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A Study of Physical Fitness of Selected Students in South Dakota and Iowa

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A STUDY OF PHYSICAL FITNESS OF SELECTED STUDENTS IN SOUTH DAKOTA AND IOWA

BY

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A STUDY OF PHYSICAL FITNESS

OF SELECTED STUDENTS IN

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AND IOWA

This thesis is approved as a creditable, independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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CHAPTER I

INTRODUCTION

The physical health of its citizens has always been an important part of the progress of any nation or group of people. It has been common knowledge, due to the physical requirements of the Armed Forces, that the physical well-being of the citizens of the United States of America has been dropping to a lower level when physical strength was tested. The low level of fitness became very evident when, according to the Kraus-Weber Minimum Muscular Fitness Test, it was found that the American children lagged behind their European counterparts in physical endeavors (1). Thus the public was made aware of the low quality of physical fitness of the great majority of American youth. Since these first results were published, similar tests have been given to children in the Orient and children in the United States, and the results of these studies were similar in that they indicated low fitness scores for American youth.

In 1955 Dwight D. Eisenhower, then President of the United States of America, established the President's Council on Youth Fitness. This Council was formed so that the citizens could become informed of the low fitness situation. The Council also urged the use of all facilities and leadership which were available in the community, state, and nation. This Council urged the people to promote additional activity programs which would improve the physical fitness of American youth (2).

President John F. Kennedy has continued the Council and has given personal attention and leadership to this group. He has stated, "The strength of our youth and the fitness of our adults are among our most important assets" (3). He appointed Bud Wilkinson, Head Football Coach of the University of Oklahoma, as chairman of the Council and has personally been asking for more physical education classes in our public schools.

The Council has published two guides for action for the schools in organizing physical education classes. They are the "Blue Book", which contains what the committee thinks should be a minimum program of physical fitness, and the "Gold Book", which contains the ultimate aim for a physical education and fitness program for American schools (4).

Statement of the Problem

The purpose of this study was to compare the physical fitness of the Patrick Henry Junior High School students with the physical fitness of the Junior High School students of Waterloo, Iowa, and to use the results of this study in evaluating the Junior High School Physical Education program in Sioux Falls, South Dakota. The Iowa Test of Motor Fitness was used as the evaluating criterion.

Steps in the Solution of This Problem

1. To use the results of the Iowa Test of Motor Fitness which

had been administered to the Junior High School students in the Waterloo, Iowa public schools for comparison.

2. To administer the Iowa Test of Motor Fitness to the students of Patrick Henry Junior High School in Sioux Falls, South Dakota. Six hundred ninety-three students were included in this study.

3. To compare the results of the Iowa Test of Motor Fitness taken by the students of Patrick Henry Junior High School of Sioux Falls, South Dakota, with the results of the tests taken by the students of the Junior High Schools of Waterloo, Iowa. The test results were compared statistically by grade level and by sex.

Reasons for the Study

The author wished to compare the physical fitness of the students to see if there was any significant difference between the boys and girls in the two cities, because of the comparable size of the two cities but slightly different physical education programs in the schools. The basic difference between the programs was the swimming activity offered by the Waterloo schools. Then the results were to be used to aid in evaluating the Junior High School Physical Education program in Sioux Falls, South Dakota. According to the 1960 census, Sioux Falls had a population of 65,466, and Waterloo had a population of 71,755. The boys and girls in Waterloo, Iowa, have 150 minutes of physical education each week which includes 50 minutes of swimming. The boys and girls in Sioux Falls, South Dakota, have 100 minutes of

physical education each week for one semester, and 150 minutes of physical education the alternate semester while in the seventh and eighth grades. In the ninth grade in Sioux Falls the boys and girls have 100 minutes of physical education each week for the school year. In the junior high programs in Sioux Falls, swimming is not available for the students.

A study has previously been made between the fifth grade students of Brookings, South Dakota, and Cedar Rapids, Iowa; but to the author's knowledge the junior high students have not been studied. It was hoped that this study could be used to strengthen the physical education programs for the junior high students in all schools in the state of South Dakota as well as in the city of Sioux Falls.

Delimitations

1. All seventh, eighth, and ninth grade students who were taking active part in the required physical education program were tested.

2. No attempt was made to give the test to those students who were ill at the time of testing.

3. No attempt was made to classify the students according to race, nationality, body type, motor ability, economic status, or participation in extra-curricular or advanced classes.

4. The two schools were chosen because of the types of programs they offer to the students.

5. This study covered the school year 1962-1963 in the Sioux Falls schools and norms collected in 1961-1962 from the Waterloo schools.

6. Only boys and girls of Patrick Henry Junior High School of Sioux Falls, South Dakota were tested. The students tested for this study constituted approximately one-fourth of the junior high school students of Sioux Falls. Results from all junior high schools of Waterloo, Iowa, were used.

CHAPTER II

REVIEW OF LITERATURE

Much has been written concerning the physical fitness of American youth, and recently President John F. Kennedy made the following statement:

> The strength of our democracy is no greater than the collective well-being of our people. The vigor of our country is no stronger than the vitality and will of all our country men. The level of physical, mental, moral and spiritual fitness of every American citizen must be our constant concern (5).

The foregoing statement by the President has been repeated many times since it was first given to the nation's schools. It expresses very well the concern of the President and other national leaders over the low level of physical fitness shown by the American youth on various fitness tests, in particular the Kraus-Weber Minimum Muscular Fitness test (6).

Physical fitness has always been a concern of man. This concern is growing rapidly in the United States today with the public becoming aware of the low level of fitness made known to them in various articles such as "What's Wrong With American Youths," which appeared in the U. S. News and World Report in 1954. The article reported, "In terms of muscular ability to do jobs requiring physical strength, the average American youth of today appears to be growing soft. His counterpart in some nations of Europe, enjoying fewer of the advantages of modern civilization, is stronger" (7).

The article continued, "American youngsters tend to be more alert-mentally....While they may have strong minds, there appears to be more weak backs" (8).

With all the talk of fitness, one question is constantly asked: What is physical fitness? Physical fitness means different things to different people. The following are some of the thoughts on physical fitness:

Clarke defined physical fitness in this way:

> The development and maintenance of a sound physique, and of soundly functioning organs, to the end that the individual realizes his capacity for physical activity, unhampered by physical drains or by a body lacking physical strength and vitality (9).

Stafford and Duncan had the following comments:

> The individual who is physically fit has a well-proportioned and a well developed body, without a surplus of soft fat, and his posture is usually good. He has adequate muscular strength for his needs, and this strength is well controlled. He performs his activities with a high degree of motor proficiency. He has a supple, well-balanced body which he uses in a skillful, well co-ordinated manner, and with a minimum of energy expended. The physically fit individual usually has an alert mind. He also has that confidence, courage, initiative, pride, and self discipline which accompanies good morale. Finally he has an abundance of energy which allows him to push himself to the limits of his endurance in sustained activities involving speed, power, and strength without ill effect. His body is functioning with a maximum of efficiency (10).

Hunsicker defines physical fitness thus:

> Physical fitness includes those qualities which permit an individual to perform lifes activities involving speed, strength, agility, power, and endurance and to engage in various kinds of physical activities required of modern day living,

including sports and athletics, and to be able to maintain his optimum amount of fitness (11).

Espenchade's Committee reported, "Fitness implies the ability to perform productive and continuous work. Components of fitness would be physical strength, skill, organic vigor, and endurance" (12).

McCloy felt that the following were necessary for physical fitness: (a) Inheritance of strong vital organs; (b) Good health; (c) Good hygienic habits; (d) Physical conditioning; (e) Endurance; and (f) Body flexibility (13).

Steinhaus stated:

> Physical fitness implies freedom from disease or significant deviation from normal structure and function; enough strength, speed, and agility, endurance and skill to accomplish the maximum tasks that the day may bring; and mental and emotional adjustment appropriate to the age of the individual. Physical fitness is only a phase of total fitness. The limitations of fitness are determined and modified by inheritance; but within these limitations daily living practices may develop and otherwise influence fitness. Suitable work, adequate nutrition, exercise, rest, relaxation, the use of preventive and therapeutic medical services, and the avoidance of excesses, including alcohol and tobacco, are all important in maintaining fitness (14).

Romney speaks of fitness as

> ....a readiness, preparedness to live and function purposefully, effectively, and happily in today's society. Fitness is not something which is absolute. It is variable from individual to individual, from vocation to vocation, from sport to sport, from area to area, and from generation to generation (15).

While preparing for the 1960 White House Conference on Physical Fitness of Children and Youth, President Dwight D. Eisenhower stated, "The rapidly changing times in which we live, and the increasingly

fast pace of change, make it necessary that we plan ahead and prepare today's children well for life in tomorrow's world" (16).

Over the years Professor Cureton of the University of Illinois has tested thousands of men and women with a physical conditioning program. From studies he made he felt that, although people grew older in years, the major physical deficiencies of age such as chronic fatigue, headaches, shortness of breath, digestive upset, overweight, and a few forms of heart and circulatory trouble could have been entirely avoided or postponed for as long as fifteen years if the person had carried out a daily program of body conditioning and active recreation. The human body is the only machine that breaks down when not used and works better and is healthier the more it is used (17).

The Kraus-Weber Minimum Muscular Fitness Test given to 4,264 American children and 2,870 European children from comparable urban and suburban communities showed in six test movements, appraising strength and flexibility of trunk and leg muscles, that 57.9% of the American children failed while 9.8% of the European children failed. The poor American showing could be explained by our high degree of mechanization which eliminates much physical activity (18).

Campbell and Pohndorf found that English youth exceeded the American group in the American Association of Health, Physical Education, and Recreation Physical Fitness Test battery and other tests given except on one item, the arm power test for boys (19).

Noguchi administered both the Kraus-Weber Test battery and the American Association of Health, Physical Education, and Recreation Physical Fitness Test battery to Japanese children. He found that the Japanese children were more flexible than the American children by the Kraus-Weber Test. He also found that the Japanese children surpassed the American children in the Association fitness test battery except in sit-ups, but that the two groups were equal in the 50-yard dash and the softball throw (20-21).

Although some physical educators have been critical of these test findings, the results have emphasized the American position in muscular fitness. It also has brought a challenge to American physical educators to bring the muscular fitness of American youth to higher levels.

Hess, in a letter to the editor of The Journal of Health, Physical Education, and Recreation, wrote:

> Most of the muscular deficiencies in the Kraus-Weber test are the result of the inadequate large muscle activity of the nature and amount consistent with skeletal muscular needs. We in physical education, should accept the challenge inherent in the Kraus-Weber findings, and take another look at the philosophy and/or objectives we have so generously donated to education. In many instances, we have substituted variety for vigor with the results now before us in the Kraus-Weber findings (22).

As Hess stated, those in physical education should accept the challenge and improve the physical education programs of the nation's schools. According to a Fact Sheet, distributed at the President's

Conference on Fitness of American Youth in 1956, this is what was happening in the nation's schools:

> Less than 50% of our 7½ million boys in 28,000 high schools have physical education, and programs for 7½ million girls are even more deficient.
>
> Ninety-one percent of the nation's 150,000 elementary schools have no gymnasium and therefore the fitness of 24 million children is often neglected.
>
> Sixty-eight percent of the nation's high schools have less than the recommended ten acres of land necessary for essential play area.
>
> Many of the present fitness programs stress the star athlete at the expense of the mass, close their playground facilities at night and in the summer (23).

In reviewing the literature, the author found many facets to physical fitness. White emphasized this when he stated, "Physical fitness includes many aspects of health, one of which is the protection of the human body from infections that have beset us in the past and still threaten us..." (24). It was also evident that the level of fitness of American youth was below that of youth in both Europe and the Orient, and that the American people are becoming aware of the situation.

CHAPTER III

PROCEDURES

The Iowa Test of Motor Fitness had been administered during the school year 1961-1962 to the students in the junior high schools of Waterloo, Iowa. The results of these tests were received by the author from Dr. M. Gladys Scott, Chairman of the Women's Physical Education Department at the State University of Iowa, Iowa City, Iowa.

Permission to administer the test to the seventh, eighth, and ninth grade students at Patrick Henry Junior High, Sioux Falls, South Dakota, during the school year 1962-1963 was obtained by a personal interview with the Director of Physical Education of the Sioux Falls Public Schools and the principal and physical education instructors of Patrick Henry Junior High School. Six hundred ninety-three students were included in the study.

The testing team consisted of the physical education instructor at Patrick Henry Junior High School, the Assistant Principal of Patrick Henry Junior High School, and selected students. The testing team was trained in testing procedures and techniques before the actual administration of the Iowa Test of Motor Fitness. Pilot testing was conducted to establish the reliability of the testing team. The members of the testing team were given copies of the test to study and were encouraged to ask any questions that were in their minds before the testing took place. The procedure was followed as directed by the

manual for the Iowa Test of Motor Fitness. It was from the manual that the author found the suggestion of using students to help on certain items in the test.

During the first week of the tumbling unit at Patrick Henry Junior High School, the author described the test to the children and demonstrated the procedure that was to be followed. Opportunity was provided for the children to practice the test with advice and instruction from the testers so that they would know the proper procedure. This practice was in accordance with the instruction given in the Iowa Test of Motor Fitness manual. Even though it was practiced, each test was carefully described again before it was administered to an individual.

All students at Patrick Henry Junior High School were used in this study, with the exception of those with severe physical defects or who were convalescing from a recent illness or injury.

The age of the student on his last birthday was recorded at the time of the first period or testing.

The Iowa Test of Motor Fitness was administered to the students during their regular physical education periods. The students wore regular class uniforms, and all tests were administered in the school gymnasium, with the exception of the 50-yard dash. This item of the test battery was administered on the school football field. Results were recorded on separate class score sheets.

In Sioux Falls the regular physical education classes were held three periods a week one semester, and two periods a week during the alternate semester. Each period was 50 minutes in length. One or two items of the test battery were administered during each physical education period. The test items were administered in the following order:

The first period: (1) Standing Broad Jump and (2) the Shuttle Run.

The second period: (3) Sit-Ups, (4) Forward Bend, and (5) the Grasshopper.

The third period: (6) Pull-Ups for boys and the Bent Arm Hang for girls.

The fourth and fifth periods were used as make up periods for students who had been present on the first day of the test, but later were absent one period.

Test item 7, the 50-Yard Dash, was administered five weeks later when weather permitted that classes be held outside. This was given in one class period, the following period being used as a make up period for those who had been absent.

All test items were compared statistically by grade level and sex.

Test Battery Procedures

The following procedures were used in the testing of the students at Sioux Falls, South Dakota.

Standing Broad Jump

Capacity Involved: Power in the legs and coordination.

Equipment used: Mat and measuring tape.

Description: The test was given indoors on a mat which was large enough (five feet by ten feet) and heavy enough to prevent slipping during the test. The student stood at the end of the mat with the feet parallel and toes behind a take-off line. The student took off with both feet simultaneously and jumped as far forward as possible.

Instructions: The student was encouraged to use the swing of the arms and the flexing of the knees as preparatory movements. When the students were in proper position, they were instructed to jump as far forward as possible from the two-footed take-off. They were instructed that they would receive three trials, with the best counting as the score.

Scoring: The score was the distance, at right angles to the take-off mark, from the front edge of the take-off line to the nearest point on the mat touched by any part of the body. The best of three successive trials was recorded to the nearest half-inch.

(See Figure I on the following page)

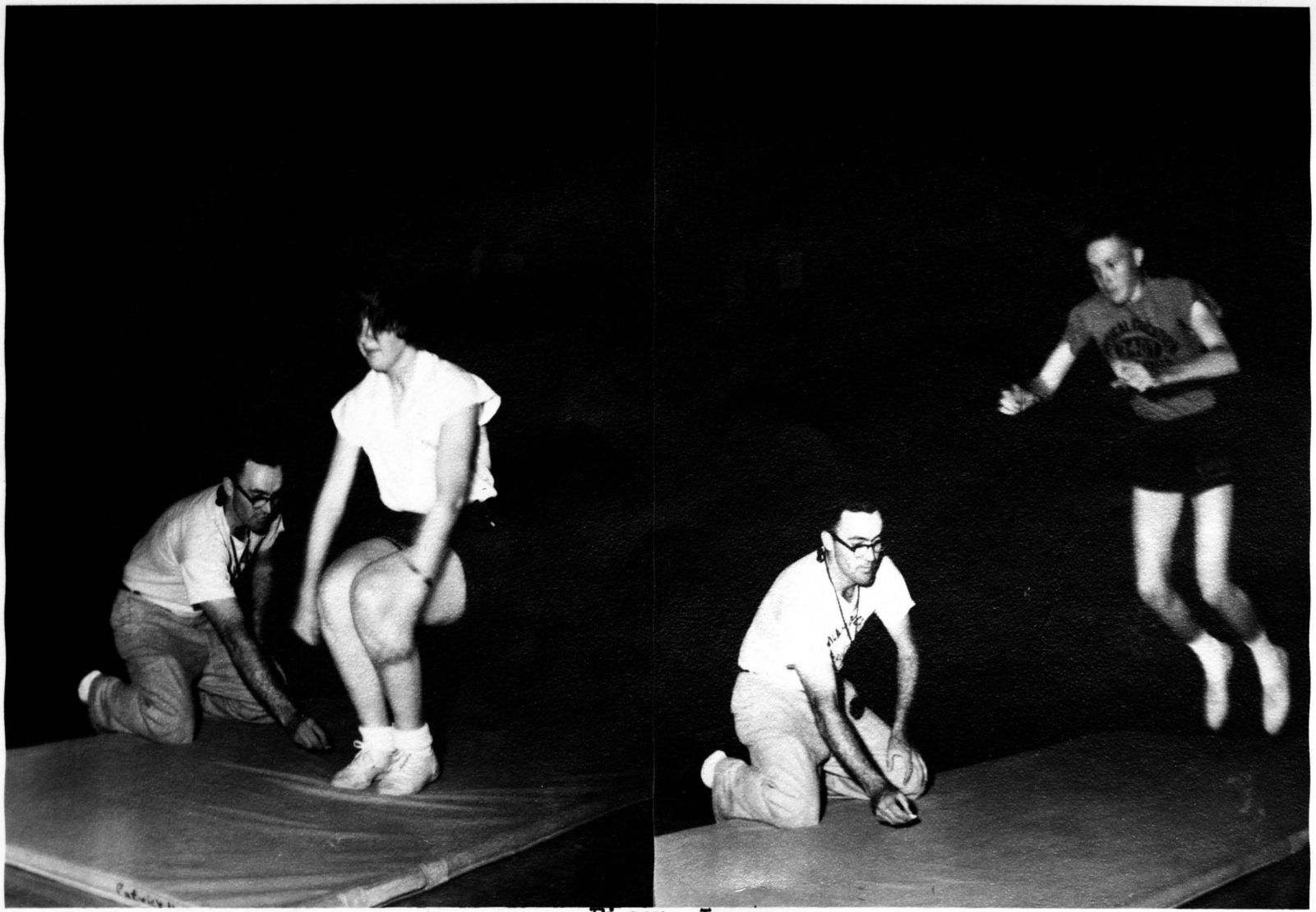

Figure I
Broad Jump
Left, Point of Marking...Right, In Flight

Shuttle Run

Capacity Involved: Agility.

Equipment used: Stop-watch; two one inch lines marked on the floor, fifteen feet between their inside edges.

Description: The test was given indoors with selected students as well as instructors as counters. One instructor was the timer and starter. The students ran back and forth between the two lines, placing one foot over the line on each trip, for a period of fifteen seconds.

Instructions: The students were instructed to begin on the signal "Go!" Since several students were tested at one time, they were encouraged to try to go faster than the student along side of them. They were to continue until the signal stop was given.

Scoring: One point was given for each one-way trip during a fifteen second interval, two points for a round trip.

(See Figure II on the following page.)

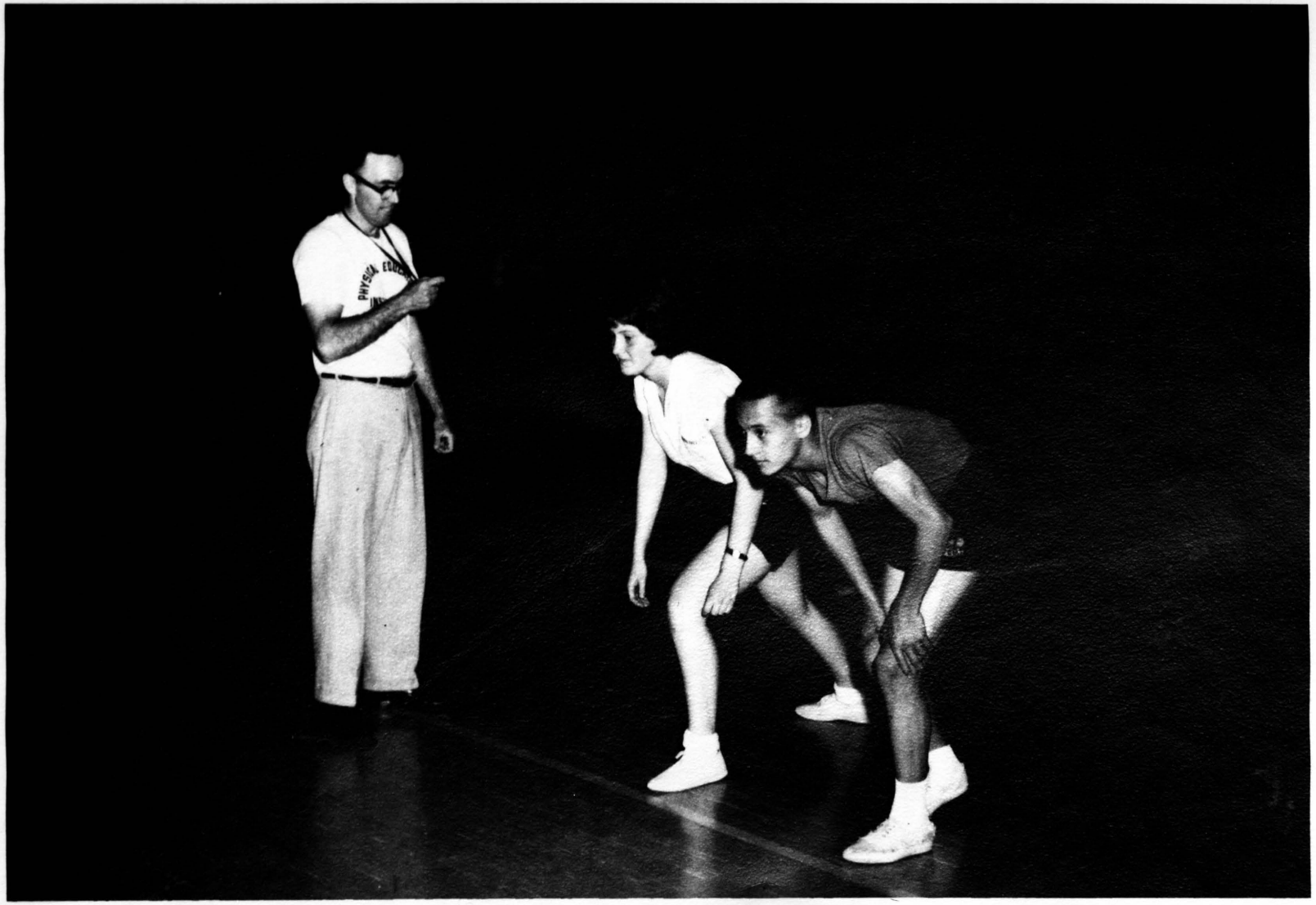

Figure II
Shuttle Run...Start

Sit-Ups

Capacity Involved: Strength and endurance of abdominal muscles.

Equipment used: Mat and stop-watch.

Description: The student assumed a hook sitting position with feet flat on the floor, back straight, with the elbows pointed forward, interlocked fingers of the two hands behind the neck. When the trunk was leaning slightly forward, the feet were brought back until the knees and elbows touched. A partner placed his hands on top of the performer's feet and held them firmly in the position determined by elbow and knee contact. The performer would then lie back on the floor to await the starting signal, with the fingers clasped behind the neck and elbows pointing up.

Instruction: On the signal, "Ready, Go", the student lifted the trunk far enough to touch the point of the elbows to the knees and return to the back-lying position (back, but not head touching). The students were informed that they could stop and rest and restart if they wished to do so. They were encouraged by the instructors not to stop unless it was absolutely necessary, but to slow the pace instead. They were instructed that if the elbows failed to make contact with the knees it would not count but that they did not have to stop.

Scoring: The score consisted of the number of times that the student came to a sitting position in one minute, with his elbows touching his knee and his fingers clasped behind his neck.

(See Figure III on the following page.)

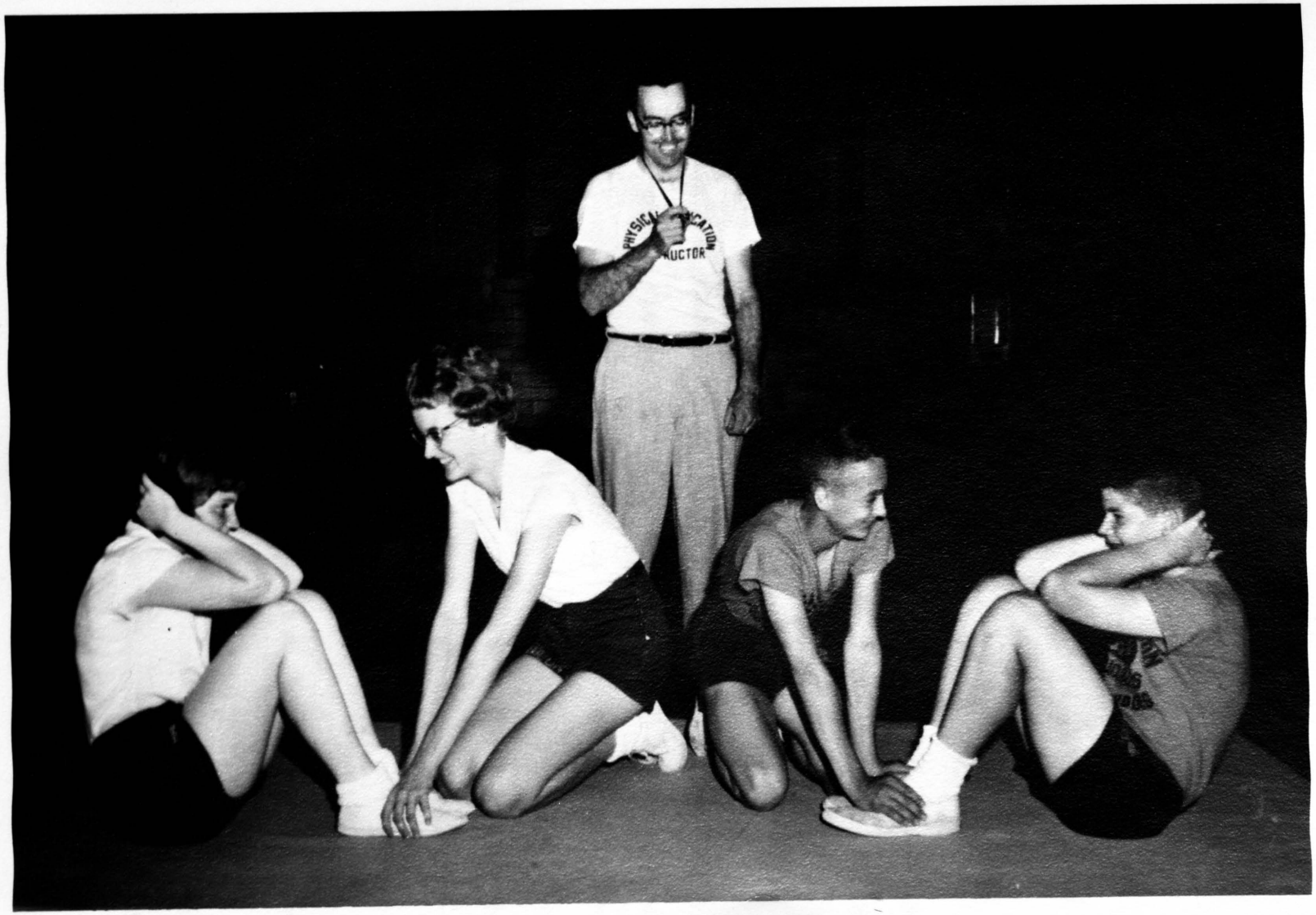

Figure III
Sit-Ups

Forward Bend

Capacity Involved: Flexibility

Equipment used: Two eighteen-inch pieces of a yard stick, mounted on a stool so that their inside edges were five inches apart with nine inches above and below the level of the platform. Another ruler was used as a guide to determine the point reached by the fingers.

Description: The student stood on the platform with the feet parallel and the toes directly behind the two vertical markers. The student was instructed to reach down the vertical marker slowly as far as possible, keeping the fingertips of both hands parallel and the knees straight.

Instructions: The student was instructed to let the body and arms relax and have the fingers move slowly down in front of the vertical markers. They were to move down as far as possible and hold that position momentarily, keeping the knees straight. No bobbing action was permitted. The students were instructed to take two or three practice trials immediately before the one which was measured. Emphasis was placed on relaxation and a progressively greater reach with each practice trial.

Scoring: The test administrator kneeled on the floor in order to be as near the level of the reach as possible. A ruler was placed horizontally at the end of the students' fingertips to aid in the accuracy of the scoring. Two trials were allowed and the best score was recorded. The score was read to the nearest half-inch and in

minus and plus. A minus score indicated that the subject had failed to reach the level of the stool platform; and a plus score indicated that the subject had reached below the platform level. A score of zero indicated that the subject had reached exactly the platform level.

(See Figure IV on the following page.)

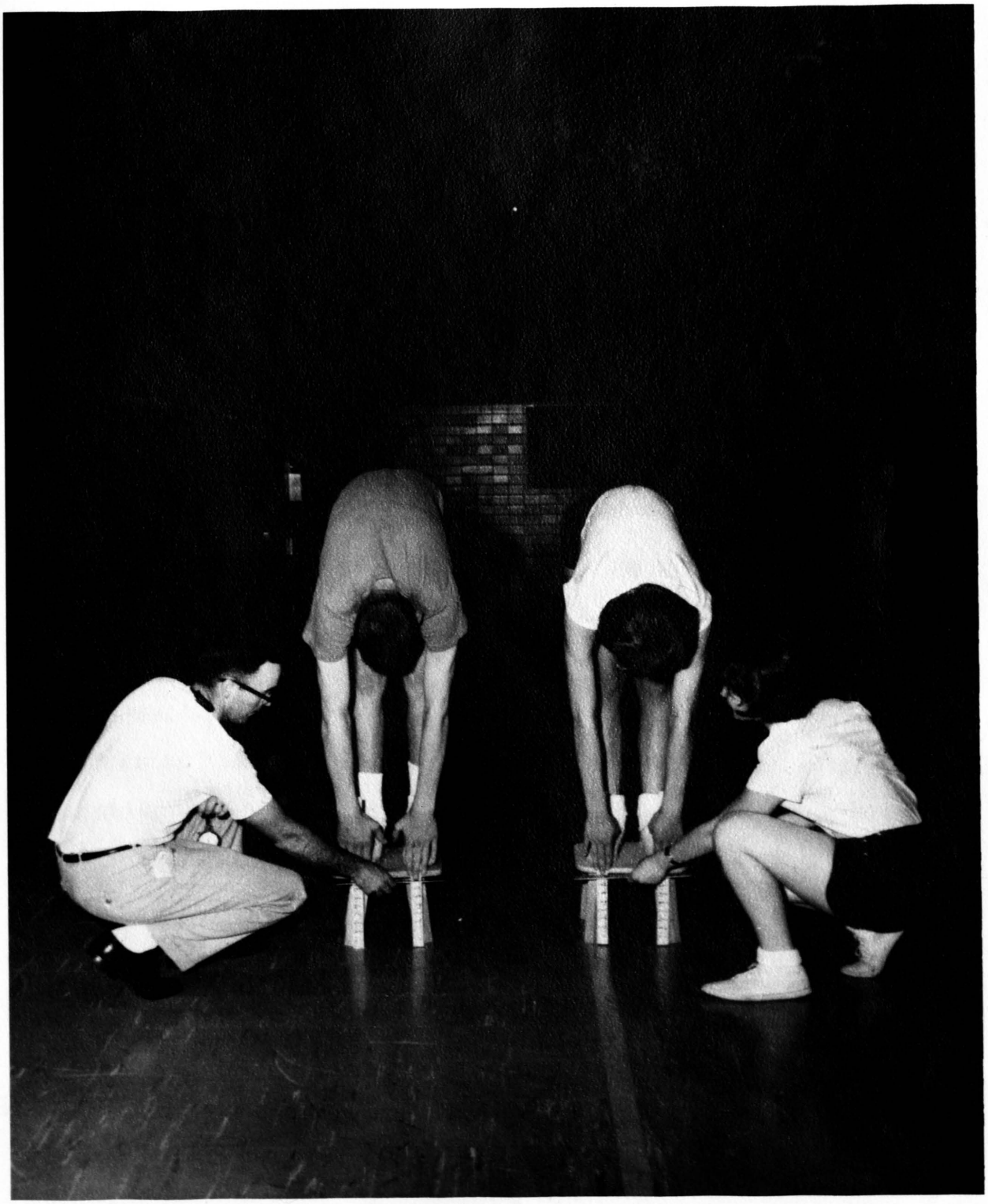

Figure IV
Forward Bend

The Grasshopper

Capacity Involved: Endurance.

Equipment used: Stop-watch.

Description: The students assumed a squat-sitting position; then they bent forward and placed their hands, shoulder-width apart, just in front of the line of the knees and then extended one leg backward. This raised the hips slightly and put more weight on the hands. The chest was resting on the forward knee. When the command "Ready, Go!" was given, the student exchanged the position of the legs and continued as rapidly as possible. Both feet left the floor at each exchange, while the forward thigh touched the chest each time the thigh was brought forward. The girls did this for thirty seconds, and the boys did this for sixty seconds.

Instructions: On the signal "Ready, Go!", the students exchanged the position of the legs and continued this procedure as rapidly as possible. They continued to do this until the signal was given to stop. They could rest and restart provided that during the rest the body was supported in the starting position. The following errors discounted the jump: the thigh not touching the chest, the rear leg not fully extended, sliding the feet during the exchange. (This movement had to be a jumping action.)

Scoring: One point was given each time the position of the feet was changed. The time allowed for the girls was thirty seconds and for the boys one minute.

(See Figure V on the following page.)

Figure V
The Grasshopper

Pull-Ups

Capacity Involved: Arm strength.

Equipment used: Horizontal bar.

Description: The bar was placed above the reaching height of the student. The student stood under the bar and grasped the bar with the palms of his hands toward his face. The hands were shoulder-width apart. The student hung in a fully extended position. He lifted himself up until his chin was above the level of the bar, then lowered to the starting position. The action in both the upward and downward directions had to be smooth and continuous. No swinging or jerking was permitted.

Instructions: The student was instructed to repeat the action as many times as possible. No resting was permitted once the student began the pull-up. The arm of the administrator was held in front of the student's legs in order to prevent natural swinging. The test was administered to each student individually in order that the form could be judged carefully. When the boy could no longer continue in good form, he was stopped.

Scoring: One point was scored each time the chin went above the bar provided the upward movement was done smoothly.

(See Figure VI on the following page.)

Figure VI
Pull-Ups

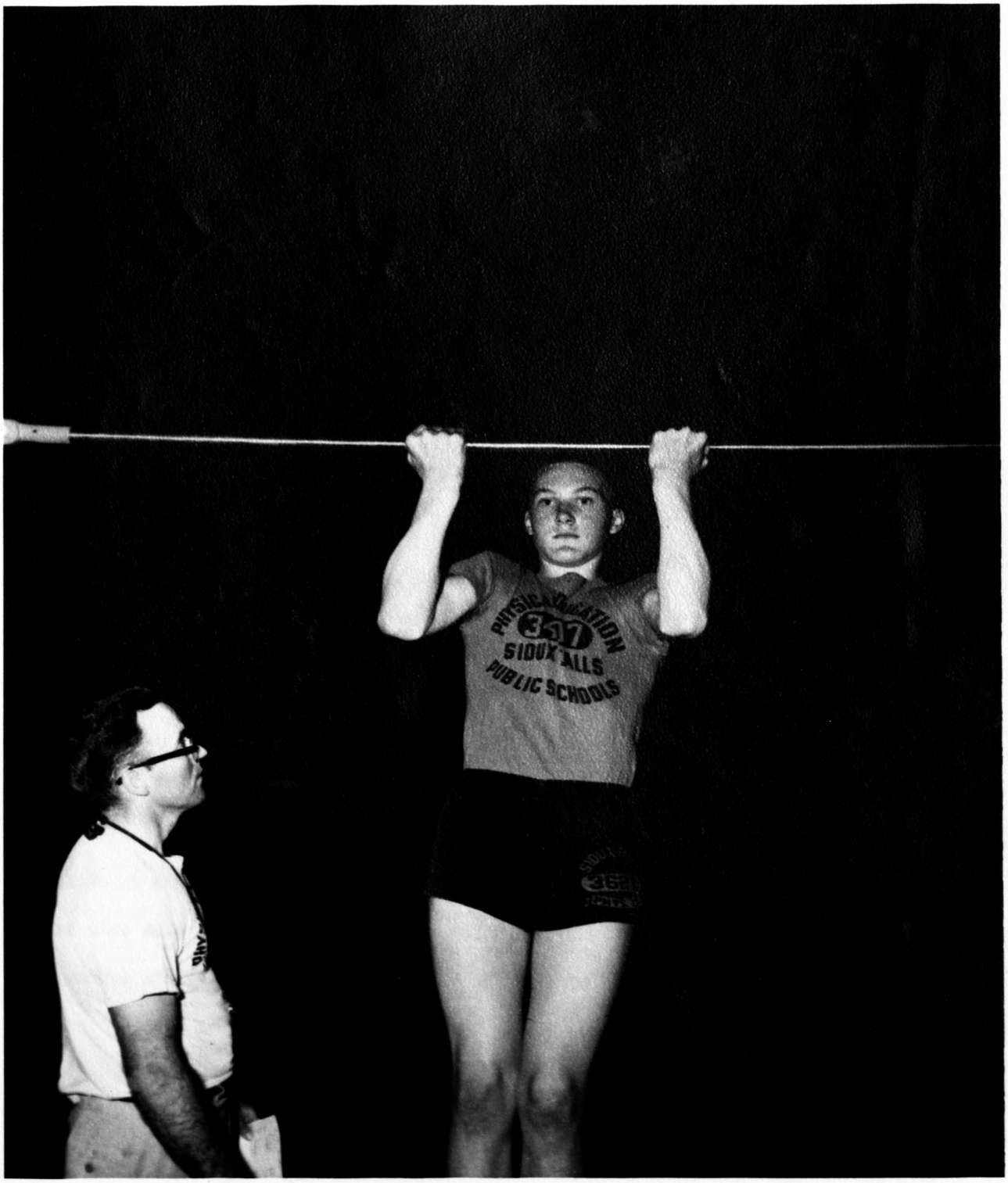

Figure VI
Pull-Ups

Bent-Arm Hang

Capacity Involved: Arm strength.

Equipment used: Stop-watch, a doorway gym bar, and a horizontal bar.

Description: The gym bar or horizontal bar was placed at a height just above the top of the student's head. The student grasped the bar with her palms toward her face and her hands shoulder-width apart. Then she jumped upward and flexed her arms fully with her chin above but not touching the bar. She stayed in this position as long as possible.

Instructions: The student was instructed to grasp the bar, then jump upward and flex her arms at the elbows so that she was hanging with her arms fully bent and the chin above the bar. When necessary, assistance was given the student in getting up to the hanging position. The administrator's arm was extended across the student's legs if they began to swing. The chin was watched carefully to see that it was not resting on the bar.

Scoring: The stop-watch was started when the correct position was assumed and stopped when the chin rested on or fell below the level of the bar. During the test only one trial was given. The student's score was the length of time, in seconds, that she hung in the proper position.

(See Figure VII on the following page.)

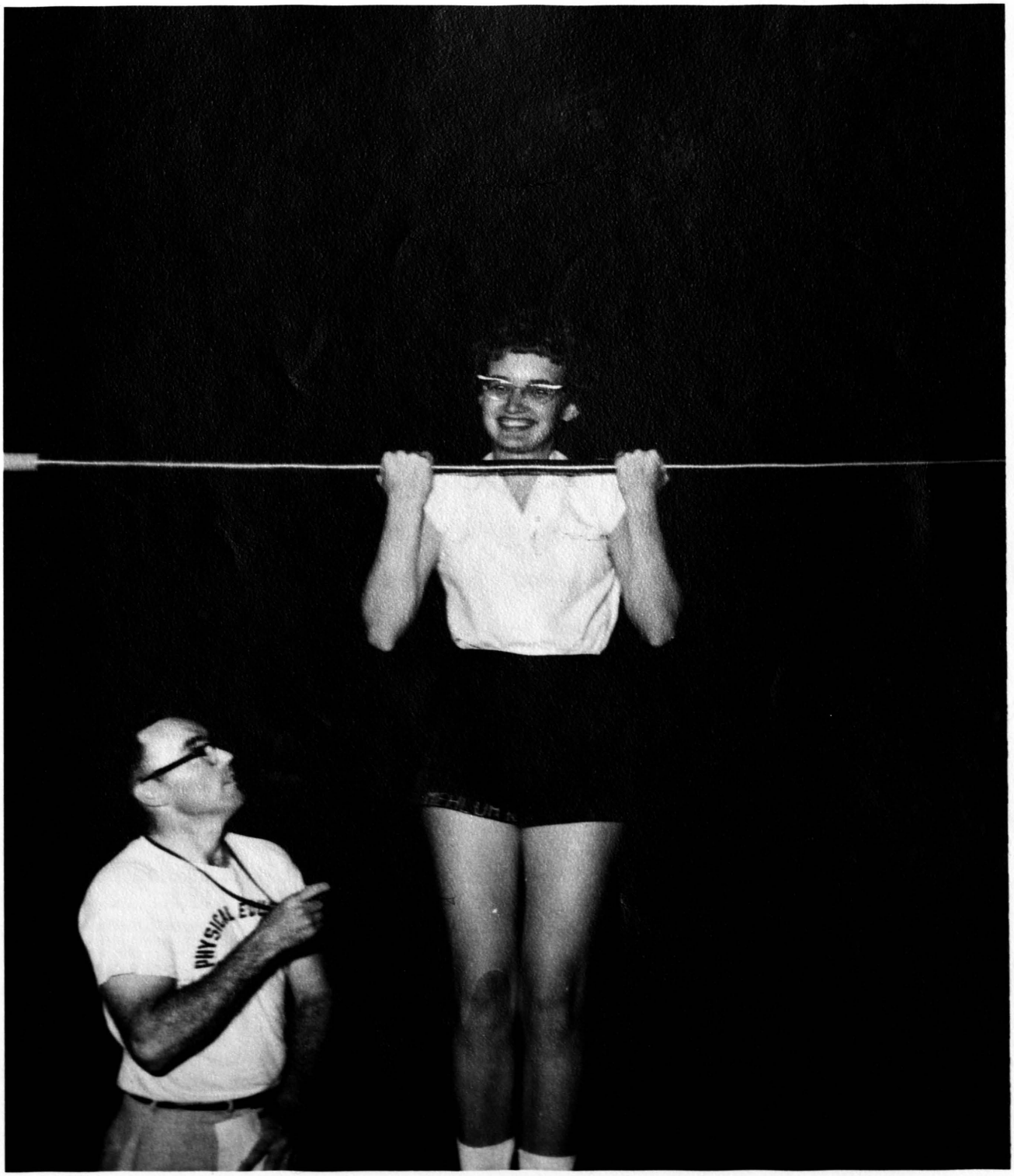

Figure VII
Bent Arm Hang

The 50-Yard Dash

Capacity Involved: Speed.

Equipment used: Stop-watch.

Description: The running path was measured on the football field. The student assumed any position he wanted to use, behind the starting line. On the command, "Ready, go!", the students ran as fast as they could until they crossed the finish line. The distance from the starting line to the finish line was 50 yards.

Instructions: The test was administered to one student at a time. Each was instructed to take his place behind the starting line; and, as the starter gave the signal "Ready, go!", each ran as quickly as he could to the finish line. There was one judge at the finish line with a stop-watch to time the student who was running. As the starter said "Go!", he lowered his arm so the judge could begin the timing of the dash.

Scoring: The student's score was the time it took him to run from the starting line to the finish line after the signal "Go!" was given. The time was recorded in seconds to the nearest tenth of a second. As soon as any part of the runner's body crossed the finish line, the watch was stopped and the time recorded.

(See Figure VIII on the following page.)

Figure VIII
50-Yard Dash...Start

CHAPTER IV

ANALYSIS OF THE DATA

Sioux Falls and Waterloo boys and girls, at three grade levels, were compared according to mean scores on the Iowa Test of Motor Fitness (seven items). The seven items in the test battery were as follows: the standing broad jump, the shuttle run, the sit-ups, the forward bend, the grasshopper, the pull-ups (boys only), the bent arm hang (girls only), and the 50-yard dash.

Reliability

The Iowa Test of Motor Fitness was administered to the subjects in both groups under the written instructions sent out in the testing manual from the State University of Iowa, Iowa City, Iowa. (See Appendix B) In order to help establish reliability in the testing technique, the testing team in Sioux Falls was trained in the correct procedures by the author and practiced the procedure in a pilot testing program. The 50-Yard Dash test for all students was timed by the same individual. It was assumed that the testing manual was followed carefully in the Waterloo schools.

Treatment of the Data

The raw scores were taken from score sheets (Appendix A) and arranged in frequency distributions. These distributions were then

used to determine the necessary statistical measures. The statistical measures used in this study were:

1. The arithmetical mean (hereafter referred to as the mean).
2. The standard deviation of the mean.
3. The standard error of the difference between the means of the two groups considered in this study.
4. The critical ratio (t ratio).

The Sioux Falls and Waterloo data were separated into groups by grade level and sex, and then the statistical measures were determined for each group. In this study, both the five per cent and the one per cent levels of confidence were considered in determining the significance of the difference between the means. As described by Garrett, a t table was used to determine the level of statistical significance of the obtained t ratio (25). The null hypothesis was then either accepted or rejected (26).

Findings

Broad Jump Test

Table 1 reveals the mean broad jump scores for all groups. As might be expected, ninth grade students had higher scores than the younger age levels. It is interesting to note that at all grade levels, boys and girls, the Waterloo means were higher than the Sioux Falls means. However, there was no statistically significant difference found between the broad jump means of the Sioux Falls students and the

Waterloo students at any grade level or for either sex.

Figure IX provides a graphic presentation of the broad jump means. A parallel pattern of development is noted between the Sioux Falls and the Waterloo students.

Table 1. The Means for the Broad Jump (inches) Test Item

Grade level and sex	Sioux Falls Mean	Waterloo Mean	t
7th Girls	63.968	65.305	1.471
7th Boys	64.965	65.190	1.234
8th Girls	63.544	64.130	.597
8th Boys	70.936	71.435	.486
9th Girls	64.505	66.490	1.797
9th Boys	76.027	76.555	1.655

Shuttle Run Test

As shown by Table 2, the best mean score on this test for either sex were made by the seventh grade girls and the ninth grade boys of Waterloo.

In the Shuttle Run test item there were no significant differences, between schools, for the seventh and eighth grade boys and the ninth grade girls. The null hypothesis was therefore accepted for these items. The eighth grade girls and the ninth grade boys of Waterloo were

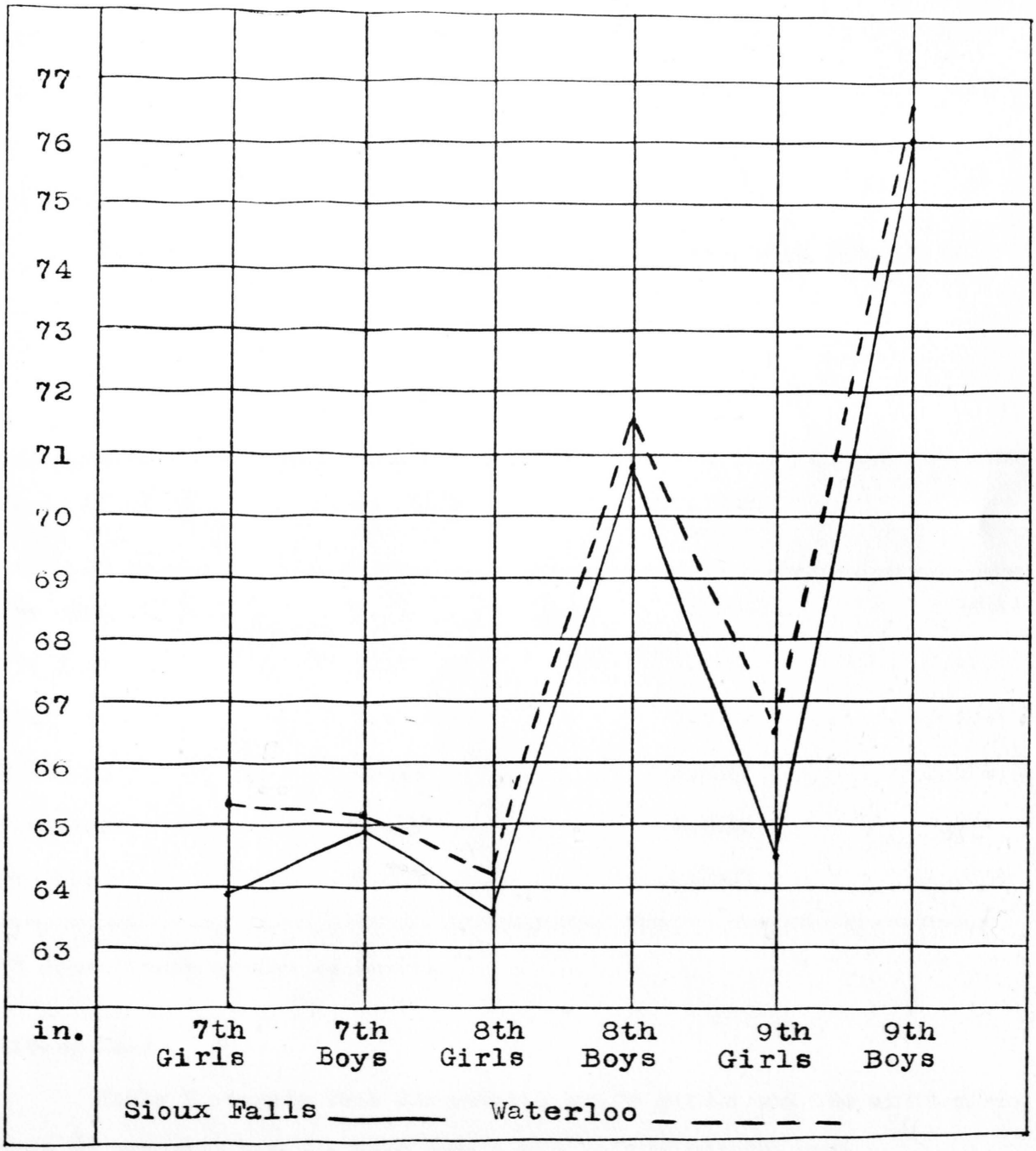

Figure IX. A comparative graph of the Broad Jump test item, showing the mean for the boys and girls of Sioux Falls, South Dakota, and Waterloo, Iowa

found to be superior to the Sioux Falls students at the five per cent level. The Waterloo seventh grade girls were superior to the Sioux Falls seventh grade girls at the one per cent level. At these levels the null hypothesis was rejected and the differences were assumed to be real.

Figure X gives a graphic presentation of the significance of the difference at each level for the Shuttle Run test.

Table 2. The Means for the Shuttle Run (laps) Test Item

Grade Level and sex	Sioux Falls Mean	Waterloo Mean	t
7th Girls	7.310	7.7726	3.850**
7th Boys	7.843	7.823	.174
8th Girls	7.493	7.714	2.304*
8th Boys	7.899	8.083	1.614
9th Girls	7.639	7.682	.374
9th Boys	8.254	8.495	1.975*

* Significant at the 5% level.
** Significant at the 1% level.

Sit-Up Test

Table 3 reveals that the seventh grade girls and the ninth grade boys of Waterloo had the best mean score on the Sit-Up test.

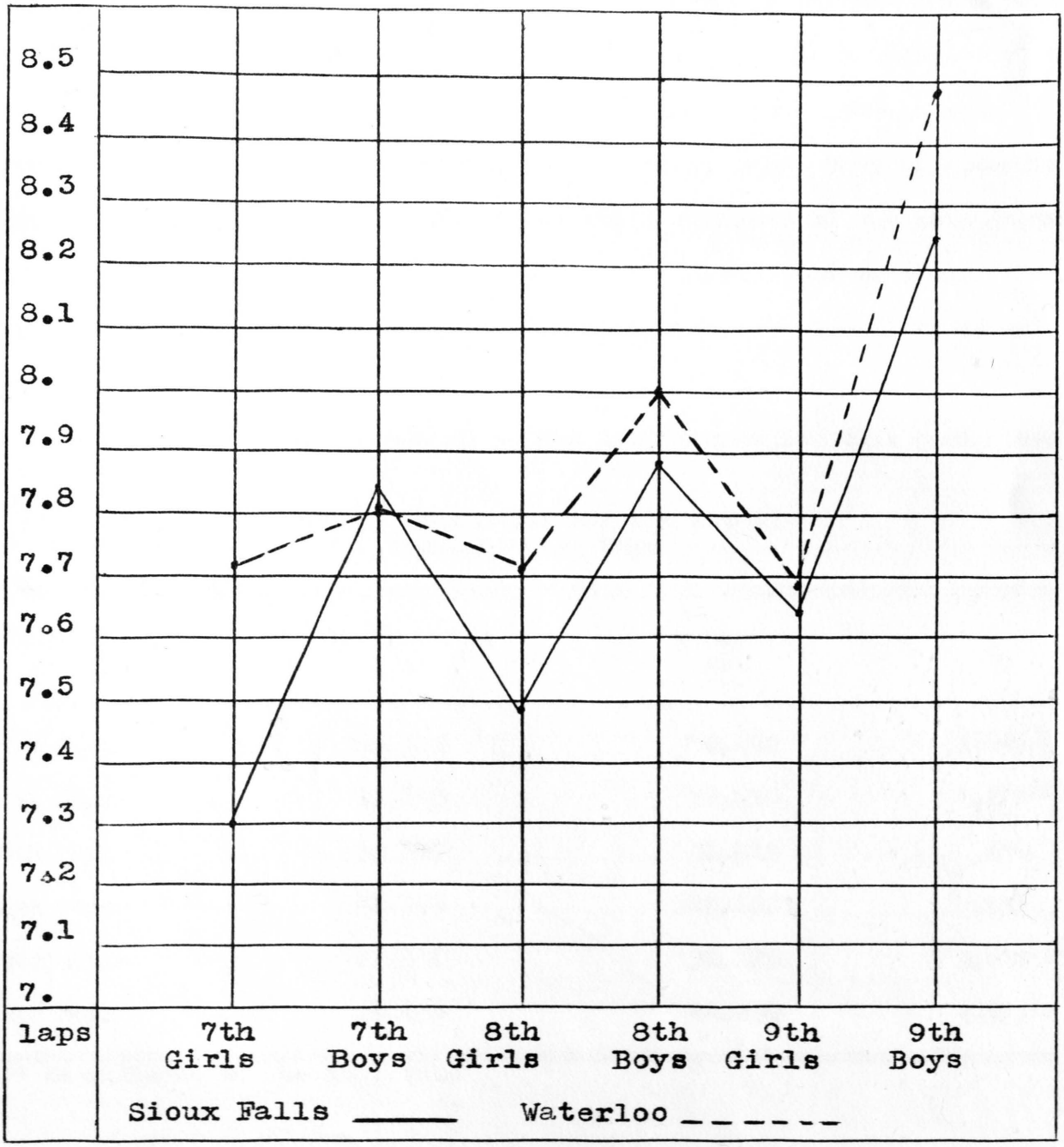

Figure X. A comparative graph of the Shuttle Run test item, showing the means for the boys and girls of Sioux Falls, South Dakota, and Waterloo, Iowa

It was found that there were no significant differences between schools in the mean scores for the girls in both the seventh and eighth grades and for the eighth grade boys. Therefore the null hypothesis was accepted at these grade levels for this test item. The seventh grade boys, the ninth grade girls, and the ninth grade boys of Waterloo were found to be superior to the Sioux Falls students of the same grades at the one per cent level of confidence. The null hypothesis was therefore rejected at these levels for this test, and the differences were assumed to be real.

Figure XI shows graphically, the mean scores for this test item.

Table 3. The Means for the Sit-Up (number) Test Item

Grade level and sex	Sioux Falls Mean	Waterloo Mean	t
7th Girls	29.103	30.460	1.604
7th Boys	35.243	38.710	3.219**
8th Girls	30.537	31.015	.644
8th Boys	41.394	40.620	.854
9th Girls	27.938	30.825	3.045**
9th Boys	38.436	44.230	4.573**

** Significant at the 1% level.

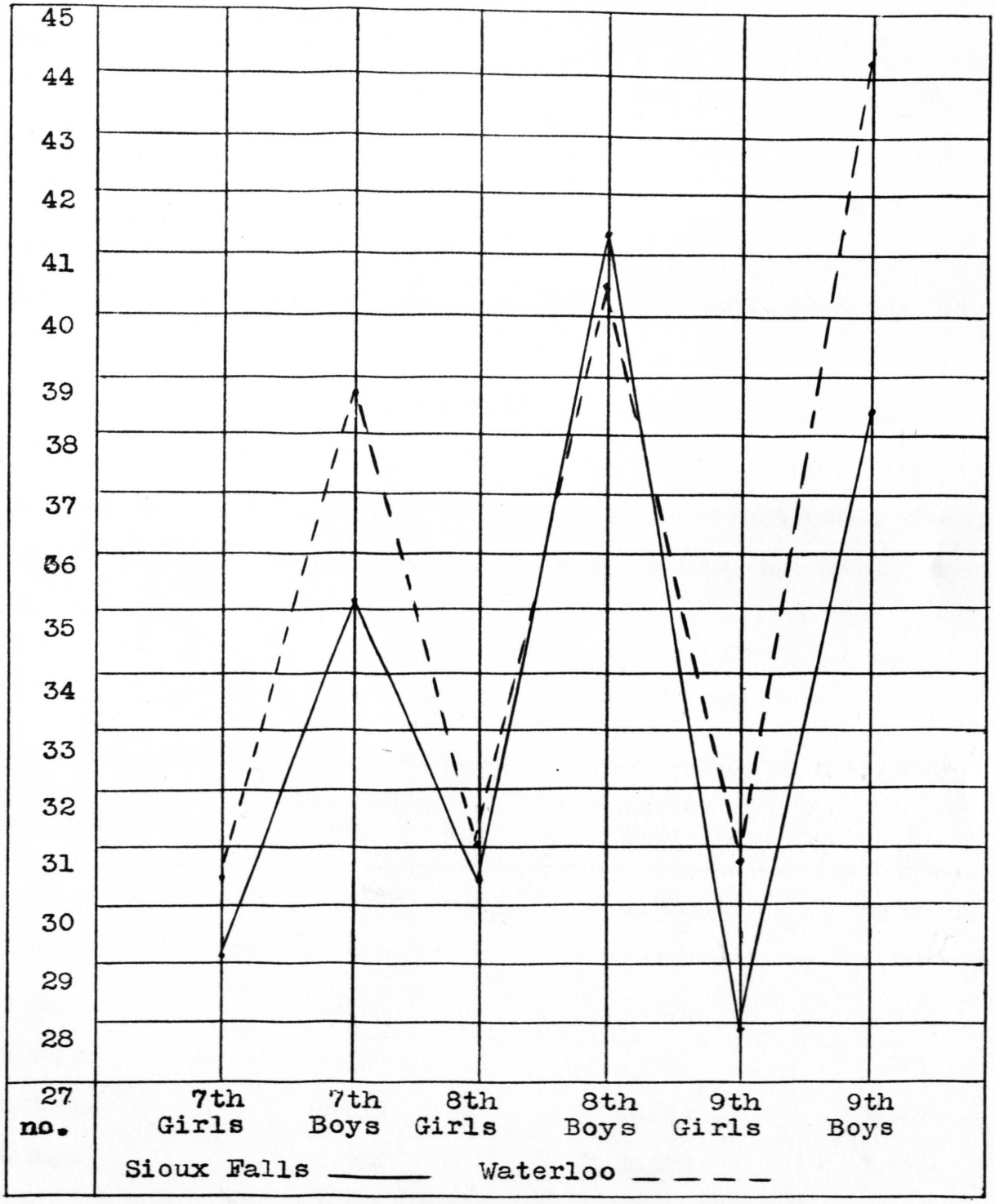

Figure XI. A comparative graph of the Sit-Up test item, showing the means for the boys and girls of Sioux Falls, South Dakota, and Waterloo, Iowa

Forward Bend Test

It will be found in Table 4 that the eighth grade girls and the ninth grade boys of Waterloo had the highest mean score on this test item.

In the Forward Bend test item, there were no significant inter-school differences at these levels: seventh grade girls, eighth grade boys, ninth grade girls, and ninth grade boys. The null nypothesis was accepted at these levels for this item. The Waterloo eighth grade girls were found to be superior to the Sioux Falls eighth grade girls at the five per cent level. In the seventh grade, the Waterloo girls were superior to the Sioux Falls girls at the one per cent level. The null hypothesis was therefore rejected at these levels, and the differences were assumed to be real.

Table 4. The Means for the Forward Bend Test (inches) Test Item

Grade level and sex	Sioux Falls Mean	Waterloo Mean	t
7th Girls	1.194	1.789	3.306**
7th Boys	- .262	- .197	.210
8th Girls	1.912	2.370	1.966*
8th Boys	.330	.454	.425
9th Girls	2.175	2.851	1.254
9th Boys	.559	1.024	1.243

* Significant at the 5% level.
** Significant at the 1% level.

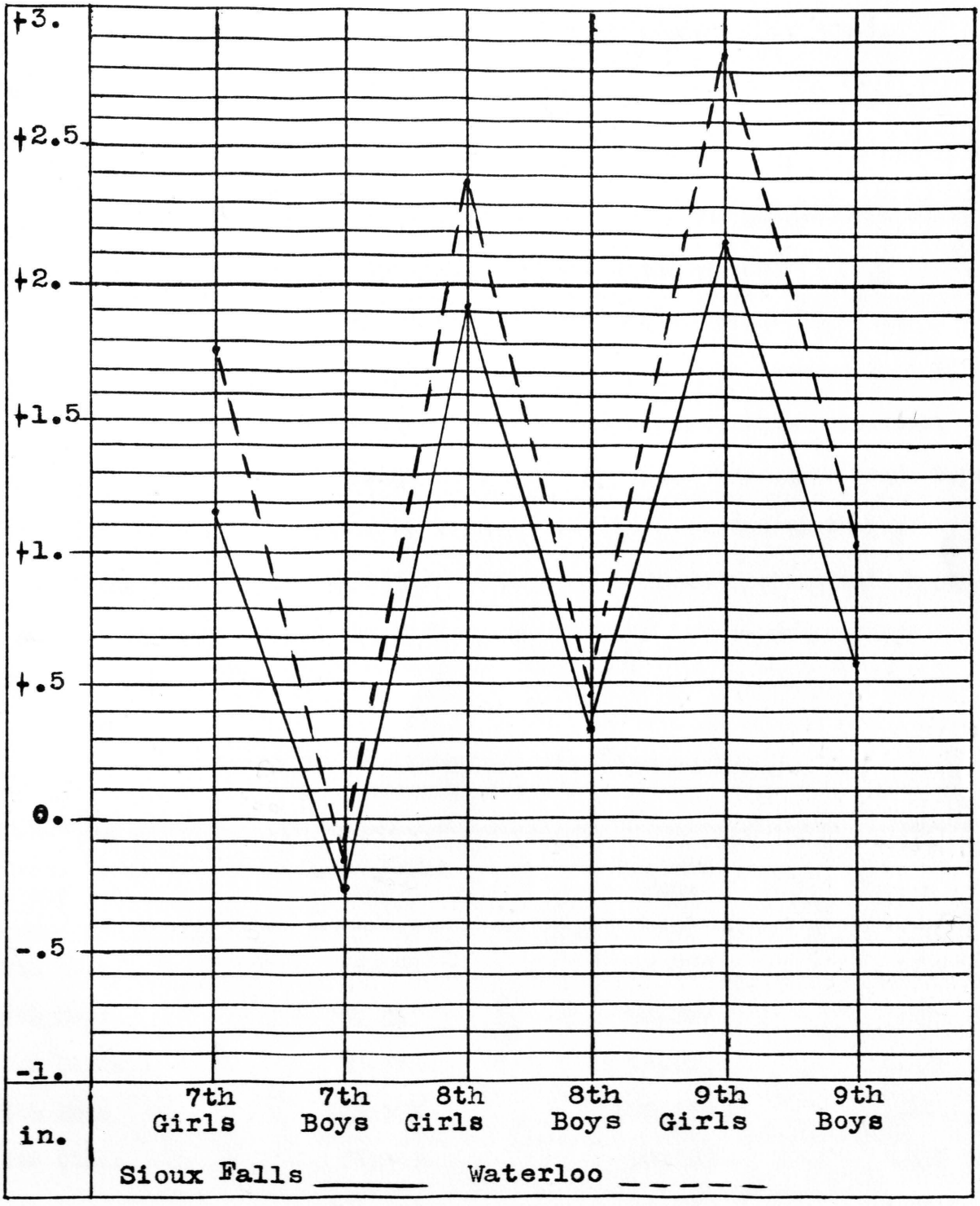

Figure XII. A comparative graph of the Forward Bend test item, showing the means for the boys and girls of Sioux Falls, South Dakota, and Waterloo, Iowa

Figure XII depicts graphically the differences in the mean scores of the groups by grade level and sex.

Grasshopper Test

In Table 5 it will be noted that the best mean scores were made by the boys and girls of Sioux Falls in the eighth grade.

The seventh grade boys and girls, the eighth grade boys and girls, and the ninth grade girls showed no significant inter-school difference in their mean scores for the Grasshopper test item. The null hypothesis was therefore accepted at these levels. The ninth grade boys of Sioux Falls were found to be superior to the Waterloo ninth grade boys at the one per cent level for this item. Therefore the null hypothesis was rejected, and the differences at this level were assumed to be real.

Table 5. The Means for the Grasshopper (changes) Test Item

Grade level and sex	Sioux Falls Mean	Waterloo Mean	t
7th Girls	52.000	52.355	.318
7th Boys	91.513	91.267	.105
8th Girls	55.971	54.285	1.775
8th Boys	103.972	100.550	1.161
9th Girls	51.443	50.420	.959
9th Boys	101.100	96.473	5.495**

** Significant at the 1% level.

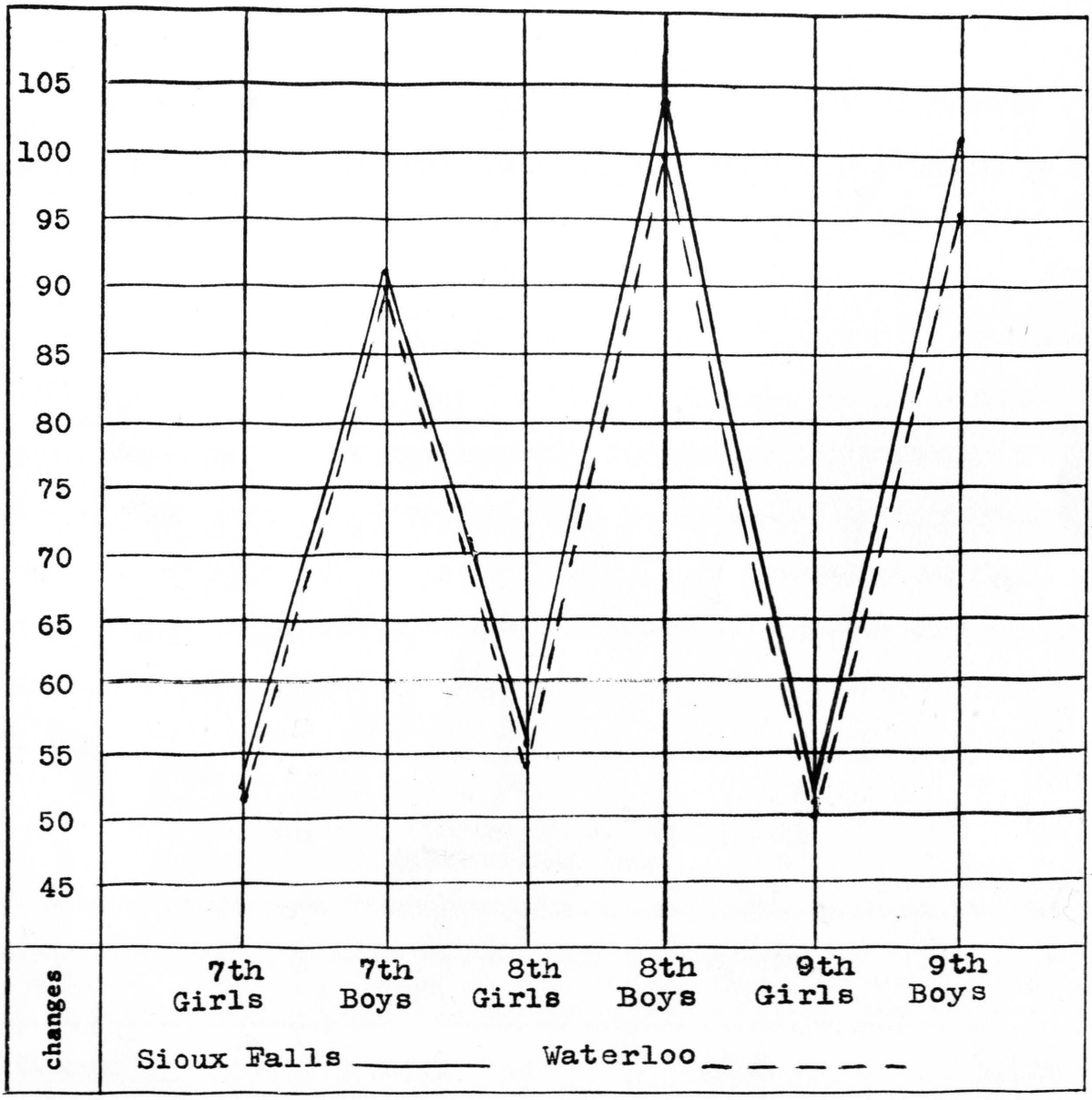

Figure XIII. A comparative graph of the Grasshopper test item, showing the means for the boys and girls of Sioux Falls, South Dakota, and Waterloo, Iowa

Figure XIII provides a comparative graph, showing the closeness of the groups on the Grasshopper test item.

Pull-Up Test

Table 6 reveals that the ninth grade boys of Waterloo had the highest mean score on this test item. It was found that there was no significant interschool difference in the mean score for the eighth grade boys. The null hypothesis was then accepted for this level. The Waterloo boys in the ninth grade were found to be superior to the Sioux Falls boys at the five per cent level of confidence. In the seventh grade, the Waterloo boys were superior to the Sioux Falls boys at the one per cent level. At these levels for this item the null hypothesis was therefore rejected, and the differences were assumed to be real.

Figure XIV shows the extreme difference in the mean scores which were significant on this test item particularly at the seventh grade level.

Table 6. The Means for the Pull-Up (number) Test Item

Grade level and sex	Sioux Falls Mean	Waterloo Mean	t
7th Boys	2.957	5.168	5.880**
8th Boys	4.881	5.664	1.713
9th Boys	4.827	5.759	2.209*

* Significant at the 5% level.
** Significant at the 1% level.

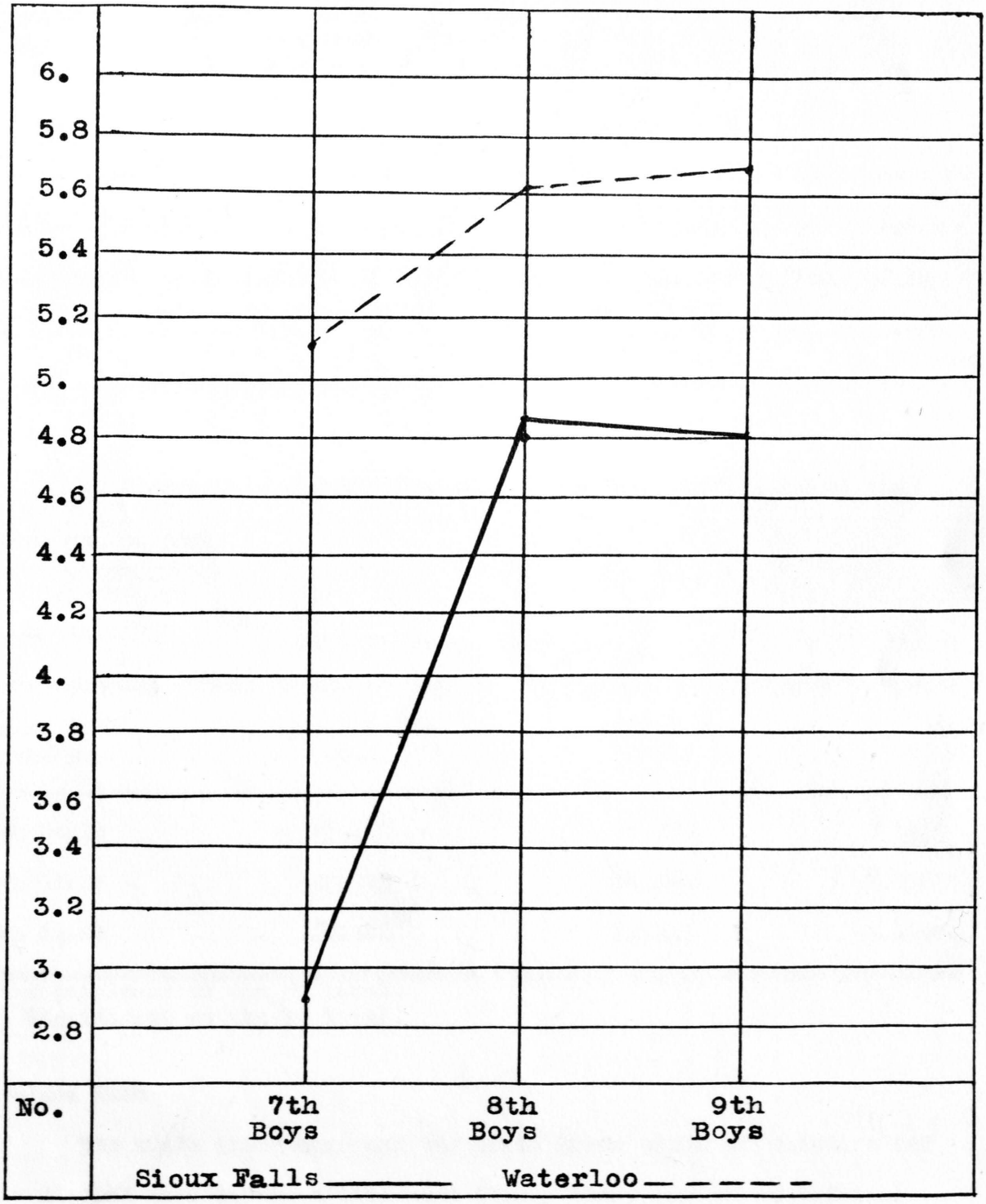

Figure XIV. A comparative graph of the Pull-Up test item, showing the means for the boys of Sioux Falls, South Dakota, and Waterloo, Iowa

Bent Arm Hang Test

Table 7 indicates that the eighth grade girls of Waterloo had the highest mean score for this test item. It was found that the seventh grade girls of Waterloo were superior to the Sioux Falls seventh grade girls at the five per cent level. In the eighth and ninth grades the Waterloo girls were found to be superior to the Sioux Falls girls at the one per cent level. The null hypothesis was therefore rejected at all levels for this test, and the differences were assumed to be real.

In Figure XV a graphic presentation of the difference of the means can be found.

Table 7. The Means for the Bent Arm Hang (seconds) Test Item

Grade level and sex	Sioux Falls Mean	Waterloo Mean	t
7th Girls	25.201	27.580	2.063*
8th Girls	20.729	34.843	7.256**
9th Girls	20.588	27.713	3.689**

* Significant at the 5% level.
** Significant at the 1% level.

50-Yard Dash

The ninth grade boys and the ninth grade girls of Waterloo had the highest mean score on this test item. There was no significant

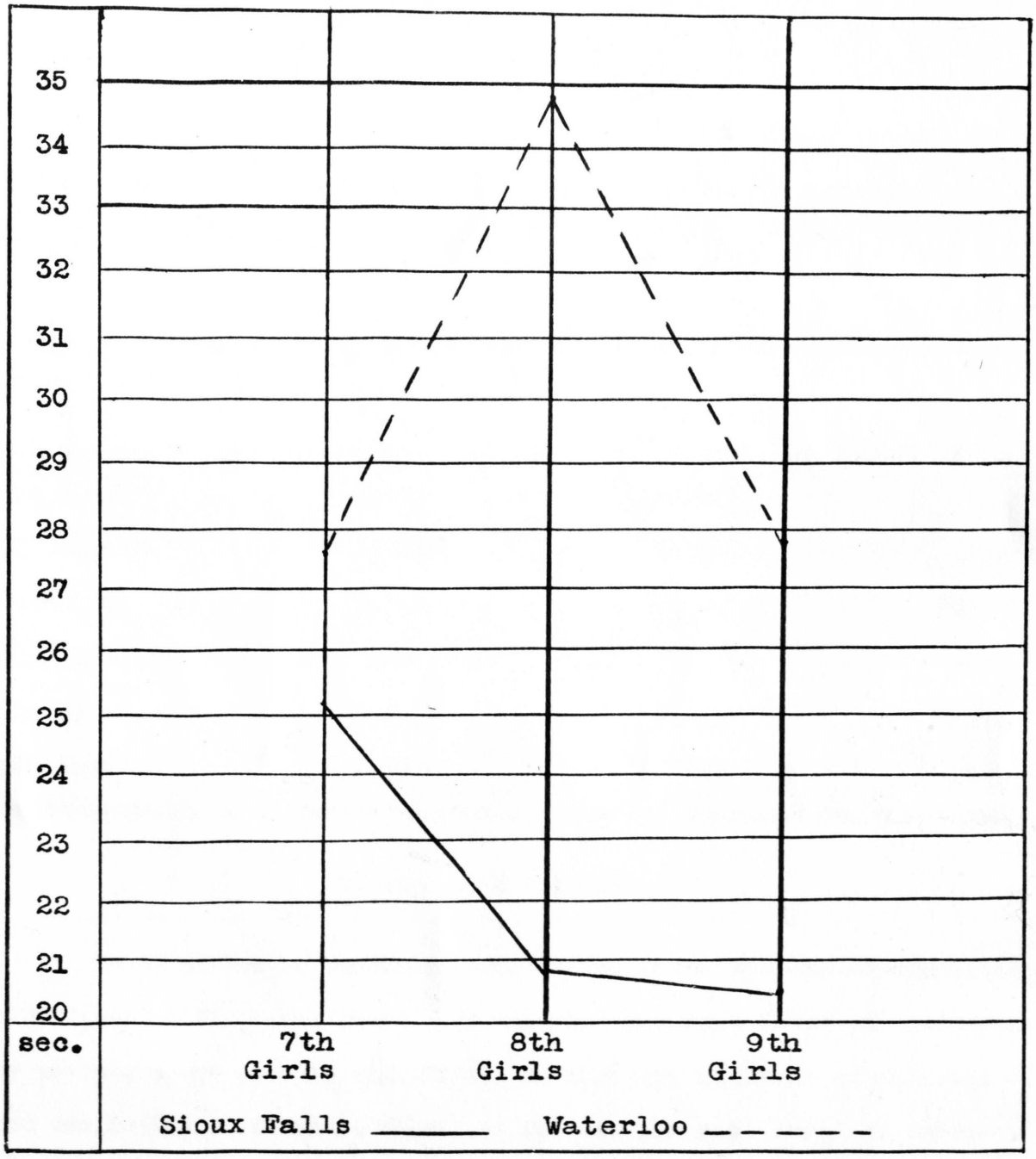

Figure XV. A comparative graph of the Bent Arm Hang test item, showing the means for the girls of Sioux Falls, South Dakota, and Waterloo, Iowa.

difference found at any grade level or for either sex on this test item; therefore the null hypothesis was accepted for this entire test item.

Figure XVI shows by graph the closeness of the mean scores and the somewhat parallel results of the two schools in this study.

Table 8. The Means for the 50-Yard Dash (seconds) Test Item

Grade level and sex	Sioux Falls Mean	Waterloo Mean	t
7th Girls	8.097	7.805	.420
7th Boys	7.928	7.592	.466
8th Girls	7.909	8.000	.129
8th Boys	7.763	7.215	.417
9th Girls	7.873	7.330	.582
9th Boys	7.337	7.200	.183

Discussion of Findings

On 28 of the 42 possible comparisons, there were no statistically significant differences found. At the five per cent level of confidence, or beyond, there were 13 significant differences in favor of Waterloo and one in favor of Sioux Falls. At the one per cent level of confidence there were eight significant differences in favor of Waterloo,

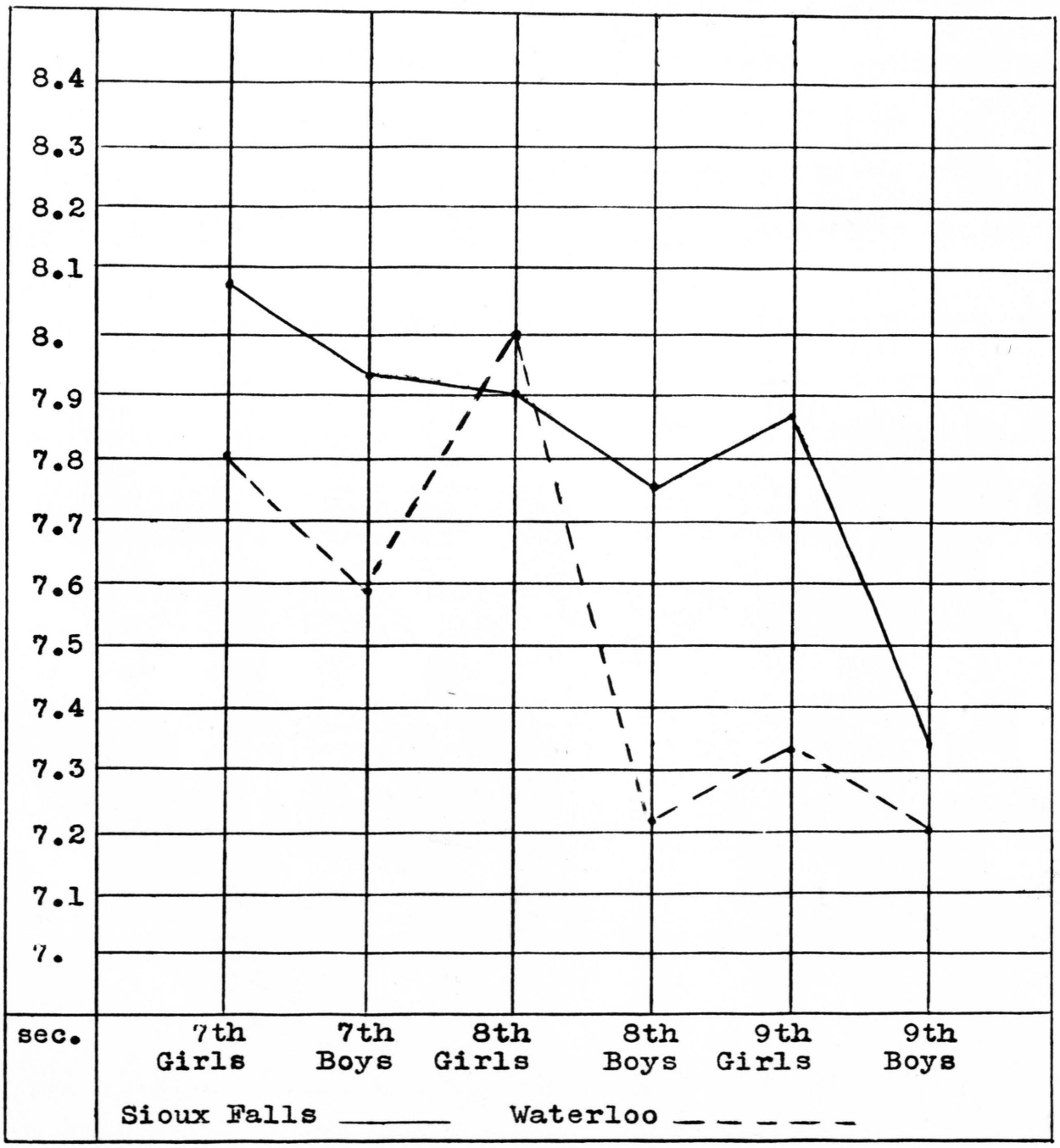

Figure XVI. A comparative graph of the 50-Yard Dash test item, showing the means for the boys and girls of Sioux Falls, South Dakota, and Waterloo, Iowa

while there was one in favor of Sioux Falls. It was noted by the author that in the test involving arm and upper body strength, the Waterloo schools were significantly superior at five of the six comparisons. Three of these differences were at the one per cent level and two were at the five per cent level. Perhaps this can be attributed to the differences in the physical education programs at the two schools.

CHAPTER V

SUMMARY

The purpose of this study was to compare the physical fitness of the students of Patrick Henry Junior High School of Sioux Falls, South Dakota, with the physical fitness of the students of the junior high schools of Waterloo, Iowa.

The Iowa Test of Motor Fitness was administered to the students of Patrick Henry Junior High School in Sioux Falls and to the junior high students of Waterloo. The students of Sioux Falls had an average of 125 minutes in physical education class each week in the seventh and eighth grades. In the ninth grade they had 100 minutes of physical education each week. In Waterloo all students had an average of 150 minutes of physical education each week.

The raw scores were arranged in frequency distributions after which statistical procedures were applied to determine the means and the level of significance of the difference between the means.

Findings

The findings of the investigation are as follows:

1. The seventh grade girls of Waterloo were significantly superior to the seventh grade girls of Sioux Falls in the Shuttle Run, the Forward Bend, and the Bent Arm Hang.

2. The seventh grade boys of Waterloo were significantly

superior to the seventh grade boys of Sioux Falls in the Sit-Ups and the Pull-Ups.

3. The eighth grade girls of Waterloo were significantly superior to the eighth grade girls of Sioux Falls in the Shuttle Run, the Forward Bend, and the Bent Arm Hang.

4. There was no significant difference in any items at the eighth grade boys level.

5. The ninth grade girls of Waterloo were significantly superior to the ninth grade girls of Sioux Falls in Sit-Ups and the Bent Arm Hang.

6. The ninth grade boys of Sioux Falls were significantly superior to the ninth grade boys of Waterloo in the Grasshopper test.

7. The ninth grade boys of Waterloo were significantly superior to the ninth grade boys of Sioux Falls in the Shuttle Run, the Sit-Ups, and the Pull-Ups.

8. There were no statistically significant differences in 28 of the 42 items compared.

Conclusion

In studying the statistical findings of this investigation, it appears that the students of Waterloo, Iowa, junior high schools and the students of Patrick Henry Junior High School of Sioux Falls, South Dakota, are quite similar when considering certain aspects of physical fitness, as measured by the Iowa Test of Motor Fitness. However, the

Waterloo junior high students showed a definite superiority in the area of arm and upper body strength.

Recommendations

In completion of this study, the author feels that the following recommendations are justified:

1. That the physical education programs of the two schools in this study be evaluated and compared.

2. That a study concerning the arm and upper body strength of these two schools be carried out.

3. That a similar study be made at the sophomore, junior, and senior level in South Dakota high schools.

4. That a study be made to help the schools of South Dakota establish a physical fitness test that would be adaptable to our climate, which hinders outdoor testing.

LITERATURE CITED

1. Hans Kraus and Ruth P. Hirschland, "Muscular Fitness and Health," Journal of Health, Physical Education, and Recreation, Vol. XXIV, 17-19, December, 1953.

2. "President's Conference on Fitness of American Youth," Journal of Health, Physical Education, and Recreation, Vol. XXVIII, 8, September, 1956.

3. John F. Kennedy, "The Soft American," Sports Illustrated, December, 1960, p. 15.

4. Youth Physical Fitness, President's Council on Youth Fitness, U. S. Government Printing Office, 1961.

5. "A Presidential Message to the Schools on Physical Fitness of Youth," Youth Physical Fitness, President's Council on Youth Fitness, U. S. Government Printing Office, 1961.

6. Hans Kraus and Ruth P. Hirschland, "Muscular Fitness and Health," Journal of Health, Physical Education, and Recreation, Vol. XXIV, 17-19, December, 1953.

7. "Whats Wrong With American Youths," U. S. News and World Report, March, 1954, p. 35.

8. "Whats Wrong With American Youths," U. S. News and World Report, March, 1954, p. 35.

9. H. Harrison Clarke, Application of Measurements to Health and Physical Education, p. 16, Prentice-Hall, Inc., Englewood Cliff, New Jersey, 1960.

10. George T. Stafford and Ray O. Duncan, Physical Conditioning, p. 1, A. S. Barnes and Co., New York, 1942.

11. Paul A. Hunsicker, "American Association of Health, Physical Education, and Recreation's Youth Fitness Project," Journal of Health, Physical Education, and Recreation, Vol. XXVIII, 17, November, 1956.

12. Anna Espenschade, "Report to the Test Committee of the Western Society of Departments of Physical Education for Women in Colleges and Universities," The Research Quarterly, Vol. XIV, 397, December, 1943.

13. C. M. McCloy, "What is Physical Fitness," Journal of Health, Physical Education, and Recreation, Vol. XXVII, 14, September, 1956.

14. Arthur H. Steinhaus, "The Role of Exercise in Physical Fitness," Journal of Health, and Physical Education, Vol. XIV, 299, June, 1943.

15. G. Ott Romney, "The What, Why, and How of Youth Fitness," The Physical Educator, Vol. XVI, 123-128, December, 1959.

16. T. R. Doppen, "Physical Fitness," The Physical Educator, Vol. XVI, 145, December, 1959.

17. Thomas K. Cureton, "Exercise to Keep Fit," Sports Illustrated, Vol. II, 63, January 17, 1955.

18. Hans Kraus and Bonnie Prudden, "Minimum Muscular Fitness Tests in School Children," Research Quarterly, Vol. XXV, 178-188, May, 1959.

19. L. A. Larson, "Health and Fitness in the Modern World," Journal of Health, Physical Education, and Recreation, Vol. XXXI, 59, December, 1960.

20. Yoshiuiki Noguchi, "Fitness Testing of Japanese Children," Journal of Health, Physical Education, and Recreation, Vol. XXVII, 20, October, 1956.

21. Yoshiyuki Noguchi, and Kiyoshi Yoshida, "Comparative Study of Motor Fitness Between Japanese and American Youth," Research Society for Motor Ability, Kagashima University, 1959, (Research Quarterly, Vol. XXXIII, 4, December, 1962.)

22. Ford Hess, "Letters to the Editor's Mail," Journal of Health, Physical Education, and Recreation, Vol. XXVII, 6, February, 1956.

23. Charles A. Bucher, "Education for Fitness," Foundations of Physical Education, p. 25-26, C. V. Mosby Co., St. Louis, 1960.

24. Paul Dudley White, M. D., "The Advantages of Physical Fitness," Illinois Medical Journal, October, 1959.

25. Henry E. Garrett, "Testing Experimental Hypothesis," Elementary Statistics, second edition, p. 127-129, David McKay Company, Inc., New York, 1962.

26. Research Methods in Health, Physical Education, and Recreation, second edition, p. 187, American Association for Health, Physical Education, and Recreation, Washington, D. C., 1959: edited by M. Gladys Scott for the Research Council.

APPENDIX A

SAMPLE SCORE SHEET

Name of School_____ Address_____

Grade___ No. of P.E.Classes per Week____ Length of Period_____

Dates on which testing was done:_____

Name of Student	Sex	Age	Sit-Up	Broad Jump	Shuttle Run	Fwd. Bend	Grass-hopper	Dash	Pull-Ups	Bent Arm Hang
1.										
2.										
3.										

This was made to fit the size of each class tested.

APPENDIX B

THE IOWA TEST OF MOTOR FITNESS

The Iowa Test of Motor Fitness is designed to help each school evaluate the physical status and capacity for motor activity of each boy and girl. It is designed for use of pupils in grades four through twelve.

GENERAL ADMINISTRATION

It is suggested that the tests be given on two or three different days; however, this procedure is flexible. Consideration should be given for the nature of the tests. In the grades where the boys and the girls are in class together, the tests should be so divided that those which are identical for boys and girls are given one day, and those which are administered differently for boys and girls are given on different days. Some of the tests are given indoors, others must be given out-of-doors, a factor that might influence the plan for administering the tests. A possible plan might be:

First day: Standing broad jump
Shuttle run

Second day: Sit-ups*
Forward bend
Grasshopper*

Third day: Pull-ups (for boys)*
Bent-arm hang (for girls)*
40-yard dash

In the above design, the tests would doubtless not take an entire class period. The tests have also been planned to require the minimum of equipment. All tests can be administered by the teacher alone or with the help of trained student assistants. If class time is extremely limited and a shorter battery of tests is needed, use tests which are starred. (*) They could be completed in one lesson.

SIT-UPS

Capacity Involved: Strength and endurance of abdominal muscles.

Equipment Needed: Stop watch; preferably done on mat or turf, but may be done on the floor.

Starting Position: Assume a hook sitting position with feet flat on the floor, back straight. With elbows pointing forward, interlock fingers of the two hands behind the neck. When the trunk is leaning slightly forward, bring the feet back until the knees and elbows touch. The partner places hands on top of performer's feet and holds them firmly in the position determined by elbow and knee contact. Performer then lies back on the floor to await the starting signal, keeping the fingers clasped behind the neck, and elbows pointing up.

Instructions: On signal, "Ready, Go!" Lift trunk far enough to touch the point of the elbows to the knees and return to the back-lying position (back, but not head touching). You may stop, rest, and restart if you wish; but there is a one-minute time limit so you should keep going if possible.

Score: The number of times the pupil comes to a sitting position, with elbows touching the knees, in one minute, (2 minutes for boys in grades 10, 11, and 12).

Instructions to Test Administrator: Trunk flexion should be encouraged throughout the test; the head should be held forward at all times. In this position the use of the abdominal muscles is facilitated, and safety in returning to the lying position is enhanced. The fingers must be kept in position behind the neck at all times or the sit-ups do not count. The elbows should be forward at all times to prevent substitution of arm momentum for abdominal action. Swinging the arms forward, disqualifies the sit-up. The partner should hold the feet firmly. The partner's hands should be on the instep, arms straight, and shoulders over the hands.

STANDING BROAD JUMP

Capacity Involved: Power in the legs and coordination.

Equipment Needed: Indoors--mat which should be marked with lines at two-inch intervals. Outdoors--jumping pit, take-off board or take-off line near pit; measuring tape. Pupils should wear rubber-soled shoes.

Starting Position: Stand with feet parallel and toes just behind the front edge of the take-off board or the take-off line.

Instructions: Take-off from both feet simultaneously; jump as far forward as possible. The score is the distance from the edge of the take-off line to the nearest point touched by any part of the body. The best of three trials will be counted.

Score: Measure, at right angles to the take-off line, from the line to the nearest point of contact on the mat or pit. Measurement should be to the nearest half inch. If the three trials are taken in succession, only the longest of the three need be measured. The marked mat makes possible the instantaneous reading for each jump.

Instructions to Test Administrator: Preliminary swinging of arms and flexing of knees are permissible providing the feet are kept in place on the board until the actual take-off. Be sure the performer understands what is to be done. When the test is given indoors on a mat, the take-off may be taken from a wooden block or a beat board, or from the mat if it is large enough to prevent slipping. Comparisons from year to year should always be under identical testing conditions.

SHUTTLE RUN

Capacity Involved: Agility.

Equipment Needed: Stop watch; two one-inch lines marked on the floor, fifteen feet between their inside edges. If this test is to be administered to each student individually, the lines need be only about five feet long. The test may be scored by students, in which case the lines should be extended the length of the gymnasium and about six feet should be allowed for each student. Sufficient lines will permit administration of the test to all students by two repetitions, partners scoring.

Starting Position: Stand in any position you wish with your toes behind the line.

Instructions: On the signal, "Ready, Go!" Run forward toward the other line 15 feet away until one foot is on or over the line. Turn and run back toward the starting line until one foot is on or over the line. Repeat as rapidly as possible until the signal to stop is given.

Score: One point is given for each one-way trip during a 15 second interval. (Two points for a round trip.)

Instructions to Test Administrator: Either a run or a side step is permissible but the foot must reach the line before the student reverses his direction. Be sure the partner understands that he does not count the trip that is cut short without touching the line, or a trip that is in process when the final whistle blows.

FORWARD BEND

Capacity Involved: Flexibility.

Equipment Needed: Use two 18-inch pieces of a yard stick, or two narrow strips of wood marked in half-inch intervals. Mount the two strips on the front of a stool, platform, lowest plank of the bleachers, or the bottom step on the stairs. The inside edges of the two strips should be five inches apart and should extend exactly nine inches above the level of the platform and nine inches below the level of the platform. It is preferable to mark the deviation in inches from the platform level, those above being marked minus. Use another ruler or small strip of wood as a guide to determine the point reached by the fingers.

Starting Position: With your feet parallel and your toes immediately behind the vertical markers, stand on the platform.

Instructions: Let the arms, trunk and neck relax and hang forward, fingers moving down in front of the markers. Reach down slowly as far as possible, the finger tips of both hands moving along parallel and equally down the two markers. The knees must be kept straight. The score is the lowest point reached and held momentarily by the finger tips.

Score: The extra ruler or piece of wood is held horizontally against the finger tips. In order to measure the lowest position held by the performer, read score to the nearest half-inch, indicating a minus score if the lowest point reached is above the platform level, and a plus score if the point is below the platform level.

Instructions to Test Administrator: The most common error is bending the knees. The knees must be watched at all times. A student assistant may watch for this error and also be available in case the performer loses balance. The test administrator should sit on the floor, in order to be as near the level of the reach as possible. The horizontal ruler aids in the accuracy of scoring. Be sure that the ruler is level and that both hands are reaching equally. Do not permit a bobbing action; the measurement must be made for a sustained reach. It is preferable to have vertical markers with platform level marked zero and the plus and minus deviations indicated. These markings may be painted over the numbers on the yard stick. The subject may take two or three relaxed "practice warm-up" trials immediately before the trial which is measured. Emphasis should be on relaxation and a progressively greater reach. The test may then be administered and the best of two trials be recorded.

THE GRASSHOPPER

Capacity Involved: Endurance.

Equipment Needed: Stop watch (mats optional).

Starting Position: Assume a squat sitting position; bend forward and place the hands, shoulder-width apart, just in front of the line of the knees; extend one leg backward (this raises the hips slightly and puts more weight on the hands). The chest should be resting on the forward knee.

Instructions: On the signal, "Ready, Go!" Exchange the position of the legs and continue as rapidly as possible. Both feet must leave the floor at each exchange. The forward thigh must touch the chest each time the thigh is brought forward. Continue until the signal to stop is given. You may rest if necessary, and restart provided that during the rest the body is supported in the starting position.

Score: One point is given for each change during the time interval. The time is thirty seconds for girls of all ages; thirty seconds for boys in grades 4, 5, and 6, and one minute for boys in grades 7 and up.

Instructions to Test Administrator: Students may be used to help score this test but they must be carefully trained on judging the form. The following errors discount the jump; thigh not touching the chest, rear leg not fully extended, sliding the feet during the exchange (the movement must be a jumping action). Careful instruction and practicing of the judging of the form before the test is administered will minimize the errors during the test.

THE 40-YARD DASH

Capacity Involved: Speed.

Equipment Needed: Stop watch; a straight-away, preferably outdoors. A running track may be used, or a good turf. The test may be given indoors if space is sufficient. Runners should have rubber soled shoes; spikes and cleats are not permitted. The distance in grades 4 through 6 is 40 yards. The distance in grades 7 through 12 is 50 yards.

Starting Position: Assume any position you wish behind the starting line. No part of the body may touch the ground on or beyond the line.

Instructions: On the signal, "Get set, Ready, Go!", Run as fast as you can until you have crossed the finish line.

Score: The score is the time to the nearest .1 second from the starting signal until the runner reaches the finish line.

Instructions to Test Administrator: This test should be administered to the students individually, but if the students are ready, they can run rapidly one after the other. This should be administered according to track rules, that is, the starter giving the runner the signals and simultaneously signalling the timer, who is stationed at the finish line, and should stop the watch when any part of the runner crosses the line. The use of a yarn or finish tape will add to the accuracy of the scoring.

PULL-UPS (for boys)

Capacity Involved: Arm strength.

Equipment Needed: Horizontal bar (or substitute such as doorway gym bar, side of parallel bars or horizontal ladder, or cross-bar on outdoor playground equipment). Bar must be above the reaching height of the students.

Starting Position: Grasp the bar with palms toward the face and hands shoulder-width apart. Hang in a fully extended position (i.e., arms and body straight).

Instructions: Lift yourself up until your chin is above the level of the bar, lower to starting position again. Repeat as many times as possible. Action in both the upward and downward direction must be smooth and continuous. No jerking or body swinging is permitted.

Score: One point is scored each time the chin goes above the bar providing the upward movement was done smoothly without kip or swing.

Instructions to Test Administrator: It is preferable to administer the test to each student individually because the form in which it is done must be judged carefully. The boy should be dropped when he can no longer continue in good form.

BENT-ARM (for girls)

Capacity Involved: Arm strength.

Equipment Needed: Stop watch; horizontal bar (or substitute such as a doorway gym bar, side or parallel bars or horizontal ladder, top round of stall bars, or crossbars on outdoor playground equipment). The height of the bar should be adjusted so that the bar is just above the top of the performer. If the bar is higher, a stool or box should be used for the performer to start from. A height of more than one foot above the pupil's head is not recommended.

Starting Position: Grasp the bar with palms toward face and shoulder-width apart.

Instructions: Spring upward and bend the arms so that you are hanging with the arms fully bent and the chin is above but not touching the bar. Stay in this position as long as possible.

Scoring: The watch is started when the correct position is assumed, and stopped when the chin drops below the level of the top of the bar.

Instructions to Test Administrator: If necessary, assistance may be given the performer in getting up to the hanging position. The arm may be extended across the performer's legs if the legs start to swing. Watch the chin carefully and see that it is not resting on the bar. This test may also be given to younger boys who are unable to do pull-ups. This test, and the slow lowering of the body at the end of the test, will help to develop the strength needed for the pull-ups. Older girls who can do pull-ups may be permitted to do so.

GENERAL INSTRUCTIONS

If you need additional help in understanding the testing material and procedure, the Audio-Visual Bureau of the State University of Iowa, Iowa City, Iowa, has available a film that shows the proper administration. This film was made with the cooperation of the State University of Iowa and the Iowa Association for Health, Physical Education and Recreation.

Tests should be given once a year at approximately the same date each year. Whether they are given at the beginning of the school year or at the end will depend upon your reason for giving the tests and the use that is to be made of them. A test given in the fall is more helpful for diagnostic purposes than one given the previous spring, though either may serve that purpose. If the main purpose in giving the tests is evaluation of the year's physical education program, then spring is the most appropriate time for giving the test.

Form for all tests should be taught before the tests are given, so that on the testing day errors will be avoided and little time will be spent in giving instructions.

In the interests of a varied program and one that appeals to the students, training in the capacities involved should be provided in many ways other than in doing the tests as such.

If tests are to be meaningful, they should elicit maximum effort from the students. The way in which they are presented is important; your interest and enthusiasm will be helpful. Give encouragement to everyone before and during the tests.

The tests should be given only to those pupils who have been approved medically for unlimited activity. Tests should not be given to pupils who are ill, (including such ailments as hay fever or colds) or who are convalescing from illness or accidents.

Previous practice and conditioning should be provided. Student leaders may be trained to help administer the tests, thereby reducing class time needed. With junior or senior high students, partners may officiate as scorekeepers after they have practiced on the form and the administration of the tests. Individual score cards will be used if partners score, squad cards if leaders do the scoring and class score sheets if a teacher does the scoring.