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A Comparative Study of the Physical Fitness of the Fifth Grade Students in Brookings, South Dakota with the Fifth Grade Students in Cedar Rapids, Iowa Based on the Iowa Test of Motor Fitness

Donald Duane Hanson

A COMPARATIVE STUDY OF THE PHYSICAL FITNESS OF THE FIFTH GRADE STUDENTS IN BROOKINGS, SOUTH DAKOTA WITH THE FIFTH GRADE STUDENTS IN CEDAR RAPIDS, IOWA BASED ON THE IOWA TEST OF MOTOR FITNESS

BY

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A COMPARATIVE STUDY OF THE PHYSICAL FITNESS OF THE FIFTH GRADE STUDENTS IN BROOKINGS, SOUTH DAKOTA WITH THE FIFTH GRADE STUDENTS IN CEDAR RAPIDS, IOWA BASED ON THE IOWA TEST OF MOTOR FITNESS

This thesis is approved as a creditable, independent investigation by a candidate for the degree, Master of Science, and 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.

Thesis Advisor

Head of the Major Department

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CHAPTER I

INTRODUCTION

Never in the history of our country has there been greater concern for the fitness of the youth of America than during the past six years. The public awareness of the rather unfavorable results of the Kraus-Weber Minimum Muscular Fitness Tests[1] (that the American children lagged behind their European counterparts in physical endeavors) emphasized the need for cooperative action by a united citizenry.

In Dr. Kraus' opinion, we have let our physical fitness fall below a certain minimum and as a result, we are jeopardizing our well-being and health.[2]

Dwight D. Eisenhower, the president of the United States at the time, started the youth fitness movement in 1955 when he ordered the establishment of a Council on Youth Fitness.[3] The purpose of this council was to urge the adequate use of the facilities and leadership that were available and to promote additional programs which would

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[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]Ibid.

[3]"President's Conference on Fitness of American Youth", Journal of Health, Physical Education, and Recreation, vol. XXVII, 8, September, 1956.

improve the fitness of American youth.

President Kennedy cited the concern for physical fitness when he stated, "The strength of our youth and the fitness of our adults are among our most important assets".[4]

Although the national government has shown concern for physical fitness, only when every American is willing to assume responsibility for his own fitness and the fitness of his children, can the physical soundness of our nation be fully restored.

Statement of the Problem

The purpose of this study was to compare the physical fitness of fifth grade students in Brookings, South Dakota, with the fifth grade students in Cedar Rapids, Iowa.

Steps in the solution of this problem were:

1. To evaluate the results of The Iowa Test of Motor Fitness which had been administered to the fifth grade students in Cedar Rapids, Iowa.

2. To administer The Iowa Test of Motor Fitness to the fifth grade students in Brookings, South Dakota.

3. To compare the results of The Iowa Test of Motor Fitness of the fifth grade students in Brookings, South Dakota, with the fifth grade students in Cedar Rapids, Iowa.

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[4]John F. Kennedy, "The Soft American", Sports Illustrated, December, 1960, p. 15.

The test results of the fifth grade boys in Brookings, South Dakota, were compared with the test results of the fifth grade boys in Cedar Rapids, Iowa; and the test results of the fifth grade girls in Brookings, South Dakota, were compared with the test results of the fifth grade girls in Cedar Rapids, Iowa.

Reasons for the Study

The author wanted to compare the physical fitness of students to see if there was any significant difference between those who had sixty minutes of instruction in physical education per week (Brookings, South Dakota) with students who had one hundred minutes of instruction in physical education per week (Cedar Rapids, Iowa).

Delimitations

1. Only those fifth grade students who were ten or eleven years old were included in this study.

2. No attempt was made to classify students according to race, nationality, body type, motor ability, or economic status.

3. No attempt was made to compare the students individual physical fitness.

4. No attempt was made to compare the physical education programs in the two schools.

CHAPTER II

REVIEW OF LITERATURE

Physical fitness has always been a concern of man. This concern gained momentum after Dr. Hans Kraus made known the results of the Kraus-Weber Minimum Muscular Fitness Test[5] which showed that the American children fell below the achievement of the European children.

"What's Wrong With American Youths", is the title of an article which appeared in the U. S. News and World Report. This article goes on to say, "In terms of muscle and 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".[6]

The article continues, "American youngsters tend to be more alert - mentally . . . while they may have strong minds, there appears to be more weak backs".[7]

What is physical fitness? "Fitness" means different things to different people.

H. Harrison Clarke says physical fitness is:

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[5]Hans Kraus and Ruth P. Hirschland, loc. cit.

[6]"What's Wrong With American Youths", U. S. News and World Report, March, 1954, p. 35.

[7]Ibid.

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 in physical strength and vitality.[8]

Paul A. Hunsicker defines physical fitness:

Physical fitness includes those qualities which permit an individual to perform life activities involving speed, strength, agility, power, and endurance and to engage in the 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.[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 supple, well-balanced body which he uses in a skillful, well-coordinated 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 effects. His body is functioning with a maximum of efficiency.[10]

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[8]H. Harrison Clarke, Application of Measurement to Health and Physical Education, p. 16, Prentice-Hall Inc.: Englewood Cliff, New Jersey, 1960.

[9]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, 1957.

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

Dr. Anna Espenschade's committee reports, "Fitness implies the ability to perform productive and continuous work. Components of fitness would be physical strength, skill, organic vigor and endurance."[11]

C. M. McCloy felt that the following were necessary for physical fitness: (1) Hereditary of vital organs (one born with organs of high quality); (2) good health; (3) good hygienic habits; (4) physical conditioning; (5) endurance; and (6) body flexibility.[12]

Much has been said about physical fitness. However, physical fitness is but a part of total fitness. Physical fitness is related to the tasks a person must perform, his capacity for physical effort, and the relationship of his physical fitness to his total self. The question, "Fitness for what?" must always be asked. The same degree of physical fitness is not necessary for everyone. It should be sufficient for him to carry out his daily tasks without fatigue, and a little extra in reserve for emergencies. A person's physical fitness depends on the capacity of his own physical make-up.

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[11]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.

[12]C. M. McCloy, "What is Physical Fitness", Journal of Health, Physical Education and Recreation, vol. XXVII, 14, September, 1956.

Steinhaus stated:

> Physical fitness implies freedom from disease or significant deviation from normal structure and function; enough strength, speed, 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.[13]

G. Ott 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.[14]

The federal government can make a substantial contribution toward improving the health of our citizens by providing leadership and keeping physical fitness as one of the nation's leading concerns.

While preparing for the 1960 White House Conference on Physical Fitness of Children and Youth, President Eisen-

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[13]Arthur H. Steinhaus, et al., "The Role of Exercise in Physical Fitness", Journal of Health and Physical Education, vol. XIV, 299, June, 1943.

[14]G. Ott Romney, "The What, Why and How of Youth Fitness", The Physical Educator, vol. XVI, 123-128, December, 1959.

hower stated that 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.[15]

All groups working in the best interests of children agree that all American children should have the opportunity to grow in health and physical fitness.

Shane MacCarthy said to the Committee on Youth Fitness that "as the human being moves up the rungs of the ladder of material progress, he is prone to measure the advance by the amount of ease, comfort, and leisure he has acquired. In this process of waging war on work, he has a tendency to extol everything as "good" if it reduces the demands on him to work, to struggle, to strain, to energize, and to be vigorous."[16]

Many of the everyday activities which our forefathers took for granted are no longer part of our modern daily life.

A look at the parking lot of the average high school, packed with cars, will tell us what happened to the traditional hike to school that helped build strong bodies a generation ago. The television set, the movies and the numerous conveniences of modern life all attract our youth away from the

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[15] T. R. Doppen, "Physical Fitness", The Physical Educator, vol. XVI, 145, December, 1959.

[16] Shane MacCarthy, "Fitness and the Future", Fitness of American Youth, President's Council on Youth Fitness, 1958, p.27.

physical activity that is the basis of fitness in youth and in later life.

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] Over the years, Professor Thomas K. Cureton of the University of Illinois, has tested thousands of men and women with a physical conditioning program. From the 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, a few forms of heart and circulatory trouble could have been avoided entirely or postponed for as long as fifteen years if the person had carried out a daily program of body conditioning and active recreation.

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 Americans failed and 8.7% of the Europeans failed. The poor American showing can be explained by our high degree of mechanization which eliminates much physical activity.[18]

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[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, 1954.

John D. Lawther, in an article criticizing the Kraus-Weber findings explained the weakness of American children as compared with European children in four ways: (1) The American children are taller, heavier and live longer than at any preceding time; (2) The individual test items in the Kraus-Weber test are closely related to the gymnastic programs of Europe; (3) The question, "Fitness for what?" needs to be asked in determining physical fitness; (4) Physical performance is a unit reaction and the functional efficiency of the whole organism cannot be measured by tests of isolated movements.[19]

Although Lawther was critical of the Kraus-Weber findings, he emphasized the importance of muscular fitness. We are striving for adequate muscularity and suitable posture to prevent mechanical strains and needless fatigue.

Fox and Atwood hold the theory that the American children performed poorly on the Kraus-Weber test because they have a better diet and grow at a faster rate than the European children and are, therefore, not as physically coordinated.[20]

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[19]John D. Lawther, "Flexibility for What?", Journal of Health, Physical Education, and Recreation, vol. XXVII, 23, March, 1956.

[20]Margaret G. Fox and Janet Atwood, "Results of Testing Iowa School Children for Health and Fitness", Journal of Health, Physical Education, and Recreation, vol. XXVI, 20 and 76, September, 1955.

Ford Hess, in a letter to the editor, wrote that most of the muscular deficiencies in the Kraus-Weber test are the result of inadequate large muscle activity of the nature and amount consistent with skeletal muscular needs. He also says, "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".[21]

As Hess stated, those in physical education should accept the challenge and improve the physical education programs of our schools. However, according to a Fact Sheet, distributed at the President's conference on Fitness of American Youth in 1956, this is what is happening in our 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.
>
> 91% of the nation's 150,000 elementary schools have no gymnasiums and therefore, the fitness of 24 million children is often neglected.

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[21]Ford Hess, "Letters to the Editor's Mail", Journal of Health, Physical Education, and Recreation, vol. XXVII, 6, February, 1956.

> 68% of the nation's high schools have less than the recommended ten acres of land space 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.[22]

One of the chief avenues for reaching the youth of America is through the schools. The schools are the only agency through which more than 40,000,000 children and youths can be reached directly. The schools have the teachers who are trained for instilling youngsters with the desire to be fit and for carrying out conditioning programs. Unless this desire is in each child, the way of life that results in physical fitness will not be achieved. By the time children leave school and enter adult life, the importance of fitness in personal ambitions and desires and in feeling well and happy must be imprinted in every boy and girl. It has been estimated that 80% of the physical activity skills acquired during a lifetime are learned by children between the ages of 7 and 17 years. The schools have a responsibility of teaching the skills which are to be used elsewhere in the development and maintenance of physical fitness. The schools, however, represent only one force for developing a fit populace. Schools should work closely with and play a leading role in mobilizing the entire resources of each com-

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

munity to do the job.[23]

The habit of regular physical activity should assume the same importance as eating and sleeping in maintaining physical fitness.

All of us must consider our responsibilities for the physical well-being of our children and of the young men and women of our community. We do not want our children to become a generation of spectators and "softies". Rather, we want each of them to be participants and physically fit.

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[23] Ibid.

CHAPTER III

PROCEDURES

The Iowa Test of Motor Fitness had been administered in the spring of the previous year (1960) to the students in the elementary schools of Cedar Rapids, Iowa. The results had been sent to Dr. M. Gladys Scott, chairman of the Women's Physical Education Department at the State University of Iowa, Iowa City, Iowa. The results of the fifth grade students were obtained from Dr. Scott by the author.

Permission to administer the test to the fifth grade students in the elementary schools in Brookings, South Dakota, in the spring of 1961, was obtained by a personal interview with the superintendent, the principals and the physical education instructors.

The testing team consisted of the author and the physical education instructors in the Brookings schools. The testing team was trained in testing procedures and techniques before the actual administration of The Iowa Test of Motor Fitness. The procedure was followed as directed by the Iowa Motor Fitness Program except for the shuttle run, which was omitted from this study because the range of scores was too small to make a good comparison.

A week prior to the beginning of the testing program, 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 instructions of The Iowa Test of Motor Fitness. Each test was carefully described again before it was administered to an individual.

At the time of testing, encouragement was given to each student in order that he would perform at his maximum physical ability.

Those students who had obvious physical defects or who were convalescing from an illness were not included in this study.

The child's age was recorded during the first period of testing. The age recorded was that of his last birthday.

The Iowa Test of Motor Fitness was administered to the students during the physical education period. The students wore their regular physical education uniforms. The test was administered in the school gymnasium except for the 40-yard dash which was administered on the playground.

In Brookings, South Dakota, the regular physical education period consisted of two periods per week, each thirty minutes in length. One or two items of the test were administered during each physical education period. The test items were administered in the following order: The first period;

(1) the forward bend, and (2) the standing broad jump. The second period; (3) the grasshopper, and (4) pull-ups for the boys and (5) bent-arm hang for the girls. The third period; (6) sit-ups. The fourth period; (7) the 40-yard dash. A description of the items and detailed instructions for the administration of The Iowa Test of Motor Fitness will be found on the following pages.

Forward Bend

Capacity Involved: Flexibility.

Equipment: Two 18-inch pieces of a yard stick. The two strips were mounted on the front of a stool or the lowest plank of a bleacher. The inside edges of the two strips were five inches apart and extended exactly nine inches above the level of the platform and nine inches below the level of the platform. It was used as a guide to determine the point reached by the fingers.

Description: The student stood on the platform with his feet parallel and his toes immediately behind the vertical markers. The student was instructed to reach down slowly as far as possible, with the fingertips of both hands moving along parallel down the markers.

Instructions: The student was instructed to relax the arms, and body while the fingers moved down in front of the markers. The student reached down slowly as far as possible and held that position momentarily. The knees were kept straight. A bobbing action was not permitted; the measurement was made for a sustained reach. The student took two or three relaxed "practice warm-up" trials immediately before the ones which were measured. Emphasis was 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 placed horizontally at the end of the students' fingertips aided in the accuracy of the scoring. It was essential that both hands were reaching equally and that the knees were kept straight. Two trials were allowed with the best score recorded. The score was read to the nearest half-inch. (See Figure 1 on the following page.)

Figure 1. The Forward Bend

Standing Broad Jump

Capacity Involved: Power in the legs and coordination.

Equipment: Mat and measuring tape.

Description: The test was given indoors on a mat which was large and heavy enough to prevent slipping. The student stood on the edge of the mat with feet parallel and toes just behind the front edge of the take-off line. The students took-off from both feet simultaneously; jumping as far forward as possible.

Instructions: The student was encouraged to swing his arms and to flex his knees as preparatory movements. The jump was not counted unless the feet were kept in place on the mat until the actual take-off. When the student was in the proper position, he was instructed to jump forward as far as possible from the two-footed take-off.

Scoring: The score was the distance from the front edge of the take-off line to the nearest point touched by any part of the body. The jump was measured at right angles to the take-off line. The measurement was recorded to the nearest half-inch. Three trials were made in succession. The best of the three trials was counted. (See Figure 2 on the following page.)

Figure 2. The Standing Broad Jump

The Grasshopper

Capacity Involved: Endurance.

Equipment: Stop watch.

Description: The student assumed a squat-sitting position; he bent forward and placed the hands, shoulder-width apart just in front of the line of the knees and 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 commanded to begin, the student exchanged the position of the legs and continued as rapidly as possible. Both feet left the floor at each exchange. The forward thigh touched the chest each time the thigh was brought forward.

Instructions: On the signal, "Ready, Go!" the student exchanged the position of the legs and continued this procedure as rapidly as possible. He continued to do this until the signal was given to stop. He 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 (the movement had to be a jumping action). Careful instruction and practicing of the judging of the form was given to the student before the test was administered.

Scoring: One point was given each time the position of the feet was exchanged. The time allowed was thirty seconds. (See Figure 3 on the following page.)

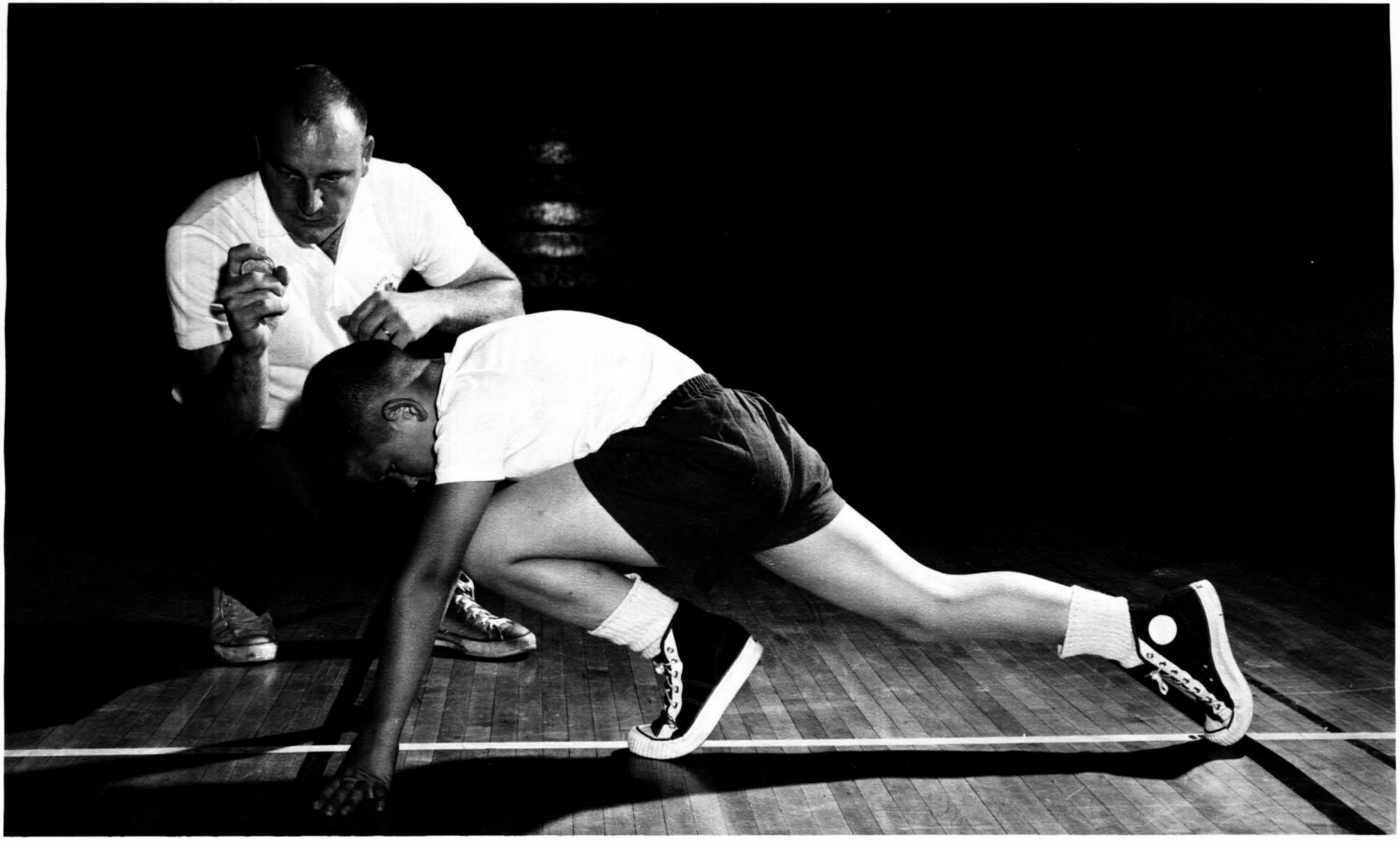

Figure 3. The Grasshopper

Pull-Ups (for boys)

Capacity Involved: Arm strength.

Equipment: Horizontal bar or substitute a doorway gym bar, and a bench.

Description: The bar was placed above the reaching height of the student. The student stood on a bench 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, i.e., arms and the body were straight. The student lifted himself up until his chin was above the level of the bar, then he lowered himself to the starting position again. The action in both the upward and downward direction 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 providing the upward movement was done smoothly without kip or swing. (See Figure 4 on the following page.)

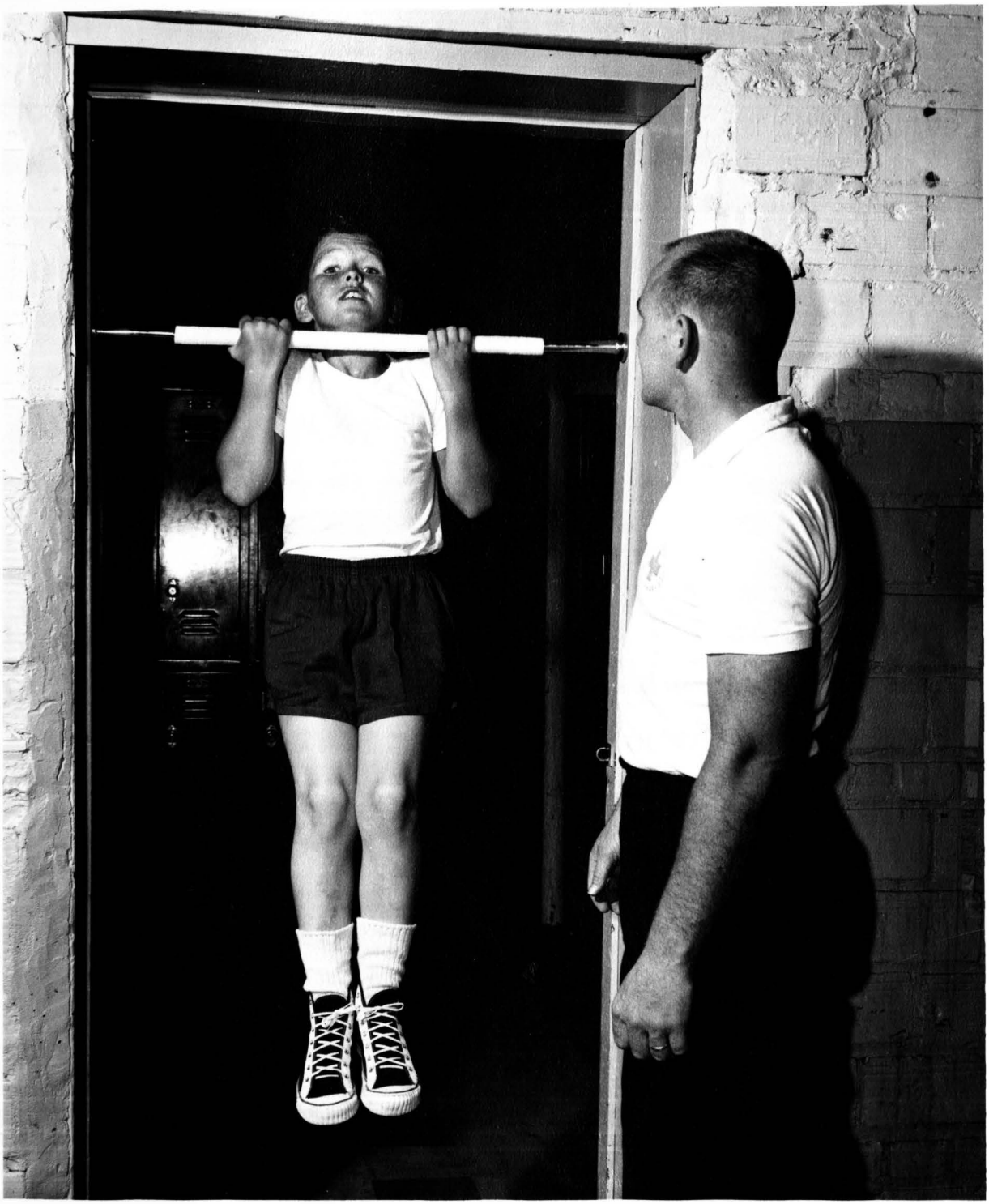

Figure 4. The Pull-Up (boys)

Bent-Arm Hang (for girls)

Capacity Involved: Arm strength.

Equipment: Stop watch and a doorway gym bar.

Description: The gym bar was placed in the doorway 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 at the elbows so that she was hanging with her arms fully bent and 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, jump upward and flex her arms at the elbows so that she was hanging with her arms fully bent and 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 5 on the following page.)

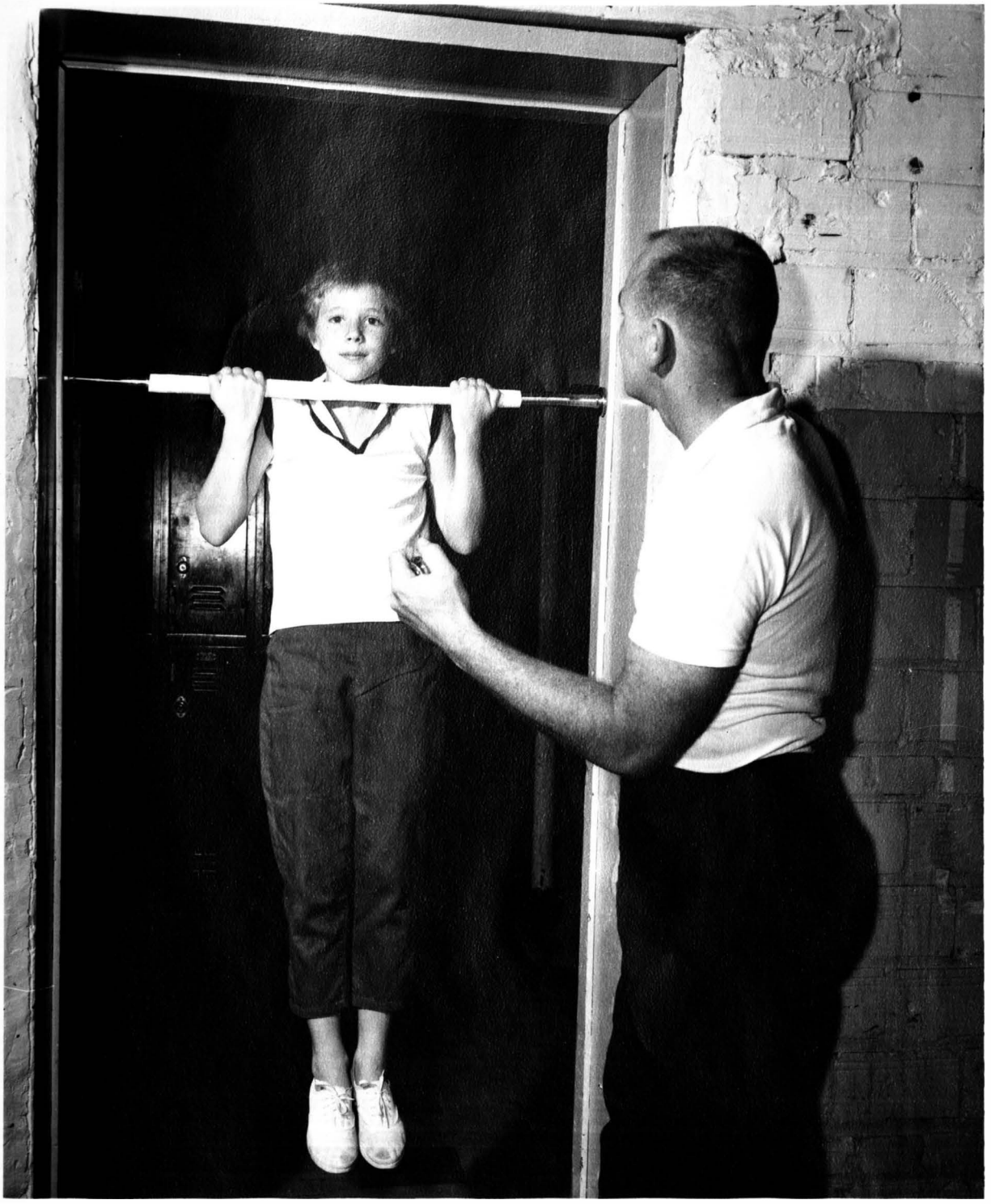

Figure 5. The Bent-Arm Hang (girls)

Sit-Up

Capacity Involved: Strength and endurance of abdominal muscles.

Equipment: Stop watch; mat or floor.

Description: The student assumed a hook sitting position with his feet flat on the floor, back straight. With his elbows pointing forward, he interlocked the fingers of his two hands behind the neck. When the trunk was leaned 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 then lay back on the floor to await the starting signal, with the fingers clasped behind the neck, and the elbows pointed up.

Instructions: On the signal, "Ready, Go!", the student lifted his trunk far enough to touch the point of the elbows to the knees and returned to the back-lying position (his back but not his head touched). He could stop, rest and restart if he wished but there was a one-minute time limit so he was urged to keep going if possible. Trunk flexion was encouraged throughout the test; the head was held forward. In this position the use of the abdominal muscles was facilitated, and safety in returning to the lying position was enhanced. The fingers had to be kept in

position behind the neck at all times, or the sit-up did not count. The elbows were forward at all times to prevent substitution of arm momentum for abdominal action. Swinging the arms forward disqualified the sit-up.

Scoring: The number of times the student came to a sitting position, with his elbows touching his knees, in one minute, was his score. (See Figure 6 on the following page.)

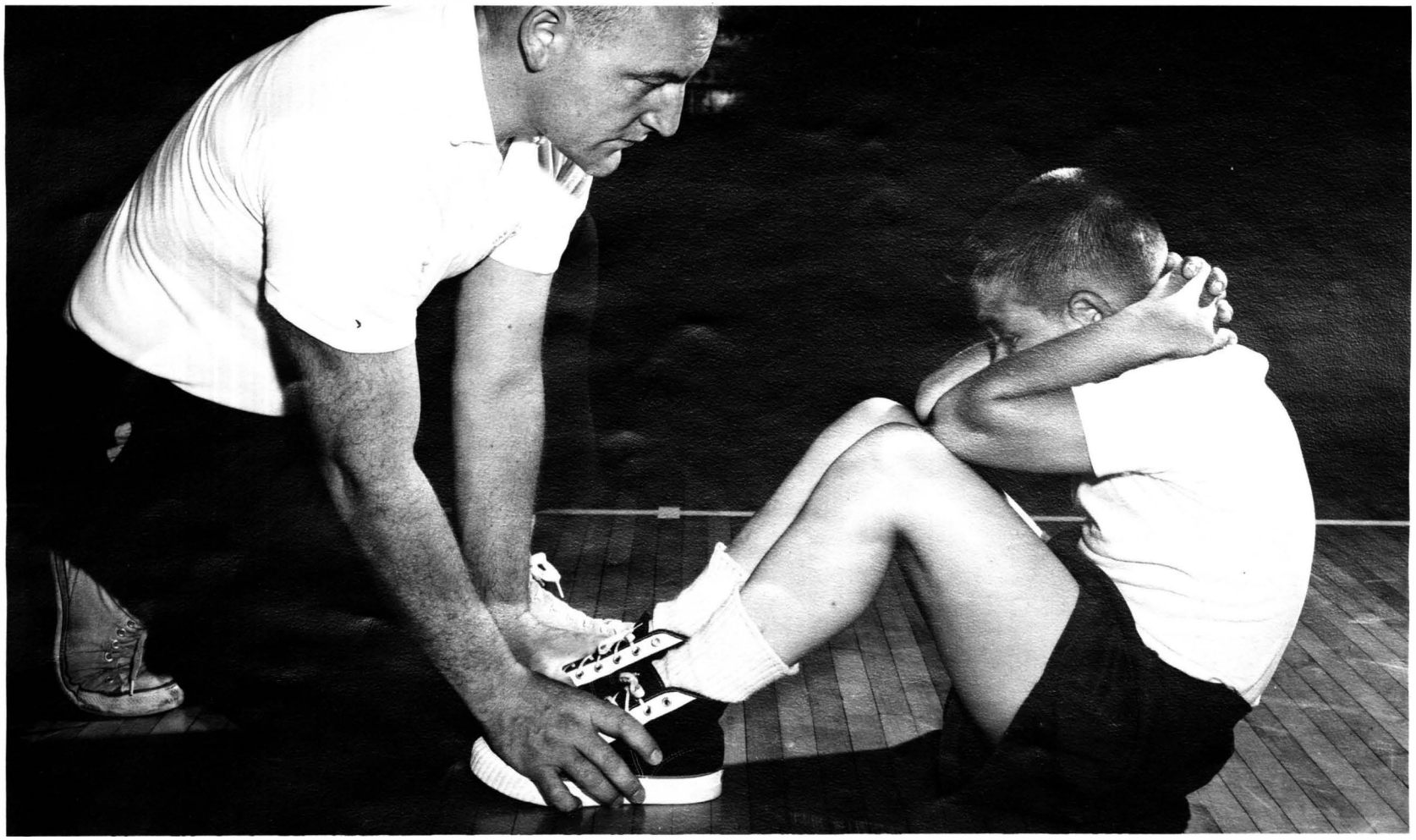

Figure 6. The Sit-Up

The 40-Yard Dash

Capacity Involved: Speed.

Equipment: Stop watch.

Description: The running path was measured on the dirt area of the playground. The student assumed any position he wanted to behind the starting line but no part of his body could touch the ground or go beyond the line. On the command to begin, the student ran as fast as he could until he crossed the finish line. The distance from the starting line to the finish line was 40 yards.

Instructions: The test was administered to two students at a time. They were instructed to take their place behind the starting line and as the "starter" gave the signals, "On your mark, Get set, Go", they ran as quickly as they could to the finish line. There were two judges at the finish line, each with a stop watch, to time the students who were running. As the "starter" said "Go!", he lowered his arm so the judges 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 "Go!" signal 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 stop watch was stopped, and the time recorded. (See Figure 7 on the following page.)

Figure 7. The 40-Yard Dash

CHAPTER IV

TREATMENT AND INTERPRETATION OF THE DATA

Treatment of the Data

The raw scores were taken from the score sheets (Appendix A) and were arranged in frequency distributions in order to facilitate their use. The frequency distributions considered were those of the fifth graders in Brookings, South Dakota and Cedar Rapids, Iowa. These distributions were then used in order to determine statistical measures such as the arithmetic mean (hereafter referred to as the mean) and the level of significance as based on the chi square method.[24] (Hereafter referred to as X^2).

Based on the "Assumed Mean" method of calculation as described by Garrett,[25] the means of the various items in the test battery were determined. The data was separated for the boys and the girls and the mean scores of each item were then computed for each school. The formula used and the meanings of the symbols were:

$$\text{MEAN} = \text{AM} + \frac{\Sigma fx'}{N} \times i$$

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[24] Palmer O. Johnson, "Procedures in Testing Statistical Hypotheses", Statistical Methods in Research, second edition, pp. 94-96, Prentice-Hall, Inc: New York, 1950.

[25] Henry E. Garrett, "Measures of Central Tendency", Statistics in Psychology and Education, fifth edition, pp. 35-38, Longman, Green and Co.; New York, 1958.

AM----Midpoint of the interval in which the mean is assumed.

Σ----Summation of:

f-----Total number of scores at each class interval.

x'----Deviations of the midpoints of the different steps measured from the assumed mean in units of class intervals.

N-----Number of scores.

i-----Size of the class interval.

Because of the skewedness of the distributions, it was necessary to apply the X^2 test as described by Johnson,[26] to testing the hypothesis that two frequency distributions could have come from the same homogeneous population. The formula used and the meanings of the symbols can be observed below.[27]

$$X2 = \frac{1}{\bar{p}\,\bar{q}} \left[\Sigma(ap) - n\bar{p}\right]$$

$$p = \frac{a}{(a+a')}$$

$$\bar{p} = \frac{n^1}{n^1 + n^2}$$

q---- 1 minus p

a---- Fifth graders from Cedar Rapids, Iowa.

a'--- Fifth graders from Brookings, South Dakota.

n^1---Number of fifth graders from Cedar Rapids, Iowa.

n^2---Number of fifth graders from Brookings, South Dakota.

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[26] Johnson, loc. cit.

[27] Ibid.

The degrees of freedom are referred to as the number of free variables in the distribution of the random variables connected with it. For each restriction imposed upon observations, the number of degrees of freedom is reduced by one.[28] In this study, the degrees of freedom (df) equal the number of intervals in the frequency distribution minus one.

In this study the significance was taken at either the five per cent level or the one per cent level. The X^2 table which gave the probability of exceeding the tabulated value of X^2 for the specified number of degrees of freedom can be observed in Garrett.[29] The null hypothesis[30] was then applied to the test results.

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[28] Ibid. p. 140.

[29] Garrett, op. cit., p. 450.

[30] Ibid., p. 213.

Interpretation of the Data

By referring to Tables I and II, one will note the actual differences for the boys and for the girls from the two schools on various items of the test. The tables show the means, degrees of freedom, results of the X^2 test and the level of significance. The null hypothesis was applied to the test results.

It is shown by Table I, that there is not a significant difference between the boys of the two schools in the forward bend, the standing broad jump, and the 40-yard dash. The null hypothesis was therefore accepted for these test items. The boys from Cedar Rapids, Iowa were superior at the one per cent level in the pull-up test item. The boys from Brookings, South Dakota, were superior in the grasshopper test item at the one per cent level and in sit-ups at the five per cent level. In the latter four items, the null hypothesis was rejected and the differences assumed to be real. (See Table I on the following page.)

TABLE I. THE MEANS, DEGREES OF FREEDOM, X^2, AND THE LEVEL OF SIGNIFICANCE
(Fifth grade boys)

Test items	M^1 (Brookings)	M^2 (Cedar Rapids)	df	X^2	Level of significance
Forward bend	.82	.913	13	15.66	N.S.*
Standing broad jump	57.36	57.75	11	10.37	N.S.*
The grasshopper	53.66	40.72	11	77.09	.01
Pull-ups	2.53	3.80	12	48.80	.01
Sit-ups	32.21	28.63	12	26.17	.05
40-yard dash	6.80	6.86	12	10.47	N.S.*

*N.S.--Not significant.

It is shown by Table II that there is not a significant difference between the girls of the two schools in the forward bend, the standing broad jump, the bent-arm hang and the sit-ups. The null hypothesis was therefore accepted for these test items. The girls from the Brookings schools were significantly superior at the one per cent level in the grasshopper test item and in the 40-yard dash test item. The null hypothesis for these two items was rejected and the difference assumed to be real. (See Table II on the following page.)

TABLE II. THE MEANS, DEGREES OF FREEDOM, X^2, AND THE LEVEL OF SIGNIFICANCE
(Fifth grade girls)

Test items	M^1 (Brookings)	M^2 (Cedar Rapids)	df	X^2	Level of Significance
Forward bend	2.36	1.98	10	17.38	N.S.*
Standing broad jump	54.45	54.70	9	13.74	N.S.*
The grasshopper	49.31	43.77	8	53.36	.01
Bent-arm hang	21.45	20.22	10	17.27	N.S.*
Sit-ups	21.72	22.93	10	11.37	N.S.*
40-yard dash	6.71	7.28	11	37.73	.01

*N.S.--Not significant.

Tables III through XIV show the range, frequency distributions, and the method of calculating X^2 for the items of the test. In Table III, the forward bend for boys, the range is from a minus five inches to a plus five inches for the boys from Brookings; and from a minus six inches to a plus seven inches for the boys from Cedar Rapids. (See Table III on the following page.)

TABLE III. THE RANGE AND FREQUENCY DISTRIBUTION OF THE FORWARD BEND FOR THE BOYS

Intervals in inches	a'	a	$p = \frac{a}{a'+a}$	ap
6.5 to 7.4	0	1	1.000	1.000
5.5 to 6.4	0	4	1.000	4.000
4.5 to 5.4	1	25	.961	24.025
3.5 to 4.4	4	40	.909	36.360
2.5 to 3.4	7	95	.931	88.445
1.5 to 2.4	7	120	.944	113.280
.5 to 1.4	26	119	.820	97.580
- .5 to .4	13	62	.826	51.212
-1.5 to - .4	8	61	.884	53.924
-2.5 to -1.4	4	40	.909	36.360
-3.5 to -2.4	1	35	.972	34.020
-4.5 to -3.4	1	19	.950	18.050
-5.5 to -4.4	0	6	1.000	6.000
-6.5 to -5.4	0	5	1.000	5.000
	n^2 72	n^1 632	$\bar{p}$=.898	Σ ap569.256

In Table IV, which is the forward bend for girls, the range for the girls of Brookings is found to be a minus three inches to a plus seven inches. The same range, a minus three inches to a plus seven inches, is found to be present for the girls of Cedar Rapids. (See Table IV on the following page.)

TABLE IV. THE RANGE AND FREQUENCY DISTRIBUTION OF THE FORWARD BEND FOR THE GIRLS

Intervals in inches	a'	a	$p=\frac{a}{a'+a}$	ap
6.5 to 7.4	1	2	.666	1.332
5.5 to 6.4	2	6	.750	4.500
4.5 to 5.4	10	12	.545	6.540
3.5 to 4.4	7	37	.840	31.080
2.5 to 3.4	11	45	.803	36.135
1.5 to 2.4	17	81	.826	66.906
.5 to 1.4	11	45	.803	36.135
- .5 to .4	6	11	.647	7.117
-1.5 to - .4	2	17	.894	15.198
-2.5 to -1.4	1	17	.944	16.048
-3.5 to -2.4	2	2	.500	1.000
	n^2 70	n^1 275	p=.797	Σ ap221.991

In Table V, which is the broad jump test item for the boys, the range for the boys of Brookings is found to be 71.5 inches to 35.5 inches. The range for the boys of Cedar Rapids is found to be from 79.5 inches to 35.5 inches. (See Table V on the following page.)

TABLE V. THE RANGE AND FREQUENCY DISTRIBUTION OF THE BROAD JUMP FOR THE BOYS

Intervals in Inches	a'	a	$p=\frac{a}{a'+a}$	ap
78-81	0	4	1.000	4.000
74-77	0	7	1.000	7.000
70-73	1	32	.969	31.008
66-69	4	61	.938	57.218
62-65	17	101	.855	86.355
58-61	16	127	.888	112.776
54-57	17	127	.881	111.887
50-53	10	78	.886	69.108
46-49	5	59	.921	54.339
42-45	1	18	.947	17.046
38-41	1	14	.933	13.062
34-37	1	7	.875	6.125
	n^2 73	n^1 635	$\bar{p}$=.896	Σ ap 569.924

Table VI, which shows the results of the broad jump test item for the girls, is on the following page. The range for the girls of Brookings is found to be from 71.5 inches to 39.5 inches. The range for the girls of Cedar Rapids is found to be 71.5 inches to 35.5 inches. (See Table VI on the following page.)

TABLE VI. THE RANGE AND FREQUENCY DISTRIBUTION OF THE BROAD JUMP FOR THE GIRLS

Intervals in inches	a'	a	$p=\frac{a}{a'+a}$	ap
70-73	2	7	.777	5.439
66-69	3	13	.812	10.556
62-65	8	25	.757	18.925
58-61	19	46	.707	32.522
54-57	9	66	.880	58.080
50-53	20	40	.666	26.640
46-49	11	42	.792	33.264
42-45	1	16	.941	15.056
38-41	2	9	.818	7.362
34-37	0	2	1.000	2.000
	n^2 75	n^1 266	$\bar{p}$=.780	Σ ap209.844

Table VII, which shows the results of the grasshopper test item for the boys, is on the following page. The range for the boys of Brookings is found to be from 32 times to 72 times in thirty seconds. The range for the boys of Cedar Rapids is found to be from 17 times to 72 times in thirty seconds. (Table VII is on the following page.)

TABLE VII. THE RANGE AND FREQUENCY DISTRIBUTION OF THE GRASSHOPPER TEST FOR THE BOYS

Intervals in repetitions	a'	a	$p=\frac{a}{a'+a}$	ap
70-74	2	5	.714	3.570
65-69	3	23	.884	20.332
60-64	11	31	.738	22.878
55-59	16	43	.728	31.304
50-54	20	56	.736	41.216
45-49	14	60	.810	48.600
40-44	2	77	.974	74.998
35-39	3	75	.961	72.075
30-34	1	57	.982	55.974
25-29	0	50	1.000	50.000
20-24	0	41	1.000	41.000
15-19	0	42	1.000	42.000
	n^2 72	n^1 560	$\bar{p}$=.886	Σ ap 503.947

Table VIII, which shows the results of the grasshopper test for the girls, is on the following page. The range for the girls of Brookings is found to be from 32 times to 67 times in thirty seconds. The range for the girls of Cedar Rapids is found to be from 32 times to 72 times in thirty seconds. (See Table VIII on the following page.)

TABLE VIII. THE RANGE AND FREQUENCY DISTRIBUTION OF THE GRASSHOPPER TEST FOR THE GIRLS

Intervals in repetition	a'	a	$p=\frac{a}{a'+a}$	ap
70-74	0	6	1.000	6.000
65-69	1	10	.909	9.090
60-64	5	20	.800	16.000
55-59	7	11	.611	6.721
50-54	22	30	.576	17.280
45-49	19	25	.568	14.200
40-44	9	27	.750	20.250
35-39	4	27	.870	23.490
30-34	2	92	.978	89.976
	n^2 69	n^1 248	$\bar{p}$=.782	Σ ap=203.007

Table IX, which shows the results of the pull-up test item for the boys, is on the following page. The range of scores for the boys of Brookings is from zero times to 13 times. The range of scores for the boys of Cedar Rapids is from zero times to 25 times. (See Table IX on the following page.)

TABLE IX. THE RANGE AND FREQUENCY DISTRIBUTION OF THE PULL-UP TEST FOR THE BOYS

Intervals	a'	a	$p=\frac{a}{a'+a}$	ap
24-25	0	1	1.000	1.000
22-23	0	2	1.000	1.000
20-21	0	10	1.000	10.000
18-19	0	5	1.000	5.000
16-17	0	6	1.000	6.000
14-15	0	5	1.000	5.000
12-13	1	15	.937	14.055
10-11	1	19	.950	18.050
8-9	4	34	.894	30.396
6-7	2	43	.955	41.065
4-5	9	68	.883	60.044
2-3	22	112	.835	93.520
0-1	33	263	.888	233.544
	n^2 72	n^1 578	$\bar{p}$=.889	Σ ap 518.674

Table X, which shows the results of the bent-arm hang test item for the girls, is on the following page. The range of scores for the girls of Brookings is from 4.5 seconds to 104.5 seconds. The range of scores for the girls of Cedar Rapids is from 4.5 seconds to 74.5 seconds. (See Table X on the following page.)

TABLE X. THE RANGE AND FREQUENCY DISTRIBUTION OF THE BENT-ARM HANG FOR THE GIRLS

Interval	a'	a	$p=\frac{a}{a'+a}$	ap
100-109	1	0	.000	.000
90-99	1	0	.000	.000
80-89	1	0	.000	.000
70-79	2	1	.333	.333
60-69	1	6	.857	5.142
50-59	1	11	.916	10.076
40-49	3	24	.888	21.312
30-39	4	28	.875	24.500
20-29	12	41	.773	31.693
10-19	22	77	.777	59.829
0-9	24	90	.789	71.010
	n^2 72	n^1 278	$\bar{p}$=.794	Σ ap223.562

Table XI, which shows the results of the sit-up test item for the boys, is on the following page. The range of scores for the boys of Brookings is from 7 times to 47 times. The range of scores for the boys of Cedar Rapids is from 2 times to 62 times. (See Table XI on the following page.)

TABLE XI. THE RANGE AND FREQUENCY DISTRIBUTION OF THE SIT-UP TEST FOR THE BOYS

Interval	a'	a	$p=\frac{a}{a'+a}$	ap
60-64	0	1	1.000	1.000
55-59	0	1	1.000	1.000
50-54	0	8	1.000	8.000
45-49	1	20	.952	19.040
40-44	12	48	.800	38.400
35-39	23	106	.821	87.026
30-34	16	117	.879	102.843
25-29	7	95	.931	88.445
20-24	5	107	.955	102.185
15-19	7	83	.922	76.526
10-14	1	40	.975	39.000
5-9	1	13	.928	12.064
0-4	0	13	1.000	13.000
	n^2 73	n^1 652	$\bar{p}$=.899	Σap 588.529

Table XII, which shows the results of the sit-up test item for the girls, is on the following page. The range of scores for the girls of Brookings is from 7 times to 37 times. The range of scores for the girls of Cedar Rapids is from 2 times to 52 times. (See Table XII on the following page.)

TABLE XII. THE RANGE AND FREQUENCY DISTRIBUTION OF THE SIT-UP TEST FOR THE GIRLS

Interval	a'	a	$p=\frac{a}{a'+a}$	ap
50-54	0	1	1.000	1.000
45-49	0	1	1.000	1.000
40-44	0	6	1.000	6.000
35-39	2	14	.875	12.250
30-34	7	52	.881	45.812
25-29	17	50	.746	37.300
20-24	20	52	.722	37.544
15-19	13	48	.786	37.728
10-14	8	40	.833	33.320
5-9	4	9	.692	6.228
0-4	0	6	1.000	1.000
	n^2 71	n^1 279	$\bar{p}$=.797	Σ ap210.182

Table XIII, which shows the results of the 40-yard dash test item for the boys, is on the following page. The range of scores for the boys of Brookings is from 5.8 seconds to 8.2 seconds. The range of scores for the boys of Cedar Rapids is from 5.5 seconds to 9.1 seconds. (See Table XIII on the following page.)

TABLE XIII. THE RANGE AND FREQUENCY DISTRIBUTION OF THE 40-YARD DASH FOR THE BOYS

Interval	a'	a	$p=\frac{a}{a'+a}$	ap
9.0-9.2	0	7	1.000	7.000
8.7-8.9	0	3	1.000	3.000
8.4-8.6	0	9	1.000	9.000
8.1-8.3	1	14	.933	13.062
7.8-8.0	1	27	.964	26.028
7.5-7.7	7	39	.847	33.033
7.2-7.4	11	46	.807	37.122
6.9-7.1	13	99	.883	87.417
6.6-6.8	12	89	.881	78.409
6.3-6.5	12	97	.889	86.233
6.0-6.5	6	63	.913	57.519
5.7-5.9	6	23	.793	18.239
5.4-5.6	0	10	1.000	10.000
	n^2 69	n^1 526	$\bar{p}$=.884	Σ ap437.062

Table XIV, which shows the results of the 40-yard dash test item for the girls, is on the following page. The range of scores for the girls of Brookings is from 5.8 seconds to 7.9 seconds. The range of scores for the girls of Cedar Rapids is from 5.8 seconds to 9.1 seconds. (See Table XIV on the following page.)

TABLE XIV. THE RANGE AND FREQUENCY DISTRIBUTION OF THE 40-YARD DASH FOR THE GIRLS

Interval	a'	a	$p=\frac{a}{a'+a}$	ap
9.0-9.2	0	5	1.000	5.000
8.7-8.9	0	3	1.000	3.000
8.4-8.6	0	10	1.000	10.000
8.1-8.3	0	14	1.000	14.000
7.8-8.0	2	31	.939	29.109
7.5-7.7	3	23	.885	20.355
7.2-7.4	9	26	.743	19.318
6.9-7.1	10	39	.796	31.044
6.6-6.8	15	38	.717	27.246
6.3-6.5	18	23	.561	12.903
6.0-6.2	9	10	.526	5.260
5.7-5.9	2	1	.333	.333
	n^2 68	n^1 223	$\bar{p}$=.766	Σ ap177.568

The Iowa Test of Motor Fitness

Forward bend:

Figure 8 shows that the fifth grade girls of Brookings, South Dakota had the best results in the forward bend with an average reach of 2.36 inches below their standing level. Following the fifth grade girls of Brookings, were the fifth grade girls of Cedar Rapids, Iowa with an average reach of 1.98 inches below their standing level.

The means of the fifth grade boys of Brookings, South Dakota and the fifth grade boys of Cedar Rapids, Iowa, fell below that of the fifth grade girls, indicating that the flexibility of the boys is less than the flexibility of the girls. (See Figure 8 on the following page.)

Standing broad jump:

Figure 9 represents the means of the fifth grade students from Brookings, South Dakota and Cedar Rapids, Iowa in the standing broad jump. It can be seen that the fifth grade girls are about equal in jumping ability. The distance the boys were able to jump was slightly greater than that of the girls; however, the boys from the two schools were about equal in their ability to jump. (See Figure 9 on the following page.)

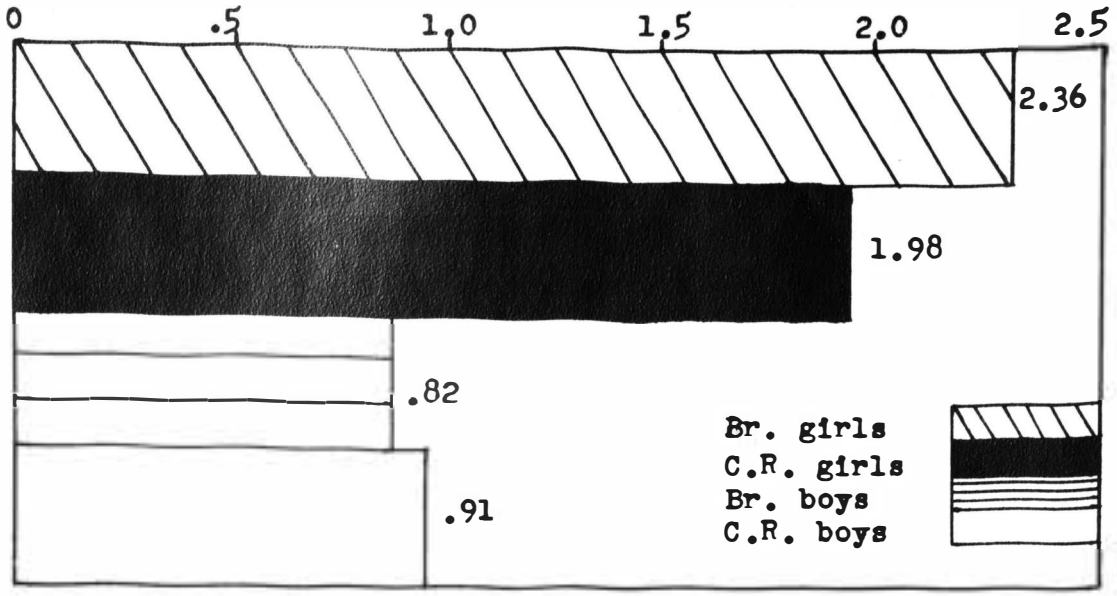

Figure 8. A Comparative Graph of the Forward Bend Test Item Showing the Results of the Mean for the Boys and Girls of Brookings, South Dakota and Cedar Rapids, Iowa.

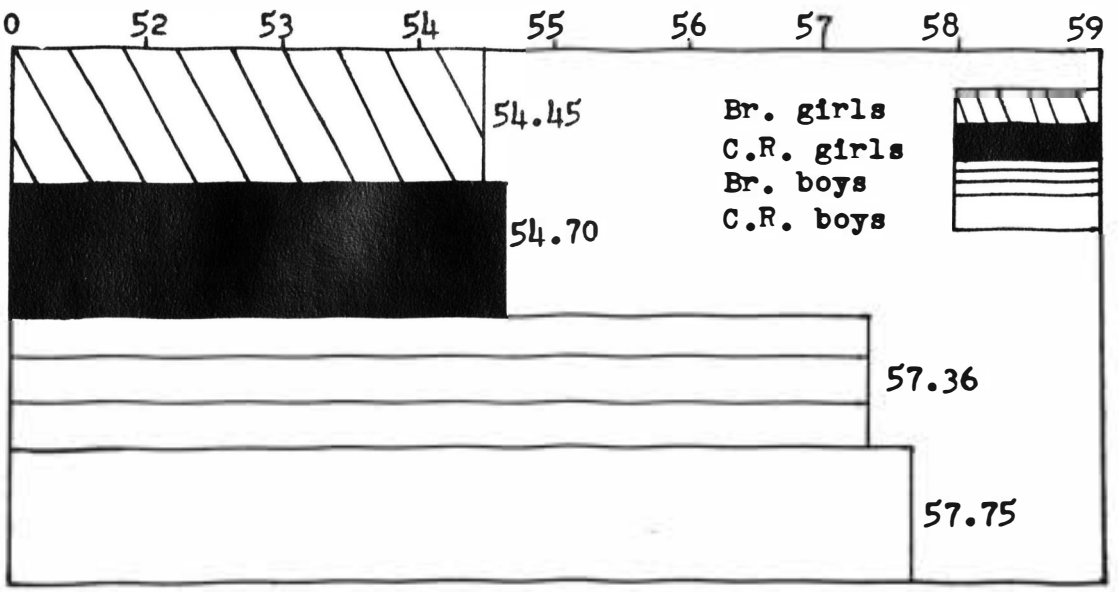

Figure 9. A Comparative Graph of the Standing Broad Jump Test Showing the Results of the Mean for the Boys and Girls of Brookings, South Dakota and Cedar Rapids, Iowa.

The grasshopper:

Figure 10 represents a comparison of the means of the fifth grade students in Brookings, South Dakota and Cedar Rapids, Iowa, on the grasshopper test item. The fifth grade students of Brookings were superior to the fifth grade students in Cedar Rapids in this test item. The fifth grade girls of Cedar Rapids scored slightly higher than did the fifth grade boys of Cedar Rapids. (See Figure 10 on the following page.)

Pull-ups:

Figure 11 is a comparison of the means of the fifth grade boys from Cedar Rapids, Iowa, and the fifth grade boys of Brookings, South Dakota. The figure shows that the boys of Cedar Rapids are superior to the boys of Brookings in the pull-ups. The mean score of each school was relatively low for this test. The boys of Cedar Rapids were able to do an average of 3.8 pull-ups while the boys of Brookings were able to do an average of only 2.53 pull-ups. (See Figure 11 on the following page.)

Bent-arm hang:

Figure 12 shows the mean results of the bent-arm hang for the fifth grade girls of Brookings, South Dakota and Cedar Rapids, Iowa. The results showed that the mean of the fifth grade girls of Brookings was slightly higher than the mean of the fifth grade girls of Cedar Rapids, but they were not enough to give significance to the difference. (See Figure 12 on the following page.)

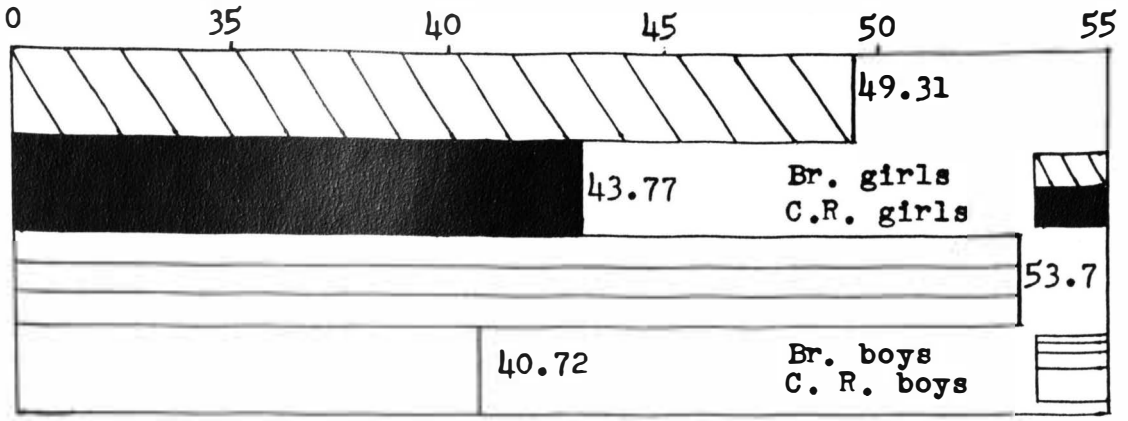

Figure 10. A Comparative Graph of the Grasshopper Test Item Showing the Results of the Mean for the Boys and Girls of Brookings, South Dakota and Cedar Rapids, Iowa.

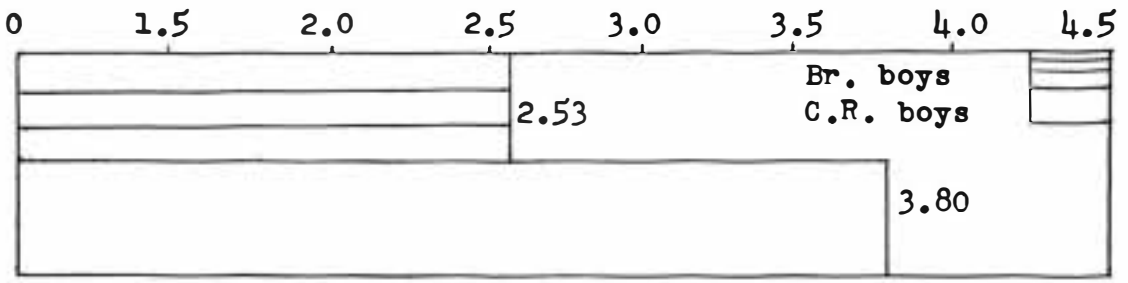

Figure 11. A Comparative Graph of the Pull-Up Test Item Showing the Results of the Mean for the Boys of Brookings, South Dakota and Cedar Rapids, Iowa.

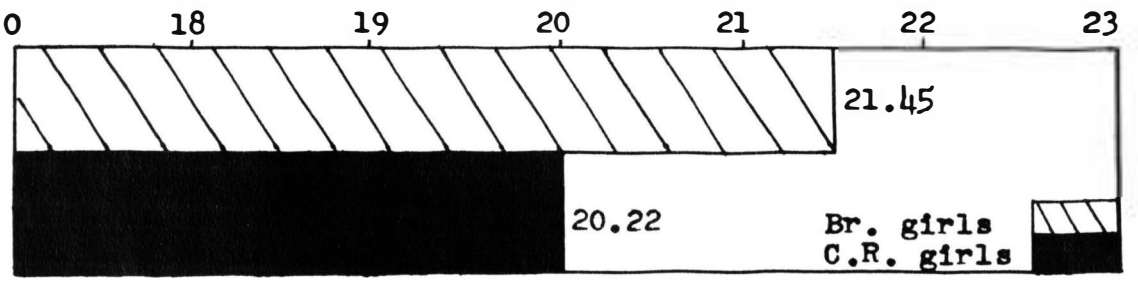

Figure 12. A Comparative Graph of the Bent-Arm Hang Test Item Showing the Results of the Mean for the Girls of Brookings, South Dakota and Cedar Rapids, Iowa.

Sit-ups:

Figure 13 shows the mean results of the sit-up test item for the fifth grade students of Brookings, South Dakota, and Cedar Rapids, Iowa. It can be seen that the boys scored higher than the girls on this test item. The boys of Brookings achieved the highest mean score, while the girls of Brookings made the lowest mean score. (See Figure 13 on the following page.)

40-yard dash:

Figure 14 is a comparison of the means of the fifth grade students of Brookings, South Dakota and Cedar Rapids, Iowa in the 40-yard dash. The girls from Cedar Rapids had the slowest time while the girls of Brookings had the fastest time. The time for the boys from the two schools was only slightly slower than that of the girls of Brookings. (See Figure 14 on the following page.)

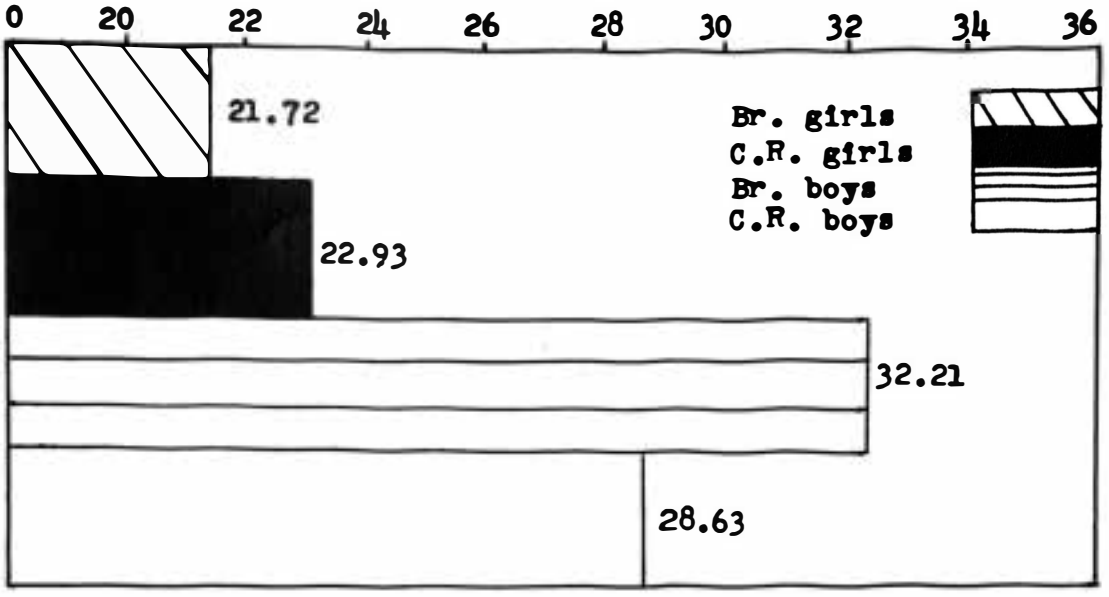

Figure 13. A Comparative Graph of the Sit-Up Test Item Showing the Results of the Mean for the Boys and Girls of Brookings, South Dakota and Cedar Rapids, Iowa.

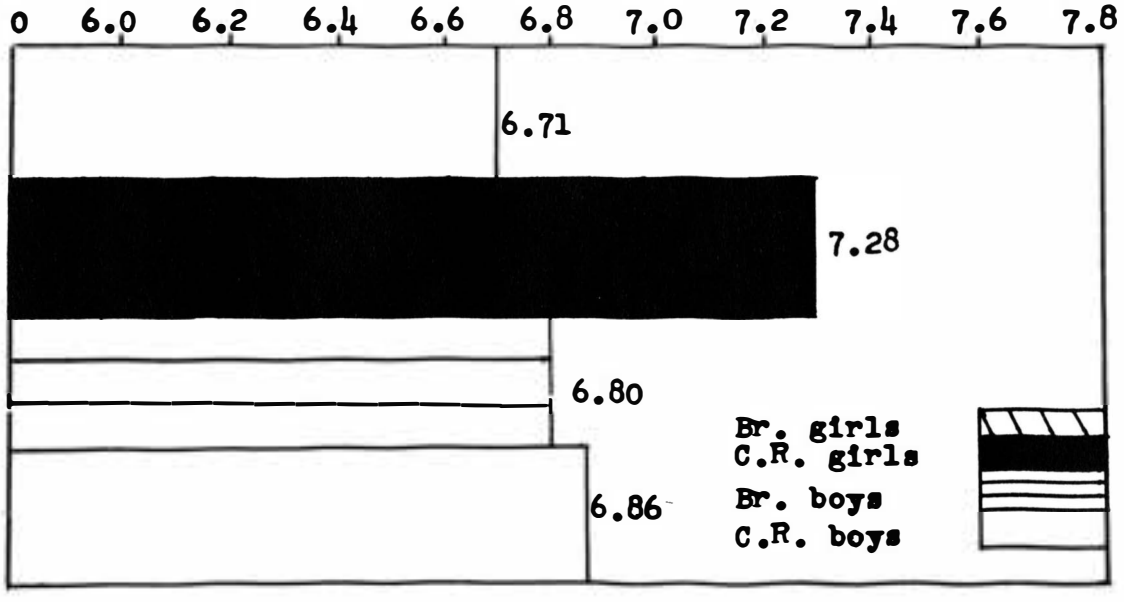

Figure 14. A Comparative Graph of the 40-Yard Dash Test Item Showing the Results of the Mean for the Boys and Girls of Brookings, South Dakota and Cedar Rapids, Iowa.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The Iowa Test of Motor Fitness was administered to the ten and eleven year old fifth grade students in the elementary schools of Brookings, South Dakota and Cedar Rapids, Iowa. The students in Cedar Rapids had an average of one hundred minutes of physical education per week, and the students of Brookings had an average of sixty minutes of physical eduoation per week.

Standard statistical procedures were used to determine the significance of the results. The raw scores were placed in frequency distributions and then the means and the levels of significance were completed in turn.

Conclusion

From the data obtained in the study, the following conclusions have been shown:

1. The fifth grade boys of Cedar Rapids, Iowa were significantly superior at the one per cent level to the fifth grade boys of Brookings, South Dakota in pull-ups.

2. The fifth grade boys of Brookings, South Dakota were significantly superior in the grasshopper at the one per cent level and in the sit-ups at the five per cent

level to the fifth grade boys of Cedar Rapids, Iowa.

3. No significant difference between the fifth grade boys of Brookings, South Dakota and the fifth grade boys of Cedar Rapids, Iowa was noted for the forward bend test item, the standing broad jump test item, and the 40-yard dash test item.

4. The fifth grade girls of Brookings, South Dakota were significantly superior at the one per cent level to the fifth grade girls of Cedar Rapids, Iowa in the grasshopper test item and in the 40-yard dash test item.

5. There was no significant difference between the means of the fifth grade girls of Brookings, South Dakota, and the fifth grade girls of Cedar Rapids, Iowa in the forward bend test item, the standing broad jump test item, the bent-arm hang test item, and the sit-up test item.

6. The students in the fifth grade of Cedar Rapids, Iowa were significantly superior to the fifth grade students of Brookings, South Dakota on only one test--the pull-up test item for the boys; whereas, the students in the fifth grade of Brookings, were significantly superior to the fifth grade students of Cedar Rapids on four test items--the grasshopper and the sit-up test items for the boys; and the grasshopper and the 40-yard dash test items for the girls.

7. From the standpoint of physical fitness as determined by the Iowa Test of Motor Fitness, the fifth grade

students of Brookings, South Dakota, who receive sixty minutes of physical education instruction per week, appear to be as physically fit as the fifth grade students of Cedar Rapids, Iowa, who receive one hundred minutes of physical education instruction per week.

Recommendations

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

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

2. That more South Dakota schools be given the test and comparisons made.

3. That similar comparisons be made in other grades.

4. That all schools use a testing program in physical education to evaluate the physical fitness of the students. It gives factual evidence which can be used to motivate improvement of the physical education program.

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APPENDIX A

THE IOWA TEST OF MOTOR FITNESS

Name_____ Age____ Sex____ Grade_____
(last) (first)

Birth_____ Date tested_____
(month, day, year)

Name of school_____

Number of Phy. Ed. classes per week ____ Length of class_____

Forward Bend.....

Standing Broad Jump....., _____, _____, _____.

The Grasshopper.....

Pull-ups (for boys).....

Bent-arm Hang (for girls)..... seconds.

Sit-ups.....

40-yard dash..... seconds.

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 tottouch 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 islarge 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. The timer should be 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 HANG (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 cross-bars 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 Stat 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 theIIowa 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.