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A Study of Reliability of the AAHPER Youth Fitness Test as Applied to Male Visually Handicapped Students at the North Dakota State School for the Blind

David P. Shyiak

A STUDY OF THE RELIABILITY OF THE AAHPER YOUTH FITNESS TEST AS APPLIED TO MALE VISUALLY HANDICAPPED STUDENTS AT THE NORTH DAKOTA STATE SCHOOL FOR THE BLIND

by

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A STUDY OF THE RELIABILITY OF THE AAHPER YOUTH FITNESS TEST AS APPLIED TO MALE VISUALLY HANDICAPPED STUDENTS AT THE NORTH DAKOTA STATE SCHOOL FOR THE BLIND

David P. Shyiak, Master of Science

The University of North Dakota, 1970

Faculty Advisor: Professor Koenig

The lack of physical fitness exhibited by American youth as compared to European youth has prompted the development of the AAHPER Youth Fitness Test to assay the physical fitness of children in the public schools. This test is being administered to thousands of public school children every year. Today, over sixty percent of the visually handicapped students are receiving their education in the schools of the communities where they live. The AAHPER Youth Fitness Test has been found to be reliable when administered to normal children. This study was formulated to determine the reliability of the AAHPER Youth Fitness Test as applied to visually handicapped children.

The total male population between the ages of ten and eighteen, at the North Dakota State School for the Blind, was administered the AAHPER Youth Fitness Test on a test-retest basis. The two test dates were one week apart so that the subject's physical condition should not have changed appreciably. Using Spearman's Rank-Difference Correlation, a correlation coefficient was established for each test item. The null hypothesis stated that the reliability of the AAHPER Youth Fitness Test would be zero. The alternate hypothesis was that

if the coefficients were above the designated level of significance, the items were related. The .01 level of significance was used in accepting or rejecting the null hypothesis.

The rank order reliability coefficients obtained were 0.60 for the sit-up, 0.93 for the shuttle run, 0.99 for the standing broad jump, 0.98 for the pull-up, 0.97 for the 50-yard dash, 0.87 for the 600-yard run-walk, and 0.98 for the softball throw for distance. The rank order reliability coefficient obtained in the sit-up test item was not significant at the .01 level. All other reliability coefficients were found to be significant.

This thesis submitted by David P. Shyiak in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota is hereby approved by the Faculty Advisory Committee under whom the work has been done.

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Permission

Title A STUDY OF THE RELIABILITY OF THE AAHPER YOUTH FITNESS TEST AS APPLIED TO MALE VISUALLY HANDICAPPED STUDENTS AT THE NORTH DAKOTA STATE SCHOOL FOR THE BLIND

Department Physical Education

Degree Master of Science

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Date May 21, 1970

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ABSTRACT

The lack of physical fitness exhibited by American youth as compared to European youth has prompted the development of the AAHPER Youth Fitness Test to assay the physical fitness of children in the public schools. This test is being administered to thousands of public school children every year. Today, over sixty percent of the visually handicapped students are receiving their education in the schools of the communities where they live. The AAHPER Youth Fitness Test has been found to be reliable when administered to normal children. This study was formulated to determine the reliability of the AAHPER Youth Fitness Test as applied to visually handicapped children.

The total male population between the ages of ten and eighteen, at the North Dakota State School for the Blind, was administered the AAHPER Youth Fitness Test on a test-retest basis. The two test dates were one week apart so that the subject's physical condition should not have changed appreciably. Using Spearman's Rank-Difference Correlation, a correlation coefficient was established for each test item. The null hypothesis stated that the reliability of the AAHPER Youth Fitness Test would be zero. The alternate hypothesis was that if the coefficients were above the designated level of significance, the items were related. The .01 level of significance was used in accepting or rejecting the null hypothesis.

The rank order reliability coefficients obtained were 0.60 for the sit-up, 0.93 for the shuttle run, 0.99 for the standing broad jump, 0.98 for the pull-up, 0.97 for the 50-yard dash, 0.87 for the 600-yard run-walk, and 0.98 for the softball throw for distance. The rank order reliability coefficient obtained in the sit-up test item was not significant at the .01 level. All other reliability coefficients were found to be significant.

CHAPTER I

INTRODUCTION

Nature of the Problem

The physical fitness of the youth of America has received much attention in the last two decades. This interest, on the part of a few people, has brought about national interest. The sources of the current importance placed on fitness are (1) the number of draftee rejections during World War II and the Korean War, and (2) a study by Kraus and Hirschland, which disclosed that the "muscular fitness" of American youth compared unfavorably with that of European youth (Hasche, 1967). As a result of these findings, a chain of events was unleashed that resulted in the formation of President Eisenhower's Council on Youth Fitness in July of 1956 (AAHPER, 1956). As an aftermath of the Council, the American Association for Health, Physical Education, and Recreation (AAHPER) developed a Youth Fitness Test in 1957, (AAHPER, 1958) to determine the fitness of American youth in most educational institutions.

In view of the importance placed on the physical fitness of youth, the logical place to begin such an important program is in the schools. The curriculum of all schools should provide an equal opportunity for all students to improve their levels of physical fitness through their physical education programs.

Twenty years ago, ten percent of the visually handicapped were being educated in the public schools of the United States. Today, over sixty percent of the visually impaired children are receiving their education in the schools of the community where they live (Buell, 1967). Ever since the development of the AAHPER Youth Fitness Test, schools across the nation have been using this test as a measure of physical fitness.

Numerous studies have been done on the reliability of the Youth Fitness Test as applied to normal children. There have been some studies done on the validity of this test for visually handicapped students, but this researcher has been unable to locate any studies done on the reliability of this test as applied to visually handicapped students. It is felt that there is a need for this type of study since hundreds of visually handicapped students are being administered this fitness test every year.

It is intended that this study will provide physical educators of the visually handicapped with preliminary evidence to show that the items of this test are or are not reliable when administered according to the procedures outlined in the Youth Fitness Test Manual. Physical educators of the visually handicapped will profit by assaying the results of this study.

Definition of Terms

AAHPER: American Association for Health, Physical Education, and Recreation.

Physical fitness: the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to

enjoy leisure-time pursuits and to meet unforeseen emergencies (Clarke, 1959).

Reliability: consistency or stability of measuring in a test-retest situation.

Visually handicapped individual: one who has no sight or whose sight is, or is likely to become, so defective that he may require education by methods not involving the use of sight, or by the use of partial sight. (Wallace, 1959)

Limitations

The following limitations must be taken into consideration when interpreting the results of this study:

1. Such factors as heat, light, and humidity will have affected the results of performance on certain test items, especially the softball throw for distance which was administered outdoors.

2. Conditions such as the momentary attitudes of the subjects will have affected the results of the study to some extent.

3. Previous testing experiences on the part of the subjects were not taken into consideration.

4. The diet, sleep, and daily habits of each individual were not controlled.

Delimitations

1. This study was directly concerned with physical fitness testing and was adapted for the indoor and outdoor facilities at the University of North Dakota and the North Dakota State School for the Blind.

2. The study was delimited to the total male population between the ages of ten and eighteen, at the North Dakota State School for the Blind.

3. The test-retest was administered during a two week period. The subjects were administered the sit-up, standing broad jump, and softball throw for distance test items on three consecutive days. The retest was administered one week later in the same order. The subjects were administered the pull-up, shuttle run, 50-yard dash, and 600-yard run-walk test items in one day, with the retest administered in the same order one week later.

4. Standard procedures and equipment were used by the testers during each day of the testing. Testing of each subject was done at the same time each day for the test and the retest.

Review of the Related Literature

Many studies have been made and many articles have been written concerning the physical fitness of the youth of this nation. The interest in physical fitness received its impetus from tests made by Kraus and Hirschland (1954) who tested more than four thousand United States children from both rural and urban communities and compared their achievement with more than three thousand European children. The results of this study showed that only 8.7 percent of the European children failed one or more of the tests, while 57.9 percent of the American children failed one or more of the tests.

The research studies of Kraus and associates caused the American Association for Health, Physical Education, and Recreation to hold a conference to determine specific steps which the physical education

profession might take to improve the level of fitness among American youth. One important result of this national meeting was to set in motion the AAHPER Youth Fitness Project, an attempt to measure and improve the fitness of this country's boys and girls.

The AAHPER Youth Fitness Test is a battery of seven test items designed to give a measure of physical fitness for both boys and girls. The tests were selected to evaluate specific aspects of physical status which, taken together, give an over-all picture of one's general fitness.

The test battery includes seven items which can be given in the gymnasium or outdoors. They are: pull-ups - for judging arm and shoulder girdle strength; sit-ups - for judging efficiency of abdominal and hip flexor muscles; shuttle run - for judging speed and change of direction; standing broad jump - for judging explosive power of leg extensors; 50-yard dash - for judging speed; softball throw for distance - for judging skill and coordination; and the 600-yard run-walk - for judging cardiovascular efficiency. The test purports to measure elements of strength, agility, and endurance, as well as proficiency in running, jumping, and throwing (AAHPER, 1958).

The AAHPER physical fitness test was adopted immediately and used by physical education teachers in schools throughout the country. The test has become a technique for improving physical fitness as well as stimulation for broadening and enriching the opportunities for physical activities in the public schools. Due to results of fitness testing, programs of health education, physical education, and recreation, around the country have been strengthened. It is estimated that

the AAHPER Youth Fitness Test has been administered to millions of boys and girls throughout the United States (AAHPER, 1958).

Today in the United States there are over 18,000 children who are so visually handicapped that they read either Braille or large-type books to gain their education. About sixty percent of them are attending public schools, while the rest are attending residential schools for the blind. A conservative estimate is that two-thirds of the more than 18,000 visually handicapped children attending public schools are not being offered any vigorous activity (Buell, 1969). When one considers the physical fitness of the youth of the nation, one must consider the handicapped individuals as well.

From the current literature and research available, people have become aware of the glaring reality, that physical fitness can give benefits to all individuals at all age levels. The earlier one becomes fit, the more one will enjoy life. To illustrate the diverse nature of physical fitness, Carolyn and Karl Bookwalter (1956) reported a research study which involved ten strong and ten weaker boys from their childhood through adolescence:

> At the end of adolescence, the stronger boys were rated superior to the weaker boys in physical strength, size, early maturity, proficiency in athletics, high popularity, social prestige, and good emotional adjustment.

Bergquist (1961) attempted to determine the physical education practices in North Dakota. After reviewing vast amounts of current literature, Bergquist concluded that the fitness levels of the nation in general, were quite low. For North Dakota, Bergquist tested students in two schools using two different fitness tests. In one school he used the AAHPER Youth Fitness Test and in the other he used the

Minnesota Physical Efficiency Test. Bergquist concluded that the students involved in these tests were lacking in fitness. He recommended, among other things, a more vigorous program of activities designed to promote physical fitness in the high schools.

Kaufman (1960) stated that physical educators should include physical fitness as a primary objective in their physical education programs. Physical educators and their programs must accept the responsibility of the physical aspects of the growth and development of young people. When a pupil has been identified as being physically underdeveloped, the physical educator should do extra work with him to improve his physical capacity.

The physical capacity of visually handicapped students has been determined to some extent in a study done by Charles Buell (1950). This study attempted to measure gross motor performance of the blind and partially seeing children by means of administering a battery of tests, including the 50-yard dash, basketball throw for distance, standing broad jump, and the Iowa Brace Test. The tests were administered to 865 children in twelve residential schools and eight Braille classes. Mean performances of the visually handicapped were compared with norms for seeing children. Comparisons were made by obtaining means, standard deviations, probable errors, and significance of difference of the means. Some of the conclusions drawn from this study included:

1. On all levels of the Iowa Brace Test, the scores of the visually handicapped fall far below those of seeing children.

2. In most track and field events, mean scores for pupils in schools for the blind fall far below those for seeing children.

The visually handicapped score lowest in the basketball throw for distance and perform significantly better in running than in throwing events.

3. The weakness of the visually handicapped in track and field events is a result of limited physical activity before entering school. This is caused by lack of vision and parental over-protection.

4. In comparison with the seeing, children with defective vision perform just as consistently in track and field events. Correlation coefficients between trials are over .90 for the visually handicapped.

5. In the Iowa Brace Test, there is little difference between the scores of the blind and the partially seeing at the high school level and the junior high school.

6. Children who lose their vision after six years of age do not have as much difficulty in adjusting to physical activities as do those blind from early childhood.

Various studies on the physical fitness of visually handicapped children have been conducted over the last twenty years. In general, these test results indicated that the performance of blind youngsters is equal to that of sighted children in pull-ups, sit-ups, squat-thrusts, and standing broad jump. Visually handicapped children perform far below the average in the 50-yard dash and the 600-yard run-walk. The weakest event for sightless children is throwing, particularly a softball. These weaknesses in running and throwing are probably due to the fact that sight plays an important role in learning and performing these skills (Buell, 1966).

During the school year 1961-62, the AAHPER Youth Fitness Test was administered to 1400 students in eighteen residential schools for the blind and five public school classes. The test results indicated that the performance of the blind youngster was poorer than that of the sighted youngster in the 50-yard dash and softball throw for distance, and his performance was better than his sighted peer group in the squat thrust and sit-up tests. Test scores of both groups in the pull-up and broad jump were about equal. The results of this survey indicate that about fifty percent of the youngsters tested were found to be physically underdeveloped. Blind children, like sighted children, need to be provided with more opportunities for experiences and activities which require vigorous physical exercise (American Association of Instructors of the Blind, 1962).

If physical fitness testing is to be done in the schools, Kendall (1956) suggested that certain criteria are to be satisfied in a good fitness test. There should be evidence of reliability and validity, ease of administration, economy of time, standardization of directions, and availability of norms. Tests should also measure important abilities, be interesting and meaningful, be of suitable difficulty, and the factor of safety should be given thoughtful consideration.

Several procedures for establishing reliability were investigated. The three types of reliability are the coefficient of equivalence, the coefficient of stability, and the coefficient of equivalence and stability. The coefficient of stability is the test-retest coefficient which was used in this study.

Reliability is defined by H. Harrison Clarke (1959) in his text concerning measurement in physical education. Clarke stated that there are three major factors that influence the reliability of a measure. They are (1) the randomness of the sample, (2) the size of the sample, and (3) the variability of the distribution. In justifying reliability after it has been measured, Clarke suggested that physical tests should have a minimum reliability coefficient of approximately 0.90.

The reliability of the AAHPER Youth Fitness Test, as administered to normal children, has been established in previous studies. In a study on reliability and efficiency of performance measures, Klesius (1968) determined the reliability coefficients for all seven test items. Rothermal, Pollock, and Cureton (1968), at the University of Illinois, established reliability coefficients for the AAHPER fitness test items in determining whether test scores change after an eight week sports and fitness program. These reliability coefficients are listed in Table 1.

TABLE 1

RELIABILITY COEFFICIENTS OF THE AAHPER YOUTH FITNESS TEST ITEMS

Test Item	Reliability Coefficients	
	Klesius	Rothermal et al.
Sit-up	0.85	0.86
Pull-up	0.95	0.80
Standing broad jump	0.98	0.95
Shuttle run	0.91	0.86
50-yard dash	0.94	0.94
Softball throw for distance	0.98	0.97
600-yard run-walk	0.94	0.92

Edwin A. Fleishman (1964) in his Examiner's Manual for Fitness Tests, discussed the reliability of four of the items that are included in the AAHPER Youth Fitness Test. These coefficients reflected the extent to which repeated administrations of the test, ranked these high school students in the same order of performance. The reliability coefficients of the four test items were found to be: (1) sit-up 0.72, (2) shuttle run 0.85, (3) pull-up 0.93, and (4) 600-yard run-walk 0.80. It should be stressed that these reliability coefficients are based on the administration procedures recommended in this particular manual, which were modified to improve reliability.

Soderberg (1969) administered a Modified AAHPER Fitness Test to thirty-seven male freshman college students at the University of North Dakota. All the items of this fitness test were the same as those of the AAHPER Youth Fitness Test, with the exception of the softball throw for distance which was replaced by the shot put in the Modified Fitness Test. Administering this test on a test-retest basis, Soderberg found the reliability coefficients for the test items to be as follows: sit-up 0.74, pull-up 0.91, standing broad jump 0.90, shuttle run 0.74, 50-yard dash 0.59, and the 600-yard run-walk 0.55. The reliability coefficients of the Modified AAHPER Fitness Test were found to be significant at the .01 level of significance.

The reliability of the 600-yard run-walk, as an item of the Youth Fitness Test, has been the subject of much controversy. Wilgoose, Askew, and Askew (1961) reported an identical rank order test-retest reliability of 0.92 for seventy boys and seventy-six girls at

the junior high school level. More recently, Shultz and Brigham (1965) found the Rho reliability for thirty-three sophomore boys to be 0.77 for the 600-yard run-walk. This study brought out another important point. There seems to be some question as to the selection of the proper statistic to determine reliability. Rank order does not take into account the value of each score and so is positional in nature. It is a non-parametric statistic, and therefore does not require the assumption of a normal distribution. Because of its cumbersome calculation, it is usually suggested that it only be used with fewer than twenty-five cases (Garrett, 1958). The Spearman Rank-Difference Coefficient of Correlation (r_s) was the statistic used by this researcher for establishing reliability coefficients in this study.

The International Committee on Standardization of Physical Fitness Tests (1966) has proposed some physical fitness measurement standards that will aid the reliability of a test. Some factors concerning this study deserve mentioning. It is very probable in the endurance run that the scores obtained in the test items would vary according to the amount of intensity of vocal encouragement given while the run is in progress. Also, having an individual pace another runner or runners would almost certainly affect the times. In running events, stop watch timing, even when carefully done, is subject to considerable error. Attention, interest, and effort may all contribute to results. Special importance must be placed on the degree and amount of external motivation from the tester on others. The subject must also be fully acquainted with the details of the test technique and understand clearly the objectives of the test program.

Previous studies done on physical fitness have offered suggestions that could be made to improve the administration of the AAHPER Youth Fitness Test as applied to visually handicapped children. These suggestions were not followed in this study. The results attained in this study directly apply to the methods of the AAHPER Youth Fitness Test as it was administered to visually handicapped students at the North Dakota State School for the Blind. The reliability coefficients attained in this study were used in determining the usefulness of the test.

Summary of Review of Literature

In the review of literature, the researcher has included:

1. background information on the AAHPER Youth Fitness Test,
2. research done on the physical fitness of the youth of the nation,
3. research done on the physical fitness of visually handicapped students,
4. studies done on the reliability of the test items of the AAHPER Youth Fitness Test as applied to normal children.

Fitness tests revealing the poor physical fitness of the nation's youth, led to the establishment of the AAHPER Youth Fitness Test in 1957. This test has been administered to millions of children in the public schools within the last decade.

Today, sixty percent of the visually handicapped students attend public schools throughout the nation. Many of these visually handicapped children are being administered the AAHPER Youth Fitness Test in the public schools as well in residential schools for the blind.

The AAHPER Youth Fitness Test has been found to be a reliable test for measuring physical fitness of normal children. This researcher has been unable to find any research done on the reliability of this test as applied to visually handicapped children.

The research completed in this study will prove valuable to physical educators of the visually handicapped. The results are intended for use as preliminary evidence to indicate whether this test is reliable when administered to visually handicapped students.

CHAPTER II

METHODOLOGY

Preliminary Planning and Group Selection

The data used in this study were obtained from the total male population, between the ages of ten and eighteen, at the North Dakota State School for the Blind. The subjects were administered the AAHPER Youth Fitness Test on a test-retest basis, during the fall of 1969.

Eighteen subjects, the names of which were supplied by the superintendent of the school, qualified for the study. Only sixteen of these subjects obtained scores in both the test and retest. The scores of the two subjects who did not participate in both tests were not used in the study.

Procedure

The tests were administered according to the recommendations and instructions of the American Association for Health, Physical Education, and Recreation Youth Fitness Test Manual.

The purpose of this study was explained to the subjects before they were administered the test. All subjects were stimulated to participate by being told that their test scores would be an important contribution to visually handicapped students and physical educators of the visually handicapped. No other motivational devices were used.

One fitness test item was administered to the subjects on each of three consecutive days. These items were the sit-up on Monday, standing broad jump on Tuesday, and the softball throw for distance on Wednesday. The retest was administered in the same order, one week later.

The group was administered the remaining four items of the fitness test on Saturday morning of the first week. These items were the shuttle run, pull-up, 50-yard dash, and the 600-yard run walk, respectively. The retest was given at the same time and in the same sequence one week later.

The single group design was chosen to complete the test analysis because it allows for a minimum of time between tests and thus the results would not be biased. In using this design, each of the subjects was his own control and therefore, no outside controls were necessary. With this design, paired data from two different test sessions were used to statistically compute correlation coefficients and significance levels for determining reliability (Gulsvig, 1969).

Test Administration

The physical fitness test battery included the following test items:

1. sit-ups
2. pull-ups
3. standing broad jump
4. shuttle run
5. 50-yard dash
6. softball throw for distance
7. 600-yard run-walk

Three of the test items were administered at the North Dakota State School for the Blind. The sit-up and standing broad jump test items were administered in the auditorium. The softball throw for distance was administered on the field adjacent to the boy's dormitory. The remaining four test items were administered at the University of North Dakota. The pull-up test item was administered in the apparatus gym. The shuttle run was administered in the activity gym. The 50-yard dash and the 600-yard run-walk were administered on the dirt track in the Fieldhouse Arena.

Test Assistants

All testing was under the direct supervision of this researcher. The times, measurements, and test scores were made and recorded by this researcher. Four non-participating students at the North Dakota State School for the Blind aided in the administration of the AAHPER Youth Fitness Test.

Directions for Test

A complete description of the directions for the test is presented in Appendix A, page 32.

Recording and Tabulating the Data

The data collected on each subject were recorded on individual score cards. A sample of this score card is presented in Appendix B, page 38.

Statistical Procedure

The reliability coefficients were calculated from the test-retest data. After the results of the test-retest were obtained, they

were listed on a separate sheet of paper. Using Spearman's Rank-Difference Correlation (Garrett, 1958) whereby $r_s = \frac{6\ (\ \Sigma D^2)}{N\ (N^2 - 1)}$, a correlation coefficient was established for each test item. A correction factor was incorporated into the computation of the reliability coefficients to compensate for tied ranks (Siegel, 1956).

The null hypothesis stated that the reliability of the AAHPER Youth Fitness Test, as applied to visually handicapped students, would be zero. The alternate hypothesis is that if the coefficients are above the designated level of significance, the items are related. The null hypothesis was tested by comparing the correlation coefficients to a value obtained from a table on correlation coefficients at the five percent and one percent levels of significance. Siegel (1956) described using the table for finding the values of the correlation coefficient for the two levels of significance. The degrees of freedom are equal to the number of subjects minus two, and the level of significance is .01. The correlation coefficients for reliability must be above 0.645 before the null hypothesis can be rejected. The mathematical procedures for obtaining correlation coefficients of the test items are located in Appendix C, page 40.

CHAPTER III

ANALYSIS TO DETERMINE RELIABILITY

The results obtained from the test-retest of the seven AAHPER Youth Fitness Test items were used to calculate the correlation coefficients for the reliability of the fitness test as applied to visually handicapped students. The means of the test and the retest were also calculated using these results.

The reliability coefficients that were calculated by using Spearman's Rank-Difference Correlation, are listed in Table 2.

TABLE 2

MEANS, RANK ORDER RELIABILITY COEFFICIENTS AND SIGNIFICANCE LEVELS FOR DETERMINING THE RELIABILITY OF THE AAHPER YOUTH FITNESS TEST

Test Item	Mean Test 1	Mean Test 2	r_s	Value needed for significance at the .01 level
Sit-up	93.06	95.50	0.60	.645
Shuttle Run	10.80	10.90	0.93	.645
Standing Broad Jump	68.40	68.40	0.99	.645
Pull-up	6.0	7.1	0.98	.645
50-Yard Dash	8.1	8.0	0.97	.645
600-Yard Run-Walk	2.17	2.14	0.87	.645
Softball Throw for Distance	106.40	109.30	0.98	.645

Note: Significance was determined at the .01 level for 14 degrees of freedom.

This table also contains the means that were attained. The significance factor stated in this table was determined by Siegel (1956) for validating the correlation coefficients. The test of significance was used to estimate the probability of the calculated coefficients.

Table 3, page 21, graphically presents the means from the test-retest data. It also indicates any changes and the direction of those changes that have occurred in the value of the mean.

The following material is a statement of the statistical results of the seven items of the AAHPER Youth Fitness Test. The figures for the two means and the reliability coefficients were taken from Table 2.

Sit-up

The mean calculated from the data recorded in test one for the sit-up test item was 93.06 repetitions. The test two mean was 95.50 repetitions. The correlation coefficient for reliability was found to be 0.60. The statistical analysis indicated that the sit-up test item was not reliable because the rank order reliability coefficient did not attain the value needed for significance and therefore the null hypothesis was retained at the .01 level.

Shuttle run

The two means for the test-retest of the shuttle run were 10.8 seconds for test one and 10.9 seconds for the retest. This was the only test item in which the performance of the group was not the same as or improved in the retest. The rank order reliability coefficient was found to be 0.93. The reliability coefficient is greater than the hypothetical value, therefore the null hypothesis was rejected at the .01 level.

TABLE 3

GRAPH OF MEANS FROM TEST-RETEST DATA

KEY

TEST ONE MEAN_____

TEST TWO MEAN-----

Time in seconds	Number completed	Distance in inches	Time in seconds	Number completed	Time in minutes and seconds	Distance in feet
7.5-	100.-	75.-	10.5-	10.-	2.10-	110.-
7.6-	99.-	74.-	10.6-	9.-	2.11-	109.-----
7.7-	98.-	73.-	10.7-	8.-	2.12-	108.-
7.8-	97.-	72.-	10.8_____	7.-----	2.13	107.-
7.9-	96.-----	71.-	10.9-----	6._____	2.14-----	106._____
8.0-----	95.-	70.-	11.0-	5.-	2.15-	105.-
8.1_____	94.-	69.-	11.1-	4.-	2.16-	104.-
8.2-	93._____	68.----------	11.2-	3.-	2.17_____	103.-
8.3-	92.-	67.-	11.3-	2.-	2.18-	102.-
8.4-	91.-	66.-	11.4-	1.-	2.19-	101.-
8.5-	90.-	65.-	11.5-	0.-	2.20-	100.-

SCALE

50-Yard Dash	Sit-up	Standing Broad Jump	Shuttle Run	Pull-up	600-Yard Run-Walk	Softball Throw for Distance

TEST ITEM

Standing broad jump

The mean calculated from the data recorded in test one for the standing broad jump was 68.4 inches. The test two mean was also 68.4 inches. The rank order reliability coefficient was found to be 0.99. This reliability coefficient value exceeds the hypothetical value, therefore the null hypothesis was rejected at the .01 level.

Pull-up

The mean calculated from the data recorded in test one for the pull-up was 6.0 repetitions. The test two mean was 7.1 repetitions. The reliability coefficient was found to be 0.98. This rank order reliability coefficient exceeds the hypothetical value, therefore the null hypothesis was rejected at the .01 level.

50-yard dash

The two means for the test-retest of the 50-yard dash were 8.1 seconds for test one and 8.0 seconds for the retest. The rank order reliability coefficient calculated was 0.97. This value exceeds the hypothetical value and therefore the null hypothesis was rejected at the .01 level.

600-yard run-walk

The two means for the test-retest of the 600-yard run-walk were 2 minutes, 17 seconds for test one and 2 minutes, 14 seconds for the retest. The 600-yard run-walk was found to have a rank order reliability coefficient of 0.87. This coefficient is significantly higher than the hypothetical value and therefore the null hypothesis was rejected at the .01 level.

Softball throw for distance

The mean calculated from the data recorded in test one for the softball throw for distance was 106.4 feet for test one, and 109.3 feet for the retest. The rank order coefficient of reliability of the softball throw for distance was found to be 0.98. Since this value is greater than the hypothetical value, the null hypothesis was rejected at the .01 level.

These results indicate that all of the test items of the AAHPER Youth Fitness Test, with the exception of the sit-up, are reliable as applied to visually handicapped students, because the calculated r_s value exceeded the value needed for significance. Since the calculated value was greater than the table value, the null hypothesis was rejected for all items except the sit-up. In the sit-up, the correlation value of 0.60 was less than the value needed for significance, therefore, the null hypothesis was retained.

CHAPTER IV

DISCUSSION

Fitness testing without certainty of the reliability and validity of the test may be a waste of time and effort. Physical educators would be wise to take the time necessary to verify existing tests presently in use. This would include verification of a physical fitness test that is devised for a particular program or a school district.

All reliability coefficients of the AAHPER Youth Fitness Test items, with the exception of the sit-up, were found to be significant for visually handicapped students at the .01 level, although some were much higher than others. The reliability coefficients of the standing broad jump, pull-up, 50-yard dash, softball throw for distance, and the shuttle run were 0.99, 0.98, 0.97, 0.98, and 0.93 respectively. These coefficients indicate acceptability by many standards. Clarke (1959) indicated that if reliability is to be computed by the correlation technique, the desirable relationship should be 0.90 or above. However, 0.80 would be considered a significant value.

One of the lowest reliability coefficients was attained in the 600-yard run-walk. The reliability coefficient of the 600-yard run-walk, a test of cardiovascular efficiency, was found to be 0.87. The 600-yard run-walk coefficient was lower than some of the other test items because of the motivational factors involved. Although the subjects were instructed to do their best in this test item, many subjects

were reluctant to put forth their maximum effort. The two means established for the test-retest of the 600-yard run-walk show an improvement in performance on the retest. This improvement was due to the fact that certain individuals learned to pace themselves after having run in the previous test.

The sit-up test item is an efficiency test of the abdominal and hip flexor muscles. The coefficient correlation for this test item was established as 0.60, which was the lowest reliability coefficient attained. This was an interesting statistic. The mean of test one was 93.06 repetitions and the mean of test two was 95.50 repetitions. One might think that means this close would support a substantially higher correlation value. However, the correlation coefficient seemed to refute the closeness of the means. A correlation like this would be calculated when the subjects score differently during the two testing periods. Some of the subjects scored better the first test period and some had a higher test score on the retest. The calculated means were almost identical but because of the difference in scoring of the subjects, the correlation value was low.

This researcher found through experimentation, that by having a subject score high on the first test and low on the retest, the correlation coefficient would drop to a minus value. The exact value would depend on the number of subjects and the rank each subject attained. This indicates the importance of administering the test to the subjects under the same conditions for the test and the retest. A subject who is suffering from fatigue, emotional problems, or an illness, would certainly score lower than normal on either the test

or the retest. The scores obtained by this individual would greatly affect the computation of a reliability coefficient correlation. It would be well worthwhile for researchers to keep this in mind.

The directions as outlined in the Youth Fitness Test Manual, indicated that the subject is not to exceed one-hundred sit-ups. This resulted in a great number of tied ranks. The rank order reliability coefficient as established by using the correction factor for ties, was 0.60. The rank order reliability coefficient as established by not using the correction factor for ties, was 0.81. This test item administered according to the directions in the Youth Fitness Test Manual, is not reliable. The sit-up test item could possibly be made more reliable by not imposing a maximum limit upon the number of sit-up repetitions to be performed.

The two means for the test-retest of the shuttle run were 10.8 seconds for test one and 10.9 seconds for the retest. This was the only test item in which the performance of the group was lower in the retest. This was due to the lighting in the gymnasium on the day of the retest. There were two light bulbs that were not functioning, directly above the shuttle run area. The visually handicapped students with partial vision, had difficulty in perceiving the blocks as well as the line markers on this particular day.

The related literature reveals that running and particularly throwing events are the weakest for visually handicapped children. Since it has no practical value, it has been suggested (Buell, 1966) that the softball throw for distance be replaced by the basketball throw for distance as a test item for the visually handicapped. This researcher, in conducting an earlier experiment on throwing, found

that visually handicapped students improved significantly in the softball throw for distance after participating in a four-week softball unit. This would indicate that the softball throw for distance test item should not be replaced in the AAHPER Youth Fitness Test when administered to the visually handicapped. These students should be taught the fundamentals of throwing so that they will understand the act.

A review of related literature also revealed that, with the exception of the sit-up, the reliability coefficients which were calculated from the results of this study, closely approximated reliability data reported in previous investigations on normal children.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The lack of physical fitness exhibited by American youth as compared to European youth has prompted the development of the AAHPER Youth Fitness Test to assay the physical fitness of children in the public schools. This test is being administered to thousands of public school children every year. Today over sixty percent of the visually handicapped students are receiving their education in the schools of the communities where they live. The AAHPER Youth Fitness Test has been found to be reliable when administered to normal children. This study was formulated to determine the reliability of the AAHPER Youth Fitness Test as applied to visually handicapped children.

The total male population between the ages of ten and eighteen, at the North Dakota State School for the Blind, were administered the AAHPER Youth Fitness Test on a test-retest basis. The two test dates were one week apart so that the subject's physical condition should not have changed appreciably. Using Spearman's Rank-Difference Correlation, a correlation coefficient was established for each test item. The null hypothesis stated that the reliability of the AAHPER Youth Fitness Test would be zero. The alternate hypothesis was that if the coefficients were above the designated level of significance, the

items were related. The .01 level of significance was used in accepting or rejecting the null hypothesis.

The rank order reliability coefficients obtained were 0.60 for the sit-up, 0.93 for the shuttle run, 0.99 for the standing broad jump, 0.98 for the pull-up, 0.97 for the 50-yard dash, 0.87 for the 600-yard run-walk, and 0.98 for the softball throw for distance. The rank order reliability coefficient obtained in the sit-up test item was not significant at the .01 level. All other rank order reliability coefficients were found to be significant.

Conclusions

Within the limitations, delimitations, and assumptions of this study, the following conclusions appeared to be justified:

1. All the test items, with the exception of the sit-up, proved to be reliable measures of physical fitness as applied to male visually handicapped students between the ages of ten and eighteen.

2. The reliability coefficients established for the visually handicapped in this study, compare favorably with the reliability coefficients established for normal children in previous studies.

Recommendations

The following recommendations are suggested as a result of this study:

1. The reliability of the sit-up test item was calculated as 0.60, the lowest reliability coefficient established. The reliability coefficient of this test item was also low as calculated in previous studies on normal children. These results indicate that this item

as it is employed in the AAHPER Youth Fitness Test, measures the efficiency of abdominal and hip flexor muscles in an inaccurate manner, and weakness of these muscles can go undetected. The bent knee sit-up would correct this problem if used in the AAHPER Youth Fitness Test.

2. The rank order reliability coefficient obtained for the sit-up test item was not significant at the .01 level. The sit-up test item could possibly be made more reliable by not imposing a maximum limit upon the number of sit-up repetitions to be performed.

3. Spearman's Rank-Difference Correlation is the proper statistic to employ when working with fewer than twenty-five subjects. This was previously suggested by Shultz and Brigham, and Garrett.

4. The shuttle run test item for visually handicapped children could be highly unreliable. After experimentation, Buell (1966) has suggested modifications that could be made in the shuttle run for visually handicapped children. Instead of picking up blocks, visually handicapped children could touch the ground. A sighted child stands about three feet behind one line and the timer stands the same distance behind the starting and finishing line. The student shouts to give the visually handicapped runner direction and the timer does the same on the return trip. The timer also tells the runner when to touch the ground and return. This modification would insure the reliability of the shuttle run test item.

5. Further research should be done on the performance of visually handicapped children at the North Dakota State School for the Blind, with respect to norms as set up by Charles Buell (1966) for visually handicapped children.

6. Further research should be done to determine whether the administrative procedures recommended by the Youth Fitness Test Manual to evaluate performance, are justifiable for visually handicapped children.

APPENDIX A

DIRECTIONS FOR TEST

Sit-ups

Starting Position

The pupil lies on his back with legs extended, feet about one foot apart. The hands, with fingers interlaced, are grasped behind the neck. The other pupil holds his partner's ankles and keeps his heels in contact with the floor while counting each successful sit-up.

Action

1. The fingers must remain in contact behind the neck throughout the exercise.
2. The knees must be on the floor during the sit-up but may be slightly bent when touching elbow to knee.
3. The back should be rounded and the head and elbows brought forward when sitting up as a "curl" up.
4. When returning to a starting position, elbows must be flat on the mat before sitting up again.
5. The pupil should do as many sit-ups as he can, but not exceed the maximum limit which is 100 for boys.
6. One complete sit-up is counted each time the pupil returns to the starting position.

Pull-ups

Equipment

A bar of sufficient height and comortable to grip is required.

Starting Position

The bar is grasped with palms facing forward; the pupil hangs with his arms and legs fully extended. His feet must be free of the floor. The partner stands slightly to one side of the pupil being tested and counts each successful pull-up.

Action

1. The body is pulled with the arms until the chin is placed over the bar.
2. The body is lowered until the elbows are fully extended.
3. The exercise is repeated as many times as possible.

Rules

1. The pull must not be a snap movement.
2. The knees must not be raised.
3. Kicking the legs is not permitted.
4. The body must not swing. If the pupil starts to swing, his partner stops the motion by holding an extended arm across the pupil's thighs.
5. One complete pull-up is counted each time the pupil places his chin over the bar.

Standing Broad Jump

Equipment

Any level surface and a tape measure comprise the equipment.

Starting Position

The pupil stands with the feet comfortably apart, with the toes just behind the take-off line. Preparatory to jumping, the pupil should have his knees flexed and should swing the arms backward. The jump is

accomplished by simultaneously extending the knees and swinging the arms forward.

Action

The pupil jumps, swinging the arms forcefully forward and upward, taking off from the balls of the feet.

Rules

1. Three trials are allowed.
2. The distance is measured from the take-off line to the heel or any part of the body that touches the surface nearest the take-off line.
3. The best of three trials is recorded in feet and inches to the nearest inch.

Shuttle Run

Equipment

Two blocks of wood, 2 x 2 x 4 inches (blackboard erasers may be used) and a stopwatch are needed. Two parallel lines 30 feet apart are marked. The blocks of wood are placed behind one of the lines.

Starting Position

The pupil stands behind the line opposite the blocks ready to run.

Action

On the signal, "Ready?" "Go!" the pupil runs to the blocks, picks up one, returns and places it behind the starting line. He does not throw or drop it. He then runs and picks up the second block and carries it back across the starting line.

Rules

1. Two trials are allowed.
2. Any trial in which the block is thrown or dropped is disqualified.

3. The better of the two trials is recorded in seconds to the nearest tenth.

50-yard Dash

Equipment

A stopwatch is needed.

Starting Position

The pupil stands behind the starting line. The starter takes a position at the finish line with a stopwatch. He raises one hand preparatory to giving the starting signal.

Action

The starter uses the command "Are you ready?" "Go!" and brings his hand down simultaneously. The pupil leaves his mark. As the pupil crosses the finish line, the time is noted and recorded.

Rules

1. The score is the lapsed time between the starter's signal and the instant the pupil crosses the finish line.
2. The time is recorded in seconds to the nearest tenth.

Softball Throw for Distance

Equipment

A softball and a tape measure are needed.

Starting Position

The pupil throws the ball while remaining within two parallel lines, six feet apart.

Rules

1. Only an overhand throw may be used.
2. Three throws are allowed.

3. The distance recorded is the distance measured at right angles from the point of landing to the restraining line.

600-yard Run-Walk

Equipment

A stopwatch, and running area with designated starting and finishing lines are required.

Starting Position

The pupil stands behind the starting line.

Action

On the signal, "Ready?" "Go!" the pupil starts running the six hundred yard distance (walking only if necessary).

Rules

1. Walking is permitted, but the object is to cover the distance in the shortest possible time.
2. The time is recorded in minutes and seconds.

   Note: It is possible to have a dozen pupils run at one time by having the pupils pair off before the start of the event. Each pupil then listens for and remembers his partner's time as the latter crosses the finish line. The timer merely calls out the times as the pupils cross the finish line.

APPENDIX B

AAHPER YOUTH FITNESS TEST

PERSONAL FITNESS RECORD

PERSONAL DATA

	Trial 1	Trial 2
Age (in months)	_____	_____
Height (in inches)	_____	_____
Weight	_____	_____
Classification	_____	_____

	Trial 1		Trial 2	
	Date_____		Date_____	
	Score	Rank	Score	Rank
Pull-Ups	_____	_____	_____	_____
Sit-Ups	_____	_____	_____	_____
Shuttle Run	_____	_____	_____	_____
Standing Broad Jump	_____	_____	_____	_____
50-Yard Dash	_____	_____	_____	_____
Softball Throw For Distance	_____	_____	_____	_____
600-Yard Run-Walk	_____	_____	_____	_____

APPENDIX C

TABLE 4

RELIABILITY COEFFICIENT OF THE SIT-UP

Subject Number	Sit-ups Test 1	Sit-ups Test 2	Rank Test 1	Rank Test 2	Rank Difference	D^2
1	100	100	6.5	7.5	-1.0	1.0
2	100	100	6.5	7.5	-1.0	1.0
3	100	100	6.5	7.5	-1.0	1.0
4	100	100	6.5	7.5	-1.0	1.0
5	100	100	6.5	7.5	-1.0	1.0
6	100	100	6.5	7.5	-1.0	1.0
7	100	100	6.5	7.5	-1.0	1.0
8	100	100	6.5	7.5	-1.0	1.0
9	100	100	6.5	7.5	-1.0	1.0
10	100	100	6.5	7.5	-1.0	1.0
11	100	100	6.5	7.5	-1.0	1.0
12	100	100	6.5	7.5	-1.0	1.0
13	86	85	13	15	-2.0	4.0
14	83	100	14	7.5	6.5	42.25
15	70	43	15	16	-1.0	1.0
16	50	100	16	7.5	8.5	72.25
					ΣD^2 =	131.50

(a) $r_s = \dfrac{\Sigma X^2 + \Sigma Y^2 - \Sigma D^2}{2\sqrt{\Sigma X^2\ \Sigma Y^2}}$

(b) $r_s = \dfrac{196.17 + 112.50 - 131.50}{2(148.56)}$

(c) $r_s = \dfrac{177.17}{297.12}$

(d) $r_s = .60$*

*The correction factor was used to compensate for the large number of tied ranks. If the correction factor were not used, r_s is computed at .81.

TABLE 5

RELIABILITY COEFFICIENT OF THE SHUTTLE RUN

Subject Number	Shuttle Run Test 1	Shuttle Run Test 2	Rank Test 1	Rank Test 2	Rank Difference	D^2
1	9.0	9.4	1	3	-2.0	4.00
2	9.1	8.9	2.5	1	1.5	2.25
3	9.1	9.2	2.5	2	0.5	0.25
4	9.3	9.6	4	4	0.0	0.00
5	9.5	9.7	5	5	0.0	0.00
6	9.9	10.5	6	8	-2.0	4.00
7	10.0	10.1	7	6	1.0	1.00
8	10.5	11.0	8	12	-4.0	16.00
9	10.7	10.9	9	10.5	-1.5	2.25
10	10.8	10.7	10.5	9	1.5	2.25
11	10.8	10.4	10.5	7	3.5	12.25
12	11.0	10.9	12	10.5	1.5	2.25
13	12.0	11.9	13	13	0.0	0.00
14	13.0	12.8	14	14	0.0	0.00
15	13.3	13.5	15	15	0.0	0.00
16	14.2	14.5	16	16	0.0	0.00
					ΣD^2 =	46.50

(a) $r_s = 1 - \frac{6(\Sigma D^2)}{N(N^2 - 1)}$

(b) $r_s = 1 - \frac{6(46.50)}{16(255)}$

(c) $r_s = 1 - \frac{279}{4080}$

(d) $r_s = 1 - .07$

(e) $r_s = .93$

TABLE 6

RELIABILITY COEFFICIENT OF THE STANDING BROAD JUMP

Subject Number	Standing Broad Jump Test 1	Standing Broad Jump Test 2	Rank Test 1	Rank Test 2	Rank Difference	D^2
1	7'5"	7'6"	1	2	-1.0	1.00
2	7'4"	7'8"	2	1	1.0	1.00
3	7'1"	6'11"	3	3	0.0	0.00
4	6'10"	6'8"	4	4	0.0	0.00
5	6'4"	6'5"	5	5	0.0	0.00
6	6'1"	6'0"	6	7.5	-1.5	2.25
7	6'0"	6'0"	7	7.5	-0.5	0.25
8	5'11"	6'2"	8	6	2.0	4.00
9	5'8"	5'9"	9	9.5	-0.5	0.25
10	5'6"	5'9"	10	9.5	0.5	0.25
11	5'5"	5'6"	11	11	0.0	0.00
12	5'0"	4'11"	12	12	0.0	0.00
13	4'6"	4'6"	13	13	0.0	0.00
14	4'5"	4'4"	14	14	0.0	0.00
15	3'8"	3'7"	15	15.5	-0.5	0.25
16	3'3"	3'7"	16	15.5	0.5	0.25
					ΣD^2 =	9.50

(a) $r_s = 1 - \frac{6(\Sigma D^2)}{N(N^2 - 1)}$

(b) $r_s = 1 - \frac{6(9.50)}{16(255)}$

(c) $r_s = 1 - \frac{57}{4080}$

(d) $r_s = 1 - .01$

(e) $r_s = .99$

TABLE 7

RELIABILITY COEFFICIENT OF THE PULL-UP

Subject Number	Pull-ups Test 1	Pull-ups Test 2	Rank Test 1	Rank Test 2	Rank Difference	D^2
1	15	17	1	1	0.0	0.00
2	14	13	2	2	0.0	0.00
3	11	12	3	3	0.0	0.00
4	10	11	4.5	4	0.5	0.25
5	10	10	4.5	6	-1.5	2.25
6	8	10	6.5	6	0.5	0.25
7	8	8	6.5	8	-1.5	2.25
8	6	7	9	9.5	-0.5	0.25
9	6	7	9	9.5	-0.5	0.25
10	6	10	9	6	3.0	9.00
11	1	6	11.5	11	0.5	0.25
12	1	3	11.5	12	-0.5	0.25
13	0	0	14.5	14.5	0.0	0.00
14	0	0	14.5	14.5	0.0	0.00
15	0	0	14.5	14.5	0.0	0.00
16	0	0	14.5	14.5	0.0	0.00
					ΣD^2 =	15.00

(a) $r_s = 1 - \frac{6(\Sigma D^2)}{N(N^2 - 1)}$

(b) $r_s = 1 - \frac{6(15.00)}{16(255)}$

(c) $r_s = 1 - \frac{90}{4080}$

(d) $r_s = 1 - .02$

(e) $r_s = .98$

TABLE 8

RELIABILITY COEFFICIENT OF THE 50-YARD DASH

Subject Number	50-yard Dash Test 1	50-yard Dash Test 2	Rank Test 1	Rank Test 2	Rank Difference	D^2
1	6.2	6.3	1	1	0.0	0.00
2	6.4	6.5	2	3.5	-1.5	2.25
3	6.5	6.5	3.5	3.5	0.0	0.00
4	6.5	6.4	3.5	2	1.5	2.25
5	6.6	6.6	5	5	0.0	0.00
6	7.3	7.2	6	6.5	-0.5	0.25
7	7.4	7.3	7	8	-1.0	1.00
8	7.5	7.6	8	10	-2.0	4.00
9	7.6	7.6	10	10	0.0	0.00
10	7.6	7.6	10	10	0.0	0.00
11	7.6	7.2	10	6.5	3.5	12.25
12	8.2	8.4	12	12	0.0	0.00
13	9.8	9.9	13	13	0.0	0.00
14	10.0	10.0	14	14	0.0	0.00
15	10.5	10.5	15	15	0.0	0.00
16	13.1	13.0	16	16	0.0	0.00
					ΣD^2 =	22.00

(a) $r_s = 1 - \frac{6(\Sigma D^2)}{N(N^2 - 1)}$

(b) $r_s = 1 - \frac{6(22.00)}{16(255)}$

(c) $r_s = 1 - \frac{132}{4080}$

(d) $r_s = 1 - .03$

(e) $r_s = .97$

TABLE 9

RELIABILITY COEFFICIENT OF THE 600-YARD RUN-WALK

Subject Number	600-yard Run-walk Test 1	600-yard Run-walk Test 2	Rank Test 1	Rank Test 2	Rank Difference	D^2
1	1:42	1:53	1	5	-4.0	16.00
2	1:47	1:45	2	2.5	-0.5	0.25
3	1:54	1:55	3	7	-4.0	16.00
4	1:55	1:45	4.5	2.5	2.0	4.00
5	1:55	1:54	4.5	6	-1.5	2.25
6	1:56	1:42	7	1	6.0	36.00
7	1:56	1:50	7	4	3.0	9.00
8	1:56	1:56	7	8	-1.0	1.00
9	1:59	2:02	9	9	0.0	0.00
10	2:08	2:03	10	10	0.0	0.00
11	2:17	2:21	11	12	-1.0	1.00
12	2:22	2:15	12	11	1.0	1.00
13	2:44	2:41	13	13	0.0	0.00
14	3:03	2:56	14	14	0.0	0.00
15	3:15	3:12	15	15	0.0	0.00
16	3:42	3:33	16	16	0.0	0.00
					ΣD^2 =	86.50

(a) $r_s = 1 - \frac{6(\Sigma D^2)}{N(N^2 - 1)}$

(b) $r_s = 1 - \frac{6(86.50)}{16(255)}$

(c) $r_s = 1 - \frac{519}{4080}$

(d) $r_s = 1 - .13$

(e) $r_s = .87$

TABLE 10

RELIABILITY COEFFICIENT OF THE SOFTBALL THROW FOR DISTANCE

Subject Number	Softball Throw for Distance Test 1	Softball Throw for Distance Test 2	Rank Test 1	Rank Test 2	Rank Difference	D^2
1	190	200	1	1	0.0	0.00
2	172	168	2	2	0.0	0.00
3	152	155	3	3	0.0	0.00
4	150	152	4	4	0.0	0.00
5	135	146	5	5	0.0	0.00
6	132	138	6	6	0.0	0.00
7	115	112	7	7	0.0	0.00
8	110	105	8	9	-1.0	1.00
9	103	107	9	8	1.0	1.00
10	94	96	10	10	0.0	0.00
11	83	93	11	12	-1.0	1.00
12	80	95	12	11	1.0	1.00
13	65	70	13	13	0.0	0.00
14	42	35	14	16	-2.0	4.00
15	41	38	15	14.5	0.5	0.25
16	40	38	16	14.5	1.5	2.25
					ΣD^2 =	10.50

(a) $r_s = 1 - \frac{6(\Sigma D^2)}{N(N^2 - 1)}$

(b) $r_s = 1 - \frac{6(10.50)}{16(255)}$

(c) $r_s = 1 - \frac{63}{4080}$

(d) $r_s = 1 - .02$

(e) $r_s = .98$

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