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A Comparative Study of Fitness Development Involving Two Methods of Administering Physical Activity to Improve Fitness

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A COMPARATIVE STUDY OF FITNESS DEVELOPMENT INVOLVING TWO METHODS OF ADMINISTERING PHYSICAL ACTIVITY TO IMPROVE FITNESS

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This thesis, submitted by Neil M. Wilson in partial fulfillment of the requirements for the Degree of Master of Science in the University of North Dakota, is hereby approved by the committee under whom the work has been done.

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ABSTRACT

The purpose of this study was to discover a method of administering exercises in a graded physical education program that would not use excessive class time for the calisthenic period. Twenty-four elementary school children from the Benjamin Franklin Elementary School in Grand Forks, North Dakota, participated in the study. Experimental Group One took part in a graded program which included types of calisthenics within the activity. Experimental Group Two exercised for twelve minutes before regular activity. The Grand Forks Physical Fitness Test was used to measure levels of physical development.

Two statistical comparisons were: (1) a within group comparison between the results of the pre-test and post-test means of the groups, (2) a between group comparison of the means of the pre-test and post-test. The null hypothesis was assumed in the analysis of the significance of the difference between means at the .05 level. This hypothesis was tested with the "t" technique for the difference between means derived from correlated and uncorrelated scores from small samples.

Based on the results of this study it seems apparent that there were some aspects of differences in physical fitness within groups. However, the treatment of the data with respect to the difference between the two groups indicated no significant difference at the .05 level of confidence with respect to physical fitness.

Based on these facts that only small significant differences were elicited in this study it is recommended the time formerly spent on calisthenics may be utilized more efficiently on activity skills.

CHAPTER I

INTRODUCTION

Statement of the Problem

The problem of this study was to discover a method of administering exercises in a graded physical education program without using excessive class time for the calisthenic period.

Need for the Study

There is a definite need for better methods of teaching exercises so that all students will properly benefit and enjoy physical activities. There is also a definite need for a new method of teaching calisthenics without subtracting time from the activity period. By using combined calisthenics within the graded program activity, it is believed that as much or more can be gained in improving physical fitness.

It is hoped that this study will prove beneficial toward improving the methods of teaching calisthenics within the activity of a graded physical education program.

Delimitations

This study has been limited to the fifth grade co-educational physical education classes at the Benjamin Franklin Elementary School, Grand Forks, North Dakota.

The subjects were divided and equated into two groups by grade level. Experimental Group One took part in a graded program which included types of calisthenics within the activity. Experimental Group Two included class activity with special time at the beginning of each period devoted to calisthenics.

The test used in measuring physical fitness development was the Grand Forks Physical Fitness Test used in the elementary school today. The items of the physical fitness test are found and described in Appendix A, pages 34-42.

Definitions

Calisthenics. Any body exercises that usually require little or no equipment. They are performed to gain strength, health, or grace. Such exercises are push-ups, sit-ups, and squat thrusts are called calisthenics.

Exercise. Any type of physical activity that uses the muscles of the body. Sports of all kinds, such as football, baseball, and swimming, provide healthful exercise. So do gardening, painting, and other odd jobs that have to be done around the home. All such activities may require running, jumping, throwing, squatting, lifting, pushing, or other movements that put the body's muscles to work.

"Physical fitness is one phase of total fitness. The components of physical fitness are resistance to disease, muscular strength and muscular endurance, cardiovascular respiratory endurance, muscular power, flexibility, speed, agility, coordination, balance, and accuracy."[1]

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[1]Thomas Kirk Cureton, Physical Fitness Appraisal and Guidance, (St. Louis: The C. V. Mosby Company, 1947), p. 18.

The Experimental Group One. This group consisted of boys and girls who participated in the required physical education class two days a week for periods of forty-five minutes. This group engaged in the graded physical education program which included the calisthenics within the activities. A description of this graded physical education program has been presented in the Review of the Literature.

The Experimental Group Two. This group consisted of boys and girls of the same age and grade level. These children took part in the calisthenics at the beginning of each class period with the rest of the forty-five minutes devoted to the graded activity.

Review of Related Literature and Research

A number of studies have been undertaken in the area of physical fitness and its relationship to the graded physical education program. Necessary adaptation of physical education to meet the needs of all individual children is a complicated and constantly changing problem. To make this adaptation, the teacher must know the values which may be found in the different activities. The activities that are possible in a given school will depend to some extent upon the available facilities, equipment, and supplies, and the knowledge and attitudes of teachers, supervisors, and administrators.

The fundamental movements such as walking, running, hopping, skipping, jumping, climbing, throwing, catching, and their combinations are used again and again in a great variety of physical education activities. These fundamental skills have utilitarian value in daily life through use in protection and recreation. The development of

skill in these movements is a progressive matter for each child who proceeds at his own rate. Hence, adaptation to individual needs is less difficult in activities which require the performance of individual pupils than in group activities where the performance of one is dependent upon the performance of others in the group.

Logically, the activity program should be graded according to the developmental age of the pupil with the difference due to chronological age and sex. With these individual divergencies in structural and functional traits, the teacher in the elementary school has the responsibilities for groups of activities other than physical education to make it an impractical situation. To be practical and to give the most help to teachers, it seems necessary that the physical activity should not tax the pupils' endurance too severely. Boys and girls of this age have similar interests and capacities and should participate together in the same activities. Even though young children tend to individualize, the emphasis should be on group participation.

Curiosity, imagination, rhythmic expression, and interest in dramatic situations are characteristic of young children and should not be stifled. Opportunity should be provided for the development of the spirit of rivalry. Self-testing activities under guidance are extremely valuable and may be experienced through the frequent use of simple stunts on the lawn and playground apparatus. At least three periods each week should be scheduled for experiencing, with or without music, the fundamentals of locomotion, dramatic expression, and singing games. Additional motor experiences may be provided as part of the program in social studies, poetry, and music. These needs

require the careful planning of programs by the teacher.

During the fourth, fifth, and sixth grades, individualism gives way to the ability to cooperate in the development of group interests. The introduction of simple team games caters to group interest and gives emotional satisfactions which are basic at this age. Children delight in the ability to control body balance while in motion, turning right, turning left, starting, and stopping. Because of rapid growth, they need activities which help to develop the coordinations basic to good posture. Hanging activities on pieces of apparatus which strengthen the arm and shoulder girdle muscle groups are desirable and essential.

For pre-adolescent children, growth and developmental needs may be met satisfactorily by providing a more vigorous type of activity carried on for longer periods of time without a rest period. Only by large amounts of activity can muscular strength and organic power be developed. The program for pre-adolescent children should provide opportunity for improvement in a variety of skills, participation in social dance activities which give social ease, increased use of team games of simple organization, and pupil leadership and responsibility. Some program adjustments should be made to meet sex differences.

Since the desire for group approval is inherent, adequacy in a social environment is needed for the adjustment of children to group living. Most social illiterates are unhappy. Schools have a responsibility of preparing children for social competence. Participation in coeducational play experiences is one way of developing social adequacy.

During the junior high grades, young people are approaching the time when they must assume many of the responsibilities of adults. This is a sex maturing period when the physical education program should

include preparation for successful mingling in social groups.

In grades seven and eight, interschool league games to determine school championships are seriously questioned by many educators. A strong intramural program with an occasional invitational game is a more desirable procedure.

Leisure becomes a liability if youth is not prepared to use it wisely. The school should help youth to acquire skill in diversified leisure-time interests. High specialization in any one field or in any one activity is not desirable during these years. Youths should be prepared for success in social situations by engaging in numerous games, by participating in parties, play days, picnics, excursions, and social functions during which social amenities are observed and continually practiced.

America needs a program of physical education activities to meet the conditions of the time. America needs a physical education program that will educate people in the free, democratic, and self-directing responsibilities of American citizenship. The foundations for such a program are extremely important and must be laid in the elementary school because it is the only social institution in which the majority of the young children can be reached.

Because of the importance of the program, most states have passed laws making physical education compulsory in the schools. A few states have made provision for a compulsory program by regulations passed by their state boards of education. It is believed that these laws and regulations have greatly reduced the time necessary to attain the present accomplishments toward the universality of physical education. Some of the important findings on physical fitness, calisthenics,

and the graded physical education program have been summarized in this chapter.

History and previous research in physical fitness in recent years have developed rapidly to a major concern with physical educators. Physical educators everywhere are beginning to recognize their responsibilities and obligations in this area to the people whom they serve. However, physical fitness still seems to exist in the midst of confusion. There are many definitions and concepts in this particular area of physical education. This area of physical fitness developed a great deal of impetus when the late President John F. Kennedy tried to focalize the importance of physical fitness. In an article in Sports Illustrated, the late president stated:

> Physical fitness is not only one of the most important keys to a healthy body; it is the base of dynamic and creative intellectual activity. The relationship between the soundness of body and the activities of the mind is complex. Much is not yet understood. But, we do know what the Greeks knew: that intelligence and skill can only function at the peak of their capacities when the body is healthy and strong; that the body spirits and tough minds usually inhabit social bodies. Since the peak performance of intelligence and skills depends upon the physical fitness of the body, it is important that we utilize means to evaluate the fitness and strength of the individual.[1]

Paul Hunsicker, chairman of the AAHPER Fitness Council, made the following statement:

> The physical performance tests in the youth fitness test include running, jumping, throwing, strength, agility, and endurance. Those activities should be part of physical education program and, within limits, an improvement in test scores should accompany continuous participation in physical education. If pupils are enrolled in physical education

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John F. Kennedy, "The Soft Americans," Sports Illustrated, (December 26, 1960).

classes and fail to improve throughout the school year, in all probability the program was not sufficiently vigorous.[1]

Howell, Hodgson, and Sorenson conducted a study on the effects of circuit training using the Harvard Step Test as the determining factor for physical efficiency. The study revealed that special work or calisthenics and circuit training over a timed period caused statistical improvement in these test results. The other controlled group which took part in the service school program of volleyball and badminton showed very little statistical gains in the step test.[2]

Robert White conducted a study in which he compared two methods of developing physical fitness in fourth and fifth grade boys. The two methods he used were the basic skills method through a graded program which included calisthenics within the activity itself, without the children knowing it. The second method was a calisthenic period in which special time was taken.

(1) The skills group made a large gain over the calisthenic group in six of the seven items in the Latchaw test of motor ability.

(2) On the President's Physical Fitness Screening Test, the basic skills group made more improvement over the calisthenic group in the pull-ups at the .001 level of confidence. The basic skill group showed a slight improvement over the calisthenic group in sit-ups, but the gain was not considered significant.

(3) The calisthenic group recorded its only superiority over

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[1]Helen M. Starr, "How to Fit in Fitness Testing," Journal of Health, Physical Education and Recreation, Vol. 30, (March, 1958), p. 19.

[2]Maxwell L. Howell, James L. Hodgson and Thomas J. Sorenson, "Effects of Circuit Training on the Modified Step Test," Research Quarterly, (May, 1963).

the skills group in performing squat thrusts. However, this gain was not a large gain.

(4) The final results of this study showed or indicated that improvement in physical fitness can be made through using both the calisthenic and the basic skills practice.

(5) In some aspects of body development, basic skills practice accomplished better results in gaining physical fitness than when using the calisthenics method.[1]

The purpose of De La Barre's study was to determine the effect that the five period physical education week had on fitness values compared to the effect the two period physical education week had upon fitness values. The test was carried out for one semester.

De La Barre concluded that the five period physical education week did produce significant changes in most measurements of physical fitness. Although the two period per week class did show improvement, only the back strength and push-ups showed any significant difference.[2]

Sundre conducted a study to determine which of two programs of physical education was most effective in:

(1) The development of physical fitness.

(2) The development of good attitudes toward physical education.

(3) The development of knowledge of sports skills.

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[1]Robert Eugene White, "A Comparison of Two Methods of Developing Physical Fitness in Fourth and Fifth-Grade Boys," Dissertation Abstracts, Vol. XXIV, (July, 1963), p. 176.

[2]Craig H. De La Barre, "A Study of the Fitness Values Derived From A Five Day Per Week Activity Compared With Like Values From A Two Day Per Week Activity," (unpublished Master's Thesis, Dept. of Physical Education, University of North Dakota, 1962).

Sundre organized introductory physical education programs at the University of North Dakota. One program consisted of recreational sports and the other program consisted of recreational sports supplemented by conditioning exercises.

Sundre found that the conditioning exercises used in the second program increased the physical fitness of the group to a significant level. No change was shown in the attitude or the knowledge of sports skills in either group.[1]

Pachee conducted two experiments to determine the effects of warming up upon jumping performance as measured by the vertical jump. In the first experiment, one female and nine male graduate students were tested several times by performing six jumps with one and a half minutes of rest between each two jumps. The subjects followed a rotating order in performing these warm-up methods: (1) no warm-up, (2) three minutes of exercise to stretch the leg and hip muscles, (3) three minutes of stationary running at the subject's own pace, and (4) three minutes of deep knee bends done at a prescribed cadence. It was found that, with only two minor exceptions, all subjects jumped significantly higher after all three of the warm-up methods than when no warm-up preceded the testing. The improvement after stationary running was the most highly significant. In the second experiment fifty male university students were tested on five jumps per period directly after deep knee bends and with no preliminary

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[1]Orlo A. Sundre, "A Comparative Study of Two Physical Education Programs For Male Students at The University of North Dakota," (unpublished Master's Thesis, Dept. of Physical Education, University of North Dakota, 1960).

exercise. Once again, warming up was found to be statistically significant in improving jumping performance.[1]

Esslinger brought out some of the criticisms in regard to the use of a national test in physical education programs. Certain critics are opposed to a national test because some teachers make the standards their programs. In their anxiety to have their students do well on the tests, they design their entire program toward this end. In this way the national test determines the curriculum. The norms rather than the generally accepted purposes become the objectives of the program. Another objection is that, in any typical group of children, half will be below the norm or average. In trying to get all the children in their class "up to the grade level" it is feared that some teachers ignore or overlook the individual differences which exist among them.[2]

From the review of literature, there is evidence that activity from a physical education class aids in the development of physical fitness. Generally, it has been shown that the activity programs that provide for definite area development will yield the more productive returns. If such is the case, then the physical education programs are justified within the schools and every individual should be encouraged to participate in a wide variety of physical activities.

The President's Council specifically outlines selected principles that must undergird any effective physical fitness program:

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[1]Betty A. Pachee, "Improvement in Jumping Performance Due to Preliminary Exercise," Research Quarterly, XXVIII, (March, 1957), pp. 55-63.

[2]Arthur A. Esslinger, "Perspective on Testing," Journal of Health, Physical Education and Recreation, Vol. 31, No. 6, (September, 1960), p. 37.

(1) Programs to improve physical fitness must provide vigorous activities that will develop the physique, increase the efficiency of the cardiovascular system and contribute to the development of physical skills.

(2) Progressive resistive exercises involving increased work loads for longer periods are essential to increase the level of fitness.

(3) Endurance develops in proportion to the total work done over a period of time.

(4) Strength is increased through activities requiring more than 50 per cent of the total strength capacity.

(5) Organic efficiency is improved where rhythmical muscular activity is continued over a long, unbroken period.

(6) Physical fitness is directly proportional to the levels of strength, power, and endurance achieved.

(7) The school physical education program should include a core of developmental and conditioning activities, appropriate to each grade level. Those activities should be carefully identified and stressed in progressive order.[1]

Perhaps one obstacle in the achievement of physical fitness by the American people is the desire to gain health and fitness with a minimum of effort. Stafford and Duncan suggested that greater emphasis in physical education be placed upon activities of a more vigorous nature such as jumping, running, and climbing, in an effort to overcome this obstacle.[2]

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[1]President's Council on Youth Fitness.

[2]George T. Stafford and Ray Duncan, Physical Condition (New York: A. S. Barnes and Company, 1952), p. 1.

Strong did a study of motivation as related to the performance of sixth grade children on physical fitness tests, including five items of the AAHPER Youth Fitness Test. He used six motivating methods including:

(1) Competition with class of equal ability.

(2) Competition with self.

(3) Group versus group.

(4) Competition to establish class records.

(5) Level of aspiration.

(6) Competition with classmate of markedly different ability.

Motivation was found to be an influential factor in increasing scores on the physical fitness tests. The level of aspiration and team competition situations were the most effective methods.[1]

Mathews and Kruse, in their study, said the purpose of their investigation was to study the effects of isometric type exercises. One hundred and twenty Springfield College male students were tested, half exercising isometrically and the other half isotonically. The 60 subjects in the isotonic unit exercised to exhaustion on the Kelso-Hellebrandt ergometer with a weight load equal to 3/16 of their maximum strength. The subjects in the isometric unit exercised by exerting maximum effort in three consecutive six-second pulls on a strap. The respective groups exercised two, three, four, and five times a week over a period of four weeks.

The following results were obtained: (1) no common regression line was found in the eight groups, indicating the strength changes

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[1]Clinton H. Strong, "Motivation Related to Performance of Physical Fitness Tests," Research Quarterly, XXXIV, No. 4, (December, 1963), pp. 497-507.

peculiar to the individual, regardless of exercise frequency; (2) the isometric type exercise caused a greater number of subjects to significantly gain in strength; and (3) the five-day-a-week exercise program was most beneficial in terms of strength gains.[1]

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[1]D. K. Mathews and Robert Kruse, "Effect of Isometric and Isotonic Exercise on Elbow Flexor Muscle Groups," Research Quarterly, XXVIII, No. 1, (March, 1957), pp. 26-38.

CHAPTER II

METHOD OF RESEARCH

The experimental study was initiated in October of 1966, and included the boys and girls of the fifth grade at Benjamin Franklin Elementary School, Grand Forks, North Dakota. The total number of students included in both groups was twenty-four. Prior to the experimental program Groups One and Two participated in six weeks of regular physical education class activity in accordance with the Grand Forks Education Curriculum for elementary schools. The initial test was given to both experimental groups six weeks after school opened. At the end of the eight week experimental program, each subject was retested with the Grand Forks Physical Fitness Test. The raw scores were changed to standard scores, and these standard scores were used in the final mathematical analysis.

The boys and girls were encouraged to do their best on each phase of this test, although little motivation was necessary as children of this age level love to compete, not only with classmates of equal ability, but with themselves. The subjects worked in groups of two and three, depending on the part of the test they were performing. This method tended to enhance objectivity in scoring.

After the test was given, Experimental Group One continued with the graded program of activity, and Experimental Group Two

participated in the graded program with twelve minutes of time devoted, at the beginning of each forty-five minute period, to calisthenic exercises.

The calisthenic program used was characterized by three distinct exercise categories described as the following:

(1) Warm-up (bend and stretch, knee lift, wing stretcher, half knee bend, arm circle, and body bender):

(2) Conditioning (toe touch, sprinter, sitting stretch, knee push-up, leg-raisers, and flutter kick):

(3) Circulation (walk, jog, run, run-in-place, and straddle hop).

Experimental Group Two performed these types of exercises in the regular calisthenic manner with everyone in the group performing the same number of repetitions on each exercise. As the experimental program continued, more repetitions were added for group progression.

After the calisthenic period of twelve minutes, Experimental Group Two progressed into the same type of graded activity as Experimental Group One had done the previous day.

At the end of this eight week period, the subjects were retested and results were used to compare methods of class organization with respect to improvement in physical fitness.

The exercises used with the Experimental Group Two have been explained, along with the standard scores of the physical fitness test, in Appendix B, pages 43-68.

Statistical Procedure

After gathering the data which were related to the problem, the researcher assumed the null hypothesis in analyzing the difference

between the means obtained on the pre-test and the post-test. That hypothesis asserts that no true difference exists between the two means, and the difference found between the sample means is a chance difference and is accidental and unimportant.[1]

Investigation of several tests of the null hypothesis indicated that the "t" technique for testing the significance of the difference between means derived from correlated scores from small samples was suitable for a within groups comparison in this study. This test determines the ratio between the mean difference and the estimate of sampling error of the mean difference. This ratio is expressed as "t" and is checked for significance in a "t" table. The value of "t" is proportional to the degree of freedom (N-1) allowed in determing the relationship between the mean difference and the estimate of sampling error of the mean difference.

The investigator decided to reject the null hypothesis at the .05 level of significance at which "t" equals 2.20 with 11 degrees of freedom. Comparisons were also made between Experimental Group One and Experimental Group Two by testing the significance of the difference between the mean differences found within the groups. The between group comparison used the "t" technique for uncorrelated data from small samples.

Mathematical processes employed in this research for each testing area have been presented in Appendix C, pages 69-90.

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[1]Quinn McNemar, Psychological Statistics. (New York: John Wiley and Sons, Inc., 1949).

CHAPTER III

ANALYSIS OF THE DATA

The purpose of the testing in the study was to determine whether or not any significant changes results in different areas of physical fitness within and between the results of Experimental Group One and Experimental Group Two. The bases for comparisons were the results of the Grand Forks Physical Fitness Test. For the purpose of analysis, the scores of the individual test items of the fitness battery are expressed as standard scores throughout this paper.

Results of Comparisons

Sit-ups

Experimental Group One had a mean standard score on the sit-ups of 7.50 in the pre-test and a mean standard score of 9.00 in the post-test. This represented a mean increase of 1.50 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was .34. The "t" value of 4.45 with 11 degrees of freedom indicated significance at the .05 level and the null hypothesis was therefore rejected.

Experimental Group Two had a mean standard score on the sit-ups of 9.50 in the pre-test and a mean standard score of 10.25 in the post-test. This represented a mean increase of .75 between the pre-test and the post-test. The estimate of the sampling error of this mean difference

was .57. The "t" value of 1.31 with 11 degrees of freedom indicated no significance at the .05 level, and the null hypothesis was therefore retained.

Pull-ups

Experimental Group One had a mean standard score on the pull-ups of 5.83 in the pre-test and a mean standard score of 7.16 in the post-test. This represented a mean increase of 1.33 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was .64. The "t" value of 2.07 with 11 degrees of freedom indicated no significance at the .05 level, and the null hypothesis was therefore retained.

Experimental Group Two had a mean standard score on the pull-ups of 8.17 in the pre-test and a mean standard score of 9.17 in the post-test. This represented a mean increase of 1.00 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was .79. The "t" value of 1.28 with 11 degrees of freedom indicated no significance at the .05 level, and the null hypothesis was therefore retained.

Shuttle Run

Experimental Group One had a mean standard score on the shuttle run of 4.33 in the pre-test and a mean standard score of 7.91 in the post-test. This represented a mean increase of 3.58 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was .96. The "t" value of 3.71 with 11 degrees of freedom indicated significance at the .05 level, and the null hypothesis was therefore rejected.

Experimental Group Two had a mean standard score on the shuttle run of 5.92 in the pre-test and a mean standard score of 8.00 in the post-test. This represented a mean increase of 2.08 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was .76. The "t" value of 2.73 with 11 degrees of freedom indicated significance at the .05 level, and the null hypothesis was therefore rejected.

Standing Broad Jump

Experimental Group One had a mean standard score on the standing broad jump of 6.50 in the pre-test and a mean standard score of 7.25 in the post-test. This represented a mean increase of .75 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was .35. The "t" value of 2.13 with 11 degrees of freedom indicated no significance at the .05 level, and the null hypothesis was therefore retained.

Experimental Group Two had a mean standard score on the standing broad jump of 5.92 in the pre-test and a mean standard score of 7.00 in the post-test. This represented a mean increase of 1.08 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was .47. The "t" value of 2.60 with 11 degrees of freedom indicated significance at the .05 level, and the null hypothesis was therefore rejected.

Vertical Jump

Experimental Group One had a mean standard score on the vertical jump of 2.67 in the pre-test and a mean standard score of 3.50 in the post-test. This represented a mean increase of .83 between the pre-test

and the post-test. The estimate of the sampling error of this mean difference was .26. The "t" value of 3.25 with 11 degrees of freedom indicated significance at the .05 level, and the null hypothesis was therefore rejected.

Experimental Group Two had a mean standard score on the vertical jump of 3.50 in the pre-test and a mean standard score of 4.33 in the post-test. This represented a mean increase of .83 between the pre-test and the post test. The estimate of the sampling error of this mean difference was .37. The "t" value of 2.28 with 11 degrees of freedom indicated significance at the .05 level, and the null hypothesis was therefore rejected.

Squat Thrust

Experimental Group One had a mean standard score on the squat thrust of 8.42 in the pre-test and a mean standard score of 7.75 in the post-test. This represented a mean decrease of -.66 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was .43. The "t" value of -1.54 with 11 degrees of freedom indicated no significant decrease at the .05 level, and the null hypothesis was therefore retained.

Experimental Group Two had a mean standard score on the squat thrust was 8.08 in the pre-test and a mean standard score of 9.00 in the post-test. This represented a mean increase of .92 between the pre-test and the post-test. The estimate of the sampling error of this mean difference was 1.01. The "t" value of .91 with 11 degrees of freedom indicated no significance at the .05 level, and the null hypothesis was therefore retained.

Within Group Comparisons

Experimental Group One had a mean standard score for the total of physical fitness test scores of 35.58 on the pre-test and a mean standard score of 43.00 on the post-test. This represented a mean increase of 7.42 between the means of the pre-test and the post-test. The estimate of the sampling error of the mean difference was 2.23. The "t" value of 3.32 with 11 degrees of freedom indicated significance at the .05 level, and the null hypothesis was therefore rejected.

Experimental Group Two had a mean standard score, for the total physical fitness test of 41.67 on the pre-test and a mean standard score of 48.33 on the post-test. This represents a mean increase of 6.66 between the means of the pre-test and the post-test. The estimate of the sampling error of the mean difference was 1.57. The "t" value of 4.25 with 11 degrees of freedom indicated significance at the .05 level, and the null hypothesis was therefore rejected.

Between Group Comparisons

Sit-ups

The mean increase in sit-ups results between the pre-test and the post-test was 1.50 for Experimental Group One and .75 for Experimental Group II. The difference between the mean differences of these two groups was .75. The estimate of the sampling error for the distribution of the difference between the mean differences was .66. The "t" value resulting from the relationship of the actual difference between the mean differences of the two groups and the estimate of the sampling error for the distribution of the difference between the mean differences was 1.14. With 22 degrees of freedom, this "t" value indicated

no significant difference between the two groups and therefore the null hypothesis was retained.

Pull-ups

The mean increase in pull-ups results between the pre-test and the post-test was 1.33 for Experimental Group One and 1.00 for Experimental Group Two. The difference between the mean differences of these two groups was .33. The estimate of the sampling error for the distribution of the difference between the mean differences was 1.00. The "t" value resulting from the relationship of the actual difference between the mean differences of the two groups and the estimate of the sampling error for the distribution of the difference between the mean differences was .33. With 22 degrees of freedom, this "t" value indicated no significant difference between the two groups and therefore the null hypothesis was retained.

Shuttle Run

The mean increase in shuttle run results between the pre-test and the post-test was 3.58 for Experimental Group One and 2.08 for Experimental Group Two. The difference between the mean differences of these two groups was 1.50. The estimate of the sampling error for the distribution of the difference between the mean differences was 1.22. The "t" value resulting from the relationship of the actual difference between the mean differences of the two groups and the estimate of the sampling error for the distribution of the difference between the mean differences was 1.23. With 22 degrees of freedom, this "t" value indicated no significant difference between the two groups and therefore the null hypothesis was retained.

Standing Broad Jump

The mean increase in standing broad jump results between the pre-test and the post-test was .75 for Experimental Group One and 1.08 for Experimental Group Two. The difference between the mean differences of these two groups was -.33. The estimate of the sampling error for the distribution of the difference between the mean differences was .55. The "t" value resulting from the relationship of the actual difference between the mean differences of the two groups and the estimate of the sampling error for the distribution of the difference between the mean differences was -.60. With 22 degrees of freedom, this "t" value indicated no significant difference between the two groups and therefore the null hypothesis was retained.

Vertical Jump

The mean increase in vertical jump results between the pre-test and the post-test was .83 for Experimental Group One and .83 for Experimental Group Two. The difference between the mean differences of these two groups was .00. The estimate of the sampling error for the distribution of the difference between the mean differences was .45. The "t" value resulting from the relationship of the actual difference between the mean differences of the two groups and the estimate of the sampling error for the distribution of the difference between the mean differences was .00. With 22 degrees of freedom, this "t" value indicated no significant difference between the two groups and therefore the null hypothesis was retained.

Squat Thrust

The mean increase in squat thrust results between the pre-test and the post test was -.66 for Experimental Group One and .92 for Experimental Group Two. The difference between the mean differences of these two groups was -1.58. The estimate of the sampling error for the distribution of the difference between the mean differences was 1.20. The "t" value resulting from the relationship of the actual difference between the mean differences of the two groups and the estimate of the sampling error for the distribution of the difference between the mean differences was -.40. With 22 degrees of freedom, this "t" value indicated no significant difference between the two groups and therefore the null hypothesis was retained.

The mean increase in total results between the pre-test and the post-test was 7.42 for Experimental Group One and 6.67 for Experimental Group Two. The difference between the mean differences of these groups was .75. The estimate of the sampling error for the distribution of the difference between the mean differences was 2.73. The "t" value resulting from the relationship of the actual difference between the mean differences of the two groups and the estimate of the sampling error for the distribution of the difference between the mean differences was .28. With 22 degrees of freedom, this "t" value indicated no significant difference between the two groups and therefore the null hypothesis was retained.

TABLE 1

MEAN SCORES OF THE TEST WITH MEAN DIFFERENCE

Area of Comparison	Experimental Group One		
	Pre-test	Post-test	Mean Difference
Sit-ups	7.50	9.00	1.50
Pull-ups	5.83	7.16	1.33
Shuttle run	4.33	7.91	3.58
Standing broad jump	6.50	7.25	.75
Vertical jump	2.67	3.50	.83
Squat thrust	8.42	7.75	- .66
Area of Comparison	Experimental Group Two		
	Pre-test	Post-test	Mean Difference
Sit-ups	9.50	10.25	.75
Pull-ups	8.17	9.17	1.00
Shuttle run	5.92	8.00	2.08
Standing broad jump	5.92	7.00	1.08
Vertical jump	3.50	4.33	.83
Squat thrust	8.08	9.00	.92

TABLE 1 Continued

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison	Experimental Group One	Experimental Group Two
	Significant at .05 Level	Significant at .05 Level
Sit-ups	yes	no
Pull-ups	no	no
Shuttle run	yes	yes
Standing broad jump	no	yes
Vertical jump	yes	yes
Squat thrust	no	no

TABLE 2

"t" AND THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN GROUPS ON THE PRE-TEST AND POST-TEST

Area of Comparison	"t" Value and Significance
Sit-ups	1.14 not significant at the .05 level
Pull-ups	.33 not significant at the .05 level
Shuttle run	1.50 not significant at the .05 level
Standing broad jump	- .60 not significant at the .05 level
Vertical jump	.00 not significant at the .05 level
Squat thrust	- .49 not significant at the .05 level

"t" AND THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN THE MEANS OF THE TOTAL OF THE TEST SCORES, WITHIN GROUPS ON THE PRE-TEST AND POST-TEST

Experimental Group One	3.32 Significant at the .05 level
Experimental Group Two	4.25 Significant at the .05 level

"t" AND THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN THE MEAN DIFFERENCE, OF THE TOTAL OF THE TEST SCORES, BETWEEN GROUPS

Group Comparison	"t" Value and Significance
Experimental Group One to Experimental Group Two	.75 not significant at the .05 level

CHAPTER IV

DISCUSSION

While conducting this investigation, the writer discovered certain facets which should be considered in developing a well planned and administered physical education program that appeals to most elementary school students. A good program must, first of all, attempt to reach the needs of most participants. A director who instructs the class to do twenty-five squat thrusts, fifteen push-ups, and thirty-five sit-ups is not using very good judgment on physical fitness. Thirty-five sit-ups, to a really physically fit student may not even be a warm up, but for a non-physically fit student who habitually spends leisure hours seated in front of the television set, this might be a nearly impossible feat. This is one phase of the program where a well planned, graded physical education program of activity could easily include the administering of conditioning exercises. Fitness types of exercises should be included within the activity without subtracting from the learners' game-like situation and time.

A good fitness program should also produce results in terms of improved performance on the part of participants. If a boy can do thirty-five push-ups at the outset, and increases to sixty push-ups after a well organized unit of physical activity, fitness goals may be presumed achieved with respect to the push-ups. However, if at the end

of the program, no improvement is discernible, then progress toward achieving fitness goals may be in question.

A graded program must work on the overload basis if there is to be improvement in overall fitness. A child must want to push himself a little bit more than he did on the previous performance if satisfying improvement is to be made in fitness. The body tends to make adaptations to demands placed upon it.

Thoughts on the Study

One might assume that since Experimental Group One and Experimental Group Two showed significant improvements in physical fitness, there is little to be gained for the type of exercise program used by Experimental Group Two. It is believed, that maturation of the subjects was a major reason why both groups showed a significant gain in fitness. Maturation may play a significant part in the true benefit that can be gained from the type of activity program that was employed by the experimental investigation.

It must be assumed the participants' motivation, enthusiasm, and use of outside physical activities will, undoubtedly, be among the variables that could not be accurately measured in this investigation. These factors play an important part in the physical growth of the individuals.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The purpose of this study was to determine and compare differences in physical fitness levels of elementary school children elicited by two distinct methods of activity periods.

The subjects selected for this eight week investigation were twenty-four fifth grade girls and boys of Benjamin Franklin Elementary School, Grand Forks, North Dakota. These twenty-four subjects made up Experimental Groups One and Two. All subjects were pre-tested in October and retested in December of 1966.

Both groups experienced basically the same program over the eight week experimental period with the exception that Experimental Group Two participated in twelve minutes of calisthenics at the beginning of each class period.

The two groups were statistically compared to determine whether any significant changes occurred in physical fitness levels during the experimental period. A statistical analysis was made of the pre-test and post-test mean differences within groups, and the post-test means between groups. The null hypothesis was assumed with respect to the differences between and within groups of the initial and final physical fitness tests. This hypothesis was tested with the "t" technique at the .05 level of significance.

Conclusions

The following conclusions seem warranted on the basis of the data collected in this study:

1. Experimental Group One gained significantly at the .05 level on the sit-ups, shuttle run, and the vertical jump of the physical fitness test items. Group One showed no significant decrease in the mean score on the squat thrust, from pre-test to post-test; and showed only non-significant increases in the pull-ups and standing broad jump.

2. Experimental Group Two gained significantly at the .05 level in the shuttle run, standing broad jump, and the vertical jump of the physical fitness test items. Group Two showed no decreases in mean scores on any of the test items during the experimental period. Only a non-significant improvement was shown by Experimental Group Two in the sit-ups, pull-ups, and the squat thrust.

3. Both groups gained significantly, with respect to their cumulative fitness scores from pre-test to post-test.

4. Though Experimental Group Two improved more in its cumulative fitness scores, neither group gained significantly more than did the other.

5. Based on the results of this study it seems apparent that there were some differences in physical fitness within groups. However, the treatment of the data with respect to the difference between the two groups indicated no significant difference at the .05 level of confidence with respect to physical fitness.

6. From this treatment of the data, it was concluded that there was no difference in the significant gains of fitness obtained by taking

part in a program of calisthenic activity as compared to a graded program of activity.

Recommendations

1. It is recommended that in future investigations the number of subjects in each group be larger.

2. It is recommended a similar study be made over a longer period of time, using three controlled groups in different economic areas and different schools.

3. It is recommended that skills test items and a standardized fitness test be used to determine significant or non-significant gains in physical fitness.

4. It is recommended that further investigations be made in this area using more mature subjects with a similar program to find out if there would be any significant changes in physical fitness.

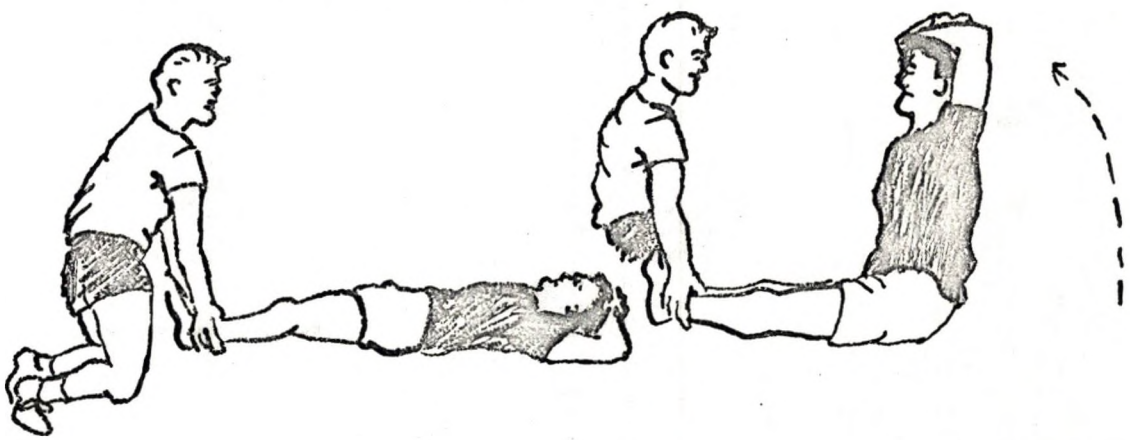
5. Because no differences were elicited in this study, it is recommended that time formerly spent on calisthenics may be utilized more efficiently on activity skills.

PHYSICAL FITNESS TEST

1. SIT-UP (Boys and Girls)

Equipment: Mat

Description: The pupil will lie on his back, on a mat, with legs extended and feet about shoulder width apart. His hands are placed on the back of the neck with the fingers interlaced. Elbows are retracted. A partner holds the ankles down, the heels being in contact with the mat at all times. The pupil sits up, turning the trunk to the left and touching the right elbow to the left knee, returns to starting position, then sits up turning the trunk to the right and then touching the left elbow to the right knee. The exercise is repeated, alternating sides.



Rules: 1. The fingers must remain in contact behind the neck throughout the exercise.

2. The knees must be on the floor during the sit-up, but may be slightly bent when touching elbow to knee.

3. When returning to starting position, elbows must be flat on the mat before sitting up again.

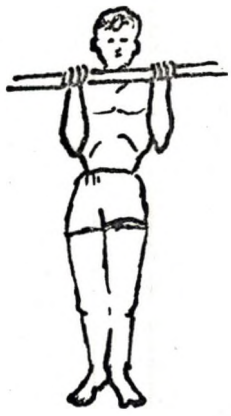
4. Pupil can stop and rest if he or she feels it is necessary to do so.

Scoring: The total number of legal sit-ups completed during a 2 minute time limit shall be recorded.

2. PULL-UP (Boys Only)

Equipment: A metal or wooden bar approximately one and one-half inches in diameter is preferred. A doorway gym bar can be used and, if no regular equipment is available, a piece of pipe or even the rungs of a ladder can also serve the purpose.

Description: The bar should be high enough so that the pupil can hang with his arms and legs fully extended and his feet free of the floor. Use the overhand grasp. After assuming the hanging position, the pupil raises his body by his arms until his chin can be placed over the bar and then lowers his body to a full hang as in the starting position. The exercise is repeated as many times as possible.



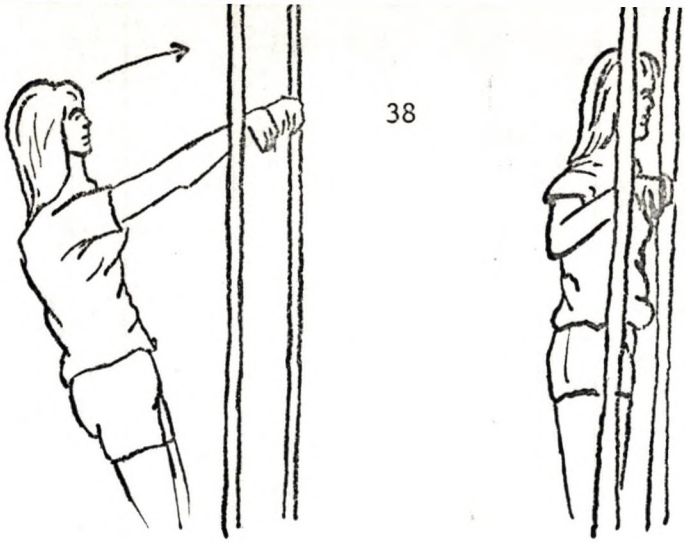
Rules: 1. Allow only one trial unless it is obvious that the pupil has not had a fair chance.

2. The body must not swing during the execution of the movement. The pull must in no way be a snap movement. If the pupil starts swinging, check this by holding your extended arm across the front of the thighs.
3. The knees must not be raised and kicking of the legs is not permitted.

MODIFIED PULL-UP (Girls Only)

Equipment: A metal or wooden bar approximately one and one-half inches in diameter is preferred. A doorway gym bar can be used and, if no regular equipment is available, a piece of pipe can also serve the purpose. In some instances, it is possible to use the aisle between bleacher seats and have the bleachers support the pipe at the desired height.

Description: If possible adjust the height of the bar so it is approximately at chest level. Use an overhand grasp. The pupil extends her legs under the bar and extends the arms fully. The arms should form an angle of 90 degrees with the body line, and the body line should form an angle of 45 degrees with the floor (see figure below). (The heels should be braced to prevent slipping.) From this position the pupil raises her body by her arms until the chest touches the bar, then lowers her body to a full hang.



Rules: 1. No resting is permitted.

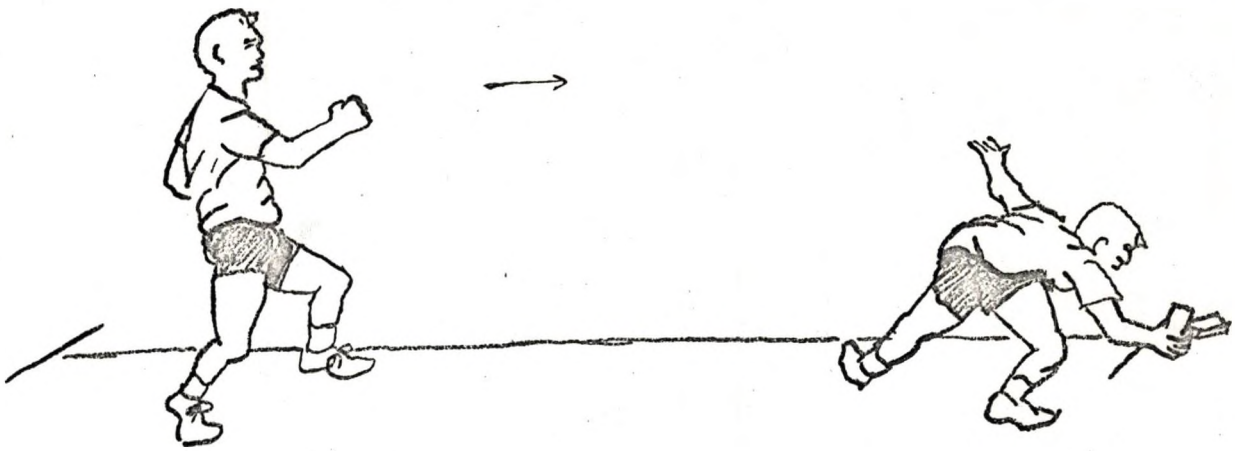
2. No pull-up shall be counted in which the pupil fails to keep the body straight, come to a full extension of the arms, or touch the chest to the bar.

Scoring: Record the number of completed pull-ups.

3. SHUTTLE RUN (Boys and Girls)

Equipment: Two erasers and stop-watch. Pupils should wear sneakers or run barefooted.

Description: Two parallel lines are marked on the floor 30 feet apart. The width of a regulation volleyball court serves as a suitable area. Place the erasers 12 inches apart and parallel to end line. The pupil starts from behind the other line. On the signal "Ready? Go!" the pupil runs to the eraser behind the line; he then runs back and picks up the second eraser which he carries back across the starting line. To eliminate the necessity of returning the eraser after each race, start the races alternately, first from behind one line and then from behind the other.

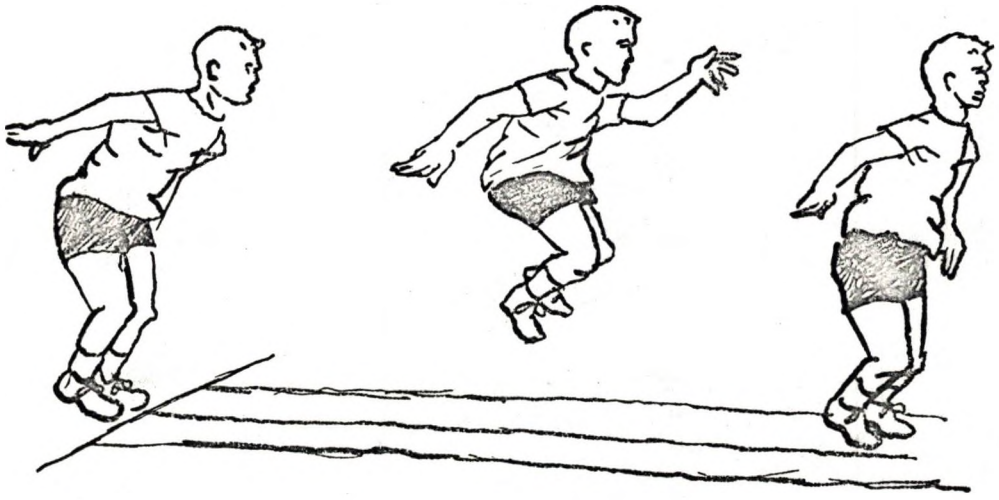


Rules: Record the time of the trial to the nearest tenth of a second. The runner does not have to go over the line before turning around to go back the other way. Only one trial will be given in all cases.

4. STANDING BROAD JUMP (Boys and Girls)

Equipment: Mat marked off in feet and inches.

Description: Pupil stands as indicated with feet several inches apart and the toes just behind the take-off line. Preparatory to jumping, the pupil swings the arms backwards and bends the knees. The jump is accomplished by simultaneously extending the knees and swinging forward the arms.



Rules: 1. Allow two trials. It is recommended that the second trial immediately follow the first.

2. Measure from the take-off line to the heel or other part of the body that touches the floor nearest the take-off line.

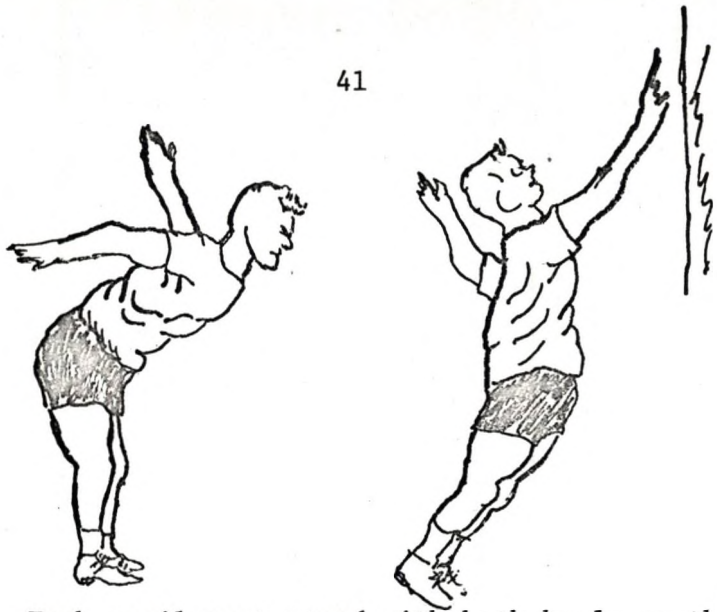
3. It is convenient to tape the tape measure to the floor at right angles to the take-off line and have the pupils jump along the tape. The scorer stands to the side and observes the mark to the nearest inch made.

Scoring: Record the best of the two trials in feet and inches to the nearest inch made.

5. VERTICAL JUMP (Boys and Girls)

Equipment: A piece of slate (black or green) mounted on the wall. This slate must be placed at such a height that its lower edge can be reached by all pupils and its length must be great enough so that no pupil can jump higher from a full-reach position than the top edge. Have a wet sponge for children to set their hand so they can make the mark on the slate, stick or tape measure.

Description: Stand facing the wall and reach as high as possible and mark the wall. Move comfortably away from the wall and get ready to jump. With the wet fingers of the near hand, jump as high as possible and make a mark on the board at the maximum height of the jump. The jump should be measured from the reaching height to the maximum height made in the jump to the nearest inch.



Rules: 1. Each pupil must stand with both heels on the floor when determining his reach preparatory to jumping.

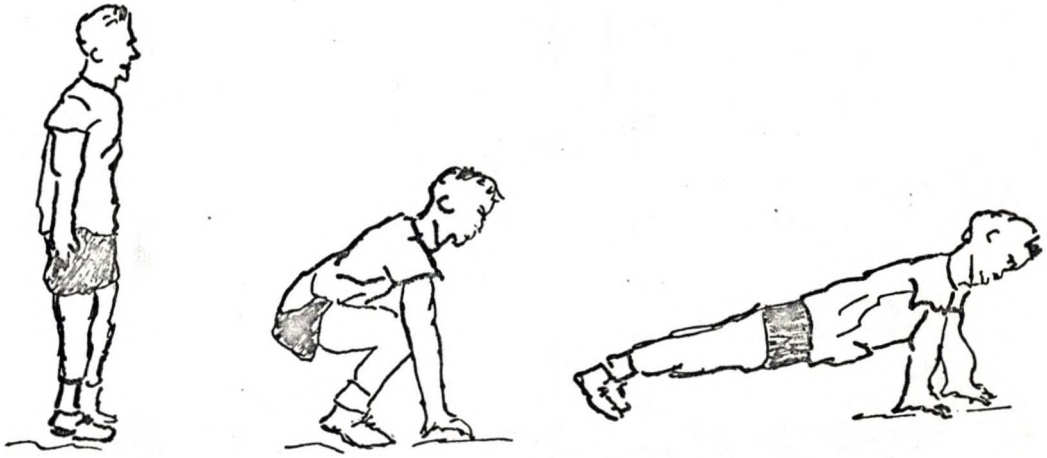
2. Each pupil will receive two consecutive trials with the best trial being recorded.

Scoring: Record the best jump of the two trials to the nearest inch.

6. BURPEE (Squat Thrusts) (Boys and Girls)

Equipment: Stop-watch.

Description: The pupil is directed in the following manner: the starting position at "Attention." Squat and place hands on floor approximately 8 inches in front of feet. Thrust feet backward, arms straight, legs and back straight. Return to squat position and then return to "Attention" position. Count one point for each full burpee.



Rules: 1. The squat thrust will not be counted if any of the following occur:

(a) Feet start backward before hands are on the floor (watch close).

(b) Hips are above shoulder line when feet are in back.

(c) Pupil does not completely straighten on the fourth count.

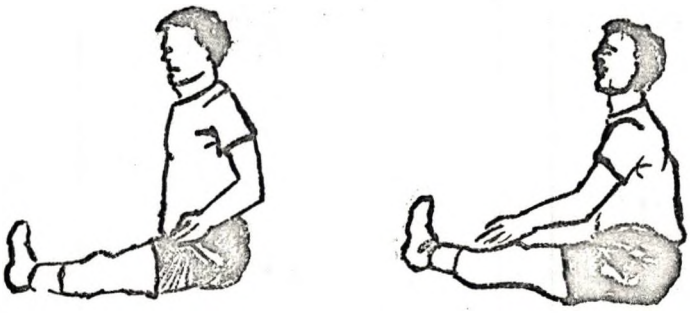
2. Only those squat thrusts that the pupil can do in 30 seconds.

The test will be administered at the beginning of the experimental period which will be the eighth week of the school year and again the twenty-eighth week for the final results.

The experimental study will be conducted in the school year of 1966-67 first and second semester.

APPENDIX B

SIT-AND-BOB

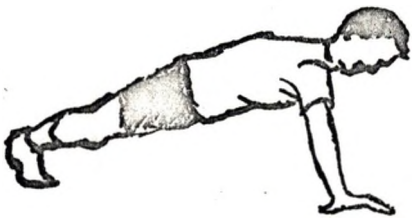


Sit-and-Bob: Sitting with legs straight out and feet at right angles to the legs. Extend arms toward toes by bending at hip joints and tilting pelvis forward. Bob forward (count one), reaching for toes and forehead to knee. Back to sitting position on count two.

BICYCLE

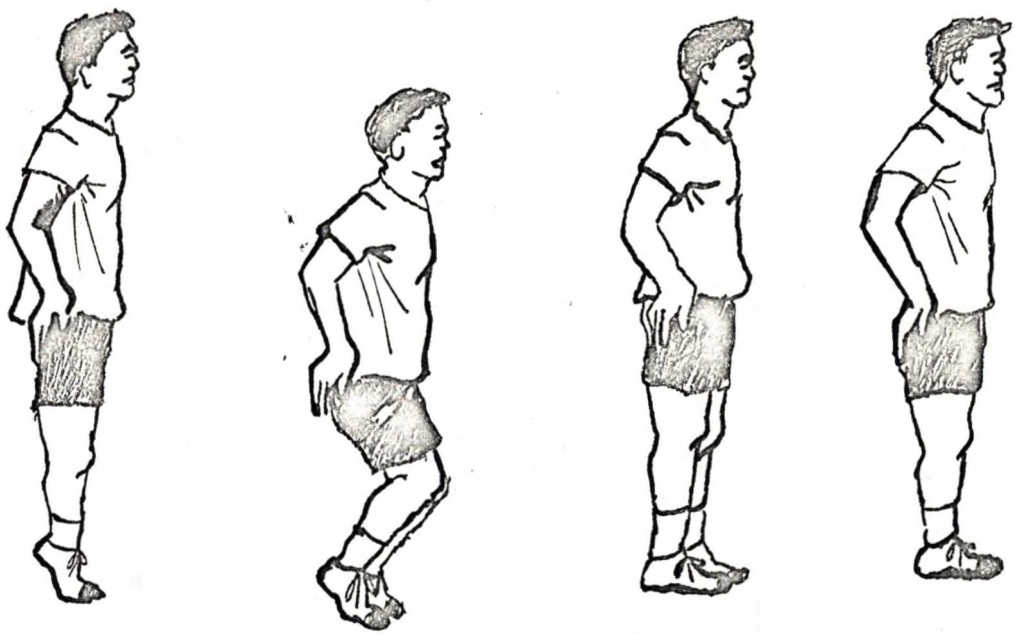
Bicycle: Lie on floor with legs extended toward the ceiling, bracing the hips with your hands. Flex and extend the legs as in running.

BURPEE



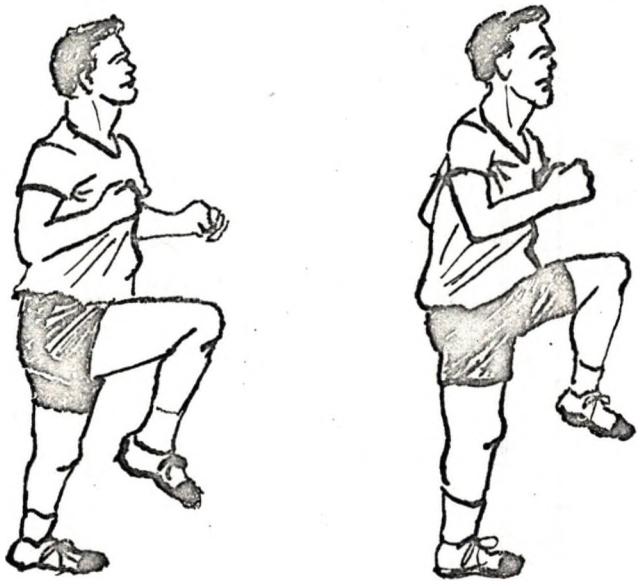
Burpee: Start in normal standing position. On count one bend at the knees and place hands on the floor. Count two, extend legs behind you with hands in position from count one. Count three return to position in count number two. Count four return to starting position.

LITTLE DIPPER



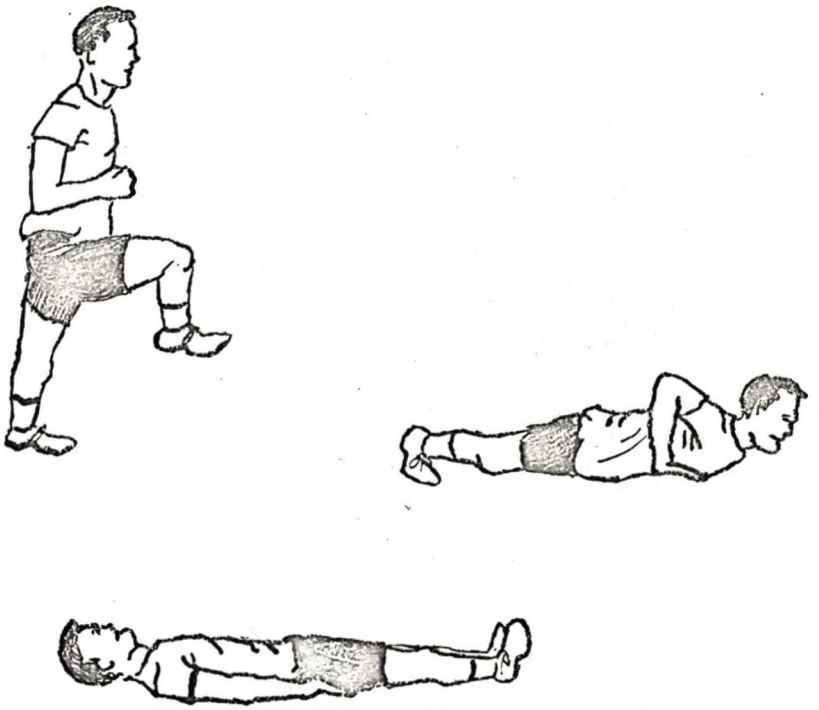
Little Dipper: From the ready position, place hands on hips. Raise on toes, dip to a half-knee bend, raise on the toes, lower heels to surface. "Stop."

TREADMILL



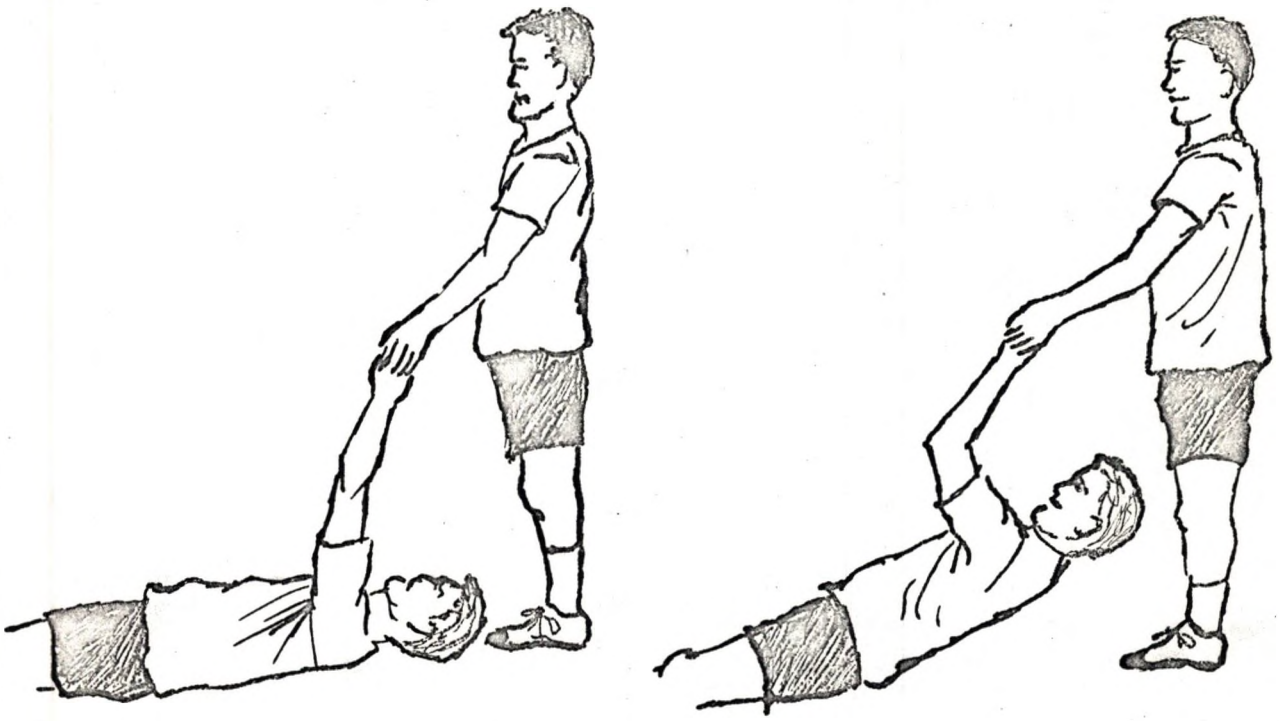
Treadmill: In a standing position bring knees one at a time as close to the chest as possible. Use same procedure as if running but stay in a stationary place on the floor. One foot contacts the surface on each count. This action is to be continuous. "Stop." Variation: Using described action, face left, rear and right on command.

GRASS DRILL



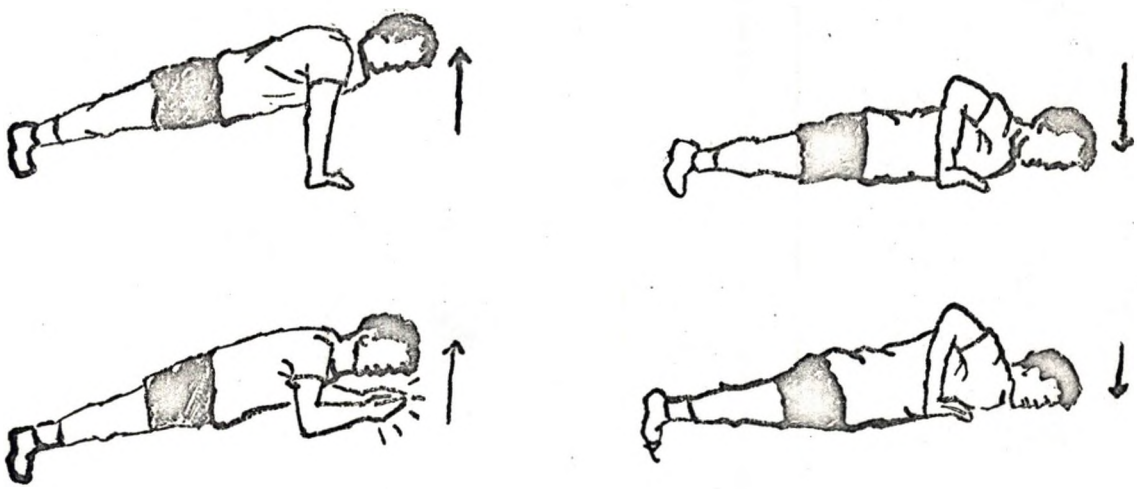
Grass Drill: Begin running in place at top speed on the toes and balls of the feet, knees raised high, arms pumping, body bent slightly forward at the waist. Place the body in prone position, palms flat on the floor directly under the shoulders, legs together and extended. From the prone the body moves to the supine position (flat on the back), arms extended alongside the body with palms down, legs together and straight. This drill is conducted by giving the commands, "Go," "Front," "Back," changing the sequence continuously. Allow sufficient time between commands for pupils to assume proper position.

MODIFIED PULL-UP



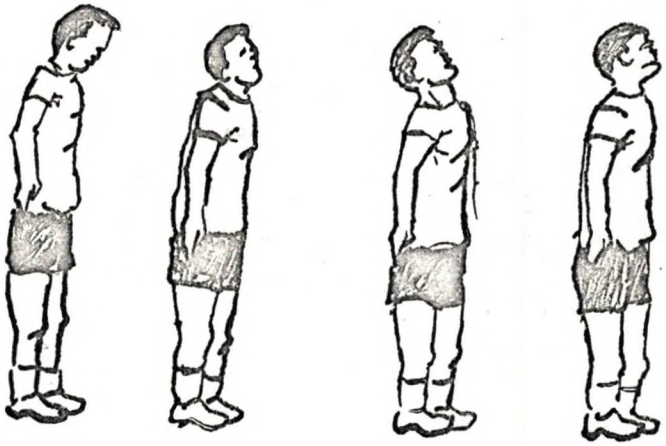
Modified Pull-Up: Partner lying on the floor reach up and clasp hands with partner in standing position. On count one raise the body from the floor using only the arms. Keep the body straight and heels on the floor.

BOUNCING BALL



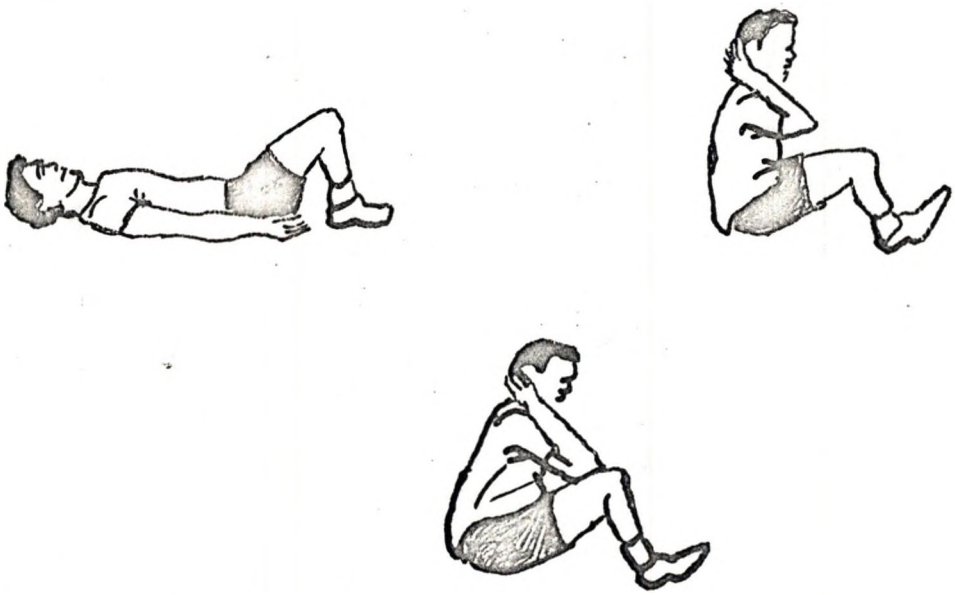
Bouncing Ball: Pupil assumes pushup position, by bending forward extending the arms and placing the hands on the floor, shoulder width apart, fingers pointing forward, and extending trunk and legs backward in a straight line. The body is supported on the hands and toes. With the body bouncing up and down by a series of short, upward springs. (Try clapping hands together while body is in the air.)

NECK TWISTER



Neck Twister: Standing in a normal position, on count one, bend neck forward so the chin touches the chest. On count two, rotate the head to the right so the ear touches the right shoulder. On count three rotate the head to the back. On count four, rotate the head so the left ear touches the left shoulder.

SIT-UP

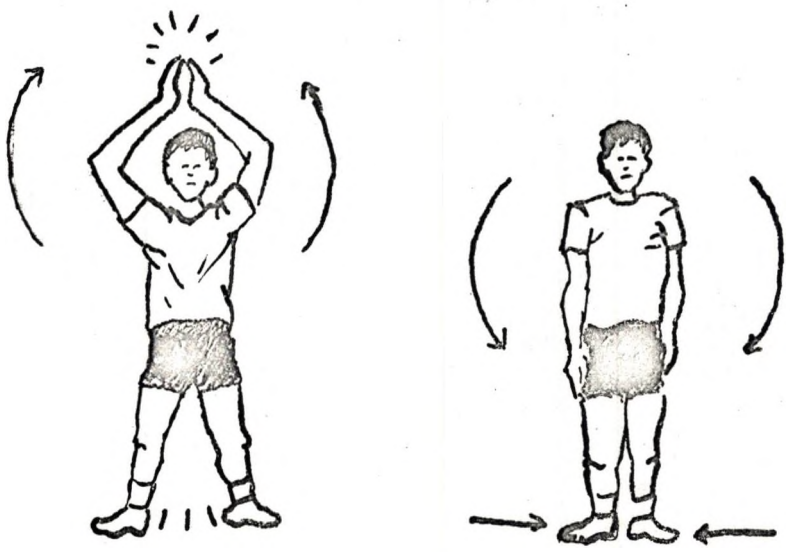


Sit-Ups: Lie on your back. Tilt pelvis to flatten lower back to floor. With hands clasped behind the head, curl head, shoulders back and come to sitting position. Keep knees slightly bent, with a partner or some support on them.

PUSH-UP

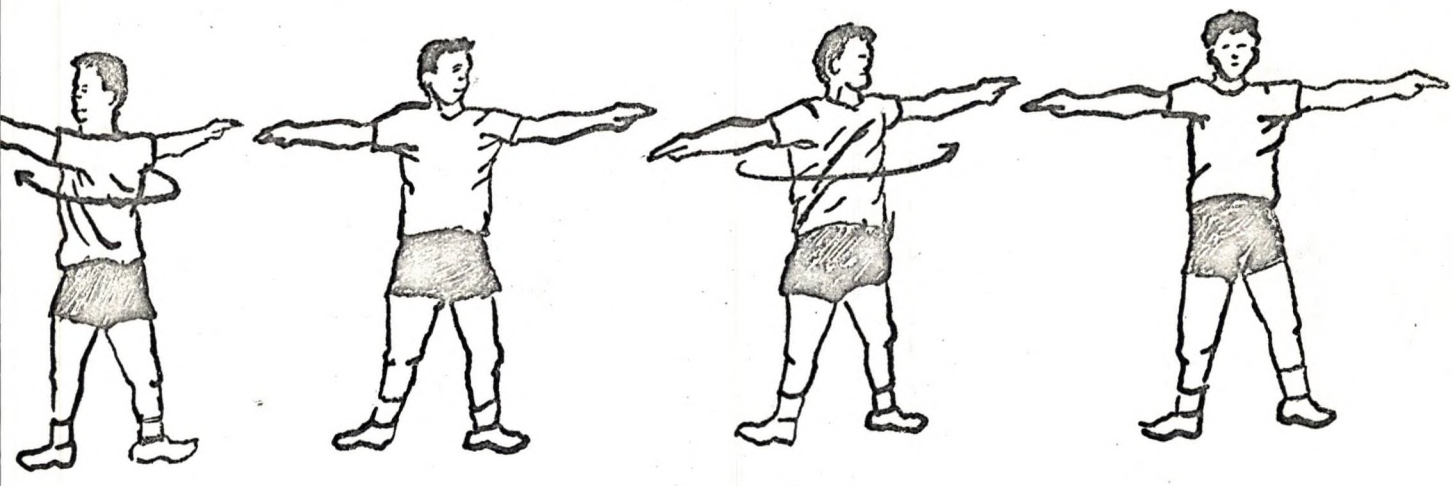
Push-Up: Lie flat down on floor. Place hands directly under shoulder joint with fingers parallel and turned inward slightly. Extend arms and lift body in straight line. Lower body slowly until chin touches the floor and then push up again. Movement in arms and shoulders, not in any other part of the body. Chin touches before thighs. Keep body line straight from head to toes.

JUMPING JACK



Jumping Jack: Start in a normal standing position and on count one flex and abduct the arms above the head, and abduct the legs to the side. Count two return to the starting position.

TWISTER

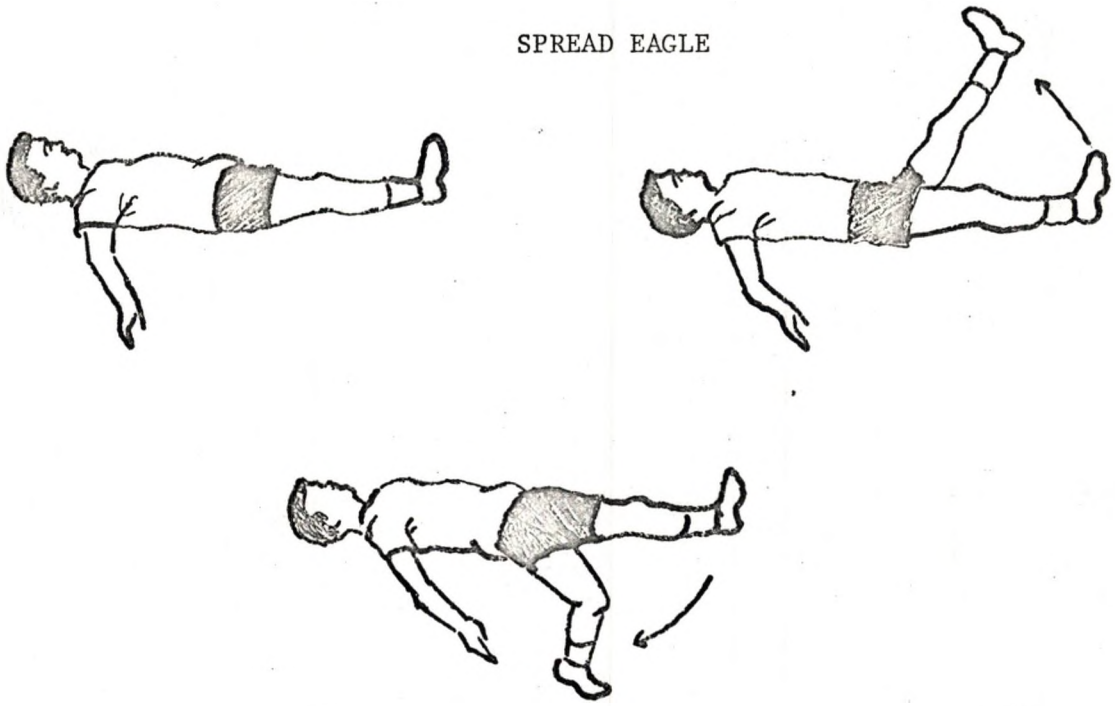


Twister: From the ready position, extend arms sideways, shoulder height, feet apart. Twist trunk to the right; twisting trunk to the left, return to the original position; twist trunk to the left; twisting trunk to the right, return to the original position. "Stop."

ARM CIRCLES

Arm Circling: Standing, feet parallel and shoulder distance apart, arms out from body at horizontal level, move arms in small, medium, and large circles. Reverse and go in opposite direction.

SPREAD EAGLE

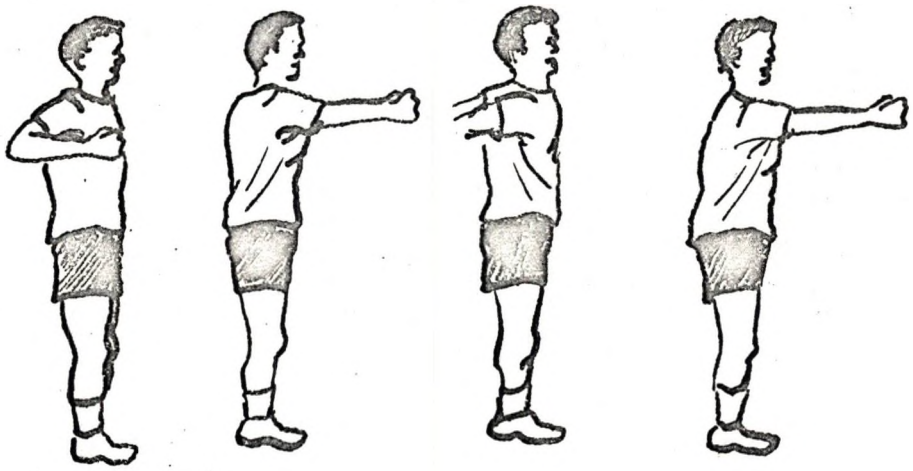


Spread Eagle: Lie on back with arms out from body at horizontal level. Raise left leg vertical to the floor, then rotate hips so leg touches hand. Try not to move the arms from the floor. Alternate using both legs.

BOBBLE

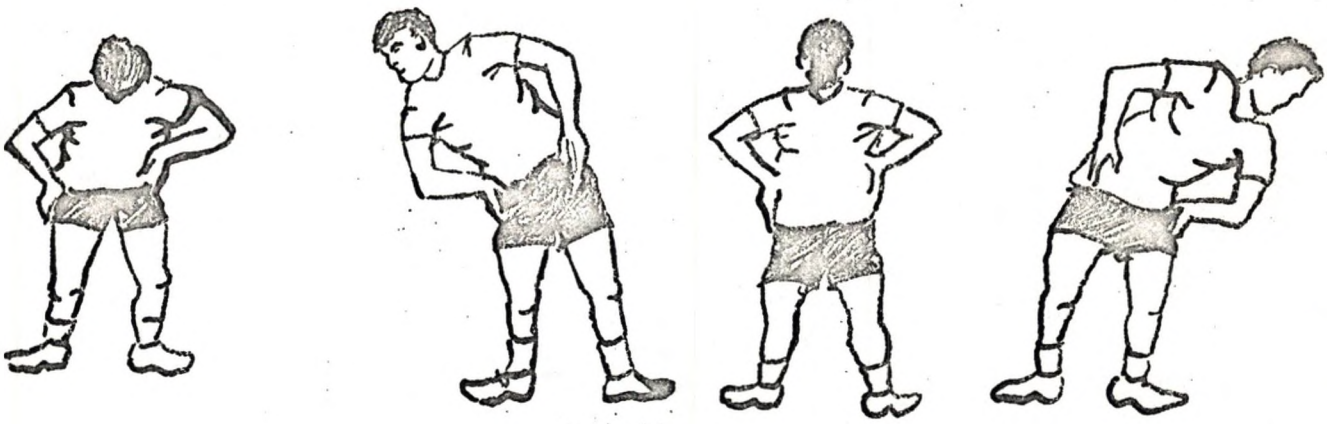
Bobble: From the ready position, place hands on hips, feet apart. Bend forward from the waist; bob trunk three times without assuming an upright position, but on fourth count assume an upright position. Each downward motion is a count. "Stop."

THRUST



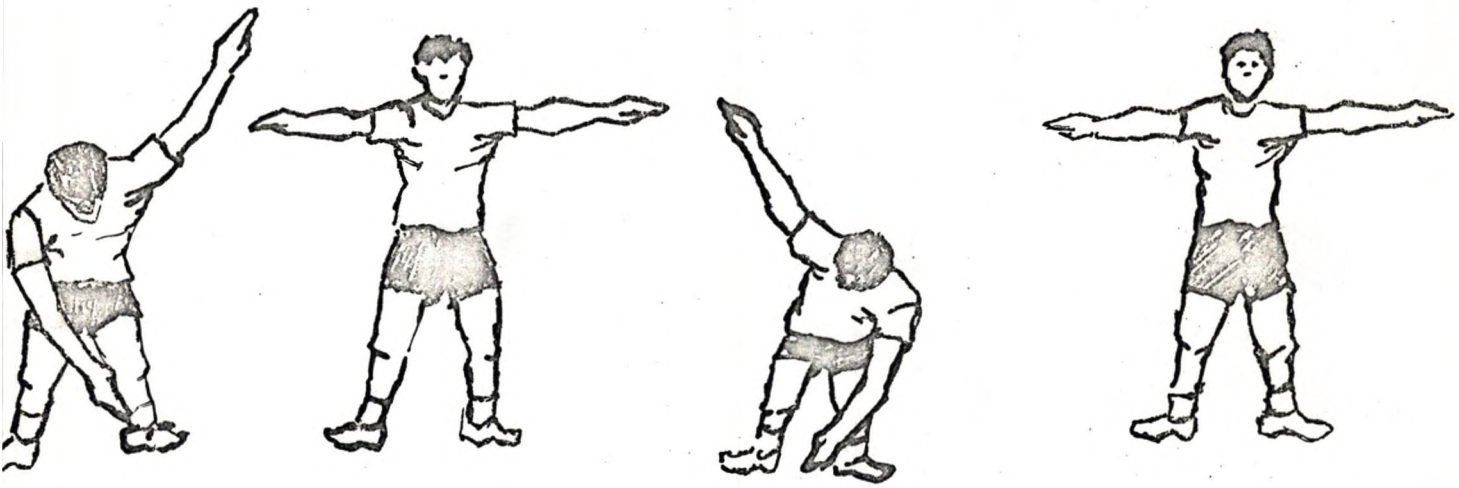
Thrust: From the ready position, extend fists and arms forward at shoulder height. Move fists back to the shoulders and elbows to the rear at shoulder level; thrust arms and fists forward to original position; with arms, make a shoulder high arc to rear; return arms to original forward position. "Stop."

LARIAT



Lariat: From the ready position, place hands on hips, feet apart. Bend forward from the waist, bend trunk to the right, bend trunk backward, bend trunk to the left. "Stop."

WINDMILL



Windmill: From the ready position, extend arms sideways, shoulder height, feet apart. Bend trunk forward and to the left, right hand touching left toe; return to upright position; bend trunk forward and to the right, left hand touching right toe; return to upright position. "Stop."

WING LIFT

Wing Lift: Lie face down on the floor, arms clasped at the back of neck and eyes directed straight down, legs straight, and toes touching floor. Lift head, upper back, and arms off floor about 12 inches. Chin in. Return to starting position. Do not allow elbows to touch floor or toes to leave floor. Repeat.

On the following pages you will find the "Scoring Table" for boys and girls on the Physical Fitness Test. Please note that each of the six test items has a maximum point score which is placed in parentheses under the test item at the top of the scoring table.

BOYS PULL-UP
(Max. Pts. 20)

No.	Pts.
16	20
15	18
14	16
13	14
12	13
11	12
10	11
9	10
8	9
7	8
6	7
5	6
4	5
3	4
2	3
1	2

GIRLS PULL-UP
(Max. Pts. 20)

No.	Pts.
40	20
38	19
36	18
34	17
32	16
30	15
28	14
26	13
24	12
22	11
20	10
18	9
16	8
14	7
12	6
10	5
8	4
6	3
4	2
2	1

BOYS AND GIRLS SIT-UPS
(Max. Pts. 15)

No.	Pts.
85+	15
80	14
75	13
70	12
65	11
60	10
55	9
50	8
45	7
40	6
35	5
30	4
25	3
18	2
10	1

BOYS AND GIRLS SQUAT THRUST
(Max. Pts. 15)

No.	Pts.
25+	15
25	14
24	13
23	12
22	11
21	10
20	9
19	8
18	7
17	6
16	5
14	4
12	3
8	2
4	1

GIRLS VERTICAL JUMP
(Max. Pts. 15)

In.	Pts.
21+	15
20	14
19	13
18	12
17	11
16	10
15	9
14	8
13	7
12	6
11	5
10	4
9	3
8	2
6	1

BOYS VERTICAL JUMP
(Max. Pts. 15)

No.	Pts.
25	15
24	14
23	13
22	12
21	11
20	10
19	9
18	8
17	7
16	6
15	5
14	4
13	3
12	2
6	1

BOYS STANDING BROAD JUMP
(Max. Pts. 15)

Ft.	In.	Pts.
9	--	15
8-	9	14
8-	6	13
8	--	12
7-	6	11
7	--	10
6-	6	9
6	--	8
5-	6	7
5	--	6
4-	6	5
4	--	4
3-	6	3
3	--	2
2-	6	1

GIRLS STANDING BROAD JUMP
(Max. Pts. 15)

Ft.	In.	Pts.
7	--	15
6	9	14
6	6	13
6	3	12
6		11
5	9	10
5	6	9
5	3	8
5		7
4	9	6
4	6	5
4		4
3	6	3
3		2
2	6	1

BOYS AND GIRLS SHUTTLE RUN
(Max. Pts. 20)

Sec.	Pts.
-9	20
9.1.2	19
9.3.4	18
9.5-7	17
9.8-10. . . .	16
10.1.3	15
10.4.5	14
10.6.7	13
10.8	12
10.9	11
11	10
11.1.3	9
11.4-7	8
11.8-12.2. . .	7
12.3.4	6
12.5.9	5
13-13.4. . . .	4
13.4-9	3
14-14.4. . . .	2
14.5-16. . . .	1

APPENDIX C

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Sit-ups

Individual Norm Scores of Experimental Group One

	Pre-test	Post-test	D	D^2
1.	5	7	2	4
2.	11	12	1	1
3.	9	10	1	1
4.	8	10	2	4
5.	4	6	2	4
6.	8	8	0	0
7.	12	13	1	1
8.	5	8	3	9
9.	7	10	3	9
10.	9	12	3	9
11.	6	6	0	0
12.	6	6	0	0
	Σ 90	Σ 108	Σ 18	Σ 42

$N = 12$

$\Sigma D_2 = 18$

$\Sigma D = 42$

$$S_{\bar{D}} \text{ (estimate of sample error of } \bar{D}) = \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Bigg/ \sqrt{N}$$

$$= \sqrt{\frac{42 - \frac{324}{12}}{12-1}} \Bigg/ \sqrt{12} = \frac{42 - \frac{324}{12}}{\sqrt{12}} = \frac{15}{11} = 1.36$$

$$= \frac{1.36}{\sqrt{12}} = \frac{1.17}{3.46}$$

$S_{\bar{D}} = .34$

$\bar{D}$ (mean difference) $= \frac{18}{12} - 1.50$

"t" $= \frac{\bar{D} \text{ (mean difference)}}{S_{\bar{D}} \text{ (estimate of sample error of } \bar{D})} = \frac{1.50}{.34} = 4.45$

df = N - 1= 11

"t" at the .05 level = 2.20 - Difference is significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Sit-ups

Individual Norm Scores of Experimental Group Two

	Pre-test	Post-Test	D	D^2
1.	9	11	2	4
2.	10	10	0	0
3.	7	10	2	9
4.	6	7	1	1
5.	8	8	0	0
6.	7	9	2	4
7.	14	14	0	0
8.	11	10	- 1	1
9.	14	10	- 4	16
10.	10	12	2	4
11.	10	11	1	1
12.	8	11	3	9
	Σ114	Σ123	Σ 9	Σ49

$N = 12$

$\Sigma D = 9$

$\Sigma D^2 = 49$

$S_{\bar{D}}$ (estimate of sampling error of $\bar{D}$) $= \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$

$$= \sqrt{\frac{49 - \frac{81}{12}}{12-1}} \Big/ \sqrt{12} = \frac{49 - \frac{81}{12}}{11} \Big/ \sqrt{12} = \frac{42.25}{11} \Big/ \sqrt{12} = 3.90 \Big/ \sqrt{12} = \frac{1.97}{3.46} = .57$$

$S_{\bar{D}} = .57$

$\bar{D}$ (mean difference $= \frac{9}{12} = .75$

"t" $= \frac{\bar{D} \text{ (mean difference}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}} = \frac{.75}{.57} = 1.31$

df $= N - 1 = 11$

"t" at the .05 level = 2.20 - Difference is not significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Pull-ups

Individual Norm Scores of Experimental Group One

	Pre-Test	Post-test	D	D^2
1.	5	7	2	4
2.	5	7	2	4
3.	7	14	7	49
4.	12	13	1	1
5.	4	7	3	9
6.	9	9	0	0
7.	4	5	1	1
8.	2	0	- 2	2
9.	4	4	0	0
10.	7	6	- 1	1
11.	0	2	2	4
12.	11	12	1	1
	Σ70	Σ86	Σ16	Σ76

$N = 12$

$\Sigma D = 16$

$\Sigma D^2 = 76$

$$S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}) = \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$$

$$= \sqrt{\frac{76 - \frac{256}{12}}{12-1}} = 76 - \frac{256}{12} = 54.6$$

$$\sqrt{12}$$

$$= 54.6 = 4.96 = \sqrt{4.96} = \frac{2.23}{3.46} = 64$$

$$\sqrt{12}$$

$S_{\bar{D}} = .64$

$\bar{D}$ (mean difference $= \frac{16}{12} = 1.33$

"t" $= \frac{\bar{D} \text{ (mean difference}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{1.33}{.64} = 2.07$

$df = N - 1 = 11$

"t" at the .05 level = 2.20

Difference is not significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Pull-ups

Individual Norm Scores of Experimental Group Two

	Pre-Test	Post-Test	D	D^2
1.	4	7	3	9
2.	10	10	0	0
3.	2	9	7	49
4.	8	13	5	25
5.	15	14	- 1	1
6.	12	10	- 2	4
7.	11	10	- 1	1
8.	5	6	1	1
9.	14	13	- 1	1
10.	9	10	1	1
11.	3	3	0	0
12.	5	5	0	0
	Σ 98	Σ 110	Σ 12	Σ 92

$N = 12$

$\Sigma D = 12$

$\Sigma D^2 = 92$

$$S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}) = \frac{S_D}{\sqrt{N}} = \frac{\sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}}}{\sqrt{N}}$$

$$= \frac{\sqrt{\frac{92 - \frac{144}{12}}{12-1}}}{\sqrt{12}} = \frac{92 - \frac{144}{12}}{\sqrt{12}} = \frac{80}{11} = \frac{7.27}{\sqrt{12}} = \frac{7.27}{3.46} = .77$$

$S_{\bar{D}} = .77$

$\bar{D}$ (mean difference) $= \frac{12}{12} = 1.00$

"t" = $\frac{\bar{D} \text{ (mean difference)}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{1.00}{.78} = 1.28$

$df = N - 1 = 11$

"t" at the .05 level = 2.20

Difference is not significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Shuttle Run

Individual Norm Scores of Experimental Group One

	Pre-Test	Post-Test	D	D^2
1.	3	7	4	16
2.	6	7	1	1
3.	9	11	2	4
4.	3	11	8	64
5.	2	7	5	25
6.	6	8	2	4
7.	4	4	0	0
8.	6	7	1	1
9.	5	7	2	4
10.	2	8	6	36
11.	4	5	1	1
12.	2	13	11	121
	Σ52	Σ95	Σ43	Σ277

$N = 12$

$\Sigma D = 43$

$\Sigma D^2 = 277$

$S_{\bar{D}}$ (estimate of sampling error of $\bar{D} = \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$

$= \sqrt{\frac{277 - \frac{1849}{12}}{12-1}} \quad 277 - \frac{1849}{12} = 122.92$

$= \frac{122.92}{11} = \frac{\sqrt{12}}{11.17} = \frac{\sqrt{11.17}}{\sqrt{12}} = \frac{3.34}{3.46} = .96$

$S_{\bar{D}} = .96$

$\bar{D}$ (mean difference $= \frac{43}{12} = 3.58$

"t" $= \frac{\bar{D} \text{ (mean difference}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}} = \frac{3.58}{.96} = 3.71$

df = N - 1 = 11

"t" at the .05 level = 2.20

Difference is significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Shuttle Run

Individual Norm Scores of Experimental Group Two

	Pre-Test	Post-Test	D	D^2
1.	3	5	2	4
2.	7	13	6	36
3.	1	7	6	36
4.	7	7	0	0
5.	7	9	2	4
6.	5	9	4	16
7.	7	8	1	1
8.	7	9	7	4
9.	11	10	- 1	1
10.	11	8	- 3	9
11.	5	7	2	4
12.	7	11	4	16
	Σ 71	Σ 96	Σ 25	Σ 131

$N = 12$

$\Sigma D = 25$

$\Sigma D_2 = 131$

$S_{\bar{D}}$ (estimate of sampling error of $\bar{D}$) $= S_D = \dfrac{\sqrt{\dfrac{\Sigma D2 - \dfrac{\Sigma(D)2}{N}}{N-1}}}{\sqrt{N}}$

$$= \frac{\sqrt{\dfrac{131 - \dfrac{650}{12}}{12-1}}}{\sqrt{12}} = \frac{131 - \dfrac{650}{12}}{11} = \frac{76.83}{11} = \frac{6.98}{\sqrt{12}} = \frac{\sqrt{6.98}}{3.46} = \frac{2.64}{3.46} = .76$$

$S_{\bar{D}} = .76$

$\bar{D}$ (mean difference $= \dfrac{25}{12} = 2.08$

"t" $= \dfrac{\bar{D} \text{ (mean difference}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \dfrac{2.08}{.76} = 2.73$

$df = N - 1 = 11$

"t" at the .05 level = 2.20

Different is significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Standing Broad Jump

Individual Norm Scores of Experimental Group One

	Pre-Test	Post-Test	D	D^2
1.	4	8	4	16
2.	9	9	0	0
3.	9	10	1	1
4.	9	11	2	4
5.	4	5	1	1
6.	7	7	0	0
7.	7	7	0	0
8.	6	6	0	0
9.	6	6	0	0
10.	5	6	1	1
11	6	6	0	0
12.	6	6	0	0
	Σ78	Σ87	Σ9	Σ23

$N = 12$

$\Sigma D = 9$

$\Sigma D^2 = 23$

$S_{\bar{D}}$ (estimate of sampling error of $\bar{D}$) $= \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$

$= \sqrt{\frac{23 - \frac{81}{12}}{12-1}} = 23 - \frac{81}{12} = 16.25$

$= \frac{16.25}{11} = 1.48 = \frac{\sqrt{12}}{\sqrt{1.48}} = \frac{1.23}{3.46} = .35$

$S_{\bar{D}} = .35$

$\bar{D}$ (mean difference) $= \frac{9}{12} = .75$

"t" $= \frac{\bar{D} \text{ (mean difference)}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{.75}{.35} = 2.13$

df = N - 1 = 11

"t" at the .05 level = 2.20

Different is not significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Standing Broad Jump

Individual Norm Scores of Experimental Group Two

	Pre-Test	Post-Test	D	D^2
1.	5	6	1	1
2.	10	9	- 1	1
3.	7	8	1	1
4.	7	8	1	1
5.	6	7	1	1
6.	3	8	5	25
7.	6	6	0	0
8.	5	6	1	1
9.	4	6	2	4
10.	6	7	1	1
11.	6	7	1	1
12.	6	6	0	0
	Σ71	Σ84	Σ13	Σ37

$N = 12$

$\Sigma D = 13$

$\Sigma D^2 = 37$

$S_{\bar{D}}$ (estimate of sampling error of $\bar{D}$) $= \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$

$= \sqrt{\frac{37 - \frac{169}{12}}{12-1}} = \frac{37 - \frac{169}{12}}{\sqrt{12}} = 22.92$

$= \frac{22.92}{11} = 2.08 = \frac{2.08}{\sqrt{12}} = \frac{1.44}{3.46} = .42$

$S_{\bar{D}} = .42$

$\bar{D}$ (mean difference) $= \frac{13}{12} = 1.08$

"t" $= \frac{\bar{D} \text{ (mean difference)}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{1.08}{.42} = 2.60$

df = N - 1 = 11

"t" at the .05 level = 2.20

Difference is significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Vertical Jump

Individual Norm Scores of Experimental Group One

	Pre-Test	Post-Test	D	D^2
1.	2	3	1	1
2.	4	6	2	4
3.	5	7	2	4
4.	7	9	2	4
5.	3	4	1	1
6.	4	4	0	0
7.	2	2	0	0
8.	1	1	0	0
9.	1	2	1	1
10.	1	1	0	0
11.	1	1	0	1
12.	1	2	1	1
	$\Sigma 32$	$\Sigma 42$	$\Sigma 10$	$\Sigma 17$

$N = 12$

$\Sigma D = 10$

$\Sigma D^2 = 17$

$$S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}) = \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$$

$$= \sqrt{\frac{17 - \frac{100}{12}}{12-1}} = 17 - \frac{100}{12} = 8.67$$

$$= \frac{8.67}{11} \qquad .78 = \frac{\sqrt{.78}}{\sqrt{12}} = \frac{.89}{3.46}$$

$S_{\bar{D}} = .26$

$\bar{D}$ (mean difference) $= \frac{10}{12} = .83$

"t" $= \frac{\bar{D} \text{ (mean difference)}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{.83}{.26} = 3.25$

df = N - 1 = 11

"t" at the .05 level = 2.20

Difference is significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Vertical Jump

Individual Norm Scores of Experimental Group Two

	Pre-Test	Post-Test	D	D^2
1.	3	3	0	0
2.	4	7	3	9
3.	5	6	1	1
4.	7	9	2	4
5.	5	5	0	0
6.	7	8	1	1
7.	1	1	0	0
8.	1	2	1	1
9.	4	4	0	0
10.	2	5	3	9
11.	1	1	0	0
12.	2	1	- 1	1
	Σ42	Σ52	Σ10	Σ26

$N = 12$

$\Sigma D = 10$

$\Sigma D^2 = 26$

$S_{\bar{D}}$ (estimate of sampling error of $\bar{D}$) $= \frac{S_D}{\sqrt{N}} = \frac{\sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}}}{\sqrt{N}}$

$$= \sqrt{\frac{26 - \frac{100}{12}}{12-1}} = 26 - \frac{100}{12} = 17.66$$

$$= \frac{17.66}{11} = \frac{1.60}{\sqrt{12}} = \sqrt{1.60} = \frac{1.27}{3.46}$$

$\sqrt{12}$

$S_{\bar{D}} = .37$

$\bar{D}$ (mean difference) $= \frac{10}{12} = .83$

"t" $= \frac{\bar{D} \text{ (mean difference)}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{.83}{.37} = 2.28$

df = N - 1 = 11

"t" at the .05 level = 2.20

Difference is significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Squat Thrust

Individual Norm Scores of Experimental Group One

	Pre-Test	Post-Test	D	D^2
1.	5	4	-1	1
2.	11	11	0	0
3.	10	10	0	0
4.	10	9	-1	1
5.	3	5	2	4
6.	5	6	1	1
7.	8	5	-3	9
8.	8	6	-2	4
9.	11	10	-1	1
10.	11	8	-3	9
11.	8	8	0	0
12.	11	11	0	0
	Σ101	Σ93	Σ8	Σ30

$N = 12$
$\Sigma D = 8$
$\Sigma D^2 = 30$

$$S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}) = \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$$

$$= \sqrt{\frac{30 - \frac{64}{12}}{12-1}} = 30 - \frac{64}{12} = 24.66$$

$$= \frac{24.66}{11} = 2.24 = \frac{\sqrt{2.24}}{\sqrt{12}} = \frac{1.50}{3.46} = .43$$

$S_{\bar{D}} = .43$

$\bar{D}$ (mean difference) $= \frac{8}{12} = -.66$

"t" $= \frac{\bar{D} \text{ (mean difference)}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{-.66}{.43} = -1.54$

df = N - 1 = 11
"t" at the .05 level = 2.20

Difference is not significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Squat Thrust

Individual Norm Scores of Experimental Group Two

	Pre-Test	Post-Test	D	D^2
1.	8	7	-1	1
2.	14	9	-5	25
3.	11	9	-2	4
4.	8	11	3	9
5.	12	9	-3	9
6.	6	5	-1	1
7.	6	10	4	16
8.	5	7	2	4
9.	10	12	2	4
10.	8	8	0	0
11.	5	11	6	36
12.	4	10	6	36
	Σ97	Σ108	Σ11	Σ145

$N = 12$

$\Sigma D = 11$

$\Sigma D^2 = 145$

$S_{\bar{D}}$ (estimate of sampling error of $\bar{D}$) $= \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$

$= \sqrt{\frac{145 - \frac{121}{12}}{12-1}} = 145 - \frac{121}{12} = 134.91$

$= \frac{134.92}{11} \quad 12.27 = \frac{\sqrt{12.27}}{\sqrt{12}} = \frac{3.50}{3.46}$

$S_{\bar{D}} = 1.01$

$\bar{D}$ (mean difference) $= \frac{11}{12} = .92$

"t" $= \frac{\bar{D} \text{ (mean difference)}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{.92}{1,01} = 0.91$

df = N - 1 = 11

"t" at the .05 level = 2.20

Difference is not significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Total of All Areas

Individual Norm Scores of Experimental Group One

	Pre-Test	Post-Test	D	D^2
1.	24	36	36	144
2.	46	52	6	36
3.	49	62	13	169
4.	49	63	14	296
5.	20	34	14	296
6.	39	42	3	9
7.	37	37	- 1	1
8.	28	28	0	0
9.	34	39	5	25
10.	35	41	6	36
11.	25	28	3	9
12.	41	55	14	296
	Σ427	Σ516	Σ89	Σ1317

$N = 12$

$\Sigma D = 89$

$\Sigma D^2 = 1317$

$$S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}) = \frac{S_D}{\sqrt{N}} = \frac{\sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}}}{\sqrt{N}}$$

$$= \sqrt{\frac{1317 - \frac{7921}{12}}{12-1}} = 1317 - \frac{7921}{12} = 656.92$$

$$= \frac{656.92}{11} = 59.72 = \frac{\sqrt{12}}{\sqrt{59.72}} = \frac{7.73}{3.46}$$

$$\sqrt{12}$$

$S_{\bar{D}} = 2.23$

$\bar{D}$ (mean difference $= \frac{89}{12} = 7.42$

$$\text{"t"} = \frac{\bar{D} \text{ (mean difference}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{7.42}{2.23} = 3.32$$

$df = N - 1 = 11$

"t" at the .05 level = 2.20

Difference is significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM CORRELATED SCORES FROM SMALL SAMPLES

Area of Comparison Total of All Areas

Individual Norm Scores of Experimental Group Two

	Pre-Test	Post-Test	D	D^2
1.	32	39	7	49
2.	55	58	3	9
3.	33	49	16	256
4.	43	55	12	144
5.	53	52	- 1	1
6.	40	49	9	81
7.	45	49	4	16
8.	34	40	6	36
9.	57	55	- 2	4
10.	46	50	4	16
11.	30	40	10	100
12.	32	44	12	144
	Σ500	Σ580	Σ80	Σ856

$N = 12$

$\Sigma D = 80$

$\Sigma D^2 = 856$

$$S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}) = \frac{S_D}{\sqrt{N}} = \sqrt{\frac{\Sigma D2 - \frac{\Sigma(D)2}{N}}{N-1}} \Big/ \sqrt{N}$$

$$= \sqrt{\frac{856 - \frac{6400}{12}}{12-1}} = 856 - \frac{6400}{12} = 322.67$$

$$= \frac{322.67}{11} = \frac{\sqrt{12}}{29.33} = \sqrt{\frac{29.33}{12}} = \frac{5.42}{3.46}$$

$S_{\bar{D}} = 1.57$

$\bar{D}$ (mean difference) $= \frac{80}{12} = 6.67$

"t" $= \frac{\bar{D} \text{ (mean difference}}{S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D})} = \frac{6.67}{1.57} = 4.25$

df = N - 1 = 11

"t" at the .05 level = 2.20

Difference is significant at .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM UNCORRELATED SCORES FROM SMALL SAMPLES

Test Sit-ups

Experimental Group One $\overline{D} = 1.50$ Experimental Group Two $\overline{D} = .75$

Experimental Group One $S_{\overline{D}} = .34$ Experimental Group Two $S_{\overline{D}} = .57$

S_{D_M} (the estimate of the sampling error for the distribution of differences between the mean differences) =

$$\sqrt{\left(S_{\overline{D}_1}\right)^2 + S_{\overline{D}_2}^2} = \sqrt{(.34)^2 + (.57)^2}$$

$S_{D_M} = .66$

$$\underline{D}_D = \overline{D}_1 - \overline{D}_2 = 1.50 - .75 = .75$$

$$\text{"t"} = \frac{\underline{D}_D}{S_{D_M}} = \frac{.75}{.66} = 1.14$$

$df = (N_1 - 1) - (N_2 - 1) = 22$

"t" at .05 level = 2.07

Difference is not significant at the .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM UNCORRELATED SCORES FROM SMALL SAMPLES

Test Pull-ups

Experimental Group One $\overline{D} = 1.33$ Experimental Group Two $\overline{D} = 1.00$

Experimental Group One $S_{\overline{D}} = .64$ Experimental Group Two $S_{\overline{D}} = .77$

S_{D_M} (the estimate of the sampling error for the distribution (of difference between the mean differences) =

$$\sqrt{\left(S_{\overline{D}_1}\right)^2 + S_{\overline{D}_2}^{\ 2}} = \sqrt{(.64)^2 + (.77)^2}$$

$$S_{D_M} = 1$$

$$D_{\overline{D}} = \overline{D}_1 - \overline{D}_2 = 1.33 - 1.00 = .33$$

$$\text{"t"} = \frac{D_{\overline{D}}}{S_{D_M}} = \frac{.33}{1} = .33$$

$$df = (N_1 - 1) - (N_2 - 1) = 22$$

"t" at .05 level = 2.07

Difference is not significant at the .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM UNCORRELATED SCORES FROM SMALL SAMPLES

Test Shuttle Run

Experimental Group One $\overline{D} = 3.58$ Experimental Group Two $\overline{D} = 2.08$

Experimental Group One $S_{\overline{D}} = .96$ Experimental Group Two $S_{\overline{D}} = .76$

S_{D_M} (the estimate of the sampling error for the distrubition (of difference between the mean differences) =

$$\sqrt{\left(S_{\overline{D}_1}\right)^2 + S_{\overline{D}_2}^{\,2}} = \sqrt{(.96)^2 + (.76)^2}$$

$S_{D_M} = 1.22$

$$D_{\overline{D}} = \overline{D}_1 - \overline{D}_2 = 3.58 - 2.08 = 1.50$$

$$\text{"t"} = \frac{D_{\overline{D}}}{S_{D_M}} = \frac{1.50}{1.22} = 1.23$$

$df = (N_1 - 1) - (N_2 - 1) = 22$

"t" at .05 level = 2.07

Difference is not significant at the .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM UNCORRELATED SCORES FROM SMALL SAMPLES

Test Stand Broad Jump

Experimental Group One $\overline{D} = .75$ Experimental Group Two $\overline{D} = 1.08$

Experimental Group One $S_{\overline{D}} = .35$ Experimental Group Two $S_{\overline{D}} = .42$

S_{D_M} (the estimate of the sampling error for the distribution (of difference between the mean differences) =

$$\sqrt{\left(S_{\overline{D}_1}\right)^2 + S_{\overline{D}_2}^2} = \sqrt{(.35)^2 + (.42)^2}$$

$S_{D_M} = .55$

$D_{\overline{D}} = \overline{D}_1 - \overline{D}_2 = .75 - 1.08 = -.33$

$$\text{"t"} = \frac{D_{\overline{D}}}{S_{D_M}} = \frac{-.33}{.55} = .60$$

$df = (N_1 - 1) - (N_2 - 1) = 22$

"t" at .05 level = 2.07

Difference is not significant at the .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM UNCORRELATED SCORES FROM SMALL SAMPLES

Test Vertical Jump

Experimental Group One $\overline{D} = .83$ Experimental Group Two $\overline{D} = .83$

Experimental Group One $S_{\overline{D}} = .26$ Experimental Group Two $S_{\overline{D}} = .37$

S_{D_M} (the estimate of the sampling error for the distribution (of difference between the mean differences) =

$$\sqrt{\left(S_{\overline{D}_1}\right)^2 + S_{\overline{D}_2}^2} = \sqrt{(.26)^2 + (.37)^2}$$

$S_{D_M} = .45$

$D_{\overline{D}} = \overline{D}_1 - \overline{D}_2 = .83 - .83 = .00$

$$\text{"t"} = \frac{D_{\overline{D}}}{S_{D_M}} = \frac{.00}{.45} = .00$$

$df = (N_1 - 1) - (N_2 - 1) = 22$

"t" at .05 level = 2.07

Difference is not significant at the .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM UNCORRELATED SCORES FROM SMALL SAMPLES

Test Squat Thrust

Experimental Group One $\bar{D} = .43$ Experimental Group Two $\bar{D} = .92$

Experimental Group One $S_{\bar{D}} = .66$ Experimental Group Two $S_{\bar{D}} = 1.01$

S_{D_M} (the estimate of the sampling error for the distribution (of difference between the mean differences) =

$$\sqrt{\left(S_{\bar{D}_1}\right)^2 + S_{\bar{D}_2}^2} = \sqrt{(-.66)^2 + (1.01)^2}$$

$S_{D_M} = 1.20$

$D_{\bar{D}} = \bar{D}_1 - \bar{D}_2 = .43 - .92 = -.49$

$$\text{"t"} = \frac{D_{\bar{D}}}{S_{D_M}} = \frac{-.49}{1.20} = -.40$$

$df = (N_1 - 1) - (N_2 - 1) = 22$

"t" at .05 level = 2.07

Difference is not significant at the .05 level

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM UNCORRELATED SCORES FROM SMALL SAMPLES

Test Totals of all areas

Experimental Group One $\overline{D} = 7.42$ Experimental Group Two $\overline{D} = 6.67$

Experimental Group One $S_{\overline{D}} = 2.23$ Experimental Group Two $S_{\overline{D}} = 1.57$

S_{D_M} (the estimate of the sampling error for the distribution of difference between the mean differences) =

$$\sqrt{\left(S_{\overline{D}_1}\right)^2 + S_{\overline{D}_2}^2} = \sqrt{(2.23)^2 + (1.57)^2}$$

$$S_{D_M} = 2.73$$

$$\frac{D}{D} = \overline{D}_1 - \overline{D}_2 = 7.42 - 6.67 = .75$$

$$\text{"t"} = \frac{\frac{D}{D}}{S_{D_M}} = \frac{.76}{2.73} = .28$$

$$df = (N_1 - 1) - (N_2 - 1) = 22$$

"t" at .05 level = 2.07

Different is not significant at the .05 level

APPENDIX D

EXPERIMENTAL GROUP ONE SCORE CARDS

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	11	5	14	7
Sit-Up	38	5	49	7
Squat Thrust	16	5	15	4
Shuttle Run	13.5	3	11.9	7
Vertical Jump	8	2	9	3
Standing Broad Jump	4	4	5:3	8
TOTAL POINTS		24		36

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	10	5	14	7
Sit-Up	65	11	70	12
Squat Thrust	22	11	22	11
Shuttle Run	12.3	6	12.1	7
Vertical Jump	10	4	12	6
Standing Broad Jump	5:6	9	5:8	9
TOTAL POINTS		46		52

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	14	7	28	14
Sit-Up	59	9	63	10
Squat Thrust	21	10	21	10
Shuttle Run	11.3	9	10.9	11
Vertical Jump	11	5	13	7
Standing Broad Jump	5:6	9	5:9	10
TOTAL POINTS		49		62

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	24	12	26	13
Sit-Up	52	8	63	10
Squat Thrust	21	10	20	9
Shuttle Run	13.7	3	10.9	11
Vertical Jump	13	7	15	9
Standing Broad Jump	5:8	9	6:1	11
TOTAL POINTS		49		63

INDIVIDUAL RECORD CARDS

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	9	4	14	7
Sit-Up	34	4	42	6
Squat Thrust	13	3	16	5
Shuttle Run	14	2	12	7
Vertical Jump	9	3	10	4
Standing Broad Jump	4:2	4	4:7	5
TOTAL POINTS		20		34

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	18	9	18	9
Sit-Up	50	8	53	8
Squat Thrust	16	5	17	6
Shuttle Run	12.3	6	11.5	8
Vertical Jump	10	4	10	4
Standing Broad Jump	5:0	7	5:2	7
TOTAL POINTS		39		42

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	3	4	4	5
Sit-Up	70	12	75	13
Squat Thrust	19	8	16	5
Shuttle Run	13	4	13	4
Vertical Jump	12	2	12	2
Standing Broad Jump	5:6	7	5:9	7
TOTAL POINTS		37		36

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	1	2	0	0
Sit-Up	38	5	51	8
Squat Thrust	19	8	17	6
Shuttle Run	12	6	11.9	7
Vertical Jump	8	1	11	1
Standing Broad Jump	5:1	6	5:1	6
TOTAL POINTS		28		28

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	3	4	3	4
Sit-Up	49	7	64	10
Squat Thrust	22	11	21	10
Shuttle Run	12.7	5	12	7
Vertical Jump	10	1	12	2
Standing Broad Jump	5:1	6	5:5	6
TOTAL POINTS		34		39

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	6	7	5	6
Sit-Up	57	9	73	12
Squat Thrust	22	11	19	8
Shuttle Run	14.3	2	11.5	8
Vertical Jump	10	1	10	1
Standing Broad Jump	4:11	5	5:2	6
TOTAL POINTS		35		41

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	9	0	1	6
Sit-Up	43	6	42	6
Squat Thrust	19	8	19	8
Shuttle Run	13	4	12.6	5
Vertical Jump	10	1	10	1
Standing Broad Jump	5:2	6	5:4	6
TOTAL POINTS		25		28

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	10	11	11	12
Sit-Up	62	10	67	11
Squat Thrust	22	11	22	11
Shuttle Run	14	2	10.6	13
Vertical Jump	11	1	12	2
Standing Broad Jump	5:2	6	5:4	6
TOTAL POINTS		41		55

EXPERIMENTAL GROUP TWO SCORE CARDS

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	9	4	14	7
Sit-Up	57	9	66	11
Squat Thrust	19	8	18	7
Shuttle Run	13.7	3	12.6	5
Vertical Jump	9	3	9	3
Standing Broad Jump	4:6	5	4:11	6
TOTAL POINTS		32		39

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	20	10	20	10
Sit-Up	64	10	62	10
Squat Thrust	25	14	20	9
Shuttle Run	11.8	7	10.6	13
Vertical Jump	10	4	13	7
Standing Broad Jump	5:10	10	5:6	9
TOTAL POINTS		55		58

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	5	2	18	9
Sit-Up	45	7	62	10
Squat Thrust	22	11	20	9
Shuttle Run	15	1	11.9	7
Vertical Jump	11	5	12	6
Standing Broad Jump	5	7	5:4	8
TOTAL POINTS		33		49

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	16	8	27	13
Sit-Up	40	6	48	7
Squat Thrust	19	8	22	11
Shuttle Run	11.8	7	11.8	7
Vertical Jump	13	7	15	9
Standing Broad Jump	5	7	5:3	8
TOTAL POINTS		43		55

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	30	15	29	14
Sit-Up	51	8	52	8
Squat Thrust	23	12	20	9
Shuttle Run	12.2	7	11.1	9
Vertical Jump	11	5	11	5
Standing Broad Jump	4:10	6	5:1	7
TOTAL POINTS		53		52

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	25	12	20	10
Sit-Up	45	7	55	9
Squat Thrust	17	6	16	5
Shuttle Run	12.9	5	11.3	9
Vertical Jump	13	7	14	8
Standing Broad Jump	3:9	3	5:3	8
TOTAL POINTS		40		49

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	10	11	9	10
Sit-Up	80	14	80	14
Squat Thrust	17	6	21	10
Shuttle Run	12.2	7	11.5	8
Vertical Jump	10	1	8	1
Standing Broad Jump	5:1	6	5:4	6
TOTAL POINTS		45		49

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	4	5	5	6
Sit-Up	67	11	63	10
Squat Thrust	16	5	18	7
Shuttle Run	11.8	7	11.3	9
Vertical Jump	11	1	12	2
Standing Broad Jump	4:11	5	5:4	6
TOTAL POINTS		34		40

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	13	14	12	13
Sit-Up	80	14	62	10
Squat Thrust	21	10	23	12
Shuttle Run	10.9	11	11	10
Vertical Jump	14	4	14	4
Standing Broad Jump	4:4	4	5:4	6
TOTAL POINTS		57		55

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	8	9	9	10
Sit-Up	64	10	74	12
Squat Thrust	19	8	19	8
Shuttle Run	10.9	11	11.4	8
Vertical Jump	12	2	15	5
Standing Broad Jump	5:4	6	5:6	7
TOTAL POINTS		46		50

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	2	3	2	3
Sit-Up	64	10	66	11
Squat Thrust	16	5	22	11
Shuttle Run	12.9	5	12.1	7
Vertical Jump	11	1	10	1
Standing Broad Jump	5:2	6	5:9	7
TOTAL POINTS		30		40

	Pre-Test "Oct."		Post-Test "Dec."	
	No.	Points	No.	Points
Pull-Up	4	5	4	5
Sit-Up	51	8	65	11
Squat Thrust	14	4	21	10
Shuttle Run	11.9	7	10.9	11
Vertical Jump	12	2	10	1
Standing Broad Jump	5:1	6	5:5	6
TOTAL POINTS		32		44

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