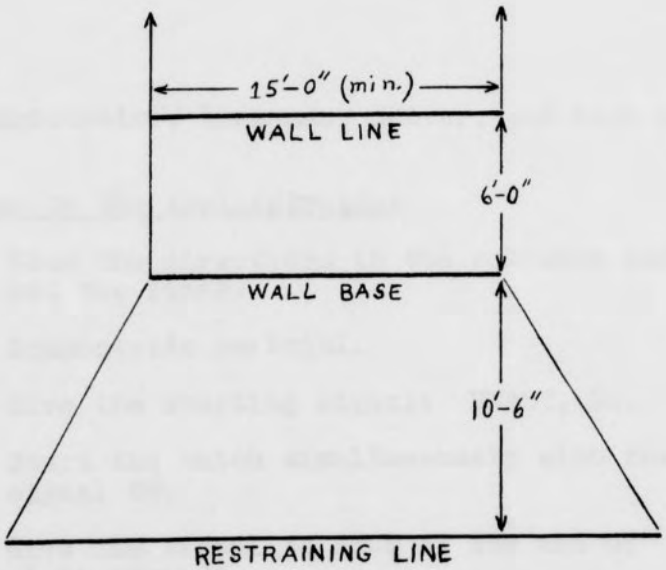
Purpose:

To measure the ability to throw and catch accurately.

Facilities and Equipment:

Smooth gymnasium wall space 15'x15' (minimum), floor space 15'x15' (minimum), stop watch, lacrosse stick, four balls, bucket or small box, one inch tape, pencils, and score cards.

Diagram of the Wall Volley Test:



Instructions to the Subject:

Start the test from behind the restraining line with a ball in your crosse. On the signal, READY, GO, throw the ball against the wall above the wall line as many times as possible in sixty seconds. Each hit on or above the line, from behind the restraining line, counts as one. Try to catch the ball on its return. You may step over the restraining line to catch the ball; however, the ball must be thrown from behind the restraining line. If you lose the ball, get another one from the box on the floor and continue the test. The signal to STOP will be given at the end of sixty seconds. Your score for each trial will be the total number of hits made in sixty seconds. The test consists of three trials of sixty seconds each. Consecutive trials should not be taken.

Personnel:

Administrator, linesman, scorer, and ball retriever.

Instructions to the Administrator:

1. Read the directions to the subjects and point out the lines.
2. Demonstrate one trial.
3. Give the starting signal: READY, GO.
4. Start the watch simultaneously with the signal GO.
5. Give the signal to STOP at the end of sixty seconds.

Instructions to the Scorer:

1. Count each hit on or above the line. Do not count the hit if the subject makes a line violation on the wall or floor.

2. Report subject's score at the end of each trial.

Instructions to the Linesman:

1. Call FAULT immediately if the subject steps on or over the restraining line.

Instructions to the Ball Retriever:

1. Return missed balls to the box at the testing station.

Scoring:

The final score of the test shall be the sum of the scores of the three trials.

PICK-UP, DODGE, TURN, RUN TEST

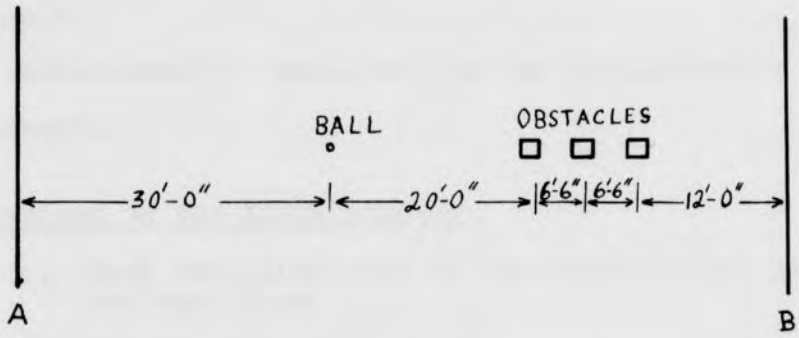
Purpose:

To measure the ability to control the ball when attempting to pick it up, dodge, turn, and run.

Facilities and Equipment:

75'x15' field area, lacrosse stick, two balls, and six 18" chairs, pencils, and score cards. Two chairs, one set upon the other, form the obstacles.

Diagram of Pick-Up, Dodge, Turn, Run Test:



Instructions to the Subject:

Start at Line A with a crosse. On the signal, ON YOUR MARK, GET SET, GO, run forward, pick up the ball and proceed to dodge in and out among the obstacles. Dodging direction at the first obstacle is optional. After dodging the last chair, run to Line B and turn. You must step on or beyond Line B before turning. If you fail to do so, the linesman

will call FAULT immediately and you must return to step on or over Line B before continuing the test. Return to Line A by dodging in and out among the chairs and running across the finish line. Do not slow down as you cross the finish line. You must carry the ball across the finish line in your crosse. If the ball is dropped, pick it up and proceed from the point where the ball was dropped. Your score for each trial will be the time in seconds to the nearest tenth from the starting signal until you cross the finish line. The test consists of three trials. Trials shall not be consecutive. Record your score after each trial.

Personnel:

Administrator, assistant to the administrator, and linesman.

Instructions to the Administrator:

1. Read the directions to the subjects and point out the lines.
2. Demonstrate one trial.
3. Stradle Line A and face the subject.
4. Give the starting signal: ON YOUR MARK, GET SET, GO.
5. Start the watch on the signal GO. Stop the watch as the leading foot crosses the finish line.
6. Announce the subject's time immediately.
7. If an obstacle is overturned, the subject should continue, if possible; if not, she must repeat the trial. Obstacles that have been moved out of position should be re-positioned before the next trial is started.

Instructions to the Assistant Administrator:

1. Place a ball on the pick-up spot immediately after each subject has completed the test.

2. Secure the ball from each subject as soon as she has finished the test.

Instructions to the Linesman:

The final score shall be the lowest of the three trials.

SHOOTING ACCURACY TEST

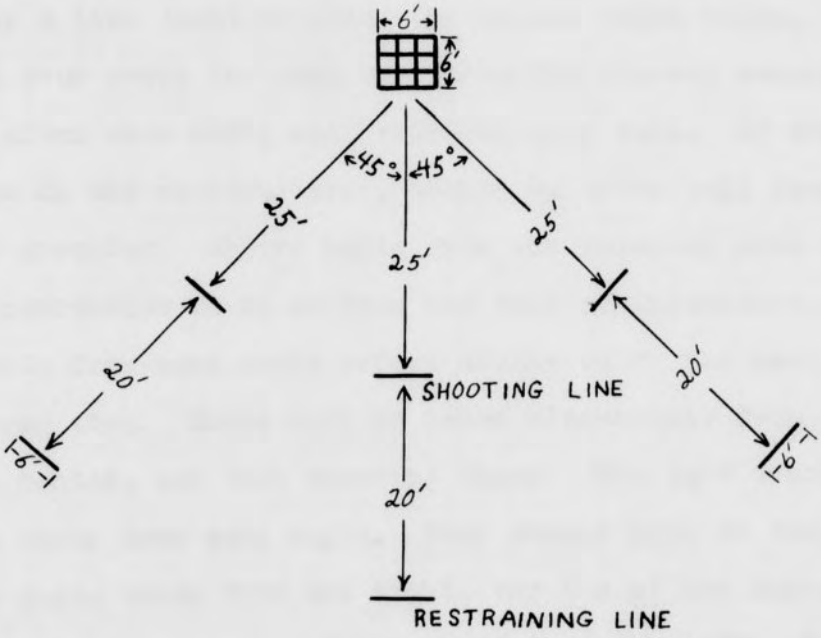
Purpose:

To measure accuracy of shooting.

Facilities and Equipment:

6'x6' target, smooth field area 60' square (minimum), lacrosse ball and stick for each student being tested, extra balls, score cards, and pencils.

Diagram of the Shooting Accuracy Test:



Personnel:

Administrator, scorer, and three linesmen.

Instructions to the Subject:

Start from behind the restraining line with the ball in your crosse. Run toward the goal and release the ball before crossing the shooting line. Your body or crosse may follow through over the line; but the ball must be released prior to crossing the line. FAULT shall be called if a foul occurs at the shooting line. The score of that trial shall be zero. The ball may hit the target on the bounce or fly. Your score will be the numerical value of the square contacted. A ball hitting a line shall be given the higher point value. Obtain your score for each shot from the scorer; record your score after each shot; and, retrieve your ball. If the ball remains in the shooting area, obtain an extra ball from the supply provided. Remove balls from the shooting area only upon instruction to do so from the test administrator. Take ten shots from each angle before moving on to the next angle. Wait your turn. Shots will be taken alternately from the right, center, and left shooting lines. The test consists of ten shots from each angle. Your scores will be the sum of the shots taken from the right, the sum of the shots from the center, and the sum of the shots from the left. Each of the thirty shots must be recorded.

Instructions to the Administrator:

1. Read the directions to the subjects.

2. Give the signal to start the test.

3. Stop the test when necessary to remove balls from the shooting area.

4. See that shots are taken in order from left to right to facilitate scoring.

Instructions to the Linesmen:

1. Call FAULT if the subject steps on or over the shooting line before releasing the ball.

2. Follow-through over the shooting line is allowed; however, the ball must be released before the line is crossed.

Instructions to the Scorer:

1. Announce the point value of the square contacted on each hit.

2. A ball hitting a line is given the higher value.

3. Balls hitting the goal posts that do not contact the target face shall not score.

Construction of the Target: (see pictures, page 106.)

The target was constructed from thirteen 1" x 6" white pine finish lumber, six feet four inches in length; five pieces of 2" x 2" lumber six feet in length; and one 2" x 2" board six feet four inches in length. The six inch planks were positioned side-by-side and nailed to three 2 x 2's. The goalposts were made from the remaining three 2 x 2's and attached to the front of the target. Corners were

TARGET: SHOOTING ACCURACY TEST

Front View

Back View

TARGET: SHOOTING ACCURACY TEST

Front View

Back View

secured with metal corner brackets. The inside measurement of the goalposts was 6' x 6', the size of a regulation lacrosse goal. The target was painted with light blue paint. The goalposts were painted white. The 2' squares and the numerical values of the squares were marked with dark blue tape. The target was then nailed to the front of a lacrosse goal. The approximate cost of the target was $15.00.

APPENDIX D

JUDGES' RATING SCALE

CATEGORIES:

(E) Excellent
(G) Good
(A) Average
(F) Fair
(P) Poor

SKILLS:

Cradling

E. Smooth, well-timed, ball under control.
G. Fairly smooth, ball under control.
A. Movements not absolutely synchronized, but maintains possession of the ball.
F. Characterized by jerky movements.
P. Does not cradle.

Picking up

E. Accomplished with ease and full control.
G. Is successful, but does not gain full control immediately.
A. Experiences difficulty, but eventually is successful.
F. Does not gain control; pushes the ball along the ground.
P. Completely misses the ball.

Catching

E. Accomplished with ease and full control.
G. Is successful but does not gain full control immediately.
A. Has difficulty controlling the ball.
F. Ball hits the stick but bounces off.
P. Completely misses the ball.

Passing

E. Pass is accurate and well-timed.
G. Pass is accurate but not well-timed.
A. Gets free to make pass, but pass is not accurate.
F. Tries to make pass when marked too closely; passes just to get rid of the ball.
P. Drops the ball or makes a poor pass.

Evading Opponents

E. Dodges, pivots, or otherwise evades opponents with ease and control.
G. Evades opponent fairly effectively.
A. Is checked in the evading attempt, but maintains possession of the ball.
F. Attempts to evade opponent, but loses the ball.
P. Does not attempt to evade opponent.

Shifting from Offense to Defense

E. Shifts immediately when opponent gets ball; constantly checks and challenges opponent.
G. Shifts quickly from offense to defense.
A. Shifts, but not soon enough.
F. Is very slow in shifting.
P. Does not shift at all when the opponent gets the ball.

Field Positioning

E. Effectively makes spaces for self or teammate.
G. Is fairly effective in making spaces.
A. Tries to make spaces, but cuts in wrong direction.
F. Crowds teammate who has the ball.
P. Stands in one place; does not cut to make spaces.

Body Control

E. Has excellent body control; rarely fouls.
G. Has body control; seldom fouls.
A. Has body control; fouls infrequently.
F. Usually has body control; fouls occasionally.
P. Lacks body control; fouls often.

INSTRUCTIONS FOR THE JUDGES

1. Become thoroughly familiar with the rating scale prior to the rating session.

2. A clipboard, rating scale, rating sheets, and pencils will be provided.

3. Supply the information requested at the top of the rating sheet.

4. Stand or sit any place on the field or on the bank where you can see.

5. Students will be wearing colored pinnies with lettered positions and numbers.

6. Each time a player performs one of the selected skills, evaluate the quality of her performance according to the specifications of the rating scale and record it on the rating sheet. Slash marks placed in the appropriate blanks will aid the judge in determining the subject's ability in each area. An evaluation of excellent, good, average, fair, or poor must be made for each skill during the rating session or as soon as the rating session is complete. A plus or minus may be used to give the judge more freedom in evaluating each student. Later EVALUATION scores will be averaged and a COMPOSITE EVALUATION will be made. The EVALUATION scores should be indicated as follows:

Excellent:	E-, E, E+	(13-15 points)
Good:	G-, G, G+	(10-12 points)
Average:	A-, A, A+	(7-9 points)
Fair:	F-, F, F+	(4-6 points)
Poor:	P-, P, P+	(1-3 points)

7. Place rating opposite the number and position corresponding to the number and position lettered on each student's pinnie.

8. Do not discuss ratings with other judges until after all scoring is completed.

9. Please note that each category includes a three-point span.

10. Please use all categories on the rating scale.

11. If at all possible, practice using the rating scale before the rating session.

JUDGE'S RATING SHEET

JUDGE'S NAME_____ DATE_____OWN CLASS?___

WEATHER CONDITIONS: TEMPERATURE___,FAIR___, WINDY__, CLOUDY__

TEAM COLOR _____

STUDENTS

	#														
CRADLE	P														
E															
G															
A															
F															
P															
EVAL															
N.V.*															
PICK-UP															
E															
G															
A															
F															
P															
EVAL															
N.V.															
CATCH															
E															
G															
A															
F															
P															
EVAL															
N.V.															
PASS															
E															
G															
A															
F															
P															
EVAL															
N.V.															

*Numerical Value

EVADE														
E														
G														
A														
F														
P														
EVAL.														
N.V.														
SHIFT														
E														
G														
A														
F														
P														
EVAL.														
N.V.														
POSITION														
E														
G														
A														
F														
P														
EVAL.														
N.V.														
CONTROL														
E														
G														
A														
F														
P														
EVAL.														
N.V.														
SUM														
COMP. EVAL.														

SCORE CARD

LACROSSE ACHIEVEMENT TESTS

Name _____ Section _____ Date _____

Number of Seasons Played Lacrosse ___ Instructor _____

WALL VOLLEY TEST

(1) _____
(2) _____
(3) _____

Total _____

PICK-UP, DODGE, TURN, RUN TEST

(1) _____ sec.
(2) _____ sec.
(3) _____ sec.

Best Score _____ sec.

SHOOTING ACCURACY TEST

(1)	____	____	____
(2)	____	____	____
(3)	____	____	____
(4)	____	____	____
(5)	____	____	____
(6)	____	____	____
(7)	____	____	____
(8)	____	____	____
(9)	____	____	____
(10)	____	____	____
Sub-Totals	____	____	____
Total	____	____	____

JUDGES' RATINGS: (1)___ (2)___ (3)___ (4)___ (5)___ Total_____

REVISED LACROSSE KNOWLEDGE TEST (40 Items): Number Correct____

APPENDIX E

TABLE IX

RAW DATA FOR WALL VOLLEY TEST, REVISED KNOWLEDGE TEST, AND PICK-UP, DODGE, TURN, RUN TEST

	WALL VOLLEY TEST				REVISED	PICK-UP, DODGE, TURN, RUN TEST			
	I		II		KNOWLEDGE	I		II	
	Best	Sum	Best	Sum	TEST	Best	Sum	Best	Sum
1.	27	73	32	90	31	15.7	47.5	14.6	45.2
2.	23	64	26	69	23	13.3	42.5	12.9	41.4
3.	12	31	19	45	26	14.6	48.5	13.5	41.6
4.	15	38	17	47	34	15.0	47.3	14.0	43.3
5.	32	88	31	87	19	13.0	41.4	13.0	39.6
6.	19	53	23	63	28	14.3	44.3	14.0	47.5
7.	22	58	21	55	24	16.0	52.5	15.4	56.4
8.	36	102	36	105	31	16.0	51.6	14.7	51.0
9.	10	19	8	20	20	14.9	47.1	14.2	49.1
10.	26	72	29	85	29	14.0	42.8	13.1	42.6
11.	16	46	23	66	20	16.2	58.2	15.5	50.2
12.	22	65	--	--	30	13.3	44.8	--	--
13.	17	41	21	52	21	15.1	45.7	14.1	43.1
14.	19	50	17	50	24	15.1	47.8	14.0	46.6
15.	19	48	19	50	32	15.3	60.1	13.5	45.3
16.	24	63	26	69	32	17.0	51.3	14.8	44.9
17.	21	59	--	--	22	14.9	51.0	--	--
18.	29	81	31	89	26	14.8	44.7	13.8	48.8
19.	29	80	30	86	28	13.6	41.5	12.8	38.7
20.	32	89	30	86	30	13.6	41.9	12.8	38.7
21.	26	66	23	68	28	13.7	49.9	14.2	56.0
22.	27	71	29	72	20	14.0	49.1	14.2	44.1
23.	22	59	20	55	29	15.2	46.2	14.5	50.2
24.	22	56	23	64	32	15.3	46.6	15.0	49.0
25.	36	95	39	104	36	14.1	42.8	13.6	41.5
26.	20	56	18	47	22	16.9	53.9	17.2	57.2
27.	18	44	18	51	24	15.5	50.3	15.4	46.7
28.	26	74	32	83	37	14.1	48.2	13.8	41.8
29.	21	53	20	48	23	14.5	46.4	14.2	42.9
30.	26	69	27	76	25	13.2	42.7	12.7	42.9
31.	11	26	21	58	14	14.3	50.8	14.1	43.3
32.	18	49	23	60	28	14.8	57.3	13.9	43.1
33.	18	49	25	66	16	16.4	49.9	15.8	53.5
34.	16	46	14	41	25	14.2	43.9	14.2	43.2
35.	28	82	30	89	34	15.4	46.7	15.4	49.2

TABLE IX (continued)

	WALL VOLLEY TEST I		WALL VOLLEY TEST II		REVISED KNOWLEDGE TEST	PICK-UP, DODGE, TURN, RUN TEST I		PICK-UP, DODGE, TURN, RUN TEST II	
	Best	Sum	Best	Sum		Best	Sum	Best	Sum
36.	29	83	33	95	32	13.7	42.4	12.8	39.3
37.	5	10	8	15	9	27.0	104.9	19.3	75.0
38.	12	29	12	33	25	17.1	52.2	16.3	49.3
39.	28	82	29	83	24	15.3	47.0	14.8	45.6
40.	26	75	25	68	26	16.2	72.6	15.5	48.1
41.	30	81	33	87	25	13.9	47.9	14.1	48.0
42.	20	53	23	63	19	15.4	53.4	14.8	46.0
43.	16	46	27	76	31	14.2	52.6	13.8	45.1
44.	27	69	27	67	25	13.8	44.5	13.5	41.3
45.	22	66	24	61	30	16.6	54.6	15.8	52.0
46.	24	62	25	71	31	13.9	42.7	13.4	58.4
47.	33	89	32	93	18	13.1	41.1	13.1	39.8
48.	35	97	36	107	24	12.6	42.0	12.9	40.9
49.	27	69	32	88	34	13.3	41.5	12.8	39.4
50.	34	96	36	94	33	12.8	40.9	12.7	39.0
51.	24	69	30	85	26	13.8	44.9	13.1	40.2
52.	25	72	23	67	20	15.6	49.8	14.5	46.4
53.	31	88	25	66	26	14.5	49.6	14.1	44.8
54.	26	66	27	70	24	14.0	52.4	14.0	47.0
55.	--	--	--	--	27	--	--	--	--
56.	32	90	31	79	28	12.6	38.9	12.7	38.9
57.	23	67	28	79	25	14.0	43.0	13.5	40.7
58.	34	85	33	93	29	13.5	43.9	13.0	39.3
59.	19	49	20	59	30	15.1	46.6	15.1	46.8
60.	14	36	23	63	32	14.2	47.1	15.5	47.1
61.	27	78	34	91	26	13.3	41.5	12.9	43.4
62.	25	70	27	74	35	13.7	44.0	14.1	42.6
63.	16	44	11	28	31	15.6	49.8	15.5	47.3
64.	18	51	22	63	28	16.9	50.8	14.2	44.4
65.	17	45	19	45	30	14.1	45.7	14.4	58.7
66.	28	74	24	60	25	14.7	44.7	13.7	42.4
67.	36	100	40	106	34	13.1	44.0	12.9	40.1
68.	32	89	37	99	37	--	--	--	--
69.	31	89	29	85	24	14.0	49.3	13.7	41.2
70.	28	82	33	85	21	13.5	42.6	13.3	40.3
71.	19	53	17	48	25	16.6	54.0	15.6	59.9
72.	24	68	26	69	25	13.6	42.1	13.9	42.7

TABLE IX (continued)

	WALL VOLLEY TEST I		WALL VOLLEY TEST II		REVISED KNOWLEDGE TEST	PICK-UP, DODGE, TURN, RUN TEST I		PICK-UP, DODGE, TURN, RUN TEST II	
	Best	Sum	Best	Sum		Best	Sum	Best	Sum
73.	18	49	19	43	21	14.1	45.1	13.3	41.9
74.	22	64	--	--	23	14.8	53.5	--	--
75.	27	77	33	91	31	12.8	41.7	12.3	38.2
76.	21	54	22	60	26	15.5	47.8	15.1	45.9
77.	10	25	17	45	23	15.7	51.9	15.0	47.1
78.	15	38	16	44	29	16.5	51.2	16.2	49.6
79.	24	63	28	81	29	14.2	43.0	14.1	43.6
80.	30	81	27	78	26	13.9	42.0	13.2	40.0
81.	21	59	24	65	27	13.2	44.1	12.5	42.7
82.	29	83	31	78	28	13.7	50.9	13.2	42.4
83.	18	48	16	43	27	16.3	50.1	14.7	48.9
84.	21	59	32	83	35	14.3	52.4	14.2	43.6
85.	19	54	22	61	35	14.8	47.5	15.0	46.1
86.	6	14	18	50	21	16.9	59.5	15.2	53.4
87.	21	59	27	63	25	15.5	49.7	15.4	47.1
88.	20	54	19	55	--	15.2	47.6	15.6	54.5
89.	24	62	23	67	24	15.0	48.3	14.7	44.9
90.	30	89	35	89	31	12.5	38.5	12.0	37.2
91.	26	74	27	72	20	13.5	41.9	12.7	40.8
92.	15	36	21	47	19	14.4	45.5	14.5	44.6
93.	26	70	27	72	26	14.0	50.1	14.0	43.2
94.	25	73	28	77	19	15.4	46.7	15.1	45.9
95.	24	57	28	76	25	14.5	48.3	13.6	41.3
96.	30	84	35	93	28	14.7	46.3	13.8	45.1
97.	29	80	30	87	23	14.9	46.8	13.8	41.9
98.	21	61	24	67	27	16.0	50.2	14.6	45.4
99.	20	54	19	53	26	15.1	56.6	15.5	50.2
100.	27	78	31	85	28	12.9	39.4	12.6	38.3
101.	26	64	32	80	29	16.9	55.3	15.0	45.6
102.	22	60	25	72	26	14.9	46.1	14.7	47.7
103.	23	68	28	68	23	14.0	48.9	13.6	42.1
104.	27	77	--	--	31	12.9	39.6	--	--
105.	6	8	8	15	31	16.4	53.0	16.2	51.5
106.	28	70	27	72	30	17.6	56.1	15.0	45.7
107.	17	48	20	51	29	14.6	52.0	14.3	43.9
108.	--	--	12	28	14	15.8	52.0	15.0	45.3
109.	28	75	24	69	26	15.3	48.9	14.5	61.7

TABLE IX (continued)

	WALL VOLLEY TEST I		WALL VOLLEY TEST II		REVISED KNOWLEDGE TEST	PICK-UP, DODGE, TURN, RUN TEST I		PICK-UP, DODGE, TURN, RUN TEST II	
	Best	Sum	Best	Sum		Best	Sum	Best	Sum
110.	23	65	25	67	22	14.3	44.5	14.3	51.8
111.	20	47	21	61	23	14.2	43.8	--	--
112.	32	90	27	77	28	14.0	42.3	13.8	42.1
113.	23	67	28	79	31	17.2	58.0	13.5	69.3
114.	20	60	17	43	33	13.9	42.5	13.4	41.5
115.	20	56	26	64	20	14.1	49.7	13.8	42.4
116.	27	71	21	56	25	15.5	49.8	15.0	45.9
117.	23	63	24	65	28	14.6	45.9	14.1	43.1
118.	23	68	24	68	27	13.9	46.1	14.0	42.0
119.	20	41	20	49	17	14.9	46.9	15.2	49.6
120.	30	84	32	84	28	15.6	47.6	14.4	43.8
121.	31	86	31	85	33	13.4	50.6	13.5	42.4
122.	23	63	25	64	30	13.5	41.0	13.3	43.6
123.	35	93	32	89	22	14.5	46.9	--	--
124.	20	55	20	55	16	14.5	44.1	14.8	54.1
125.	13	31	9	23	26	17.1	59.6	--	--
126.	28	80	33	81	25	14.3	43.2	13.9	43.7
127.	19	51	23	61	24	14.1	43.5	13.4	41.4
128.	32	86	31	87	30	12.6	38.5	12.5	41.4
129.	24	63	26	61	26	15.1	48.4	14.2	44.7
130.	26	66	21	57	25	14.5	45.1	13.9	49.2
131.	18	42	18	45	13	15.2	47.1	14.6	44.9
132.	31	90	35	97	37	12.8	39.3	12.7	39.3
133.	24	68	27	74	23	14.0	43.0	13.0	42.5
134.	12	31	17	41	21	16.9	57.9	16.4	50.1
135.	30	76	25	65	22	14.6	45.7	14.7	44.7

TABLE X

RAW DATA FOR SHOOTING ACCURACY TEST
AND AVERAGED JUDGES' RATINGS

	SHOOTING ACCURACY TEST (five trials)								AVERAGED
	I				II				JUDGES'
SUBJECT	R	C	L	Sum	R	C	L	Sum	RATINGS
1.	--	--	--	--	5	16	13	34	8.86
2.	15	17	1	33	15	8	17	40	--
3.	2	13	15	30	4	19	11	34	--
4.	14	7	9	30	15	19	17	51	--
5.	11	14	14	39	9	12	14	35	7.84
6.	15	14	1	30	10	17	9	36	--
7.	--	--	--	--	6	11	12	29	--
8.	9	6	23	38	10	11	13	34	7.44
9.	13	10	0	23	11	5	10	26	7.61
10.	4	16	8	28	4	14	16	34	8.13
11.	12	11	10	33	8	17	11	36	7.74
12.	15	12	22	49	8	15	12	35	9.33
13.	9	15	7	31	8	16	6	30	4.54
14.	11	17	8	36	13	10	6	29	7.94
15.	14	11	17	42	11	16	8	35	--
16.	12	13	11	36	20	19	10	49	--
17.	10	12	12	34	10	15	13	38	--
18.	9	19	6	34	13	18	5	36	11.58
19.	8	14	5	27	15	17	9	41	10.89
20.	14	10	9	33	15	14	9	38	7.78
21.	11	10	14	35	13	8	9	30	8.89
22.	16	11	11	38	10	15	15	40	--
23.	4	10	12	26	9	16	5	30	5.64
24.	9	18	3	30	8	17	17	42	--
25.	8	16	15	39	11	14	19	44	11.59
26.	6	13	7	26	11	12	14	37	--
27.	11	14	14	39	6	16	6	28	--
28.	6	14	8	28	13	20	16	49	9.26
29.	8	11	10	29	12	11	7	30	--
30.	7	15	7	29	14	20	15	49	6.83
31.	14	7	13	34	8	17	10	35	4.36
32.	18	12	15	45	9	21	10	40	8.29
33.	11	10	3	24	17	17	11	45	6.08

TABLE X (continued)

SUBJECT	SHOOTING ACCURACY TEST (five trials) I R	C	L	Sum	II R	C	L	Sum	AVERAGED JUDGES' RATINGS
34.	8	10	6	24	9	17	9	35	10.11
35.	16	8	16	40	13	13	18	44	6.19
36.	16	17	7	40	11	14	16	41	9.17
37.	1	15	3	19	10	8	5	23	--
38.	6	7	17	30	7	10	6	23	--
39.	6	10	15	31	2	16	15	33	5.86
40.	13	10	15	38	10	18	17	45	5.99
41.	--	--	--	--	11	12	14	37	8.90
42.	15	14	10	39	9	12	6	27	7.78
43.	11	13	10	34	16	10	8	34	--
44.	4	15	5	24	5	16	8	29	12.20
45.	15	7	17	39	10	13	7	30	6.27
46.	11	12	11	34	17	3	15	35	7.09
47.	12	11	8	31	11	10	12	33	10.17
48.	6	18	18	42	10	13	6	29	8.29
49.	10	17	19	46	10	14	9	33	10.84
50.	9	9	5	23	14	18	15	47	12.10
51.	13	14	13	40	7	14	10	31	6.65
52.	7	16	8	31	15	12	11	38	8.61
53.	11	11	10	32	13	18	17	48	6.75
54.	16	9	10	35	10	13	4	27	6.32
55.	--	--	--	--	--	--	--	--	--
56.	14	4	12	30	13	12	17	42	10.29
57.	3	14	15	32	12	10	6	28	7.95
58.	11	15	18	44	7	15	15	37	9.79
59.	7	5	13	25	7	9	16	32	--
60.	6	11	14	31	15	14	7	36	9.87
61.	10	9	0	19	8	9	6	23	8.36
62.	9	6	11	26	17	18	16	51	--
63.	10	14	7	31	9	11	9	29	--
64.	5	12	12	29	12	16	10	38	9.71
65.	2	6	18	26	5	11	0	16	--
66.	8	12	9	29	21	12	15	48	10.36
67.	14	11	10	35	14	8	17	39	11.19
68.	14	7	9	30	10	15	15	40	--
69.	16	10	11	37	18	15	16	49	8.20

TABLE X (continued)

SUBJECT	SHOOTING ACCURACY TEST (five trials) I R	C	L	Sum	II R	C	L	Sum	AVERAGED JUDGES' RATINGS
70.	13	13	2	28	17	16	19	52	10.40
71.	21	7	8	36	1	11	12	24	--
72.	6	9	15	30	9	11	11	31	7.75
73.	7	8	3	18	13	9	7	29	8.12
74.	11	13	11	35	5	15	12	32	--
75.	16	12	4	32	11	10	14	35	9.20
76.	13	14	10	37	11	13	14	38	--
77.	7	9	8	24	18	16	20	54	--
78.	14	15	16	45	8	16	12	36	10.53
79.	13	11	8	32	4	15	10	29	9.72
80.	12	18	10	40	17	17	10	44	8.34
81.	10	16	7	33	4	16	9	29	8.79
82.	9	15	15	39	12	17	12	41	--
83.	8	15	9	32	3	16	17	36	7.78
84.	7	13	4	24	11	11	5	27	9.70
85.	15	13	14	42	12	10	15	37	9.11
86.	13	13	6	32	5	8	11	24	--
87.	--	--	--	--	3	6	10	19	9.20
88.	10	12	7	29	7	5	3	15	--
89.	5	12	8	25	--	--	--	--	--
90.	19	17	16	52	6	16	8	30	10.95
91.	12	17	6	35	16	15	12	43	10.60
92.	14	13	9	36	11	12	17	40	--
93.	12	15	9	36	13	13	12	38	6.93
94.	9	8	5	22	--	11	15	--	--
95.	10	11	10	31	7	12	14	33	8.47
96.	--	--	--	--	1	10	15	26	8.28
97.	12	6	9	27	13	14	11	38	8.87
98.	14	10	18	42	15	8	5	28	6.79
99.	5	11	11	27	6	8	11	25	--
100.	17	19	14	50	17	16	13	46	10.58
101.	18	10	6	34	14	16	14	44	7.74
102.	10	4	5	19	10	11	13	34	--
103.	10	17	11	38	2	11	10	23	9.32
104.	4	6	20	30	14	11	9	34	9.62
105.	12	15	11	38	15	12	9	36	6.04

TABLE X (continued)

SUBJECT	SHOOTING ACCURACY TEST (five trials) I R	C	L	Sum	II R	C	L	Sum	AVERAGED JUDGES' RATINGS
106.	4	14	4	22	5	17	13	35	6.99
107.	16	7	6	29	8	13	13	34	7.84
108.	10	7	4	21	12	7	10	29	8.21
109.	10	14	5	29	9	9	6	24	--
110.	12	15	6	33	11	15	9	35	8.05
111.	15	11	8	34	9	10	11	30	--
112.	5	12	10	27	16	24	20	60	8.42
113.	7	14	6	27	7	4	7	18	7.50
114.	9	11	8	28	6	12	13	31	9.08
115.	5	6	12	23	6	16	16	38	--
116.	17	8	10	35	10	9	10	29	6.27
117.	2	10	10	22	14	11	11	36	6.92
118.	5	12	13	30	13	18	16	47	--
119.	12	8	4	24	2	10	7	19	--
120.	18	11	13	42	15	17	10	42	8.62
121.	13	11	8	32	13	11	14	38	10.54
122.	10	15	18	43	10	10	11	31	7.34
123.	--	--	--	--	12	13	16	41	4.78
124.	4	21	8	33	3	14	13	30	--
125.	--	--	--	--	3	11	5	19	6.43
126.	13	15	9	37	16	20	12	48	10.44
127.	11	13	9	33	12	15	9	36	7.87
128.	10	16	16	42	11	12	10	33	9.39
130.	9	7	11	27	20	14	12	46	6.33
131.	9	5	16	30	18	9	9	36	11.00
132.	11	18	11	40	18	16	13	47	12.31
133.	12	15	8	35	4	13	7	24	8.52
134.	10	17	15	42	6	13	16	35	2.75
135.	6	10	7	23	13	18	6	37	8.99