

A COMPARATIVE STUDY OF THE STATUS IN SELECTED TEAM SPORTS,
OF TENTH GRADE GIRLS IN ST. PETERSBURG SENIOR HIGH
SCHOOL AT ST. PETERSBURG, FLORIDA

A THESIS
SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF ARTS IN PHYSICAL EDUCATION
IN THE GRADUATE DIVISION OF THE
TEXAS STATE COLLEGE FOR WOMEN

DEPARTMENT OF
HEALTH, PHYSICAL EDUCATION AND RECREATION

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DENTON, TEXAS

AUGUST, 1956

ACKNOWLEDGMENT

The writer wishes to express her sincere appreciation to Doctor Mary Agnew Murphy, director of this study, for her suggestions, untiring assistance and invaluable guidance in the preparation of this thesis.

To Doctor Lois Timmons of the College of Health, Physical Education and Recreation and Mrs. Marion de Coligny of the department of Education, Philosophy and Psychology at the Texas State College for Women, acknowledgment is made for their splendid suggestions and services as members of the thesis committee.

Acknowledgment is also made to the Physical Education teachers of St. Petersburg Senior High School for their services and cooperation, and to the students to whom the tests were administered. The expenditure of their time and effort made the study possible.

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CHAPTER I

ORIENTATION TO THE STUDY

Introduction

Historical survey of the use of measurement discloses that tests in physical education have been used for many years to rate pupils and to measure their progress. In the United States, testing in physical education began as early as 1861 when Hitchcock of Amherst reported studies based upon certain anthropometric measurements. Since then, after passing through several distinct but overlapping periods, measurement has been used increasingly in this country. The types of tests used during these periods reflect, to a large extent, the prevailing philosophy toward the function of physical education current during the period when the various tests were popular.¹

Anthropometry, which dates back to the beginning of recorded history, is the oldest type of body measurement used in education. In an attempt to find the correct proportions for the human figure, Greek sculptors obtained numerous body dimensions of many individuals in order to obtain the average of body proportions. Polysletus created a statue, Doryphoros,

¹H. Harrison Clarke, The Application of Measurement to Health and Physical Education (New York: Prentice-Hall, Inc., 1945), P. 3.

or Spear Thrower, picturing the perfect man as a broad-shouldered, thick-set, and square-chested individual.¹

As the arts of civilization became more gentle, grace rather than ruggedness began to appeal to the Greek. This change indicated a passing from the pioneer struggle for national existence to the keener and more intellectual conflict of a closer community life.² Only within recent years has the subject of bodily proportions been approached from the standpoint of the anthropologist rather than the artist. Now, the anthropologist seeks to determine the relationship between body form and function, whereas the artist always has been preoccupied with the design of the human figure and how it may be portrayed more esthetically.³

A shift of the emphasis from anthropometric measurement to the measurement of the actual work of an individual may be noted in the pioneer work of Dudley A. Sargent,⁴ about 1880, when he introduced strength tests at Harvard University in connection with the physical examinations. Sargent contended that capacity, and not the size of muscles alone, should be given value in the judgement of an individual's power and working capacity.

¹R. Tait McKenzie, "The Quest for Eldorado," American Physical Education Review, Vol. XVIII, No. 5 (May, 1913), p. 295.

²Hyman Krakower, "Testing in Physical Education," The Research Quarterly, Vol. VIII, No. 1 (March, 1937), p. 54.

³Ibid.

⁴Clarke, op. cit., p. 4.

With the invention of the ergograph by Angelo Mosso in 1884, the attention of physical educators turned from strength testing to methods of determining the cardiovascular efficiency of the body. Mosso's original premise was that the ability of a muscle to perform is dependent upon the efficiency of the circulatory system.¹

During the early years of the twentieth century, interest shifted from strength tests to the ability to handle the body, utilizing the elements of running, jumping, vaulting, climbing, and throwing. These tests were arranged in batteries which purported to measure "general athletic ability".² George L. Meylan developed a comprehensive test utilizing these elements in 1904. Apparently, Meylan's work at Columbia University was well considered and spread rapidly, for by 1915 and 1916, testing individuals according to the elements involved in play was almost universal.³

In order to have an adequate physical education program, there must be measurement. Luther Halsey Gulick related, as early as 1911, that there was a definite need for the measurement of results without which neither medicine nor education ever could become scientific. He also stated, "I

¹Ibid., p. 78.

²Ibid., p. 5.

³John F. Bovard, Frederick W. Cozens, and E. Patricia Hagman, Tests and Measurements in Physical Education (Philadelphia and London: W.B. Saunders Company, 1949), pp. 25-26.

do not need to remind you that it was through the use of measurement that alchemy became chemistry, astrology became astronomy, and physics grew out of mystery."¹

McCall's philosophy in regard to measurement which may be applied to physical education measurement is:

1. Whatever exists at all, exists in some amount.
2. Anything that exists in amount can be measured.
3. Measurement in education is in general the same as measurement in physical sciences.
4. All measurements in physical sciences are not perfect.
5. Measurement is indispensable to the growth of scientific education.
6. Measurement in education is broader than educational tests.
7. The worth of the methods and materials of instruction is unknown until their effect is measured.
8. Measurement is no recent educational fad.²

Tests have been used in the field of education for some time, but teachers of physical education have been relatively slow in the development of adequate tests for their activities. Much of the work done in physical education measurement before 1925 was unscientific, but since that time investigators in this field have been trained in the scientific approach to test construction. The scientific attitude prevalent today has directed research toward a better understanding of the nature of the variables to be measured and the interrelationships among these traits.

¹Luther H. Gulick, "Measurements as Applied to School Hygiene, "American Physical Education Review, Vol. 16, No. 4 (April, 1911), p. 239.

²William A. McCall, Measurement (New York: The Macmillan Company, 1939), pp. 16-26.

Although much of the research reveals the limitations of the existing measures and the need for a great deal more research, the very recognition of this need is in itself an encouraging sign of progress.¹

The acceleration of interest in testing during the past two decades has been largely due to three factors:

(1) the publication of The Research Quarterly of the American Association for Health, Physical Education and Recreation, originating in 1930; (2) the organization of the Administrative Measurements Section of the American Association for Health, Physical Education, and Recreation; and (3) the increase in the number of institutions offering graduate work in health, physical education, and recreation.²

There are definite limitations which have hindered the development of skill tests, although the need for such tests is obvious. For the most part, their administration is often prohibitively time-consuming and, in addition, the objectivity, reliability, and validity have not been established.³

Not only is it important to measure the skill acquired by individuals in various activities included in the physical education program, but it is important to measure the various types of knowledges acquired by the pupils in relation to these activities. Not until about 1932 did

¹Bovard, Cozens, and Hagman, op. cit., p. 31.

²Clarke, op. cit., pp. 5-6.

³Ibid., pp. 262-3.

objective written tests begin to appear in physical education, but indications at present show that measurement of this sort will occupy an increasingly important place in the future.¹

As both skill and information tests are important in the physical education program, neither should be neglected. The skill tests are designed either to predict potential playing ability or to evaluate the present status of ability in the given sport. These tests usually are constructed by analyzing the component skills of a sport and by statistical methods, selecting a few skills that best represent the entire playing ability. Success in a sport is dependent upon more than merely the sum of abilities in the component skills of the game. Objective measurement in a game situation is complex and time-consuming. Progress is being made through research, and improved tests are continuously being used in the field.²

Knowledge, as measured by information tests, also demands consideration in the physical education program. These tests, usually constructed to determine the information learned concerning many factors of instruction in the sports program, are: history of the activity, fundamentals of skills, rules, team strategy, courtesy, and officiating. A number of these tests are available in periodical literature, but none has been prepared and distributed by the

¹Ibid., p. 281

²Bovard, Cozens, and Hagman, op. cit., p. 37.

national test construction agencies which supply tests in most other school subjects.¹

Reduced to its simplest terms, the function of measurement is to determine status. Status must be determined before conclusions concerning the thing measured can be drawn and before comparisons can be made.²

After the status of the individual is determined with reference to the particular ability to be measured, it is then possible to compare it with: (1) the status of another individual in reference to the same ability, (2) norms or standards, and (3) itself at different time periods.³

The physical education teacher must measure in order to evaluate the program. Furthermore, the testing project should not be undertaken unless it is part of an attack upon a clearly defined educational problem, so that the results of the testing will aid in solving this problem. In order to select tests appropriate for the situation, the teacher must select first the aims and objectives of the program. There must be a need and a real justification for the administration of the tests.⁴

The need for testing in physical education is perhaps greater in the St. Petersburg Senior High School than in average high schools, as St. Petersburg, Florida, is

¹Ibid.

²Clarke, op. cit., p. 24.

³Ibid.

⁴Ibid., p. 8.

primarily a tourist town with a year-around population of approximately 100,000 and a tourists population of approximately 200,000 during the winter months. This great influx of tourists causes a constant turn-over in enrollment.

Many of the students entering the tenth grade have not attended schools in St. Petersburg previously; some have attended St. Petersburg junior high schools for only short periods of time, and others have attended these schools for the entire three years. Therefore, the students enrolling in the tenth grade have varying backgrounds of physical education activities, and testing for purposes of classification is necessary in order to separate students of varying abilities and knowledge into homogeneous groups.

The junior high schools, numbering four in all, are located in various sections of the city. The majority of tenth grade girls from the four junior high schools enroll in the high school and are the subjects with whom the investigator was concerned in the present study.

Statement of the Problem

Recognizing the need to compare achievement in skill and information of one group with another as a result of participation in junior high school physical education classes, the investigator undertook a comparative study of the status of tenth grade girls enrolling in the St. Petersburg Senior High School at St. Petersburg, Florida, from the four St. Petersburg junior high schools, during the school

year 1951-52, in regard to skill and information in volleyball, basketball, and softball, as measured by selected and constructed skill and information tests. Information concerning time allotment and facilities for participation in the selected sports in the junior high schools was obtained by means of a check list. On the basis of the findings, implications as to the relationships existing among the four groups in respect to the selected factors and recommendations for future development of the sports program in the junior and senior high schools in St. Petersburg, Florida, were made.

Purposes of the Study

The purposes of the study were:

- A. to determine the status of tenth-grade girls enrolling in the St. Petersburg Senior High School at St. Petersburg, Florida, from the four St. Petersburg junior high schools during the school year 1951-52 in regard to skill and information in volleyball, basketball, and softball as measured by selected and constructed skill and information tests;
- B. to compare the four groups as to their status in regard to skill and information in volleyball, basketball, and softball;
- C. to determine the degree of relative proficiency in the sports within each school;
- D. to obtain information concerning time allotment and facilities for participation in the selected sports in

- the junior high schools by means of a check list;
- E. to draw implications on the basis of the findings as to the relationship of the status of the four groups in skill and information in reference to the selected team sports;
 - F. to make recommendations on the basis of the findings for future development of the sports program in the junior and senior high schools of St. Petersburg, Florida.

Limitations of the Study

The study was limited to:

- A. tenth grade girls from the four St. Petersburg junior high schools enrolling in physical education classes in the St. Petersburg Senior High School at St. Petersburg, Florida, during the school year 1951-52.
- B. constructed information tests in volleyball, basketball, and softball;
- C. selected and constructed skill tests in volleyball, basketball, and softball;
- D. check lists distributed to the teachers of girls' physical education in the four St. Petersburg junior high schools.

Definitions of Terms

In order to avoid confusion, the following terms are defined for purposes of this study:

- A. skill tests: instruments for measuring the degree of proficiency in sport techniques.

B. information tests: instruments for measuring knowledge by means of written examinations.

Survey of Previous Studies

A survey of available studies indicated no previous studies identical with the present investigation. However, certain previous studies are discussed briefly since they were of value in the selection of the skill tests to be used, in the construction of the questions included in the information tests, in the establishing of the procedures, and in the treatment of the data.

French and Cooper, after experimenting with available tests for volleyball, found that there was a definite need for objective measurement in this sport. They analyzed the skills used in volleyball and constructed a battery of tests which included repeated volleys, serving, set-up and pass, and recovery from the net. The validities of the tests were established by correlating the skill ratings given participants by four trained judges with the scores made by these participants on the four tests. The best of two test combinations for classification was found to be the repeated volleys and the serve, with a correlation of .8111. Adding "set-up and pass" and "recovery from the net" raised the four-battery correlation to .8152.¹

¹Esther French and Bernice I. Cooper, "Achievement Tests in Volleyball for High School Girls," Research Quarterly, Vol. VIII, No. 2 (May, 1937), p. 150.

The serve and volley were also included in skill tests devised by Cozens, Cubberley, and Neilson. Three variations for the serve and one form for the volley were used. The test in serving was scored by means of targets painted on the floor, and the test for volleying was scored by the number of times the ball could be volleyed above a ten-foot mark in thirty seconds. Achievement scales are available for rating students in the execution of these tests.¹

Bassett, Glassow, and Locke conducted extensive research on the validity of various volleyball skill tests. They submitted two tests: the serving test to measure force of the serve, placement of the serve, and ability to get the ball across the net; and the volleying test to measure reaction timing, passing, receiving and accuracy of placement. The criterion for establishing validity was the composite ratings given by three judges. The validity coefficients were .79 for the serving test, and .51 for the volleying test. The reliability coefficients were found to .84 for the serving test and .89 for the volleying test.²

Russell and Lange surveyed volleyball skill tests of acceptable reliability and validity and discovered that, with

¹Frederick W. Cozens, Hazel J. Cubberley, and N.J. Neilson, Achievement Scales in Physical Education for Secondary Girls and College Women (New York: A. S. Barnes and Co., 1937), pp. 43-46.

²Gladys Bassett, Ruth Glassow, and Mildred Locke, "Studies in Testing Volleyball Skills," Research Quarterly, Vol. VIII, No. 4 (December, 1937), pp. 60-72.

the exception of those by French and Cooper, the tests either required too much equipment and time to administer or that they failed to discriminate between the fair and above average player. From trials of the French and Cooper test on a small group of students, Russell and Lange found that the "set-up and pass," and "recovery from the net" tests lacked objectivity, since they involved a player other than the one tested and that these two tests also have lower reliability coefficients and add little to the validity of the battery. Thus, these two tests were not included in their battery. Modifications of the original tests were administered to students during a three month period, at which time the data were collected to determine the reliability and validity of the tests. The modifications were: (1) the repeated volleys test was changed to three trials of thirty seconds each, thus reducing the testing time by one minute, and (2) the serving test was changed to two trials of ten serves each. The increase in time resulting was compensated for partly by the reduction in time in the repeated volleys.¹ This test, by Russell and Lange, was chosen as the skill test for volleyball administered in the present study.

Young and Moser were the first to publish tests to measure playing ability in basketball for women. They constructed a short battery of five tests: (1) bounce and shoot,

¹Naomi Russell and Elizabeth Lange, "Achievement Tests in Volleyball for Junior High School Girls," Research Quarterly, Vol. XI, No. 4 (December, 1940), pp. 33-41.

(2) speed pass, (3) free jump, (4) Edgren ball handling test, and (5) moving target test. The correlation coefficients for validity of .859 was established by correlating composite scores of the test with a rating by expert judges of the player's ability in a game situation. Reliability was determined by administering the test twice to the same group one week apart, but the coefficient was not quoted.¹

Colvin, Glassow, and Schwartz also constructed a battery of tests for basketball with satisfactory reliability coefficients and a validity coefficient of .66 for three of the five tests. Since this test required special and somewhat complicated equipment and a considerable time for administration, its use is not always practical for high school groups.²

After considerable research of available tests and analysis of motor aspects, "A Basketball Motor Ability Test for College Women and Secondary School Girls" was published by Dyer, Schurig, and Apgar in 1939. This study was undertaken as the result of a definite felt need for basketball motor ability tests which would be suitable to the entire basketball playing age range, validated for each of the school

¹ Genevieve Young and Helen Moser, "A Short Battery of Tests to Measure Playing Ability in Women's Basketball," Research Quarterly, Vol. V, No. 2 (May, 1934), pp. 2-23.

² Ruth B. Glassow, Valerie Colvin, and Marguerite Schwartz, "Studies in Measuring Basketball Playing Ability of College Women," Research Quarterly, Vol. X, No. 3 (October, 1939), pp. 128-47.

levels, and for which there would be adequate and comparable norms. Data for this battery were obtained from four sources and on three levels: college women, high school girls and junior high school girls. Ten tests were investigated during 1936 and 1937. Four of these tests were subjected to further experimentation during 1938 and 1939. The four tests, which were retained in the battery, included the moving target test, the Edgren ball handling test, the bounce and shoot test, and the free jump and reach test.¹ As the objectivity was established and the validity and reliability coefficients were both high, this battery of tests was chosen for measuring the skill in basketball of the tenth grade girls in the present study.

Scott and French designed a battery of tests for softball for girls after studying skill tests published in the Official Softball-Volleyball Guide and an unpublished Master of Arts thesis by Audrey Underkofler of the University of Iowa, 1942. The battery consists of repeated throws, distance throw and batting. The reliability of the repeated throws test was .94, when corrected by the Spearman-Brown formula, and the validity was .51. For the distance throw test the reliability was .95 and the validity, .63. For the batting test in which a pitcher was involved in the testing, the

¹ Joanna T. Dyer, Jennie C. Schurig, and Sara L. Apgar, "A Basketball Motor Ability Test for College Women and Secondary School Girls," Research Quarterly, Vol. X, No. 3 (October, 1939), pp. 128-47.

reliability was .65 as determined by the split-half method and corrected to .79 by the Spearman-Brown formula. A validity coefficient of .72 was obtained by the correlation of the scores of subjective ratings of students with subjective ratings made by the instructor. The battery is fairly reliable, but not too valid.¹ The distance throw test was selected from this battery for use in the present study, and the batting test was used as a basis for the construction of a new batting test.

Comprehensive multiple-choice knowledge tests of 45 items covering each of ten physical education activities and hygiene were constructed and published by Catherine Snell and her associates in the Department of Physical Education for Women at the University of Minnesota. Reliability and validity were established for each test by use of scientific ratings. The ten knowledge tests and skill tests were used to classify students at the University of Minnesota for physical education and were judged not suited to the comprehension of high school students.²

Helen Schwartz published a knowledge test for girls' basketball on the senior high school level in 1937. To

¹ Gladys Scott and Esther French, "Softball Skill Test, "Better Teaching Through Testing," (New York: A.S. Barnes and Company, 1945), pp. 84-90.

² Catherine Snell, "Physical Education Knowledge Tests," Research Quarterly, Vol. VII, No. 2. (May, 1936), pp. 87-91; Vol. VII, No. 1. (March, 1936), pp. 73-82.

validate the test, Schwartz sent letters to some 54 women who were well-versed in the theory and technique of basketball for girls. These women were asked to criticize the test severely and to offer opinions conducive to the construction of better tests. She validated the test further by administering it to 50 matriculating freshmen women at the University of Southern California. The data obtained from the administration were used to improve the test. The test contained 50 true-false, 15 completion, 20 best answer, and 15 pictorial questions¹. The method of obtaining validity used by Schwartz is similar to the method used in the present study.

A survey of available information tests in the selected sports revealed none of which was applicable for the high school girls at the present time. The available tests, however, were used as guides in the construction of the information tests used in this study.

Summary

In this introductory chapter a brief history of measurement, the need for testing, the statement of the problem, the purposes of the study, the limitations of the study, the definitions of terms, and a survey of previous studies have been presented. In the following chapter the procedures used in the development of the study are presented.

¹ Helen Schwartz, "Knowledge and Achievement Tests in Girls' Basketball on the Senior High School Level," Research Quarterly, Vol VIII, No. 1. (March, 1937), pp. 143-56.

CHAPTER II

PROCEDURES

Sources of Data

Both documentary and human sources of data were used by the investigator in obtaining information for the study. A list of the documentary sources may be found in the bibliography and includes books in the field of tests and measurements, professional magazines, journals and research bulletins in the field of health, physical education and recreation, available in the library in the Texas State College for Women.

The human sources of data were 299 tenth grade girls from the four St. Petersburg junior high schools enrolled in physical education classes in the St. Petersburg Senior High School during the school year 1951-52. The teachers of physical education in the junior high schools provided information pertaining to the program and facilities by responding to a check list.

Methods of Collecting Data

The investigator made a careful study and assimilation of materials pertaining to the various aspects of the problem and made a thorough study of the literature in the field of tests and measurements in physical education. Check lists were distributed to the girls' physical education teachers in the junior high schools of St. Petersburg, Florida, in regard to the previous training of the subjects.

The data upon which the present study is based were also collected by means of three information tests for the purpose of testing the knowledge and seven skill tests for the purpose of testing abilities of tenth grade girls in volleyball, basketball and softball.

Procedures used in the Development of the Study

The present study was analyzed and criteria were established for its development in regard to the relation of the subjects, the construction of the check list, and selection of the tests, and the construction of the tests.

Criteria for the selection of the subjects. --The criteria for the selection of the subjects were:

1. The subjects must be available for testing.
2. The subjects must have been enrolled in physical education classes while attending one of the four junior high schools in St. Petersburg, Florida.
3. The subjects must be enrolled in physical education classes in the St. Petersburg Senior High School at St. Petersburg, Florida, during the school year 1951-52.
4. The subjects must be in the tenth grade during the school year 1951-52.
5. The subjects must be girls.

Selection of the subjects. --The subjects used in this study were selected on the basis of the criteria set up for their selection. These subjects were tenth grade girls, enrolled in St. Petersburg Senior High School during the school

year 1951-52, who had previously participated in physical education classes while in attendance at one of the four junior high schools in St. Petersburg, Florida.

Criteria for construction of the check list.--The criteria used for the construction of the check list filled out by the teachers of physical education of the junior high school girls were:

1. The check list must be short, but inclusive.
2. The check list should create interest in the study on the part of the junior high school physical education teachers.
3. The check list must include all information, in regard to junior high school training in volleyball, basketball and softball, pertinent to the present study.

Construction and distribution of the check list.--Using the criteria established, the check list was constructed. The check lists were distributed and the purposes of the study were explained to the teachers of the girls in physical education in the four junior high schools in St. Petersburg, Florida, during the pre-school period before the students enrolled for the 1951-52 session. At this time, each teacher filled out and returned the check list.

Tabulation of information on check lists.--The data from the check lists were tabulated in the following categories:

1. The number of weeks spent in instruction and participation in volleyball, basketball and softball, in the

seventh, eighth and ninth grades;

2. The number of in-door courts available for class instruction in volleyball and basketball;

3. The number of out-of-door courts available for class instruction in volleyball and basketball;

4. The number of fields available for class instruction in softball;

5. The number of physical education teachers for girls employed in each school;

6. The maximum and minimum enrollment of girls in physical education classes during 1950-51;

7. The time allotment for physical education activity per week;

8. The average size of classes.

Criteria for the selection of skill tests.---The criteria for selection of the skill tests were:

1. The test must be valid; that is, the test must measure what it purports to measure.

2. The test must be reliable; that is, each test must give a constant score for a constant degree of what it measures.

3. The test must be objective; that is, the test must be scored with uniformity by various teachers.

4. The test must not require more than one forty-five minute class period for administration.

5. The test must be inexpensive.

6. The test must be adaptable to the situation at St. Petersburg Senior High School.

7. The test must include standardized directions.

8. The test must be available.

Selection of the volleyball skill tests.--The investigator undertook a survey of available volleyball skill tests of acceptable reliability and validity. The "Achievement Tests in Volleyball for Junior High School Girls," by Russell and Lange,¹ was selected for use in the present study. Although this test was designated for use by girls in junior high school, both French and Cooper, and Glassow and Broer agreed that the combination of serve and repeated volleys is a reliable battery for grades nine to twelve.²

To determine the reliability of each test, Russell and Lange administered each test two times to the same girls. A time interval of five days between the initial administration and the readministration was held constant. The coefficients of reliability established between the first and second scores for the repeated volleys and the serve test were acceptable and were:

Best of three trials, repeated volleys; 70 cases:	.870
Sum of three trials, repeated volleys; 69 cases:	.901
Best of two trials, serving test; 53 cases:	.915
Sum of two trials, serving test; 52 cases:	.900 ³

¹Russell and Lange, op. cit., pp. 33-41.

²Ibid., p. 34.

³Ibid.

The validities of the test were determined by subjective ratings of the players by seven judges. Sixty-six members of a volleyball club played a continuous round-robin tournament throughout the semester. After the tournament was well under way, the two tests were administered to the players by Russell. Several weeks later the same girls were rated on a five point scale by seven judges.¹

The coefficients of validity resulting from correlating the sum of the judges ratings with the test scores for 66 girls were:

Best of three trials of repeated volleys: .738

Best of two trials of serving test: .634

Battery of best trials of the five trials: .824

A second test of validity was determined by rank order rating of players by the best qualified judge. After three months the same judge ranked the students again according to their playing ability. The first rank order was not available for use by the judge in ranking the students the second time. The rating of the students' abilities correlated with the test scores and the validity coefficients reported indicated that the repeated volleys and the serve test were valid tests of volleyball ability.²

¹Ibid., p. 35.

²Ibid., p. 36.

Selection of the basketball skill tests.--A thorough study of material pertaining to basketball skill testing revealed that scientific measurement of basketball ability is extremely difficult. "A Basketball Motor Ability Test for College Women and Secondary School Girls," constructed by Dyer, Schurig and Apgar,¹ was a battery of four subtests chosen to test the skills of basketball. Only the size of the multiple correlations of three tests of the four tests were given. The multiple correlation coefficients ranged from .80 to .87. The reason given for not including the multiple correlation of the four tests was that the mean for the free jump and reach test was lower for the high school level than for the junior high school and college levels as the high school girl undergoes physical changes which may cause her to lose her ability to jump.² Therefore, the free jump and reach test was not used.

The validity of the tests rests upon: (1) the relationship between the subtests; (2) the relative proportion each subtest contributed to the total battery; (3) the amount of basketball motor ability which is measured by each subtest; and (4) the relationship between the test as a whole and the activity it is supposed to measure.³

¹Dyer, Schurig and Apgar, op. cit., pp. 128-47.

²Ibid., p. 135.

³Ibid., pp. 131-32.

The coefficients of correlations between the subtests, ranging from .06 to .56, indicated that the individual tests measured different factors and included no duplication of fundamental skills. Since each test was designed to measure different factors in basketball ability and the criteria were representative of total basketball ability, the correlation between a single test and a criterion will not be high. Coefficients between subtests and the criteria ranged from .45 to .86 and may be accepted as showing that the test items are valid measures of factors of basketball playing ability.¹

The validities of the subtests ranging from .80 to .91 were obtained by:

1. Rank order list of players, based on the judgment of the experimenter as to their playing ability;
2. Expert judgment in nine categories and a cross check made to detect and correct any inconsistencies;
3. Rating by the experimenter of the players while in actual games of a round-robin tournament.²

The reliability coefficients of .89 and .90 were determined by administering the tests twice with a short interval of time intervening.³ The objectivity was examined by the method of critical analysis by applying two factors:

¹Ibid., p. 133.

²Ibid., pp. 132-33.

³Ibid., p. 138.

the amount of subjective opinion used in judging the quality of performance and whether another player was involved in the administration of the tests. Results indicated that the tests were acceptably objective.¹

Selection of the softball skill tests.--After surveying all available tests measuring skill involved in the playing of softball, the distance throw tests from the battery of softball skill tests constructed by Scott and French² was selected. The entire battery consisted of: (1) repeated throws, (2) distance throw, and (3) batting. The distance throw correlated highly with the repeated throws test, thus, there was no need for giving both tests.³

To determine the reliability of the distance throw, the test was administered several times to 118 girls in the seventh and eighth grades in the Intermediate School at Riverside, Illinois. The coefficient of reliability, computed on the successive trials, proved to be .95.⁴ The validity coefficient of this test, as determined by ratings on college girls, was .63 and, as determined by ratings on 118 seventh and eighth grade girls, was .81.⁵

The ability to throw the ball long distances is

¹Ibid., pp. 138-39.

²Scott and French, op. cit., pp. 86-90.

³Ibid., p. 85.

⁴Ibid., p. 86.

⁵Ibid.

important in softball. Since there is a relationship between the distance the ball can be thrown and the ability to throw the ball with speed, it is all the more necessary for this particular skill to be measured.¹

Construction of the batting skill test.--Since batting comprises a large part in the offensive play in softball, it is important that this technique should be tested by as reliable and valid a test as possible. Scott and French constructed the first test for batting that presented any statistical data. However, the reliability coefficient of .65 and the validity coefficient of .72 seem to indicate that there is need for further study in constructing a batting test. It is recognized that even though the same pitcher and umpire are used throughout the test the conditions are not the same for all batters, as the pitcher will tire and will vary in her deliveries.² The investigator, therefore, constructed a batting test using a batting tee instead of a pitcher. The rubber batting tee consisted of a rubber cylinder mounted on a stand the size and shape of a home plate. A smaller cylinder slid up or down inside of the permanent cylinder and could be adjusted to any height desired by the batter. The ball rests on the top of the adjustable cylinder.

The reliability of the test was determined by administering the test twice, with two days intervening, to

¹Ibid.

²Ibid., pp. 87-88.

fifty students enrolled in the St. Petersburg Senior High School. The scores obtained from the two administrations were correlated by the product-moment method and the reliability coefficient was found to be .77.

To determine the validity, the test was administered to twenty girls in St. Petersburg Senior High School who had acquired batting averages in a summer softball league in 1951. The scores for the test were correlated with the batting averages and a validity coefficient of .85 was found. The objectivity of the test was determined by critical analysis and found to be satisfactory.

Criteria for the construction of the information tests.--Criteria for the construction of the information tests consist of items that were:

1. Stated to prevent ambiguity in interpretations of the meanings;
2. Brief to allow for easy, complete comprehension;
3. Composed of easy, average and difficult items to eliminate the possibility of total failures or perfect scores;
4. Consise and adequate instructions for administration;
5. Graded objectivly by use of a key;
6. Limited so that the tests could be completed during one fifty-five minute class period;
7. Mechanically correct:
 - a. Ample space for answers;

b. Uniform arrangement of answers to facilitate marking;

c. Proper usage of English.

Construction of information tests.--A thorough study of available knowledge tests in physical education, particularly in regard to volleyball, basketball and softball, revealed no tests applicable for the selected subjects. The investigator, therefore, constructed tests which would meet the criteria for construction of information tests.

After construction, the tests were submitted to a jury of junior high school teachers who were experts in English and in the information related to volleyball, basketball and softball. Criticisms and suggestions were incorporated in the final test.

Garrett¹ states that the validity of a test is determined directly by finding the correlation between the test and some independent criterion. A high correlation between a test and a criterion is evidence of validity provided the test and the criterion are both reliable. Hewitt² states that if the criteria are valid the test will show improvement of scores for different age levels or improvement of scores after instruction.

The tests were administered to the subjects in the tenth grade and to the eleventh and twelfth grade girls.

¹Garrett, op. cit., p. 395.

²Jack E. Hewitt, "Improving the Construction of the Essay and Objective New Type Examination," Research Quarterly, Vol. X, No. 3 (October, 1939), p. 150.

The critical ratio and probability levels of significance were calculated to determine if there were significant differences in the scores of the tenth, eleventh and twelfth grade girls. The tests were found to be valid as indicated by the probability levels of significance between the tenth and eleventh grades and the eleventh and twelfth grades.

The coefficients of reliability of the half-tests were obtained by correlating chance halves of the test and the reliability of each test was obtained by applying the Spearman-Brown Prophecy formula to the reliability coefficients of the half-tests. The tests were objective in so far as each test had definite printed instructions for administering and the key used for scoring was judged to be accurate by several physical education teachers.

Administration of skill and information tests.--The investigator made a thorough study of the instructions and techniques for administering the skill tests. Student assistants were selected to aid the investigator in the administration of the tests because of the large number of subjects and tests and the limited time allowed for the testing. These student assistants were selected for the following reasons:

1. They showed a genuine interest and an outstanding ability in physical education.
2. They were members of the Physical Education Association of the St. Petersburg Senior High School,

which is composed of girls interested in majoring in physical education when they attend college.

3. They were dependable and capable leaders.

4. They displayed a willingness and eagerness to aid in the testing.

5. They had the capacity for judging the results of the tests.

In order to practice the techniques for administering the skill tests and to instruct the student assistants in these techniques, the investigator administered the tests to the student assistants as described in administration of the tests. Each test of the batteries was explained and demonstrated. To be certain that the student assistants understood fully their responsibilities and the techniques of administering the tests, each assistant administered to the other assistants the one test which she was to administer later to the entire group.

The following points were emphasized in the general directions used in orientating the subjects to the administration of each battery of skill tests:

1. Each girl should pay undivided attention to the explanation and demonstration of each test.

2. Each girl should pay strict attention to the directions given by the student assistants at each station.

3. Each girl should endeavor to do her best in the execution of each skill test.

4. Each girl should cooperate fully, remain a quiet

as possible, and remain at her designated station until the tests were completed.

5. Each test was to be administered according to a station plan--one test being given at each station.

6. Each test was made up of a number of subtests with a certain number of trials allowed for each. After the test was completed (including all trials allowed) each girl should move to the next station for another test.

Each test was explained to the subjects in regard to the description of the courts or areas for giving the test, the description of the test itself, and the description of the scoring techniques for each test.

Specific directions and information were given to the subjects before the administration of the volleyball skill test. The volleyball skill test was divided into two parts: The serve test and the repeated volleys test.

A. The serve test¹

1. The court on the opposite side from the server was marked off in areas of point values and was clearly designated by numbers in the center of the areas.

a. Area One, nearest the net in the center of the court, had a value of one point.

b. Areas Two, on either side of Area One had a value of two points each.

c. Area Three, directly behind Area One, had a value of three points.

¹Russell and Lange, op. cit., pp. 39-40.

- d. Area Four, directly behind Areas Two and on either side of Area Three, had a value of four points each.
 - e. Areas Five, the entire end of the court fartherest from the net, had a value of five points.
- 2. Each girl stood behind the end line in the serving area and served ten balls. Each "let" service was reserved.
 - 3. The point value for each serve was determined by the area in which the ball landed. The final score was the sum of the points for the ten serves. A foot fault was counted as a zero point.
 - 4. When each girl completed her ten serves, she moved to the end of the line for a second trial. The better of the two scores of the two trials was used as the final score.

B. The repeated volleys test¹

- 1. The area for the test was marked with two lines.
 - a. A line ten feet long drawn along the floor three feet from the wall and opposite the wall marking;
 - b. A line ten feet long marked on the wall at net height, or seven and one-half feet from the floor.
- 2. The player stood behind the three foot line and, on the word "go", tossed the ball to the wall with an underhand motion. When it rebounded, she volleyed it repeatedly against the wall above the net line for thirty seconds. The ball could be set up as many times

¹Ibid., p. 39.

as desired or necessary; it could be caught and restarted with a toss as in the beginning. If the ball got out of control, it was recovered by the player being tested and brought back to the three foot line and started over again.

3. The score was the number of times the ball was clearly ~~by~~ batted (not tossed) from the three foot line on the floor to the wall above or on the net line.
4. Each girl was allowed three trials of thirty seconds each; after each trial, she moved to the end of the line until the three trials were completed.

During the explanation by the investigator, the trained student assistants demonstrated each test. The class was then divided into four squads by lining up and counting off in fours. Squad I took the serving test on Court One; Squad II took the serving test on Court Two; Squad III took the repeated volleys test behind Court One; and, Squad IV took the repeated volleys test behind Court Two.

The student assistants administered the tests to the subjects. The investigator moved from station to station to see that the student assistants had no difficulty in administering the tests properly.

Specific directions and information were given to the subjects before the administration of the basketball skill tests. The basketball skill test was divided into three parts: the moving target test, the Edgren ball handling test, and the bounce and shoot test.

A. The moving target test¹

1. A target, eighteen inches square, was suspended by ropes from the back of the basketball backboard. Ten feet from the target, a line was drawn from which the player threw the ball.
2. The player stood behind the ten foot line and attempted to hit the target as it swung from one side to the other.
3. One of the student assistants released the target when she saw that the player was ready. The player could throw the ball with any motion she desired.
4. Each girl was allowed ten trials and her score was determined by the number of times she hit the target.
5. Each girl was allowed two turns of ten trials; after the first turn, she moved to the end of the line for her second turn.

B. The Edgren ball handling test²

1. The area for this test was marked as follows:
 - a. a six foot lane was drawn from the wall and perpendicular to it for a distance of ten feet;
 - b. a line was drawn eight feet from the wall and parallel to it extended across the lane.
2. The player threw the ball diagonally against the wall from the designated area which was the eight foot lane.

¹Dyer, Schurig and Apgar, op. cit., p. 142.

²Ibid.

She ran across the six foot area, catching the ball, and repeated the throw from the opposite side. This process was repeated until the ball had been recovered after the tenth pass. If the ball was fumbled and lost, it had to be recovered by the player taking the test and thrown from the proper area.

3. If the ball was recovered inside the six foot area, it had to be bounced to the proper area before throwing. No part of the foot could be touching the floor inside the six foot area while the ball was being thrown.
4. The score was the number of seconds required to complete the ten throws.
5. Each girl was allowed two trials; at the completion of the first trial, she moved to the end of the line for the second trial.

C. The bounce and shoot test¹

1. The area for the test was marked by:
 - a. the free-throw circle
 - b. the free-throw line
2. The player taking the test stood behind the center of the free-throw line, bounced the ball out of the free-throw circle, and shot for a goal, shooting alternate from the right and left sides of the basket.

¹Ibid., p. 143.

3. Each girl was allowed two trials of ten shots each; at the completion of the first trial she moved to the end of the line for the second trial.
4. Two girls took the test at the same time. While one girl recovered her own ball, the other girl shot for the basket.
5. Two points were scored for a basket legally made and one point if the ball hit the rim but did not enter the basket. The test score was the sum of points made in ten trials.

During the explanation of the test by the investigator the student assistants demonstrated each test in turn. After the explanation, the class was divided into three squads in the same manner as described for the volleyball test. Squad I started with the moving target test, moved to the Edgren ball handling test, and then, progressed to the bounce and shoot test. Squad II started with the Edgren ball handling test, moved to the bounce and shoot test, and then to the moving target test. Squad III started with the bounce and shoot test, progressed to the moving target test, and then passed on to the Edgren ball handling test. The investigator moved from station to station to see that the student assistants had no difficulty in administering the tests properly.

Specific directions and information were given to the subjects before the administration of the softball tests. The softball test was composed of two parts, the

distance throw and the batting test.

A. The distance throw¹

1. The players stood behind a restraining line and threw the ball as far as possible with an overhand or side-arm motion.
2. The player was limited to one step which must have been taken behind and not over the restraining line.
3. Three throws constituted one trial, and only the best throw of the three was measured and recorded. Each girl was allowed three trials.
4. The throw was measured as the distance in feet from the restraining line to the spot where the ball first touched the ground. The best of the three recorded throws was used as the player's final score.

B. The batting test

1. A batting tee, on which the ball was placed and then hit, was used in this test.
2. The player stood in the batter's box and attempted to hit the ball off of the batting tee which was placed over home plate at any height desired by the batter.
3. Each girl was allowed to swing at the ball ten times in one trial. Two trials were allowed each girl.
4. The score was the better of the two trials of the total number of points earned in the ten swings.

¹Scott and French, op. cit., p. 89.

- a. Five points for each outfield hit;
- b. Three points for each infield hit;
- c. One point for each foul hit;
- d. Zero point for a ball struck at and missed.

During the explanation of the tests by the investigator, the trained student assistants demonstrated each test. The class was then divided into two squads: Squad I took the batting test while Squad II took the distance throw test; the two squads then exchanged places to complete the entire softball test. The student assistants administered the distance throw test while the investigator administered the batting test.

The information tests were administered to the subjects in the library of St. Petersburg Senior High School. The subjects reported to the library during their assigned physical education class period. The following directions were given to the subjects by the investigator after the distribution of the test papers:

1. Each girl was to fill out the information called for on the top of page one as to: name, date, grade, and the name of the junior high school attended in the seventh eighth and ninth grades.
2. Each girl was to read the direction for answering the questions carefully.
3. Each girl was to take her time, read each question carefully, and answer the questions to the best of her ability.

Treatment of the Data

The raw scores from the seven skill tests and the three information tests were tabulated and T-scores were computed for the total group. These tests included:

A. Volleyball

1. Repeated volleys test
2. Serve test
3. Information test

B. Basketball

1. Moving target test
2. Edgren ball handling test
3. Bounce and shoot test
4. Information test

C. Softball

1. Distance throw test
2. Batting test
3. Information test

Nielson and Cozens state,

The achievement scores attained in ten events may be added and then averaged to give a single index of all-round achievement in one phase of the physical education program. The total achievement of a group or class may be found by adding the averaged scores of the pupils. Should the average achievement of a group or class be desired, this may also be computed.¹

The investigator found the average of the T-scores for the repeated volleys test and the serve test to establish

¹N.P. Neilson and Frederick W. Cozens, Achievement Scales in Physical Education Activities for Boys and Girls in Elementary and Junior High Schools, (California State Department of Education, Sacramento), 1934.

one T-scale for the entire battery of volleyball skill tests; the moving target test, the Edgren ball handling test and the bounce and shoot test to establish one T-scale for the entire battery of basketball skill tests; and the distance throw test and the batting test to establish one T-scale for the entire battery of softball skill tests.

The mean T-score was found for each battery of tests, the standard error of the mean was determined to establish the reliability of the mean, and the standard deviation from each mean was calculated to determine the variability of the scores from the mean.

The difference of the means, critical ratio and probability levels of significance were calculated in order to compare:

I. volleyball, basketball and softball skill and information

- A. School I with School II
- B. School I with School III
- C. School I with School IV
- D. School II with School III
- E. School II with School IV
- F. School III with School IV

II. within each school

- A. volleyball skill with basketball skill
- B. volleyball skill with softball skill
- C. basketball skill with softball skill

D. volleyball information with basketball information

E. volleyball information with softball information

F. basketball information with softball information

The means of the combined T-scores for each of the three skill tests were compared to determine the degree of relative proficiency between the sports within each school. The mean of the T-scores for each information test were compared to determine the relative information in regard to the selected factors within each school.

A felt need was developed by the investigator for finding if a relationship existed between the opportunity for participation in the three sports and the skill and information possessed by the students from the four schools. An imperical index for comparing the four schools was established by the investigator to compare the four schools with each other on the basis of class time, facilities and number of students in the classes. This index is the product of the minutes per week spent in the activity, the total weeks spent in the activity and the number of courts or fields available, divided by the average size of the classes. In the case where more courts were available than would be used by the number of students in the class, the extra courts were eliminated before calculating the index number. This index represents an over all view of time allotment, facilities and size of classes. As the index increases, the opportunity for participation in the selected sport increases in

so far as time allotment and facilities are concerned.

The data from the tests were tabulated, treated statistically, analyzed and interpreted. On the basis of the findings, implications were drawn as to the comparative status of the selected subjects in regard to skill and information pertaining to volleyball, basketball, and softball, and, on the basis of the findings, recommendations were made for future development of the sports program in the junior and senior high schools in St. Petersburg, Florida.

The study was summarized, conclusions to the study were drawn, recommendations for further study were made, and a bibliography was compiled.

CHAPTER III

ANALYSIS AND INTERPRETATION OF FINDINGS

A comparative study was undertaken to determine the status of tenth grade girls from the four junior high schools in the city in regard to skill and information in volleyball, basketball and softball enrolled in St. Petersburg Senior High School, St. Petersburg, Florida during the school year 1951-52. The four junior high schools, Disston, Lealman, Mirror Lake and South Side are referred to in this study as schools I, II, III and IV, respectively.

The number of respondents from each of the schools varied with each of the six tests administered as each test was given only once and the students not present were eliminated from the particular test missed. The raw scores obtained from the administration of the tests were converted into T-scores and are referred to in this study in T-score values.

To render the data obtained from the administration of the tests more meaningful, information concerning previous training including the amount of time spent in class work and the available facilities for instruction in the four junior high schools was obtained by use of a check list responded to by the girls' physical education instructors of the four junior high schools.

The data obtained from the check list concerning the time allotment for physical education activity per

week, the average size of classes, the maximum and minimum enrollment of girls in physical education classes, the number of weeks spent in instruction and practice, the number of courts and fields available, and the index for volleyball, basketball and softball during the three years preceeding 1951-52 in the four junior high schools in St. Petersburg, Florida are presented in Table I.

TABLE I

MINUTES PER WEEK SPENT IN PHYSICAL EDUCATION ACTIVITY
AVERAGE SIZE OF CLASSES, MAXIMUM AND MINIMUM ENROLL-
MENT OF GIRLS IN PHYSICAL EDUCATION, NUMBER OF
WEEKS SPENT IN INSTRUCTION AND PRACTICE, NUMBER
OF COURTS AND FIELDS AVAILABLE, AND THE INDEX
FOR VOLLEYBALL, BASKETBALL AND SOFTBALL
DURING THE THREE YEARS PRECEEDING 1951-
52 IN THE FOUR JUNIOR HIGH SCHOOLS
AT ST. PETERSEURG, FLORIDA

Schools	Minutes per week	Average size Classes	Enrollment		Total weeks spent			Courts or Fields			Index		
			Max.	Min.	VB	BB	SB	VB	BB	SB	VB	BB	SB
I	255	50	300	250	18	18	18	4	2½	2	295	299	183
II	200	55	340	325	19	21	18	2	1	2	138	76	130
III	150	32	390	375	30	30	30	3	3	1	262	281	140
IV	275	45	290	250	24	21	24	1	1	2	146	128	294

The number of minutes per week devoted to instruction in physical education by each of the four schools in descending order of size was: 275, school IV; 255, school I; 200, school II; and, 150, school III. The time allotment of 150 minutes per week for school III is attributed to the

fact that school III was the only junior high school in the city which devoted two-fifths of the time allotted to health and physical education to instruction in health education.

The average size of physical education classes ranged from 55 for school II to 32 for school III. Schools I and IV averaged in size of enrollment per class 50 and 45, respectively. The smaller average number of students per class for school III may be attributed to the fact that school III was the only school in the city having two instructors teaching physical education.

The largest enrollment in physical education classes was found in school III with an average of 383 students. Schools I, II and IV had average enrollments of 325, 332 and 270, respectively. The range between the minimum and maximum number of students enrolled in each school was due to the influx of tourists during the school year.

School III devoted the greatest length of time, 30 weeks, to instruction in volleyball during the three years of junior high school. School IV ranked second in the time allotted for the instruction of volleyball with 24 weeks, school II ranked third with 19 weeks, and school I ranked fourth with 18 weeks. The time allotted, in descending order, according to the number of weeks spent in instruction in basketball was: 30, school III; 21, school II and IV; and, 18, school I. In descending order, according to the number of weeks spent for instruction on softball in each school there was: 30, school III; 24, school IV; and, 18,

schools I and II. From the data concerning the total weeks devoted to instruction in the selected sports it may be noted that school III devoted an equal amount of time, which was the greatest amount of time, to each of the three sports; school IV devoted the second greatest amount of time, school II ranked third, and school I spent the least amount of time.

In descending order, according to the number of volleyball courts in each school available for class activities, there were: school I, 4 courts; school III, 3 courts; school II, 2 courts; and, school IV, one court. School III had the most facilities for basketball with 3 courts, school I ranked second with $2\frac{1}{2}$ courts, and schools II and IV had the least number of basketball courts or one each. Schools I, II and IV had 2 softball fields while school III had but one. From the data presented in Table I, it may be noted that school I had the greatest number of facilities available for volleyball, basketball and softball. School III ranked second in the number of facilities available; school II, third; and, school IV, fourth.

An imperical index for comparing the four schools was established by the investigator to compare the four schools with each other on the basis of class time, facilities and number of students in the classes. The index in Table I is the product of the minutes per week spent in the activity, the total weeks spent in the activity and the number of courts or fields available, divided by the average size of the classes. In the case where more courts were available

than would be used by the number of students in the class, the extra courts were eliminated before calculating the index. This index represents an over all view of the time allotment, the facilities and the size of the classes. As the index increases, the opportunity for participation in the selected sport increases in so far as time allotment and facilities are concerned.

The opportunity for participation in volleyball as represented by the size of the index, in descending order was: school I, 295; school III, 262; school IV, 146; school II, 138. The index, in descending order for basketball was: school I, 299; school III, 281; school IV, 128; and school II, 76. School IV ranked first in the softball index with 294, school I, second with 183, school III, third with 140 and school I fourth with 130. From the data obtained from the index it may be noted that school I ranked first in volleyball and basketball and second in softball; school III ranked second in volleyball and basketball and third in softball; school IV ranked third in volleyball and basketball, but first in softball; school II ranked last in all three sports.

Volleyball Skill Test

The results of the volleyball skill test administered to 284 tenth grade students enrolled in St. Petersburg Senior High School from the four city junior high schools are given in Table II.

TABLE II

NUMBER, RANGE, TRUE RANGE, MEAN, STANDARD DEVIATION AND
STANDARD ERROR OF THE MEAN SCORES FOR THE 284 GIRLS
FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN
THE TENTH GRADE IN ST. PETERSBURG SENIOR
HIGH SCHOOL, ST. PETERSBURG, FLORIDA
TO WHOM THE VOLLEYBALL SKILL
TEST WAS ADMINISTERED

School	Number	Range	True Range	Mean	S. D.	σM
I	53	14-80	66	50.5	8.10	1.11
II	68	25-95	70	49.9	8.75	1.06
III	105	18-93	75	49.0	8.15	.80
IV	58	29-91	62	51.0	7.45	.98
Total	284	...	...	...	...	...

The variabilities of scores made on the volleyball skill test by the students from the four schools in descending order of size, as indicated by the true ranges and ranges were: 75 or from 18 to 93, school III; 70 or from 25 to 95, school II; 66 or from 14 to 80, school I, and 62 or from 29 to 91, school IV. Skill in volleyball for students from school II was greatest as represented by the scores of 95 at the upper end and for school IV as represented by the score of 29 at the lower end of the ranges of the four schools. The spread of skill in volleyball from 14 to 80 points for students from school I indicated that their performances were the lowest at both ends of the ranges of the four schools.

The variabilities of the scores made on the volleyball skill test by the students in the four schools as indicated by the standard deviations were: 8.75, school II; 8.15, school III; 8.10, school I, and 7.45, school IV. The scores of the students from schools IV and I ranked first and second in having the least variabilities or dispersion of skill in volleyball in terms of the test scores around the means and the true range. Although the scores for volleyball skill of students from school II were less variable by five points as indicated by the true range of 70 when compared with the true range of 75 for skill of students from school III, the scores of the students' skill in volleyball from school III were less variable around the mean as indicated by standard deviations of 8.75 for school II and 8.15 for school III.

The ranking of the schools according to the students' skill in volleyball as represented by the mean scores was: school IV, 51; school I, 50.5; school II, 49.9, and school III, 49. A range of two points was found between the mean scores for schools IV and III. The standard errors of the means of the four schools ranged from .80 to 1.11. The slightly more reliable standard error of .80 for school III was probably influenced more by the number of cases than the variability of the separate measures around its mean when compared to the standard errors of .98 for school IV, 1.06 for school II, and 1.11 for school I.¹

¹Henry E. Garrett, Statistics in Psychology and Education, (New York: Longman, Green and Company, 1949), p. 183.

From the results of the test concerning volleyball skill it was evident that the average student from school IV possessed greater volleyball skill than the average student from schools I, II and III. School II ranked lowest in volleyball skill of the four groups tested.

In Table III are presented the numbers, the means, the differences between the means, the standard errors of the differences between the means, the critical ratios, and the probability levels of significance of the scores of 284 girls from the four junior high schools enrolled in the tenth grade in St. Petersburg Senior High School to whom the volleyball skill test was administered.

TABLE III

NUMBER, MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF SIGNIFICANCE COMPUTED FROM THE SCORES FOR THE VOLLEYBALL SKILL TEST OF THE 284 GIRLS FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN THE TENTH GRADE IN ST. PETERSBURG SENIOR HIGH SCHOOL, ST. PETERSBURG, FLORIDA

Schools Compared	Number	Means	D_{m1-m2}	δD	C. R.	P
I II	53 68	50.5 49.5	1	1.59	.63	.53
I III	53 105	50.5 49.0	1.5	1.35	1.11	.27
I IV	53 58	50.5 51.0	.5	1.11	.45	.65
II III	68 105	49.5 49.0	.5	1.31	.38	.70
II IV	68 58	49.5 51.0	1.5	1.06	1.41	.16
III IV	105 58	49.0 51.0	2	.78	2.56	.01
Total	284	...	...	...	...	...

In comparing the means of the volleyball skill scores of the students from the four junior high schools who participated in the present investigation, the largest mean difference of 2 was found between the mean of 49 for the 105 students from school III and the mean of 51 for the 58 students from school IV. The difference between the means of 2 divided by the standard error of the difference between the two means yielded a critical ratio of 2.56. A critical ratio of 2.56 is significant at the .01 level of reliability for 163 scores or 161 degrees of freedom.¹ This level of confidence indicated that the average student from school IV may be said to have been superior in volleyball skill to the average student from school III.

The critical ratio of 1.41 indicated that the obtained difference of 1.5 between the means of 49.5 for the scores of the 68 students from school II and 51 for the 58 students from school IV on the volleyball skill test exceeded by chance the .16 level of reliability. This reliability was in favor of the 68 students from school IV having better skills in volleyball. However, the students from school IV could not be expected to exceed the students from school II in volleyball skill more than 84 times in 100 trials.²

The critical ratios found between the volleyball skill of the students from schools I and II, I and III, I

¹Op. cit., pp. 190-91.

²Op. cit., p. 201.

and IV, and II and III were found to be unreliable at .53, .27, .65 and .70 level of reliability, respectively. The .05 level of probability of an obtained difference is demanded by most investigators to warrant the conclusion that one group is really superior to the second group in mean attainment.¹

A summary of the results of the data yielded from the administration of the volleyball skill test indicated that the students from school IV had superior volleyball skills when compared to the students from school III, as indicated by the critical ratio of 2.56. A critical ratio of 2.56 is significant at the .01 level and was the only significant critical ratio obtained from the comparisons of the differences between the means for the four groups in volleyball skill.

Volleyball Information Test

The results of administering the volleyball information test to 299 students from the four city junior high schools enrolled in St. Petersburg Senior High School, St. Petersburg, Florida are presented in table IV.

¹Op. cit., pp. 203-204

TABLE IV

NUMBER, RANGE, TRUE RANGE, MEAN, STANDARD DEVIATION AND
STANDARD ERROR OF THE MEAN SCORES FOR THE 299 GIRLS
FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN
THE TENTH GRADE IN ST. PETERSBURG SENIOR
HIGH SCHOOL, ST. PETERSBURG, FLORIDA
TO WHOM THE VOLLEYBALL INFORMATION
TEST WAS ADMINISTERED

School	Number	Range	True Range	Mean	S.D.	σM
I	54	12-80	68	56	8.65	1.17
II	69	10-82	72	52	8.25	.99
III	110	2-80	78	46	8.85	.84
IV	66	14-78	64	51	7.70	.94
Total	299	...	...	...	...	...

The largest true range in scores for students from the four schools responding to the volleyball information test was 78 points, with a high score of 80 and a low score of 2 recorded for the 110 students from school III. The scores for the 54 students from school I and the 69 students from school II had true ranges of 68 and 72, respectively. The smallest true range was 64 between the high score of 78 and the low score of 14 for the 66 students from school IV.

The standard deviations in increasing size of variability for the students' scores of the four schools were: 7.70, school IV; 8.25, school II; 8.65, school I; and 8.25, school III. The means of the respondents from the four junior high schools on the volleyball information test in

descending order of size were: 56, school I; 52, school II; 51, school IV; and 46, school III. The smallest mean and the greatest variabilities of the scores for the volleyball information test were found for the true range and the standard deviation of school III. The standard error of the mean of .84 for school III was slightly more reliable than the standard error of the means of: .94, school IV; .99, school II; and 1.17, school I. According to Garrett¹ the stability of a mean is influenced by the number of cases and the variability of the separate measures around the mean. The slightly greater reliability of the mean of the scores for the volleyball information test of the students from school III would seem to be influenced more by the larger number of students taking the test than by the variability of the scores as the standard deviation of 8.85 is the largest for the four schools.

From the results of the test concerning volleyball information, it is evident that the average student enrolled in the tenth grade from school I was better informed with respect to volleyball than the average student from schools II, III and IV. Of the four groups, the students from school III ranked the lowest on volleyball information.

¹Op. Cit., p. 183.

In Table V are presented the numbers, the means, the differences between the means, the standard errors of the differences between the means, the critical ratios, and the probability levels of significance of the scores of 299 girls from the four junior high schools enrolled in the tenth grade in St. Petersburg Senior High School to whom the volleyball information test was administered.

TABLE V

NUMBERS, MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF SIGNIFICANCE COMPUTED FROM THE SCORES FOR THE VOLLEYBALL INFORMATION TEST OF 299 GIRLS FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN THE TENTH GRADE IN ST. PETERSBURG SENIOR HIGH SCHOOL ST. PETERSBURG, FLORIDA

Schools Compared	Number	Means	D_{m1-m2}	σD	C.R.	P
I II	54 69	56 52	4	1.53	2.67	Exceeds .01
I III	54 110	56 46	10	1.44	6.94	Exceeds .01
I IV	54 66	56 51	5	1.50	3.33	Exceeds .01
II III	69 110	52 46	6	1.29	4.67	Exceeds .01
II IV	69 66	52 51	1	1.36	.73	.46
III IV	110 66	46 51	5	1.26	3.96	Exceeds .01
Total	299	...	...	...	...	...

The critical ratios of 6.94, 3.33 and 2.67 indicate complete reliability exceeding the .01 level of probability in favor of the superior information concerning volleyball by the 54 students from school I when compared with the information of the students from schools III, IV and II, respectively. The critical ratio of 4.65 which is completely reliable as it exceeds the .01 level of probability, indicated that the 69 students from school II had superior information when compared to the 110 students from school III. The information concerning volleyball possessed by the students from schools II and IV was similar. A difference of one between the means of 52 and 51 and a critical ratio of .73 with a reliability of .46 for the 135 scores or 133 degrees of freedom is greater than the .05 level of probability and is of no practical significance. A critical ratio of 3.96 is completely reliable as it exceeds the .01 level of probability in favor of superior volleyball information possessed by the 66 students from school IV when compared with the information possessed by the 110 students from school III.

It may be noted that in five of the six comparisons of the schools with the smaller number of respondents, the girls had superior information in volleyball when compared with schools with a larger number of respondents. In the sixth comparison concerning volleyball information possessed by girls from schools II and IV and the least difference in number of respondents, the smallest difference between

the means, and the least significant probability level was found.

A summary of the results of the data yielded from the administration of the volley ball information test showed that the students from school I had superior volley-ball information when their test scores were compared with the test scores of the students from schools II, III and IV as indicated by the critical ratios of 2.67, 6.94 and 3.33, respectively. The three critical ratios are completely significant as each one exceeds the probability level of significance at the .01 level. The students from school III possessed less volleyball information when compared with the students from schools I, II and IV as indicated by critical ratios of 6.94, 4.65 and 3.96, respectively. These critical ratios are statistically significant at the .01 level of probability. The students from school II and IV possessed similar volleyball information as indicated by a critical ratio of .73.

Basketball Skill Test

The data obtained from the administration of the basketball skill test to 295 tenth grade students from the four city junior high schools enrolled in St. Petersburg Senior High School during the school year 1951-52 are presented in Table VI.

TABLE VI

NUMBER, RANGE, TRUE RANGE, MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN SCORES FOR THE 295 GIRLS FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN THE TENTH GRADE IN ST. PETERSBURG SENIOR HIGH SCHOOL, ST. PETERSBURG, FLORIDA TO WHOM THE BASKETBALL SKILL TEST WAS ADMINISTERED

School	Number	Range	True Range	Mean	S. D.	6 M
I	64	11-79	68	48.33	3.49	1.15
II	63	7-79	72	53.66	2.94	.38
III	107	6-86	80	53.33	3.73	.36
IV	61	10-78	68	52.00	5.61	.71
Total	295	...	...	...	...	...

The variability of scores as indicated by the true ranges and ranges from the smallest to the largest scores made on the basketball skill test by the students from the four schools were: 80 or from 6 to 86, school III; 72 or from 7 to 79, school II; 68 or from 11 to 79, school I; and 68 or from 10 to 78, school IV. The range of scores of the students from school III includes the lowest score of 6 and the highest score of 86 of the basketball skill scores from the four schools. Although the students from schools I and IV had the same true range of 68, school I surpassed school IV by one point at both ends of the range.

The scatter of scores was the greatest for the students from school IV as indicated by the standard deviation of 5.61.

The standard deviations of 3.73, 3.49 and 2.94 were found for the students' scores from schools III, I and II, respectively. The scores of the students from school II had the least variability or dispersion of skill in basketball, for the four schools.

The ranking of the schools according to the students' skill in basketball as represented by the mean scores was: school II, 53.66; school III, 53.33; school IV, 52.00; and school I, 48.33. A range of 5.33 was found between the mean scores for the students from schools II and I. The standard errors of the means of the four schools ranged from .36 to 1.15.

From the results of the test concerning basketball skill it is evident that the average student from school II surpassed the average student from schools I, III and IV. School I ranked lowest in basketball skill of the four groups tested.

In Table VII are presented the numbers, the means, the differences between the means, the standard error of the difference between the means, the critical ratios, and the probability levels of significance of the scores of the 295 girls from the four city junior high schools enrolled in the tenth grade in the St. Petersburg Senior High School to whom the basketball skill test was administered.

TABLE VII

NUMBERS, MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF SIGNIFICANCE COMPUTED FROM THE SCORES FOR THE BASKETBALL SKILL TEST OF THE 295 GIRLS FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN THE TENTH GRADE IN ST. PETERSBURG SENIOR HIGH SCHOOL, ST. PETERSBURG, FLORIDA

Schools Compared	Number	Means	D_{m1-m2}	σD	C. R.	P
I II	64 63	48.33 53.66	5.33	1.21	4.40	Exceeds .01
I III	64 107	48.33 53.33	5.00	1.20	4.16	Exceeds .01
I IV	64 61	48.33 52.00	3.67	1.36	2.70	Exceeds .01
II III	63 107	53.66 53.33	.33	.52	.63	.53
II IV	63 61	53.66 52.00	1.66	.82	2.02	.04
III IV	107 61	53.33 52.00	1.33	.81	1.64	.10
Total	295	...	...	...	...	...

The skill in basketball of the students from schools II, III, and IV was found to be superior when compared with the skill in basketball of the students from school I. Differences between the means for skill in basketball for students from school I and schools II, III and IV were 5.33, 5.00 and 3.67, respectively. These differences in means, when divided by their respective standard errors, resulted in critical ratios that exceeded the .01 level of reliability. This level of confidence indicated that the students from schools II, III and IV possessed greater skill in basketball than the students from school I.

The students from school II possessed superior skills in basketball when compared with the skill in basketball possessed by the students from school IV. The difference of 1.66 between the mean skill in basketball of 53.66 for school II and the mean of 52.00 for school IV was found to be reliable at the .04 level of confidence. A critical ratio of 1.64 and a probability level of .10 was found when comparing the skill scores in basketball of the students from schools III and IV. The students from school III could be expected to exceed the students from school IV in basketball skill 90 times out of 100 trials if similar groups were compared. However, .10 level of probability is not considered reliable, as most experts believe a .05 level of confidence is needed to obtain a reliable difference.¹

¹Op. cit., pp. 203-204.

The skills in basketball for the students from schools II and III were for all practical purposes similar. The mean of the scores in basketball skill for the students from school II was 53.66 and for the students from school III, 53.33, a difference between the means of .33. This difference between the means of .33 when divided by the standard error of the means resulted in a critical ratio of .63 with a probability of .53. A probability level of .53 is not considered statistically reliable.

A summary of the results of the data obtained from the administration of the basketball skill test indicated that the students from schools II, III and IV possessed superior skill in basketball when compared with the skill possessed by the students from school I, as evidenced by critical ratios that were statistically significant, exceeding the .01 level of reliability. The statistically significant level of confidence of .04 indicated that the students from school II possessed superior skill in basketball when compared to the skill of the students from school IV. For all practical purposes the skill in basketball possessed by the students from schools II and III is similar as indicated by a critical ratio of .63 which is not considered statistically reliable at the .53 level of probability.

Basketball Information Test

The results of the basketball information test administered to 277 tenth grade students enrolled in St. Petersburg Senior High School from the four city junior high schools are presented in Table VIII.

TABLE VIII

NUMBER, RANGE, TRUE RANGE, MEAN, STANDARD DEVIATION AND STANDARD ERROR OF THE MEAN SCORES FOR THE 277 GIRLS FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN THE TENTH GRADE IN ST. PETERSBURG SENIOR HIGH SCHOOL, ST. PETERSBURG, FLORIDA TO WHOM THE BASKETBALL INFORMATION TEST WAS ADMINISTERED

School	Number	Range	True Range	Mean	S. D.	6M
I	51	13-93	80	60	10.55	1.47
II	61	22-76	52	52	7.05	.90
III	104	7-84	77	46	9.70	.95
IV	61	10-77	67	46	7.90	1.01
Total	277	...	...	...	...	...

Of the four schools participating in the basketball information test, the smallest true range was recorded for the 61 students from school II. The range extended from a high score of 76 to a low score of 22 with a true range of 52. The 61 students from school IV ranked second with a true range of 67 between the high score of 77 and the low score of 10. The difference between a high score of 84 and a low score of 7 and a true range of 77 was obtained for the

104 students from school III. The largest true range was 80 with a high score of 93 and a low score of 13 obtained by the 51 students from school I.

The standard deviations for the basketball information test, arranged according to the increase in size of variabilities, as made by the students from the four schools were: 7.05, school II; 7.90, school IV; 9.70, school III; and 10.55, school I. The largest mean score of 60 and the largest standard deviation of 10.55 were recorded for the students from school I. The standard deviation of 10.55 indicated the greatest variability of basketball information scores made by the students from the four schools. The students from schools III and IV made the same mean score of 46 which was the smallest mean score made on the basketball information test by the students from the four schools. However, the variabilities for the scores made by the students from schools III and IV differed as represented by standard deviations of 9.70 for the students from school III and 7.90 for the students from school IV. The students from school II had the next to the largest mean score of 52 and the smallest standard deviation of 7.05. The standard deviation of 7.05 indicated the least variability of scores made on the basketball information test by the students from the four schools to whom the test was administered.

From the results of the test concerning basketball information, it is evident that the average student enrolled in the tenth grade from school I was better informed with

respect to basketball than the average student from schools II, III and IV. The students from schools III and IV ranked lowest on basketball information of the four groups.

The results of the statistical treatment of the scores obtained from the basketball information are presented in Table IX, and include the numbers, the means, the differences between the means, the critical ratios and the probability levels of significance of 277 tenth grade students from the four city junior high schools enrolled in St. Petersburg Senior High School, St. Petersburg, Florida.

TABLE IX

NUMBERS, MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD
 ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE
 CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF
 SIGNIFICANCE COMPUTED FROM THE SCORES FOR THE
 BASKETBALL INFORMATION TEST OF 277 GIRLS
 FROM THE FOUR JUNIOR HIGH SCHOOLS EN-
 ROLLED IN THE TENTH GRADE IN ST.
 PETERSBURG SENIOR HIGH SCHOOL
 ST. PETERSBURG, FLORIDA

Schools Compared	Number	Means	D_{m1-m2}	σD	C. R.	P
I II	51 61	60 52	8	1.72	5.87	Exceeds .01
I III	51 104	60 46	14	1.75	8.00	Exceeds .01
I IV	51 61	60 46	14	1.78	7.87	Exceeds .01
II III	61 104	52 46	6	1.31	4.58	Exceeds .01
II IV	61 161	52 46	6	1.35	4.44	Exceeds .01
III IV	104 61	46 46	0	1.39	0	1.00
Total	277	...	...	...	...	...

The mean of 60 made on the basketball information test by the 51 students from school I was the largest made by the students from the four schools when compared with the mean of 52 made by the 61 students from school II and the mean of 46 made by the 104 students from school III and the 61 students from school IV. The difference between the means of school I and school II was 8. A difference of 14 was found between the means of schools I and III and schools I and IV. These differences of 8 and 14 between the means when divided by their respective standard errors resulted in critical ratios that exceeded the .01 level of reliability. These levels of reliability indicate that the students from school I had superior information concerning basketball when compared with the information possessed by students from schools II, III, and IV.

The same difference of 6 was found between the means of basketball information for groups II and III and for groups II and IV. This difference between the means of 6 was found to exceed the probability level of .01 which indicates reliable statistical significance. Therefore, it may be stated that the students from school II possessed superior information concerning basketball when compared with the information concerning basketball possessed by the students from schools III and IV.

The same mean score of 46 was made on the basketball information test by the students from schools III and IV, hence the average student from school III may be said to

have possessed the same amount of basketball information as did the average student from school IV.

A summary of the results of the data yielded from the administration of the basketball information test indicates that the students from school I had superior basketball information when compared to the basketball information of the students from schools II, III and IV as indicated by critical ratios of 5.87, 8.00 and 7.87, respectively. These critical ratios are statistically significant as each one exceeded the .01 level of confidence. The scores of the students from school II indicated that these students were better informed in reference to basketball than were the students from schools III and IV as shown by the significant critical ratios of 4.58 and 4.44 which exceeded the .01 level of reliability. The average student from schools III and IV had identical attainment in basketball information as shown by the critical ratio of zero.

Softball Skill Test

The results of the softball skill test administered to 266 tenth grade students enrolled in St. Petersburg Senior High School from the four city junior high schools are presented in Table X.

NUMBER, RANGE, TRUE RANGE, MEAN, STANDARD DEVIATION, AND STANDARD ERROR OF THE MEAN SCORES FOR THE 266 GIRLS FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN THE TENTH GRADE IN ST. PETERSBURG SENIOR HIGH SCHOOL, ST. PETERSBURG, FLORIDA TO WHOM THE SOFTBALL SKILL TEST WAS ADMINISTERED

School	Number	Range	True Range	Mean	S. D.	6 M
I	57	12-91	79	50	13.62	1.04
II	56	19-86	67	56	11.22	.91
III	99	17-98	81	50	13.80	.96
IV	54	19-81	62	46	10.75	.80
Total	266	...	...	...	...	...

The largest true range in scores for the students from the four schools responding to the softball skill test was 81 points, with a high score of 98 and a low score of 17 recorded for the 99 students from school III. The scores for the 57 students from school I have a true range of 79 and a range of scores from 12 through 91. True ranges for the 56 students from school II and the 54 students from school IV were 67 and 62, respectively, both having a low score of 19 with a high score of 86 for school II and 81 for school IV.

The standard deviation in increasing size of the variabilities of the scores for softball skill of the students from the four schools were: 10.75, school IV; 11.22, school II; 13.62, school I and 13.80, school III. The means of the

respondents from the four junior high schools on the softball skill test in descending order of size were: 56, school II; 50, school I and III, and 46, school IV. The smallest mean and smallest variabilities of scores for the softball skill test were found for the students from school IV. The standard error of the mean of .80 for the students from school IV is slightly more reliable than the standard error of the means of: .91, school II; .96, school III and, 1.04, school I.

From the results of the test concerning softball skill, it is evident that the average student enrolled in the tenth grade from school II possessed greater softball skill than the average student from schools I, III, and IV. School IV ranked lowest in softball skill of the four groups tested.

In Table XI are presented data for comparison of numbers, means, differences between the means, standard error of the difference between the means, critical ratios, and probability levels of significance of scores of 266 girls from the four city junior high schools enrolled in the tenth grade in the St. Petersburg Senior High School to whom the softball skill test was administered.

TABLE XI

NUMBER, MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF SIGNIFICANCE COMPUTED FROM THE SCORES FOR THE SOFTBALL SKILL TEST OF THE 266 GIRLS FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN THE TENTH GRADE IN ST. PETERSBURG SENIOR HIGH SCHOOL, ST. PETERSBURG, FLORIDA

Schools Compared	Number	Means	D_{m1-m2}	σD	C. R.	P
I II	57 56	50 56	6	1.41 1.41	4.25	Exceeds .01
I III	57 99	50 50	0	1.41	0	1.00
I IV	57 54	50 46	4	1.31	3.05	Exceeds .01
II III	56 99	56 50	6	1.32	4.55	Exceeds .01
II IV	56 54	56 46	10	1.21	8.24	Exceeds .01
III IV	99 54	50 46	4	1.25	3.20	Exceeds .01
Total	266	...	...	...	...	...

The largest mean score of 56 for skill in softball was recorded for the students from school II. The differences between the means for school II and for schools IV, III and I were 10, 6 and 6. These differences when divided by their respective standard errors resulted in critical ratios that exceeded the .01 level of reliability. This level of confidence indicated that the mean softball skill possessed by the students from school II was consistently higher and statistically reliable when compared with the mean softball skills possessed by the students from schools I, III and IV.

Two of the three remaining schools, I and III had the same mean of 50 for softball skill. Subtracting the mean of 46 for school IV from the mean of 50 for schools I and III resulted in a difference between the means of 4. The mean difference of 4 resulted in critical ratios of 3.05 and 3.20 which were found to be statistically reliable exceeding the .01 level of confidence, that is, the students from schools I and III had superior softball skills when compared with the softball skill possessed by the girls from school IV.

A summary of the results of the data yielded from the administration of the softball skill test indicated that the average student from school II had superior softball skill when compared with the average student from schools I, III and IV, as indicated by critical ratios of 4.25, 4.55 and 8.24, respectively. These critical ratios exceeded the probability level of significance at the .01 level which indicated

superior skill in softball for the students from school II. The scores of the students from schools I and III indicated that these students were more skilled in softball than were the students from school IV as shown by the statistically significant critical ratios of 3.05 and 3.20, respectively. These critical ratios exceeded the .01 level of probability. The students from school I and III had identical softball skill as indicated by a critical ratio of zero and a probability level of 1.00.

Softball Information Test

The data obtained from the administration of the softball information test to 281 tenth grade students from the four city junior high schools enrolled in St. Petersburg Senior High School during the school year 1951-52 are presented in Table XII.

TABLE XII

NUMBER, RANGE, TRUE RANGE, MEAN, STANDARD DEVIATION AND STANDARD ERROR OF THE MEAN SCORES FOR THE 281 GIRLS FROM THE FOUR JUNIOR HIGH SCHOOLS ENROLLED IN THE TENTH GRADE IN ST. PETERSBURG SENIOR HIGH SCHOOL, ST. PETERSBURG, FLORIDA TO WHOM THE SOFTBALL INFORMATION TEST WAS ADMINISTERED

School	Number	Range	True Range	Mean	S. D.	6 M
I	50	15-84	69	52	10.20	1.44
II	63	15-88	73	50	10.25	1.40
III	110	2-97	95	51	13.10	1.26
IV	58	11-81	70	47	9.45	1.24
Total	281	...	...	...	...	...

The variability of scores as indicated by the true ranges from the largest to the smallest scores made on the softball information test by the students from the four schools were: 95 or from 2 to 97, school III; 73 or from 15 to 88, school II; 70 or from 11 to 81, school IV; and, 69 or from 15 to 84, school I. The range of scores of the students from school III shows the highest score of 95 and the lowest score of 2 for the softball information test scores from the four schools.

The standard deviation in decreasing size of variability for the scores of the students from the four schools were: 13.10, school III; 10.25, school II; 10.20, school I; and, 9.45, school IV. The means of the respondents from the four junior high schools on the softball information test in descending order of size were: 52, school I; 51, school III; 50, school II; and 47, school IV. A range of five points was found between the highest mean score of 52 for school I and the lowest mean score of 47 for school IV. The lowest mean score, 47, and the smallest standard deviation, 9.45, recorded for the 58 students from school IV show the least variability of scores for the students from the four schools participating in the present study. The standard error of the mean of 1.24 for school IV is slightly more reliable than the standard errors of the means of: 1.26, school III; 1.40, school II; and 1.44, school I.

From the results of the test concerning softball information, it is evident that the average student from school I was better informed with respect to softball than the average student from schools II, III and IV. The students from school IV ranked the lowest in softball information of the four groups tested.

In Table XIII are presented the numbers, the means, the differences between the means, the critical ratios, and the probability levels of significance of the scores from the softball information test for 281 tenth grade students from the four city junior high schools enrolled in St. Petersburg Senior High School to whom the test was administered.

TABLE XIII

NUMBER, MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD
 ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE
 CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF
 SIGNIFICANCE COMPUTED FROM THE SCORES FOR THE
 SOFTBALL INFORMATION TEST OF 281 GIRLS
 FROM THE FOUR JUNIOR HIGH SCHOOLS EN-
 ROLLED IN THE TENTH GRADE IN ST.
 PETERSBURG SENIOR HIGH SCHOOL
 ST. PETERSBURG, FLORIDA

Schools Compared	Number	Means	D_{m1-m2}	σD	C. R.	P
I II	50 63	52 50	2	2.00	1.00	.42
I III	50 110	52 51	1	1.91	.52	.60
I IV	50 58	52 47	5	1.90	2.63	.01
II III	63 110	50 51	1	1.88	.53	.60
II IV	63 58	50 47	3	1.87	1.60	.11
III IV	110 58	51 47	4	1.77	2.26	.03
Total	281	...	...	...	...	...

In comparing the means of the softball information test scores of the students from the four junior high schools, the largest mean difference of 5 was found between the means of 52 for the 50 students from school I and 47 for the 58 students from school IV. The mean difference divided by the standard error of the difference yielded a critical ratio of 2.63. The critical ratio of 2.63 is significant at the .01 level for 108 scores or 106 degrees of freedom.¹ Therefore, the students from school I may be said to have possessed superior information concerning softball when compared with the information concerning softball possessed by the students from school IV. A statistically reliable critical ratio at the .03 level of probability was obtained when comparing the mean score of 51 for the 110 students from school III and the softball information mean score of 47 for the 58 students from school IV. Therefore, it may be stated that the students from school III had superior softball information when compared with the softball information of the students from school IV.

The critical ratio of 1.60 indicated that the obtained difference of 3 between the means of 50 for the 63 students from school II and 47 for the 58 students from school IV for the softball information test approaches reliability at the .11 level of significance for 121 scores or 119 degrees of freedom. A probability level of .11 indicated that the

¹Op. cit., p. 119.

students from school II could be expected to exceed the students from school IV in softball information eighty-nine out of 100 trials if similar experiments were conducted.

The amount of information concerning softball possessed by the students from schools I and II was similar. A difference of 2 between the means of 52 and 50, when divided by the standard error of the difference yielded a critical ratio of one for 113 scores of 111 degrees of freedom. A critical ratio of one is not considered reliable at a probability level of .42. An obtained mean difference of one way found between the mean scores for softball information of the students from schools I and III, and schools II and III. Critical ratios of .52 and .53 resulted from dividing the standard errors of the difference into the mean difference of one. The probability levels of .60 indicate no reliable significance for critical ratios of .52 and .53, therefore, the information concerning softball possessed by the students from schools I, II and III was similar.

A summary of the results of the data yielded from the administration of the softball information test indicated that the students from schools I and III had superior softball information when compared with the students from school IV, as indicated by the critical ratios of 2.63 and 2.26. These were the only significant critical ratios obtained from the comparisons of the four groups by use of the softball information test.

School I

In Table XIV are presented the numbers, the means, the differences between the means, the standard errors of the differences between the means, the critical ratios, and the probability levels of significance of the scores of the tenth grade students from school I participating in the volleyball, basketball and softball skill and information tests.

TABLE XIV

MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF SIGNIFICANCE COMPUTED FROM THE SCORES OF THE SUBJECTS FROM SCHOOL I FOR THE VOLLEYBALL, BASKETBALL AND SOFTBALL SKILL AND INFORMATION TESTS

Sports Compared	Number	Mean	D_{m1-m2}	δD	C. R.	P
Volleyball Skill	53	50.50	2.17	1.59	1.36	.17
Basketball Skill	64	48.33				
Volleyball Skill	53	50.50	.50	1.56	.32	.75
Softball Skill	57	50.00				
Basketball Skill	64	48.33	1.67	1.18	1.41	.16
Softball Skill	57	50.00				
Volleyball Information	54	56.00	4.00	1.88	2.13	.03
Basketball Information	51	60.00				
Volleyball Information	54	56.00	4.00	1.85	2.16	.03
Softball Information	50	52.00				
Basketball Information	51	60.00	8.00	2.06	3.88	Exceeds .01
Softball Information	50	52.00				

A critical ratio of 2.13, statistically reliable at the .03 level of significance, was obtained in favor of a greater amount of basketball information when compared with the information possessed in volleyball by the students from school I. A critical ratio of 3.88, exceeding the .01 level or reliability, was obtained indicating superior information in basketball when compared with the information possessed in softball by the same students.

The obtained difference of 4 between the means of 56 for the scores of the volleyball information test and 52 for the scores of the softball information test, when divided by the standard error resulted in the critical ratio of 2.16 that is statistically significant at the .03 level of confidence. This level of confidence indicated that the students from school I possessed more extensive information concerning volleyball when compared with the information possessed concerning softball.

The critical ratio of 1.36 is unreliable at the .17 level of significance for 117 scores or 115 degrees of freedom. However, the probability level of .17 indicated that the students from school I could be expected to excell in volleyball over basketball skill in eighty-three out of 100 trials if similar experiments were conducted.

The obtained difference between the mean scores for the students from school I between volleyball and basketball skill, volleyball and softball skill, and basketball and softball skill, when divided by their respective standard errors

of the differences resulted in probability levels of .17, .75 and .16. These obtained probability levels are not considered statistically reliable, as a .05 level of probability is demanded by most investigators to warrant the conclusion that students possess superior skill in one activity to that possessed in a second activity in mean attainment.¹

A summary of the results of the data obtained from the administration of the volleyball, basketball and softball skill and information tests to the students from school I indicated that the students possessed more information concerning basketball than softball and volleyball as indicated by critical ratios of 3.88 and 2.13, respectively. The critical ratio of 3.88 exceeded the .01 level of reliability and the critical ratio of 2.13 is reliable at the .03 level of confidence. For all practical purposes the students from school I had similar skills in volleyball, basketball and softball as indicated by critical ratios of 1.36, .32 and 1.41 all exceeding the .05 level of reliability.

School II

The results of the statistical treatment of the scores obtained from the volleyball, basketball and softball skill and information tests are presented in Table XV and are the means, the differences between the means, the standard errors of the differences between the means, the critical ratios and their probability levels of significance of the tenth grade students from school II.

¹Op. cit., pp 203-204

TABLE XV

MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF SIGNIFICANCE COMPUTED FROM THE SCORES OF THE SUBJECTS FROM SCHOOL II FOR THE VOLLEYBALL, BASKETBALL AND SOFTBALL SKILL AND INFORMATION TESTS

Sports Compared	Number	Mean	D_{m1-m2}	σ_D	C. R.	P
Volleyball Skill	68	49.50	4.16	1.13	3.68	Exceeds
Basketball Skill	63	53.66				.01
Volleyball Skill	68	49.50	6.50	1.39	4.67	Exceeds
Softball Skill	56	56.00				.01
Basketball Skill	63	53.66	2.34	.98	2.38	.02
Softball Skill	56	56.00				
Volleyball Information	69	52.00	0	1.37	0	1.00
Basketball Information	61	52.00				
Volleyball Information	69	52.00	2.00	1.71	1.17	.24
Softball Information	63	50.00				
Basketball Information	61	52.00	2.00	1.66	1.20	.23
Softball Information	63	50.00				

The students from school II had superior softball skill when compared to volleyball and basketball skill as indicated by critical ratios of 4.67 and 2.38, respectively. The critical ratio of 4.67 exceeds the .01 level of reliability obtained when comparing softball and volleyball skill in favor of superior softball skill of the students from school II. A reliability at the .02 level of confidence obtained when comparing softball and basketball skill indicated that the students from school II had more extensive softball skill than basketball skill. The critical ratio of 3.68, exceeding the .01 level of probability indicated that the basketball skill possessed by the students from school II was superior to their volleyball skill.

Only slight superiority, of no practical significance, was found when comparing softball information with volleyball and basketball information as evidenced by critical ratios of 1.71 and 1.66 at the .24 and .23 levels of probability, respectively.

A summary of the results of the data obtained from the administration of volleyball, basketball and softball skill and information tests to the students from school II indicated that the students possessed more skill in softball when compared to skill in volleyball and basketball, as indicated by the critical ratios of 4.67 and 2.38, respectively. The two critical ratios are statistically significant as the critical ratio of 4.67 exceeded the probability level of

significance at the .01 level and the critical ratio of 2.38 is significant at the .02 level of probability. The students from school II had less skill in volleyball when compared to their skill in softball and basketball as indicated by the statistically significant critical ratios of 4.67 and 3.68, respectively. The students had similar information in volleyball, basketball and softball as indicated by critical ratios of zero, 1.17 and 1.20 as the probabilities of significance of one, .24 and .23 are considered statistically unreliable.

School III

In Table XVI are presented the numbers, the means, the differences between the means, the standard errors of the differences between the means, the critical ratios, and the probability levels of significance of the scores of the tenth grade students from school III participating in the volleyball, basketball and softball skill and information tests.

TABLE XVI

MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF SIGNIFICANCE COMPUTED FROM THE SCORES OF THE SUBJECTS FROM SCHOOL III FOR THE VOLLEYBALL, BASKETBALL AND SOFTBALL SKILL AND INFORMATION TESTS

Sports Compared	Number	Mean	D_{m1-m2}	σD	C. R.	P
Volleyball Skill	105	49.00	4.33	.88	4.94	Exceeds
Basketball Skill	107	53.33				.01
Volleyball Skill	105	49.00	1.00	1.25	.80	.54
Softball Skill	99	50.00				
Basketball Skill	107	53.33	3.33	1.02	3.26	Exceeds
Softball Skill	99	50.00				.01
Volleyball Information	110	46.00	0	1.26	0	1.00
Basketball Information	104	46.00				
Volleyball Information	110	46.00	5.00	1.51	3.31	Exceeds
Softball Information	110	51.00				.01
Basketball Information	104	46.00	5.00	1.58	3.16	Exceeds
Softball Information	110	51.00				.01

The obtained differences of 4.33 and 3.33 between the means of 53.33 for the basketball skill test and 49 and 50 for the volleyball and softball skill tests, when divided by their respective standard errors resulted in critical ratios of 4.94 and 3.26, respectively. The critical ratios of 4.94 and 3.26 indicated statistical reliability exceeding the .01 level of probability in favor of superior basketball skill when compared with volleyball and softball skills for the students from school III.

The difference of one between the means of 49 for the volleyball skill test and 50 for the softball skill test, when divided by the standard error resulted in a critical ratio of .80 which has a probability of .54 and is not considered statistically significant.

The difference of 5, found between the means of 51 for the softball information test and 46 for the volleyball and basketball information tests, resulted in critical ratios of 3.31 and 3.16, respectively, for the students from school III. The critical ratios of 3.31 and 3.16, exceeding the .01 level of reliability, indicated that the students from school III were better informed concerning softball than they were concerning volleyball and basketball. The same mean score of 46 was made by the students from school III on the volleyball and softball information tests, hence it may be said that the students from school III possessed similar volleyball and softball information.

A summary of the results of the data obtained from the comparison of volleyball, basketball and softball skill and information tests indicated that the students from school III had superior basketball skill when compared to volleyball and softball skill as indicated by critical ratios of 4.94 and 3.26, respectively, and superior softball information when compared to volleyball and basketball information as indicated by critical ratios of 3.31 and 3.16, respectively. The critical ratios of 4.94, 3.26, 3.31 and 3.16 are considered statistically significant as each exceeds the .01 level of confidence. No other significant differences were found for the students from school III as indicated by critical ratios of .80 and zero and one for volleyball and softball skill and volleyball and basketball information, respectively. The critical ratios of .80 and zero are considered unreliable as the .05 level of confidence is demanded by most investigators to warrant the conclusion that one group is superior to another in mean attainment.¹

School IV

The results of the statistical treatment of the scores obtained from the volleyball, basketball and softball skill and information tests are presented in Table XVII and are the numbers, the means, the differences between the means, the standard errors of the differences between the means, the critical ratios and their probability levels of significance of the scores of the tenth grade students from school IV

¹Op. cit., pp. 203-204.

TABLE XVII

MEANS, DIFFERENCES BETWEEN THE MEANS, STANDARD ERROR OF THE DIFFERENCE BETWEEN THE MEANS, AND THE CRITICAL RATIOS AND THEIR PROBABILITY LEVELS OF SIGNIFICANCE COMPUTED FROM THE SCORES OF THE SUBJECTS FROM SCHOOL IV FOR THE VOLLEYBALL, BASKETBALL AND SOFTBALL SKILL AND INFORMATION TESTS

Sports Compared	Number	Mean	D_{m1-m2}	δD	C. R.	P
Volleyball Skill	58	51	1	1.34	.80	.42
Basketball Skill	61	52				
Volleyball Skill	58	51	5	1.26	3.97	Exceeds .01
Softball Skill	54	46				
Basketball Skill	61	52	6	1.07	5.59	Exceeds .01
Softball Skill	54	46				
Volleyball Information	66	51	5	1.37	3.65	Exceeds .01
Basketball Information	61	46				
Volleyball Information	66	51	4	1.56	2.56	.01
Softball Information	58	47				
Basketball Information	61	46	1	1.24	.80	.42
Softball Information	58	47				

The difference of one between the means of 51 for the volleyball skill test and 52 for the basketball skill test for the students from school IV is negligible as indicated by the critical ratio of .80 which has the probability level of .42. This level of probability is not considered statistically significant, therefore it may be expected that the students from school IV exhibit the same amount of skill in volleyball and basketball. The softball skill displayed by the students is inferior as compared to their volleyball and basketball skill as indicated by the critical ratios of 3.97 and 5.57, respectively. The critical ratios of 3.97 and 5.57 are statistically significant as they exceed the .01 per cent level of probability.

More extensive volleyball information was apparent in the students from school IV when compared to the information they possessed in basketball and softball as indicated by critical ratios of 3.65 and 2.56, respectively. The probability, exceeding the .01 level of significance obtained when comparing volleyball and basketball information, asserted that the difference of 5 between the means is statistically reliable in favor of volleyball information. The reliability at the .01 level of probability, obtained when comparing the scores of the volleyball and softball information tests indicated that the students were better informed about volleyball than they were about softball.

The obtained difference of one between the means of 46 for basketball information and 47 for softball information

was of no practical significance as indicated by the critical ratio of .80 and the probability level of significance of .42.

A summary of the data yielded from the administration of the volleyball, basketball and softball skill and information tests to the students from school IV indicated that the average student displayed less softball skill when compared with volleyball and basketball skill as shown by statistically significant critical ratios of 3.97 and 5.57, respectively. The students had more extensive information concerning volleyball than they did concerning basketball and softball as indicated by critical ratios of 3.65 and 2.56, respectively. Both critical ratios are significant at the .01 level of probability. For all practical purposes the students from school IV had similar skill in volleyball and basketball and similar information concerning basketball and softball as illustrated by the unreliable critical ratio of .80 for both of the mean differences.

The summary, conclusion, and recommendations for further studies are presented in the following chapter.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Recognizing the need to compare achievement in skill and information of one group with another as a result of participation in junior high school physical education classes, the investigator undertook a comparative study of the status of tenth grade girls enrolled in the St. Petersburg Senior High School at St. Petersburg, Florida from the four St. Petersburg junior high schools, during the school year 1951-52, in regard to skill and information in volleyball, basketball and softball, as measured by selected and constructed skill and information tests. Information concerning time allotment and facilities for participation in the selected sports in the junior high schools was obtained by means of a check list. On the basis of the findings, implications as to the relationships existing among the four groups in respect to the selected factors and recommendations for future development of the sports program in the junior and senior high schools in St. Petersburg, Florida were made.

Through this study the investigator attempted to fulfill the following purposes:

1. to determine the status of tenth grade girls enrolled in the St. Petersburg Senior High School at St. Petersburg, Florida, from the four St. Petersburg junior high schools during the school year 1951-52 in regard to skill and

information in volleyball, basketball and softball as measured by selected and constructed skill and information tests;

2. to compare the four groups as to their status in regard to skill and information in volleyball, basketball and softball;

3. to determine the degree of relative proficiency in the sports within each school;

4. to obtain information concerning time allotment and facilities for participation in the selected sports in the junior high schools by means of a check list;

5. to draw implications on the basis of the findings as to the relation of the status of the four groups in skill and information in reference to the selected team sports;

6. to make recommendations on the basis of the findings for future development of the sports program in the junior and senior high schools of St. Petersburg, Florida.

The investigator made a thorough study of literature and of previous studies in the field of physical education that had probable value and bearing upon the present study.

The volleyball skill test by Russell and Lange, "A Basketball Motor Ability Test for College Women and Secondary School Girls" by Dyer, Schurig and Apgar, the softball distance throw test by Underkofler, were selected and the batting skill test and volleyball, basketball and softball information tests were constructed to determine the status of tenth grade girls enrolled in the St. Petersburg Senior

High School at St. Petersburg, Florida, from the four St. Petersburg junior high schools during the school year 1951-52 in regard to skill and information in volleyball, basketball and softball. The tests were selected and constructed according to criteria established for a valid and reliable instrument of evaluation.

The tests were administered to from 277 to 299 tenth grade students enrolled in the St. Petersburg Senior High School.

Significant findings from each of the six tests and the check list are summarized in the following pages. Conclusions are drawn from the study as a whole and recommendations for future development of the sports program in the junior and senior high schools of St. Petersburg, Florida are presented.

Summary of the Findings

Volleyball Skill Test.--From the results of the data obtained from the administration of the volleyball skill test it was evident that the students from school IV had superior skills in volleyball when compared to the students from school III, as indicated by the critical ratio of 2.56 which exceeds the .01 level of probability. From the information obtained by check list concerning time allotment and facilities for participation in volleyball in the junior high school it was found that school IV had an index of 146 and school III had an index of 262. Since the larger index indicated that school

II and IV as indicated by the critical ratios of 6.94, 4.65 and 3.96, respectively. These critical ratios are statistically significant at the .01 level of probability. There was no relationship between the volleyball information possessed by the students and the time allotment and available facilities for the students from school III when compared with the same factors for schools I, II and IV as indicated by the index of 262 for school III and indices of 295, 138 and 146 for schools I, II and IV, respectively.

The students from schools II and IV possessed similar volleyball information as indicated by the unreliable critical ratio of .73. The indices for schools II and IV were similar, indicating a positive relationship between information and the time and facilities for volleyball.

Basketball Skill Test.---From the results of the data obtained from the administration of the basketball skill test it was evident that the students from schools II, III and IV possessed superior skill in basketball when compared with the skill possessed by the students from school I, as indicated by critical ratios of 4.40, 4.16 and 2.70, respectively. These critical ratios were statistically significant, exceeding the .01 level of reliability. From the information obtained by the check list concerning time allotment and facilities for participation in basketball in the junior high school it was found that school I had the largest index of 299 when compared with the indices of 76, 281 and 128 for schools II, III and IV, respectively. That is, the students

from school I had greater opportunity to participate in basketball than the students from schools II, III and IV. The data obtained from the basketball skill test and the check list indicated a negative relationship between the basketball skill of the students from school I and the time allotment and facilities for school I when compared with the other three schools.

The statistically significant level of confidence of .04 indicated that the students from school II possessed superior skill in basketball when compared to the skill in basketball possessed by the students from school IV. The indices of 76 for school II and 128 for school IV indicated a negative relationship between basketball skill and time allotment and facilities for schools II and IV. The index of 281 for school III in basketball indicated that these students should have been more skilled in basketball than the students from school II who had an index of 76. However, for all practical purposes the skill in basketball possessed by the students from schools II and III was similar as indicated by the critical ratio of .63 which is not considered statistically reliable at the .53 level of probability.

Basketball Information Test.—The results of the data obtained from the administration of the basketball information test indicated that the students from school I had superior information in basketball when compared with the basketball information of the students from schools II, III and IV as indicated by critical ratios of 5.87, 8.00 and 7.87,

respectively. These critical ratios are statistically significant as each one exceeds the .01 level of confidence. The data obtained from the check list concerning time allotment and facilities for basketball in the junior high schools revealed that the students from school I had greater opportunity to participate in basketball than did the students from schools II, III and IV as indicated by the index of 299 for school I and 76, 281 and 128 for schools II, III and IV, respectively. Therefore a positive relationship existed between basketball information and time and facilities for basketball between school I and schools II, III and IV.

Although the index of 76, which was the lowest index for basketball, was registered for school II, the scores of the students from school II indicated that these students were better informed in reference to basketball than were the students from schools III and IV as shown by the significant critical ratios of 4.58 and 4.44 which exceeded the .01 level of probability. The index of 281 for school III and the index of 128 for school IV indicated that the students from school III had more opportunity to participate in basketball than did the students from school IV, but the critical ratio of zero and the probability level of 1.00 indicated that the students from schools III and IV had similar information concerning basketball.

Softball Skill Test.—The data obtained from the administration of the softball skill test revealed that the average student from school II had superior softball skill.

when compared with the average student from schools I, III and IV, as indicated by critical ratios of 4.25, 4.55 and 8.24, respectively. These critical ratios exceeded the probability level of significance at the .01 level which indicated superior skill in softball for the students from school II. The index of 130 for softball in school II is the lowest index recorded for the four schools indicating that the students from school IV had fewer advantages in reference to time allotment and facilities than did the students from schools I, III and IV. There was a negative relationship between the softball skill scores and time allotment and facilities for the students from school II and schools I, III and IV.

The index of 294 for school IV indicated that the students from school IV had more opportunity to participate in softball than did the students from schools I and III with indices of 183 and 140, respectively. However, the scores of the students from schools I and III indicated that these students were more skilled in softball than were the students from school IV as shown by the statistically significant critical ratios of 3.05 and 3.20, respectively. These critical ratios exceeded the .01 level of confidence. Although school I had the larger index of 183 when compared with the index of 140 for school III, the students from schools I and III had identical softball skill as indicated by a critical ratio of zero and a probability level of 1.00.

Softball Information Test.---The results of the data yielded from the administration of the softball information

test indicated that the students from school I and III had superior softball information when compared with the students from school IV, as indicated by the critical ratios of 2.63 and 2.26. The critical ratio of 2.63 was significant at the .01 level of confidence and the critical ratio of 2.26 was significant at the .03 level of confidence. The index scores obtained from the check list concerning time allotment and facilities for participation in softball in the junior high school indicated that schools I and III ranked second and third, respectively. There was no consistent relationship between the softball information test scores and the time allotment and facilities for the four schools.

Although the index scores ranged from 294 to 130 for the four schools there were no other significant critical ratios obtained from the comparison of the four groups on the softball information test.

School I.—The data obtained from the administration of the volleyball, basketball and softball skill and information tests to the students from school I indicated that the students possessed more information concerning basketball than softball and volleyball as indicated by critical ratios of 3.83 and 2.13, respectively. The critical ratio of 3.83 exceeds the .01 level of reliability and the critical ratio of 2.13 is reliable at the .03 level of probability. The data obtained by check list concerning time allotment and facilities for participation in volleyball, basketball and softball in school I indicated that the students from school I had more opportunity to participate in basketball

than they did in volleyball and softball as indicated by the index of 899 for basketball and 295 and 183 for volleyball and softball respectively. Therefore, a positive relationship existed between time allotment and facilities and the information possessed by the students from school I.

Although the indices for volleyball, basketball and softball for the students from school I varied, for all practical purposes the students from school I had similar skills in volleyball, basketball and softball as indicated by critical ratios of 1.36, .32 and 1.41 all exceeding the .05 level of reliability.

School II.--The results of the data obtained from the administration of the volleyball, basketball and softball skill and information test to the students from school II indicated that the students possessed more skill in softball than in volleyball and basketball, as indicated by the critical ratios of 4.67 and 2.33, respectively. These two critical ratios are statistically significant as the critical ratio of 4.67 exceeds the .01 level of confidence and the critical ratio of 2.33 is significant at the .02 level of probability. The students from school II had less skill in volleyball when compared to their skill in softball and basketball as indicated by the statistically significant critical ratios of 4.67 and 3.68, respectively.

The results of the data obtained from the check list concerning time allotment and facilities for participation in volleyball, basketball and softball in school II revealed that the students from school II had more opportunity to

participate in softball than they did in basketball, but less opportunity in softball than they did in volleyball. There is no consistent relationship between time allotment and facilities, and the skills possessed by the students from school II in volleyball, basketball and softball.

The students had similar information in volleyball, basketball and softball as indicated by critical ratios of zero, 1.17 and 1.20 as the probabilities of significance of these critical ratios are considered statistically unreliable.

School III.--The data obtained from the administration of the volleyball, basketball and softball skill and information tests to the students from school III revealed that these students had superior basketball skill when compared with their volleyball and softball skill as indicated by the critical ratios of 4.94 and 3.26, respectively. The critical ratios of 4.94 and 3.26 are considered statistically significant as each exceeds the .01 level of confidence. The data obtained from the check list concerning time allotment and facilities for the three selected sports in school III revealed that the students from school III had more opportunity to participate in basketball than they did to participate in volleyball or softball as indicated by the index scores of 281 for basketball and 262 and 140 for volleyball and softball, respectively. Therefore, a positive relationship existed between the skill attained and time allotment and facilities available for the students from school III.

The students from school III had superior softball information when compared to volleyball and basketball information as indicated by critical ratios of 3.31 and 3.16, both statistically significant exceeding the .01 level of probability. A negative relationship existed between information concerning the three selected sports and the time allotment and facilities for participation in the three sports.

No other significant differences were found for the students from school III as indicated by critical ratios of .80 and zero which are considered unreliable exceeding the .05 level of confidence demanded by most investigators.

School IV.---From the results of the data obtained from the administration of the volleyball, basketball and softball skill and information tests to the students from school IV it was found that the students displayed less softball skill when compared to their volleyball and basketball skill as indicated by statistically significant critical ratios of 3.97 and 5.57, respectively. From the information obtained by check list concerning time allotment and facilities for participation in volleyball, basketball and softball in school IV it was found that the students from school IV had more opportunity to participate in softball than they did in volleyball and basketball as indicated by the index of 294 for softball and 146 and 128 for volleyball and basketball, respectively. There was a negative relationship between the skills attained and the time allotment and facilities for the students from school IV.

The students from school IV had more extensive information concerning volleyball than they did concerning basketball and softball as indicated by critical ratios of 3.65 and 2.56, respectively. Both critical ratios are significant at the .01 level of probability. No consistent relationship between the information possessed about the three sports and the time allotment and facilities in school IV existed.

For all practical purposes the students from school IV had similar skill in volleyball and basketball and similar information concerning basketball and softball as illustrated by the unreliable critical ratio of .80 for both of the mean differences.

Conclusions

The conclusions in this section are based upon three sets of findings: 1. Inter-school comparisons based upon reliable statistical findings obtained from the skill and information tests; 2. The comparison of achievement in sports by students within each school based upon reliable statistical findings obtained from the skill and information tests; and, 3. The comparisons of opportunities afforded the students in junior high school according to the established index.

From the findings presented in this study the conclusions for the inter-school comparisons by the investigator were:

1. The students from school I were superior to the

students from schools II, III and IV in the present investigation in regard to the information possessed in volleyball and basketball. These students ranked last in the attainment of basketball skill and intermediate in softball and volleyball skill.

2. The students from school II were superior to the students from schools I, III and IV in possession of softball skill and ranked higher than the students from schools I and IV in possession of basketball skill. These students placed second in basketball information when compared to the students from the other three schools and intermediate in volleyball skill and softball information.

3. The students from school III were superior in softball skill and information when compared with the students from school IV and in basketball skill when compared with the students from school I. These students possessed less volleyball skill and information than the students from schools I, II and IV.

4. The students from school IV possessed more skill in volleyball than the students from schools I, II and III and more skill in basketball than the students from school I. These students possessed the least basketball information and softball skill and information of the four groups tested.

From the findings presented in this study the conclusions for the comparison of sports achievement within each school by the investigator were:

1. The students from school I possessed more basketball information than softball or volleyball information.

These students showed similar achievement in volleyball, basketball and softball skill.

2. The students from school II possessed more softball skill than basketball or volleyball skill and more skill in basketball than in volleyball. These students showed similar achievement in volleyball, basketball and softball information.

3. The students from school III possessed more basketball skill than volleyball or softball skill and more softball information than volleyball or basketball information.

4. The students from school IV possessed less skill in softball than in volleyball or basketball and more information concerning volleyball than basketball or softball.

From the findings presented in this study the conclusions for the comparisons of opportunities afforded the students in junior high school were:

1. The students from school I had more opportunity to participate in basketball than in volleyball or softball according to the time allotment and facilities available. These students also had more opportunity to participate in basketball than the students from the other three schools.

2. The students from school II had less opportunity to participate in basketball than in volleyball or softball. These students had less opportunity to participate in the three sports than the students from the other three schools.

3. The students from school III had more opportunity

to participate in basketball than in volleyball or softball. These students were intermediate in comparison with the other three schools in opportunity to participate in all three sports.

4. The students from school IV had far more opportunity to participate in softball than in volleyball or basketball. These students also had much more opportunity to participate in softball than the students from the other three schools.

5. There was no consistent relationship between the information and skill possessed by the students from the four schools and the time allotment and facilities available to them in the four schools.

Recommendations for Future Development of the Sports Program in the Junior High Schools

As a result of this study the investigator makes the following recommendations:

1. School I spend more time in practice of the fundamental skills in basketball as well as softball and volleyball. The number of weeks spent in the activities is sufficient provided the time be spent in teaching and practice of fundamental skills rather than merely playing the game.

2. School II devote part of the time they have scheduled for basketball to volleyball and make use of any available space for the practice of the fundamental skills in volleyball.

3. School III make use of the extra courts available for volleyball by having skilled students work with the unskilled students in small groups. More time might be spent on the fundamentals of the game.

4. School IV make better use of their softball facilities in developing skill as well as teaching the information concerning softball. More time be spent on the rules and regulations of basketball.

5. The junior high schools should not spend more than six weeks a year on each of the team sports, volleyball, basketball and softball.

Recommendations for Future Development of the Sports Program in the Senior High School

As a result of this study the investigator makes the following recommendations:

1. Administer similar skill and information tests to the tenth grade students during the first week of school to determine how much time should be devoted to further teaching and practice in volleyball, basketball and softball.

2. By use of the data collected from the administration of such tests classify the students according to skills and information in the different sports.

3. Schedule longer periods of time for those students who scored low on the tests and shorter periods for those students who scored high on the tests.

4. Volleyball, basketball and softball classes be kept to a minimum for those students who already possess good skills in the sports in high school in order that they may increase their skills in other fields of physical education.

5. Within each class, classify students according to skill possessed in the sports. Make use of extra courts by

having skilled students work with the unskilled students in small groups.

Recommendations for Further Study

The investigator recommends that the following studies be undertaken either by graduate students in health, physical education and recreation or by teachers of physical education:

1. To construct a valid and reliable battery of tests for measuring skill in all sports.
2. To construct valid and reliable physical education information tests for publication by a National testing company for use on the secondary level.
3. Study of the Physical Education facilities of the junior high schools of Florida.
4. A survey of facilities, programs and personnel of the departments of Physical Education in the High Schools of Florida.
5. A comparative study to determine the relationship of information, skill and physical fitness in sports activities.

APPENDIX

Name _____
 Junior High Attended _____
 Date _____

Scores:
 T-F _____ Mult. _____
 Completion _____
 Matching _____
 Total Score _____
 Odd Score _____
 Even Score _____

VOLLEYBALL EXAMINATION

TRUE AND FALSE

Directions: Read each statement carefully. If the statement is true, encircle the T. If the statement is false or partially false, encircle the F. If you do not know the answer, DO NOT GUESS. The number of wrong answers will be subtracted from the number of right answers to determine your score.

Example: T ☒ Boys and girls have the same volleyball rules.

- T F 1. A player on the back line should pass the ball up to the player on the front line.
- T F 2. If a player uses a double hit, she may not touch the ball again until it goes over the net and is returned.
- T F 3. If a player hits a ball out-of-bounds on her own side of the net, her teammate may run out of the court and return it to the court.
- T F 4. If a player on the receiving side touches the net, sideout is called.
- T F 5. If the ball touches any part of the body except the hands or forearms the ball is dead.
- T F 6. In serving right handed, the player should step forward on her left foot.
- T F 7. If two players hit the ball at the same time, only one hit is counted.
- T F 8. In serving, a server should stand behind the baseline on the left side of the court.
- T F 9. After a player has served and her team again receives the ball to serve, she rotates to the left forward position.
- T F 10. If a forward is unable to spike the ball, she should use the drive.
- T F 11. If the ball hits the net on a return, it is a dead ball.
- T F 12. A team rotates after its serve.
- T F 13. The center back player should play behind the other two players on the back line.
- T F 14. Each player is allowed three successive hits.
- T F 15. The ball must be replayed if two players on the same team commit fouls at the same time.

- T F 16. A player may step on but not over the center line.
- T F 17. A team scores one point each time their opponents fail to return the ball.
- T F 18. Each team is allowed two time-outs during a game.
- T F 19. A spiker should hit the ball to the back line, so that her opponents are unable to return the ball.
- T F 20. A point may be scored only by the serving team.
- T F 21. A ball other than a service may not be recovered from the net.
- T F 22. The ball should be set-up with one hand whenever possible.
- T F 23. When returning the ball to the server from the opposite side of the net after the ball is dead, it should be rolled under the net.
- T F 24. Players rotate in a counter-clockwise direction.
- T F 25. A player may re-enter the game three times.
- T F 26. The spiker should develop the ability to get off the floor in a good jump.
- T F 27. One point is scored when a let ball occurs.
- T F 28. The purpose of the first hit is to slow down the ball so that it can be redirected accurately with the second hit.
- T F 29. A server who steps on the line is committing a foot fault.
- T F 30. The center forward should stay within an arm's length of the net.

COMPLETION

Directions: Read carefully. Place the word or words best completing each statement in the blanks BEFORE each number. You will receive one point for each correct answer.

Example: EYE It is important to keep your on the ball.

1. There are players on a girls' volleyball team.
2. The distance from the floor to the top of the volleyball net is feet.
3. The is the superior official of the game.
4. The calls the foul when a player steps over the center line.
5. There are players in the second line.
6. At the opening of the game the ball is put in play by the player in the position.

- _____ 7. If an illegal serve is omitted, _____ is called.
- _____ 8. The substitute entering the game should report to the _____ and the _____.
- _____ 9. Rotation is in the form of an _____.

MULTIPLE CHOICE

Directions: Each of the following statements is followed by four alternative answers. Underscore the correct answer and place the number of that answer in the space provided in the left hand margin. Your score will be based on the correct number being placed in the column and the statement underlined. No penalty for incorrect answers.

- Example: 3 The volleyball is (1. larger than a basketball; 2. larger than a soccer ball; 3. smaller than a basketball; 4. smaller than a softball);
- _____ 1. The length of a volleyball game is (1. 15 points with two points ahead of opponent; 2. four 8 minute quarters; 3. two 15 point halves; 4. 21 points with two points ahead of opponents).
- _____ 2. A set-up should be sent (1. two feet above the net; 2. level with the net; 3. as high as the player can reach; 4. as high as the player can jump).
- _____ 3. The ball is out-of-bounds when it lands (1. on the side-line; 2. on the outside edge of the line; 3. outside the line; 4. on the end line).
- _____ 4. In setting the ball up, the player should use (1. the palms of her hands; 2. the cushions of her fingers; 3. her fist; 4. the heel of her hand).
- _____ 5. The ball may be played by (1. any number of players before going over the net; 2. two players before going over the net; 3. three players before going over the net; 4. four players before going over the net).
- _____ 6. The most practical serve for high school students is (1. the underarm serve; 2. the sidearm serve; 3. the overhead serve; 4. the overarm serve).
- _____ 7. A volleyball court is (1. 30 X 60 yards; 2. 20 X 40 yards; 3. 20 X 40 feet; 4. 30 X 60 feet).
- _____ 8. The number of players who may touch the ball on the service is (1. one; 2. two; 3. three; 4. unlimited).

- _____ 9. The teams should change courts (1. after every serve; 2. after 21 points have been scored; 3. at the end of the game; 4. at the end of the half).
- _____ 10. Team A is serving. Players from both teams touch the net at the same time. The referee calls (1. side-out; 2. point; 3. re-serve; 4. net ball).
- _____ 11. When returning the ball which is above the head, one should (1. use the right hand only; 2. use both hands with the thumbs together; 3. use both hands with the little fingers together; 4. use both hands with the heels of the hands together).
- _____ 12. Team B is serving. Team A returns the ball. Center forward on team B in an effort to make a swift return hits the ball before it crosses the net. The official calls (1. point; 2. out-of-bounds; 3. side-out; 4. dead-ball).

MATCHING

Directions: Pick out from the column on the right the number which corresponds with the word or phrase on the left and place it in the space provided in front of the word. You will receive one point for each correct answer.

- | | |
|---------------------------|------------------------------------|
| Example: <u> 2 </u> net | 1. two inches wide |
| <u> 3 </u> ball | 2. divides the court in 2 sections |
| <u> 1 </u> side line | 3. weights about seven ounces |

Body foul	1. putting the ball in play
Set-up	2. a serve in which the ball, after striking the net, goes over the net within the bounds
Spike	3. the shifting of players is an "S" formation
Block	4. ball is brought forcefully downward
Drive	5. the direction the ball is traveling is changed as the ball is sent over the net
Side-out	6. technique used as a defense against the spike by forward line players
Point	7. the shifting of players in an "M" formation
Holding	8. A hard hit ball sent into the back corner of the court
Time out for rest	9. the act of elevating the ball above and close to the net so the forward can hit it down hard into the opponent's court
Let	
Follow-through	10. team receiving, fails to return the ball legally to the opponent's court
Service	11. a ball momentarily rests in the player's hands
Rotation	12. serve in which the ball fails to go over the net
Dead Ball	13. ball bounds from the player's head
Cut	14. serve which is hit with the open hand instead of the fists
Illegal serve	15. team serving fails to win its point
Volley	16. ball strikes any object within the boundary lines, except a legal play on the ball
Double foul	17. one hit or two hits in succession by the same player
Substitute	18. players on opposing sides commit a foul at the same time
Double hit	19. one player touches the net then steps over the center line
	20. time out for one minute
	21. time out for 30 seconds
	22. keeping a player from moving freely about on the court
	23. shifting about to hinder the progress of a player without the ball
	24. charging into a player in possession of the ball
	25. the only time a player may reach over the net
	26. the ball hit twice by the same player

Name _____
 Junior High Attended _____
 Date _____

Scores:
 T-F _____ Mult. _____
 Completion _____
 Matching _____
 Total Score _____
 Odd Score _____
 Even Score _____

BASKETBALL EXAMINATION

TRUE AND FALSE

Directions: Read each statement carefully. IF the statement is true, encircle the T. If the statement is false or partially false, encircle the F. If you do not know the answer, DO NOT GUESS. The number of wrong answers will be subtracted from the number of right answers to determine your score.

Example: T (F) Boys and girls' basketball rules are the same.

- T F 1. One team consists of six players, three of which are guards and three of which are forwards.
- T F 2. To start play, the referee throws the ball to a guard who is standing within the center circle.
- T F 3. Only guards may shoot for a basket.
- T F 4. A player may leave the court without permission when the ball is dead.
- T F 5. All boundary lines are out-of-bounds.
- T F 6. The ball is dead when it lodges in the supports of the basket.
- T F 7. A substitute should report to the referee or umpire before going upon the court, giving name and position.
- T F 8. A player may enter and leave the game any number of times unless she has been disqualified.
- T F 9. A substitute does not have to report to the scorers before going on the court.
- T F 10. If a team has no substitutes and a player is disqualified the team must forfeit the game.
- T F 11. There should be two scorers and two timers for a game.
- T F 12. The ball is considered "dead" when a spectator interferes with the ball.
- T F 13. A team receives two points when a free-throw is made.
- T F 14. Guards should play between the opposing forwards and the goal.
- T F 15. A goal is not counted if the ball is touched by a guard on its flight to the basket.
- T F 16. A player may step on but not over any boundary line.

- T F 17. The ball is out-of-bounds when it touches a boundary line or any object outside of the boundary line.
- T F 18. A team may have three "time outs" during a game.
- T F 19. The forward fouled must take her own free-throw.
- T F 20. A game consists of four quarters that may last no longer than eight minutes each.
- T F 21. After a free-throw, the ball is put in play from the side line opposite the free-throw line.
- T F 22. The team receiving the ball at the start of the game shall receive the ball again at the start of the second half.
- T F 23. After a goal, the ball is given in the center circle, to the team who made the last goal.
- T F 24. A player may hold the ball for five seconds when it is in play on the court.
- T F 25. When a player has committed four technical fouls she is disqualified.
- T F 26. When a player has committed three personal fouls she is disqualified.
- T F 27. When a player has a combination of five fouls, some of which are personal and some of which are technical, she is disqualified.
- T F 28. A violation is any play which is an infringement of the rules.
- T F 29. When throwing the ball with the right hand, the player should step forward on her right foot.
- T F 30. When a player "travels" the ball is given to her opponent out-of-bounds.

COMPLETION

Directions: Read carefully. Place the word or words best completing each statement in the blanks BEFORE each number. You will receive one point for each correct answer.

Example: four There are _____ quarters in a game.

- _____ 1. When a player advances in any direction on either foot, leaving the other foot at the point that it contacted the floor, she is said to have executed a _____ play.
- _____ 2. If a player, who has possession of the ball, advances in such a manner that she comes into personal contact with an opponent she is said to be _____.
- _____ 3. When a forward is fouled in the act of shooting and the basket is missed, she is awarded _____ free-throw(s).

- _____ 4. If a player intentionally shifts her position to interfere with an opponent's progress she is said to be _____.
- _____ 5. When two opponents catch the ball at the same time, it is called a _____.
- _____ 6. To start the game the referee throws the ball to a player who is standing within the _____.
- _____ 7. A player is _____ when she advances more than one step in any direction while holding the ball in her hands.
- _____ 8. When a player bounces the ball twice in succession with either or alternate hands she is using a _____.
- _____ 9. A _____ is any foul involving personal contact.
- _____ 10. A _____ is an infringement of the rules for which the ball is put in play from out-of-bounds.

MULTIPLE CHOICE

Directions: Each of the following statements is followed by four alternative answers. Underscore the correct answer and place the number of that answer in the space provided in the left hand margin. Your score will be based on the correct number being placed in the column and the statement underlined. No penalty for incorrect answers.

Example: 3 Time taken during the intermission between halves of a game is (1. 5 minutes; 2. 1 minute; 3. 10 minutes; 4. 2 minutes).

- _____ 1. A forward "charges" into a guard. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 2. A player knocks the ball out-of-bounds. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 3. A player "travels" when in possession of the ball. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 4. Two players guard an opponent who is unable to throw the ball to a teammate. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).

- _____ 5. A player holds the ball for six seconds on an out-of-bounds play. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 6. A player advances by bouncing the ball one time. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 7. A player stands in front of an opponent who does not have the ball and makes it impossible for the opponent to advance toward the ball. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 8. A player intentionally fumbles the ball on the center throw. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 9. A forward shoots for the basket from out-of-bounds. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 10. A player trips an opponent. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 11. A player tosses the ball into the air, advances around another player, and catches the ball before it touches the floor. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).
- _____ 12. A player steps on the division line in the center of the court. This is a (1. legal play; 2. violation; 3. technical foul; 4. personal foul).

MATCHING

Directions: Pick out from the column on the right the number which corresponds with the word or phrase on the left and place it in the space provided in front of the word. You will receive one point for each correct answer.

- | | |
|---------------------------|---|
| _____ Delaying the game | 1. player uses personal contact to interfere with the progress of an opponent who is legally advancing the ball |
| _____ Tagging | 2. coaching from the side line |
| _____ Crip shot | 3. official in charge of the game |
| _____ Toss-up | 4. player pretends to throw the ball to one teammate, then throws it to another |
| _____ Referee | 5. constantly touching an opponent with hand, elbow, or body |
| _____ Umpire | 6. threatening the eyes of an opponent |
| _____ Obstruction | 7. lay-up shot |
| _____ Ten minutes | 8. has authority to call violations and fouls, but is assisting the other official on the floor |
| _____ Technical team foul | 9. most widely used long shot |
| _____ Field goal | 10. ball knocked out-of-bounds |
| _____ Center-throw | 11. tie-ball |
| _____ Feint | 12. play in which one player bounces the ball to another player |
| _____ Guarding | 13. time allowed between the first and second and third and fourth quarters |
| _____ Disqualifying foul | 14. time allowed between the second and third quarters |
| _____ Substitute | 15. technical foul |
| _____ Chest shot | 16. time out for one minute |
| _____ Bounce pass | 17. two points |
| _____ Violation | 18. one point |
| _____ Time out for rest | 19. manner in which the game is started |
| _____ Two minutes | 20. may enter the game any number of times |
| | 21. has authority to change the rules |
| | 22. time out for two minutes |
| | 23. may enter the game three times |
| | 24. used to cover an opponent in possession of the ball |
| | 25. bounce to one's self |

Name _____
 Junior High Attended _____
 Date _____

Scores:
 T-F _____ Mult. _____
 Completion _____
 Matching _____
 Total Score _____
 Odd Score _____
 Even Score _____

SOFTBALL EXAMINATION

TRUE AND FALSE

Directions: Read each statement carefully. If the statement is true, encircle the T. If the statement is false or partially false, encircle the F. If you do not know the answer, DO NOT GUESS. The number of wrong answers will be subtracted from the number of right answers to determine your score.

Example: ☒ F Boys and girls have the same softball rules.

- T F 1. When throwing the ball right handed, a player steps forward on her left foot.
- T F 2. Outfielders should throw the ball into the infield with an underhand motion.
- T F 3. The first baseman should play on first base when the pitcher is preparing to pitch the ball.
- T F 4. The second baseman should play between second and third bases.
- T F 5. When the batter is waiting for the pitch, her feet should be pointed toward the pitcher's mound.
- T F 6. It can be determined which field is right field and which field is left field by standing in the catcher's position facing the pitcher.
- T F 7. The catcher should wear a mask and a chest protector.
- T F 8. The pitcher may pitch overhand if she wishes.
- T F 9. The batting order may not be changed when the players in the game exchange positions.
- T F 10. Both teams are allowed three outs in one inning.
- T F 11. The pitcher may start her delivery with one foot on the rubber.
- T F 12. On the first strike, if the catcher catches a foul tip not above the batter's head, the batter is out.
- T F 13. A batted ball which hits the ground in fair territory before reaching first base, then rolls foul, is fair.
- T F 14. A batted ball which lands in fair territory in the outfield is fair regardless of where it stops.
- T F 15. When the batter hits a fly ball, she should wait to see if it is caught before running to first base.
- T F 16. A base-runner may leave the base after a fly ball is caught.

- T F 17. Base-runners may advance after a ball is caught in foul territory.
- T F 18. When an over-throw into foul territory occurs, base-runners may advance any number of bases.
- T F 19. When running around the bases, the base-runner must touch each base in proper sequence.
- T F 20. A base-runner is out if she is hit by a batted ball.
- T F 21. A base-runner may attempt to steal a base when the batter swings and tips the ball.
- T F 22. A base-runner may take a lead off the base while the pitcher is preparing to deliver the ball.
- T F 23. When an overthrow into fair territory occurs, the runners may advance only one base.
- T F 24. The batter is out if she bunts foul on her last strike.
- T F 25. A batter is out if she hits four foul balls.
- T F 26. When a batter is hit by a pitched ball, she is allowed to walk to first base, whether or not she had tried to get out of the way of the ball.
- T F 27. Softball and baseball are the names for the same game.
- T F 28. The base-runner is out if she is hit by a thrown ball.
- T F 29. A base-runner may run out of the base line to avoid being tagged.
- T F 30. The left fielder should play farther out than the right fielder when a left handed batter is up to bat.

COMPLETION

Directions: Read carefully. Place the word or words best completing each statement in the blanks BEFORE each number. You will receive one point for each correct answer.

Example: LARGER A softball is _____ than a baseball.

- _____ 1. There are _____ players on a girls' softball team.
- _____ 2. The distance from home plate to first base is _____ feet.
- _____ 3. A player who actually makes the out is credited with a (an) _____.
- _____ 4. A player who throws a batter out at first base is credited with a (an) _____.
- _____ 5. A regulation softball game consists of _____ innings.
- _____ 6. The plate umpire indicates strikes with her _____ hand.
- _____ 7. Before stepping into the batters box the batter should glance at the _____.
- _____ 8. There are _____ outfielders on a softball team.
- _____ 9. A substitute may enter the game _____ time(s).
- _____ 10. The pitching distance for girls is _____ feet.

MULTIPLE CHOICE

Directions: Each of the following statements is followed by four alternative answers. Underscore the correct answer and place the number of that answer in the space provided in the left hand margin. Your score will be based on the correct number being placed in the column and the statement underlined. No penalty for incorrect answers.

Example: 2 There are (1. 10 players on a softball team; 2. 9 players on a softball team; 3. 8 players on a softball team; 4. 11 players on a softball team).

- _____ 1. A strike must pass over the plate between (1. the catchers shoulders and knees; 2. the batter's waist and shoulders; 3. the batter's shoulders and knees; 4. the catcher's waist and shoulders).
- _____ 2. The first batter may run on her last strike when the catcher misses the ball is (1. first base is not occupied; 2. first and second bases are occupied; 3. the bases are loaded; 4. she tipped the ball).
- _____ 3. An infield fly is an automatic out when there are less than 2 outs and (1. first base only is occupied; 2. there is no one on base; 3. first and second bases are occupied; 4. third base alone is occupied).
- _____ 4. If a runner advances from first to second base on a foul ball she (1. must return to first base without danger of being putout; 2. must return to first base with a chance of being put out; 3. may stay on second base; 4. may advance to third base).
- _____ 5. There are no outs and a runner is on first base. A fast ground ball is hit to the shortstop. She should (1. throw the ball to first base; 2. throw the ball to the second baseman on the base; 3. try to tag the runner as she rounds second base; 4. try to tag the runner before she reaches second base).
- _____ 6. There are no outs. The score is tied and there is a runner on third base. A fast grounder is hit to the third baseman and the runner runs home. The third baseman should (1. play the ball to first base; 2. chase the runner toward home to tag her; 3. throw the ball home; 4. hold the ball until the runner is near home plate, then throw the ball to the catcher).
- _____ 7. The bases are loaded with only one out. A ground ball is hit to the pitcher. She should throw the ball to (1. the third baseman; 2. the second baseman; 3. the first baseman; 4. home plate).

- _____ 8. There is a runner on base and she is cuaght between second and third bases. The third baseman has the ball. She should (1. chase the runner toward second and throw the ball to the second baseman in time to tag the runner; 2. throw the ball to the second baseman immediately who immediately throws it back; 3. throw the ball to the second baseman so she can chase the runner toward third base; 4. hold the ball until the runner has returned to second base).
- _____ 9. There is a runner on first base with no outs. A ground ball is hit slowly to the first baseman. The first baseman run in to field the ball. The second baseman should (1. back up the first baseman; 2. cover second base; 3. watch the runner going to second so she can tell the first baseman where to throw the ball; 4. cover first base).
- _____ 10. The batter hits a long fly to center field with one out. The runner on third base should (1. run home as the ball is hit; 2. stay on the base until the ball is either caught or missed; 3. take a short lead toward home; 4. take a lead half way home).
- _____ 11. There are no outs, with a runner on first and third bases. The batter should (1. swing at the first pitch if it is a strike; 2. swing at the first pitch regardless of where it is; 3. let the first pitch go by; 4. bunt at the first pitch).
- _____ 12. The players on the bench should (1. razz the opposing pitcher; 2. talk to the opposing player nearest them; 3. sit quietly so as not to disturb the game; 4. yell encouragement to teammates).

MATCHING

Directions: Pick out from the column on the right the number which corresponds with the word or phrase on the left and place it in the space provided in front of the word. You will receive one point for each correct answer.

Example: 3 run
 2 out
 1 bat

1. object used to hit the ball
2. three strikes
3. scores one point

- | | |
|-------------------------------|---|
| <u> </u> Squeeze play | 1. a player who makes the out |
| <u> </u> Error | 2. the player who throws the batter out at first base |
| <u> </u> Bunt | 3. third base |
| <u> </u> Balk | 4. a two-base hit |
| <u> </u> Inning | 5. base on balls |
| <u> </u> Clean-up | 6. fumble on the ball |
| <u> </u> On deck | 7. an expression used to denote the next batter up |
| <u> </u> Lead off batter | 8. a direct hit from the bat, low to the infield or outfield |
| <u> </u> Triple | 9. second base |
| <u> </u> Sacrifice | 10. a left handed pitcher or player |
| <u> </u> Right field | 11. the first batter on the line up |
| <u> </u> Strike | 12. advance a runner from third base on a bunt |
| <u> </u> Ball | 13. two outs during a single play |
| <u> </u> Battery | 14. the outfield behind first base |
| <u> </u> Hot corner | 15. advancing the runner with chances that the batter will be put out at first base |
| <u> </u> Double | 16. the fourth hitter in the batting order |
| <u> </u> Double play | 17. a short, looped ball which drops safely just beyond the infielders |
| <u> </u> Line drive | 18. a pitched ball not over the plate |
| <u> </u> South paw | 19. a batted ball, not swung at by the batter, but met with the bat and the ball does not go out of the infield |
| <u> </u> Texas leaguer | 20. a pitcher makes a motion to pitch, but does not release the ball |
| | 21. three outs by both teams |
| | 22. the outfield behind third base |
| | 23. a pitched ball which passes between the batter's knees and shoulders and over the base |
| | 24. a one-base hit |
| | 25. a three-base hit |
| | 26. the pitcher and catcher |

SCORE SHEET

Name _____ Junior High Attended _____
 Number Years Attended _____

VOLLEYBALL

Serve Test: 1st Trial 1 2 3 4 5 6 7 8 9 10
 2nd Trial 1 2 3 4 5 6 7 8 9 10

T-Score _____ 1st Trial _____ 2nd Trial _____

Repeated Volleys Test: 1st Trial _____ 2nd Trial _____

T-Score _____

Information Test: Raw Score _____ T-Score _____

BASKETBALL

Moving Target Test: 1st Trial _____ 2nd Trial _____

T-Score _____

Edgren Ball Handling Test: 1st Trial _____ 2nd Trial _____

T-Score _____

Bounce and Shoot Test: 1 2 3 4 5 6 7 8 9 10
 2nd Trial 1 2 3 4 5 6 7 8 9 10

T-Score _____ 1st Trial _____ 2nd Trial _____

Information Test: Raw Score _____ T-Score _____

SOFTBALL

Distance Throw Test: 1st Trial _____ 2nd _____ 3rd _____

T-Score _____

Batting Test: 1st Trial 1 2 3 4 5 6 7 8 9 10
 2nd Trial 1 2 3 4 5 6 7 8 9 10

T-Score _____ 1st Trial _____ 2nd Trial _____

Information Test: Raw Score _____ T-Score _____

TOTAL T-SCORES:

Volleyball: Skill _____ Information _____

Basketball: Skill _____ Information _____

Softball: Skill _____ Information _____

CHECK LIST FOR PARTICIPATION OF JUNIOR HIGH SCHOOL
GIRLS IN VOLLEYBALL, BASKETBALL, AND SOFTBALL

School _____

Number of Physical Education Teachers for girls _____.

Time allotment for Physical Education activity per week _____

Average size of classes _____ minutes.

Enrollment of girls, in Physical Education during 1950-51.

Maximum _____ Minimum _____

Program in selected team sports:

Please indicate approximately how much time was
spent on instruction and practice in the following sports.

GRADE	Volleyball	Basketball	Softball
Seventh	_____ weeks	_____ weeks	_____ weeks
Eighth	_____ weeks	_____ weeks	_____ weeks
Ninth	_____ weeks	_____ weeks	_____ weeks

Comments: _____

Facilities: Please indicate the number of courts or fields
available for class instruction.

IN-DOOR:

OUT-DOOR:

Volleyball _____ court(s) Volleyball _____ court(s)

Basketball _____ court(s) Basketball _____ court(s)

Softball _____ field(s)

Comments: _____

signed, _____
Girls' Physical Education
Instructor

BIBLIOGRAPHY

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BOOKS:

- Bovard, John F. and Cozens, Fredrick W. Tests and Measurements in Physical Education. Philadelphia and London: W. B. Saunders and Company, 1938.
- Bovard, John F., Cozens, Fredrick W., and Hageman, E. P. Tests and Measurements in Physical Education. 3rd ed. Philadelphia: W. B. Saunders Company, 1949.
- Brace, David K. Health and Physical Education for Junior and Senior High Schools. New York: A. S. Barnes and Company, 1948.
- Clarke, H. Harrison. The Application of Measurement to Health and Physical Education. New York: Prentice-Hall, Inc., 1945.
- Cozens, Fredrick W., Cubberley, Hazel J., and Neilson, N. J. Achievement Scales in Physical Education for Secondary Girls and College Women. New York: A. S. Barnes and Company, 1937.
- Funk and Wagnall's College Standard Dictionary of the English Language. Chicago: Wilcox and Pollett, 1943.
- Garrett, Henry E. Statistics in Psychology and Education. New York: Longman, Green and Company, 1949.
- Guildord, J. P. and Zimmerman, Wayne S. Manual of Instructions and Interpretations. Beverly Hills: Sheridan Supply Company, 1949.
- McCall, William A. Measurement. New York: The Macmillan Company, 1939.
- McCloy, Charles H. Tests and Measurements in Health and Physical Education. New York: F. S. Crofts and Company, 1944.
- Measurement and Evaluation Materials in Health, Physical Education and Recreation. Washington: National Research Section, American Association of Health, Physical Education and Recreation, 1950.

- Neilson, N. P. and Cozens, Fredrick W. Achievement Scales in Physical Education Activities for Boys and Girls In Elementary and Junior High Schools. California State Department of Education, Sacramento, 1934.
- Scott, Gladys and French, Esther. Better Teaching Through Testing. New York: A. S. Barnes and Company, 1945.
- Symonds, Percival M. Measurement in Secondary Education. New York: The Macmillan Company, 1929.
- Twigs, Erneut W. and Crawford, Claude. Statistics for Teachers. New York: Houghton Mifflin Company, 1930.
- Webster's Collegiate Dictionary. 5th ed. Springfield, Massachusetts: G. and C. Merriam Company, 1948.
- Whitney, Frederick L. The Elements of Research. New York: Prentice-Hall, Inc., 1942.

ARTICLES:

- Bassett, Gladys, Glassow, Ruth and Locks, Mildred. "Studies in Testing Volleyball Skills," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. 8, No. 4 (December, 1937), pp. 60-72.
- Dyer, Joanna T., Schurig, Jennie C. and Apgar, Sara L. "A Basketball Motor Ability Test for College Women and Secondary School Girls," Research Quarterly of the American Association for Health Physical Education and Recreation, Vol. 10, No. 3 (October, 1939), pp. 128-47.
- French, Esther and Cooper, Bernice I. "Achievement Tests in Volleyball for High School Girls," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. 8, No. 2 (May, 1937), p. 150.
- Glassow, Ruth B., Colvin, Valerie and Schwartz, Marguerite. "Studies in Measuring Basketball Playing Ability of College Women," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. 11, No. 4 (October, 1939), pp. 43-56.
- Gulick, Luther H. "Measurements as Applied to School Hygiene," American Physical Education Review, Vol. 16, No. 4 (April, 1911), p. 239.

- Hewitt, Jack E. "Improving the Construction of the Essay and Objective New Type Examination," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. 10, No. 3 (October, 1939), p. 150.
- Krakower, Hyman. "Testing in Physical Education," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. 13, No. 1 (March, 1937), p. 54.
- McKenzie, R. Tait. "The Quest for Eldorado," American Physical Education Review, Vol. XVIII, No. 5 (May, 1913), p. 295.
- Russell, Naomi and Lange, Elizabeth. "Achievement Tests in Volleyball for Junior High School Girls," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. XI, No. 4 (December, 1940), pp. 33-41.
- Schwartz, Helen. "Knowledge and Achievement Tests in Girls' Basketball on the Senior High School Level," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. 8, No. 1 (March, 1937), pp. 143-56.
- Snell, Catherine. "Physical Education Knowledge Tests," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. 7, No. 1 (March, 1936), pp. 73-82.
- Young, Genevieve and Moser, Helen. "A Short Battery of Tests to Measure Playing Ability in Women's Basketball," Research Quarterly of the American Association for Health, Physical Education and Recreation, Vol. 4, No. 2 (May, 1934), pp. 2-23.