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Comparison of the Effects of Two Variations in Program Administration on the Physical Fitness of Ninth Grade Girls

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COMPARISON OF THE EFFECTS OF TWO VARIATIONS IN PROGRAM ADMINISTRATION ON THE PHYSICAL FITNESS OF NINTH GRADE GIRLS

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

In 1917, when the Selective Service Act called all men between the ages of 18 and 25 into the armed services, many people became concerned about the physical condition of these men and about the general health of the whole nation (19:239). In the four-year period between 1916 and 1919, eleven states enacted laws requiring physical education in larger schools and making physical education optional in the smaller schools (4:306).

At the outbreak of World War II, in 1941, the Selective Service System examined approximately two million men between the ages of 21 and 35, of whom 900,000 were rejected. The vast majority of these rejections were attributed to a variety of educational and health deficiencies; however, it was necessary for the armed forces to institute extensive conditioning programs in the initial phases of training. Public concern for physical fitness was shown through the creation of a Division of Physical Fitness by President Roosevelt in 1942. The Division's function was to promote interest in physical fitness and health in the general population (9:466-470).

In 1953, the Kraus-Weber fitness test was given to American and European youth. The results showed that 56.60 per cent of the American

youth could not pass a test of basic strength and that American youth were not as fit as the European youth (14:10). When these results were made public, the nation again became concerned about the fitness of its youth. President Eisenhower established the President's Council on Physical Fitness in 1956 (19:360). In 1961, President Kennedy, concerned about the youth of the nation, redirected the efforts of the council and it became known as the President's Council on Youth Fitness (9:499). In 1958, the American Association for Health, Physical Education and Recreation started a project called Operation Fitness which was to encourage schools to administer the American Association for Health, Physical Education and Recreation Fitness test. This project is still in effect (9:500).

In the United States, technological developments have increased the number of labor saving devices thus increasing the amount of leisure time available to all citizens, adults as well as children. Therefore, it is imperative that the youth be taught how to become physically fit by giving them programs of formal exercise and recreational activities.

Many exercise programs have been developed that aim to improve physical fitness. To be more efficient teachers and to develop an effective method of improving physical fitness, studies are needed that will indicate which of these programs or methods will build qualities of physical fitness most effectively.

I. THE PROBLEM

Statement of the Problem

It was the purpose of this study to compare the Royal Canadian Air Force XBX Plan with a circuit training program as to their effectiveness in developing physical fitness for girls.

Sub-Problems

The following sub-problems were pursued in this study: (1) selection of a suitable test for measurement of physical fitness, and (2) organization of a circuit training program that employed the same exercises as the XBX Plan.

Hypothesis

The study was designed to test the hypothesis that circuit training was a significantly more effective means of administering a series of calisthenic-type exercises than the Royal Canadian Air Force XBX Plan, in producing measurable gains in physical fitness elements among a selected group of junior high school girls.

Assumptions

It was assumed that (1) the Royal Canadian Air Force XBX Plan and circuit training improve physical fitness, (2) the Royal Canadian Air Force XBX group and the circuit training group were equally motivated to

achieve, and (3) changes in performance ability over a period of one semester could be partially attributed to changes in body size (physical growth) and that this physical growth would be equally distributed between the Royal Canadian Air Force XBX group and the circuit training group.

Delimitations

This study included a comparison of types of exercise programs among forty-four ninth grade girls enrolled in two classes at Pioneer Junior High School, Wenatchee, Washington.

Limitations

The limitations of this study are as follows: (1) the subjects were students at Pioneer Junior High School, Wenatchee, Washington, and (2) no attempt was made to control the outside physical activities of the subjects.

II. DEFINITIONS OF TERMS USED

Physical Fitness

Adequate endurance, strength, agility, and flexibility to carry on the tasks of everyday living (15:3).

XBX Group

Twenty subjects that were given the Royal Canadian Air Force Fitness XBX Plan as an exercise program.

Circuit Training Group

Twenty-four subjects that participated in circuit training as an exercise program.

Royal Canadian Air Force Fitness Program--XBX Plan

A program of exercises developed by the Royal Canadian Air Force with the primary purpose of giving individuals of all ages the opportunity to develop acceptable levels of physical fitness (20:1). The program contains four charts, each of which has twelve levels. Each level and each chart is more difficult than the one preceding it (20:2). The object is to progress from level to level and chart to chart.

Circuit Training

An exercise program which consists of a number of stations of exercises. The individual has a prescribed number of repetitions of an exercise to perform at each station. The object is to complete as many stations as possible in the allotted time and to increase the number of stations completed as the program proceeds from day to day.

III. ORGANIZATION OF REMAINDER OF THE THESIS

Chapter II is a review of literature related to the circuit training programs and the Royal Canadian Air Force XBX Plan. The procedures used in the study are described in Chapter III, including selection and applica-

tion of a fitness test as well as the organization and administration of the circuit training and the XBX programs. Analysis, interpretation, and treatment of the data obtained from the experiment are presented in Chapter IV. Chapter V includes a summary and conclusions of the study with recommendations for further study.

CHAPTER II

REVIEW OF THE LITERATURE

Chapter II contains a review of the literature related to this study, including discussion of the development and implementation of circuit training as well as a summary of the research done in the area of circuit training within the last ten years. This chapter also incorporates a discussion of the Royal Canadian Air Force XBX Plan.

I. DEVELOPMENT AND USE OF CIRCUIT TRAINING

Circuit training is an exercise method composed of a number of stations of exercises. The subject is assigned a training dosage or number of repetitions to perform at each station. The subject performs the proper number of repetitions at each station and then proceeds to the next station in an effort to complete as many stations as possible in the time allowed for the total exercise period. During succeeding exercise periods, the subject tries to increase the number of stations completed within the same time period. Circuit training is based on the overload principle of exercise, since it is designed to require an individual to perform at maximum level during the entire exercise period.

Circuit training was first developed by Morgan and Adamson at Leeds University in 1953 (23:1). Morgan and Adamson felt that an exercise program which appealed to the student, built muscular strength and endurance as well as circulo-respiratory endurance was needed (23:1). Circuit training has become a popular method of improving physical fitness. In 1960, at the University of British Columbia, a circuit training program was introduced as an experimental program. Soon students were transferring out of other classes to enroll in circuit training. Some students even began to do circuit training on their own time (23:1).

Morgan and Adamson suggest that some misconceptions and misuses of circuit training were developed as circuit training became more widespread (15:73). These deviations from the original purpose of circuit training are: (1) use of the program as a method of testing physical fitness and (2) placement of emphasis on completing the circuit as fast as possible rather than emphasizing correct and maximum performance of the exercises (15:73-74).

Circuit training is adaptable to many situations. With proper modification it can be used for men, women, boys, and girls, as well as either very small or very large groups. Any desired time period can be used and little or no equipment is necessary, although some programs of circuit training are designed to use weights (23:4-5; 12:33).

Howell and Morford listed the following additional advantages of the circuit training method: (1) students work at their own rate, (2) no supervision is required, thus the teacher is free to give individual help, (3) there is always progress, (4) the student competes against himself, and (5) the time factor is a built-in motivator (13:72).

II. CIRCUIT TRAINING RESEARCH

In an effort to find research during the last ten years on circuit training, the writer investigated numerous sources. Four studies were reported in the Research Quarterly.

Two studies compared circuit training with other methods of training in an attempt to determine which method was more effective in developing qualities of physical fitness. In one of these studies, conducted by Howell, Hodgson, and Sorenson at the University of Alberta, male college freshmen were used to determine the effects of circuit training and a program of activities on the Harvard Step Test. The training sessions lasted for thirty minutes twice a week over a four-week period. The circuit group performed three laps of a twelve-station circuit. The control group took part in a program of activities. The circuit group showed significant improvement on the Harvard Step Test while the control group did not. However, there was no significant difference between the post test scores on the Harvard Step Test of the

two groups. The authors concluded that circuit training did improve physical fitness and that improvement did show in a relatively short training period (11:155-157).

A second study comparing mass calisthenics with circuit training was made by Buckley. He conducted a study using two groups of ninth grade boys. The exercise sessions were eight minutes in length and were held daily for one semester. The results showed that neither group was significantly more fit than the other at the end of the experimental period; however, Buckley concluded that both the mass calisthenics and circuit training were effective in improving physical fitness (5:53).

Another study done by Banister compared different types of circuit training programs in an effort to ascertain which kind of circuit program improved the physical fitness level of ninth grade boys more efficiently. Bannister used two circuit groups. One circuit group performed twelve stations using maximum weights and then ran two miles. The second circuit group performed the circuit with submaximal weights and ran two miles. The third group was inactive one-third of each session and then joined the circuit run groups in activities. The fourth group spent the training sessions playing active games. The training sessions were held once a week for eight weeks. Results showed that the circuit group using maximum weights and running was significantly superior to the other groups (2:388-390).

One study was found that dealt with the amount of time that should be allotted to a circuit training program. In this experiment, Hakes and Rosemier used three groups of seventeen through twenty-two year old males in five, ten, and twenty minute circuits. Class periods were thirty minutes long. For the remainder of the period, the groups participated in active games. Test items used were leg exchanges, squat thrusts, sit-ups, bench steps, push-ups, and pull-ups. There was a significant improvement with all three groups on the post-test. The fifteen minute group was significantly better than the five minute group on leg exchanges and pull-ups. On the bench step, the ten minute group was significantly better than the five minute group (10:576-583). The results of this study appeared inconclusive since no one group made significant improvements over the other groups on all of the tests administered.

III. ROYAL CANADIAN AIR FORCE FITNESS PROGRAM

The Royal Canadian Air Force experts determined that there were three major reasons why people objected to regular physical exercise: (1) they did not know how to begin, (2) they did not know which exercises to use, and (3) they wanted an exercise program that required little time and no equipment (20:10). To overcome these objections to regular physical exercise, the Royal Canadian Air Force developed an exercise program shortly after World War II that gave specific instructions on where to

begin and which exercises to use. The program also required only twelve minutes of exercise time per day for women and did not require equipment (20:1-10).

The initial research for the project was conducted at Royal Canadian Air Force stations and later included civilian girls and women. A series of physical fitness tests were administered and by analyzing the results of these tests, the physical fitness requirements of women were determined. Experimental programs of exercises were sent to individual Canadians for trial use. From the comments and criticisms made by these individuals, the final program was developed (20:11).

The XBX (ten basic exercises) Plan consists of four charts of exercises, with each chart containing twelve levels of exercises. The same exercises are employed in all the levels of each chart, although the number of repetitions of each exercise is increased from level to level. As movement from one chart to the next is attained, the exercises are basically the same in that the exercises still develop the same areas of the body, but are more difficult (20:12). The XBX Plan is basically a program of progressive overload, since the number of repetitions are gradually increased and the exercises are made more difficult.

The XBX Plan provides women, regardless of age or physical fitness level, the opportunity either to maintain or improve their present level of fitness. The previously mentioned factors contributed to the

success of the program. The Royal Canadian Air Force Fitness booklet became a Canadian best seller and requests for the program came from many foreign countries including the United States where This Week Magazine offered the program to its fourteen million readers. Pocket Books, Inc., are now selling the Royal Canadian Air Force Fitness Plan in book stores (20:1-2).

A survey of literature failed to disclose any published research that employed the XBX Plan in an experiment. The only available published literature about the XBX Plan was the Royal Canadian Air Force Fitness Booklet. (See Appendix A.)

CHAPTER III

PROCEDURES

The primary purpose of this study was to determine which of two exercise methods--the Royal Canadian Air Force XBX Plan or the circuit training program--was more effective in developing qualities of physical fitness. The procedure for testing the hypothesis is discussed in this chapter.

I. SELECTION OF A MEASUREMENT OF PHYSICAL FITNESS

To obtain a suitable tool for measurement of physical fitness, several established physical fitness tests were investigated. These were: (1) Washington State Physical Fitness Test, (2) Oregon State Physical Fitness Test, (3) American Association for Health, Physical Education and Recreation Physical Fitness Test, (4) New York State Physical Fitness Test, (5) California State Physical Fitness Test, and (6) Neilson-Cozens achievement scales. The tests were subjected to the following criteria: (a) validity, (b) reliability, (c) objectivity, (d) suitability for local field use, (e) possession of adequate norms, (f) adequate discrimination between physical fitness levels, (g) general usefulness as related to sex and age, and (h) freedom from necessity for sophisticated equipment.

A test selection chart is appended (Appendix B), comparing the physical fitness tests listed above to the criteria mentioned. The chart indicates the areas in which the physical fitness tests investigated, fulfilled or failed to fulfill the criteria used to judge the tests.

The Washington State Physical Fitness Test was selected because it satisfactorily met the criteria previously mentioned. The individual tests included in the Washington State Physical Fitness Test are pull-ups, curl-ups, jump reach, Illinois run, squat thrusts, hands behind the back-left, hands behind the back-right, and toe touch. A description of these individual tests can be found in Appendix C. The following is a summary of how the Washington State Physical Fitness Test fulfilled the requirements.

Validity

A member of the committee which developed the Washington State Physical Fitness Test, Dr. Marion Broer, was contacted. She reported that the items on the test were validated through a study of the literature on physical fitness. The committee's choice of items was based on women's most common weaknesses and needs, for example, the need for abdominal strength in childbearing and arm and shoulder strength for everyday living.

Reliability

During the development of the Washington State Physical Fitness Test, Fox conducted some research to determine the reliability of the test. In this experiment, three tests were used including the Washington State Physical Fitness Test, the Rogers Strength Test, and the Kraus-Weber Test (7:431). One hundred sixty-nine ninth, tenth, and eleventh grade girls participated in the study. The results showed that the Washington State Physical Fitness Test was a reliable test of physical fitness (7:430-435).

Objectivity

The Washington State Physical Fitness Test is an objective test. The scores for the pull-ups, squat thrusts, and curl-ups are determined by the number of repetitions of each test item that a student is able to perform. Scores for the jump reach are in terms of the number of inches a student can jump upward. The Illinois run is scored by using the number of seconds it takes for a student to complete the run.

Suitability

The Washington State Physical Fitness Test is suitable for field use in the state of Washington. The test was designed so that all of the items can be administered in a gymnasium. This becomes an important factor when the test has to be given to the students at the beginning of

the second semester of the school year when inclement weather in some locations prohibits the use of outdoor facilities. In the case of this study, the test had to be administered at the beginning of the second semester when the weather in Wenatchee, Washington, prohibits the use of outside facilities.

The Washington State Physical Fitness Test is also suitable for local field use in the public schools of the state of Washington because its norms were established specifically for secondary public school students in Washington.

Norms

The first norms for the Washington State Physical Fitness Test were established in 1958 when 12,311 (8,817 boys' and 3,494 girls') scores obtained from public schools throughout the state of Washington were evaluated at Eastern Washington State College (21:1). In 1962, it was necessary to reevaluate the norms to obtain a more accurate physical fitness rating for the secondary public school students of Washington. A chart of the 1962 norms for ninth grade girls can be found in Appendix C.

Discrimination

To establish that the Washington State Physical Fitness Test provided adequate discrimination between fitness levels, it was necessary for the investigator to design a discrimination chart. (See Appendix C.)

For each of the test items, a high raw score, an average raw score, and a low raw score were selected respectively from the "good," "average," and "poor" levels of the Washington State Physical Fitness Test norms. For each of these raw scores, the appropriate T-score was selected from the norms for an eighth grade girl, a ninth grade girl, and a tenth grade girl. If the T-scores were different for the high, average, and low raw scores as well as being different for the eighth, ninth, and tenth grade girl, the test item was considered to have adequate discrimination between physical fitness levels. Hands behind the back-right, hands behind the back-left, and toe touch were excluded from the chart because they were pass or fail tests.

Age and Sex

The Washington State Physical Fitness Test contains separate norms for the six grade levels of the secondary public schools. It also has separate norms and test items for boys and girls. Therefore, the author concluded that the Washington State Physical Fitness Test adequately met the criteria concerned with general usefulness as related to sex and age.

Necessity for Equipment

The Washington State Physical Fitness Test requires little equipment. The equipment that it does require includes a horizontal bar or wand

with a six inch ribbon attached, stop watch, chalk, eraser, yard stick, and score sheets. These were easily available to the researcher at Pioneer Junior High School, Wenatchee, Washington, where the experiment was conducted.

II. SELECTION OF EXERCISE PROGRAMS TO BE USED IN THE STUDY

Both the Royal Canadian Air Force XBX Plan and the circuit training programs were chosen partly because of their popularity and widespread use when this study was first conceived in 1965. The XBX Plan had become a very popular method of building physical fitness because it did not require group participation nor did it require special facilities or equipment. It also had very specific instructions as to how the plan should be implemented and definite directions for the exercises. Since the XBX Plan had these advantages and could easily be used in a physical education class, it was one of the exercise programs chosen. The author also felt that some investigation of the actual contribution made by the XBX Plan toward the development of physical fitness in comparison with another fitness building method would yield pertinent information of use to physical educators.

When this study was initiated, circuit training programs were already being used extensively in England and were gaining popularity in the United States as a method of effectively improving physical fitness.

However, the original circuit program involved the use of weights. The author decided that there was a possibility that the circuit method of training could be used with conventional exercises instead of weights and still be effective in improving physical fitness. The other factor contributing to the choice of the circuit training method was that the program had not had widespread use as a method of improving physical fitness among junior high school girls.

III. PUPIL ORIENTATION FOR THE WASHINGTON STATE PHYSICAL FITNESS TEST

The orientation period occurred on the fourth day of the semester. The students were given general directions for the performance of each test item included in the Washington State Physical Fitness Test; also, specific instructions were given just prior to the time that each test item was administered.

The students were instructed as to the importance of performing, as well as possible, each test item of the Washington State Physical Fitness Test. There were two reasons given for performing at full capacity. First, an accurate rating of the subject's physical fitness levels could be obtained, and secondly, the total test scores attained by each of the subjects would be graded by using the physical fitness levels presented in the Washington State Physical Fitness Test norms.

(Appendix C.) These levels were superior, good, average, poor, and very poor. Grades of A, B, C, D, or F were assigned to these levels, respectively. Grading of the tests was used as a motivational device to encourage the students to perform at full capacity.

IV. ADMINISTRATION OF THE WASHINGTON STATE PHYSICAL FITNESS TEST

Following the orientation, the Washington State Physical Fitness Test was given as a pre-test on the fifth, sixth, and seventh days of the semester. The test items of the Washington State Physical Fitness Test were administered in the following order: first day, pull-ups and squat thrusts; second day, curl-ups, hands behind the back-right, hands behind the back-left, and toe touch; third day, jump reach and Illinois run.

Immediately after each test item was administered, the scores were placed on an administrative score sheet (Appendix C) by the researcher. Later, the raw scores and the proper T-score, taken from the norms, were transferred to individual student record sheets (Appendix C.).

V. STATISTICAL TREATMENT OF THE DATA

Equating the Groups

To statistically equate the two groups, three procedures were followed. First, the scores from the toe touch, hands behind the back-left, and hands behind the back-right were eliminated because they were pass or fail tests. Secondly, the norms of the Washington State Physical Fitness Test were designed so that each of three test items--pull-ups, curl-ups, and jump reach made up one-third of a T-score scale. When the T-scores of these tests were added together they represented a total strength T-score. To deal statistically with each item individually, each T-score for pull-ups, curl-ups, and jump reach was multiplied by three.

The third procedure involved statistically equating the two groups. On some of the test items, the XBX group or the circuit group attained a higher mean than did the opposite group. To equate the groups, scores from one group may have been discarded on some of the items but not on others, depending upon the mean attained by that group. By such discarding of scores, the XBX and circuit training groups were rendered virtually statistically equal at the beginning of the experiment by use of the t ratio test for the significance of difference between means utilizing a two-tailed statistical test. The minimum level of acceptability was set at t equals 1.00. No subject was dropped from either group, but the scores from some of the items were discarded.

Analysis of Changes Due to Training

The research hypothesis as originally set forth was that girls in the circuit training group would score significantly higher on a test of physical fitness than those girls participating in the Royal Canadian Air Force XBX Plan of exercises. Thus, a one-tailed hypothesis is necessary. The t ratio test for the significance of difference between means of the groups was used to analyze the data statistically. The .05 level of confidence was the minimum acceptable.

VI. ORGANIZATION AND ADMINISTRATION OF EXERCISE PROGRAMS

Since this study was a comparison of two exercise programs, the author attempted to make the XBX Plan and the circuit training program as equal as possible by controlling the time allowance and the exercises performed. This was done so that any results obtained from the Washington State Physical Fitness Test scores would be attributed to the difference in the method of the exercise programs and not in the differences of the exercises or the time allowed for each program. The same exercises were used for both methods and the exercise time allowed for each method was twelve minutes per day.

Royal Canadian Air Force XBX Plan

Following the administration of the Washington State Physical Fitness Test, each subject in the XBX group was given a copy of the Royal

Canadian Air Force XBX Plan booklet (Appendix A). Directions for performing the exercises contained in the first chart were explained to the students. Directions for performing new exercises were given each time the subjects progressed to different ones.

The XBX group performed the prescribed number of repetitions for each exercise in the allotted time each day the class met. A subject who could do all of the exercises in the time allowed, and had spent the required number of exercise periods on each level, was allowed to progress to the next level in the next exercise period. The subject who had completed twelve levels on one chart then proceeded to the first level of the next chart and learned to do new exercises.

Each member of the XBX group was required by the XBX Plan to spend at least one exercise period on each level of Charts I and II. On Chart III, a subject was required to spend two exercise periods on each level and three days on each level of Chart IV.

After completing the twelve-minute exercise period, the XBX subjects spent the remainder of the class period in a program of physical activities. These physical activities included three weeks each of volleyball, basketball, soccer, and softball, and two weeks of table tennis.

Circuit Training

At the outset of the study, each subject in the circuit group was assigned a specific number of repetitions to perform at each station. This number or training dosage was determined by a subject performing the maximum number of repetitions in an allotted time period and then multiplying that number by two-thirds. The resulting product became the training dosage for that exercise. If the maximum number of push-ups a subject could do in two minutes was twelve, the training dosage in the circuit was eight push-ups. This procedure was repeated for each of the exercises in the XBX Plan to produce a circuit of exercises for the circuit training group.

The subjects in the circuit training group were each given a card (See Appendix D) which prescribed the training dosage for each exercise. The subjects were instructed to perform the number of repetitions at each station prescribed by their training dosage card and then move on to the next station. At the end of the twelve-minute exercise period, the subjects of the circuit training group stopped exercising and recorded the number of stations they had completed on individual score sheets (see Appendix D).

The exercises for both experimental groups remained identical throughout the fourteen and one-half weeks experimental period. As the majority of subjects in the XBX group progressed from one exercise

chart to the next, the exercises and training dosages for the circuit training group were altered accordingly.

After the subjects of the circuit group had recorded their scores each day, they participated in a program of physical activities for the remainder of the class period. This program of physical activities consisted of three weeks each of volleyball, basketball, soccer, and softball, and two weeks of table tennis.

VII. EVALUATION OF EXTRA-CURRICULAR ACTIVITIES

A questionnaire was developed by the author to determine if the extra-curricular activities in which a subject participated might affect the physical fitness level of that subject. At the end of each four-week period throughout the fourteen and one-half weeks experimental period, each subject completed the questionnaire. (See Appendix E.) At the end of the experimental period, the questionnaires were evaluated by the investigator, taking into consideration the type, frequency, and intensity of the activities.

In evaluating the questionnaire, the author included walking, horseback riding, bowling, ice skating, roller skating, hiking, basketball, badminton, and tennis as mild activities. The only activity considered to be strenuous was skiing. These conclusions were based on

a subjective analysis by the author of the subject and the activities in which the subject participated.

When the activity hours were totaled, the following results were obtained. The XBX group spent 1,938 hours in mild activities and twenty-eight hours in strenuous activity. The circuit group spent 2,203 hours in mild activities and eighty-two hours in strenuous activities.

No subject was withdrawn from the study due to participation in extra-curricular activities. Analysis of each subject's questionnaires failed to indicate that the physical fitness level of any subject was affected by participation in extra-curricular activities.

CHAPTER IV

ANALYSIS OF THE DATA

The purpose of this study was to compare the relative effectiveness of the Royal Canadian Air Force XBX Plan of exercises with a circuit training program of exercises in improving physical fitness of ninth grade girls. The Washington State Physical Fitness Test was used to evaluate the physical fitness level of both groups. This chapter contains a discussion of the analysis of the data collected in the study.

I. EQUATING THE XBX GROUP AND THE CIRCUIT GROUP

The mean, standard deviation, and t ratio were computed for the XBX group and the circuit group for each of the test items and for the total test score. The initial computation indicated that the two groups were not statistically equal, so scores were discarded from the group from which the highest mean was obtained until the means, standard deviations, and t ratio indicated that the two groups were virtually identical at the outset of the study. Table I shows the number of scores retained for each group on each test item and the total test score. The table also shows t ratios and the levels of significance obtained for each item and for the total score. In view of the very small t ratios

TABLE I

INITIAL EQUATING OF THE T-SCORE MEANS OF THE XBX AND CIRCUIT TRAINING GROUPS: SIGNIFICANCE OF DIFFERENCE BETWEEN INITIAL TEST MEANS (TWO-TAILED TEST)

	N XBX	T-score M XBX	N Circuit	T-score M Circuit	Diff.	SE Diff.	t	Probability
Pull-ups	20	52.05	24	51.25	.80	2.19	.36	>.80<.70
Curl-ups	16	49.68	24	48.12	1.56	2.36	.66	>.60<.50
Jump Reach	20	53.10	20	52.81	.29	1.83	.14	>.90<.80
Illinois Run	20	51.25	24	51.12	.13	2.36	.05	<.90
Squat Thrust	15	49.86	24	48.16	1.70	2.26	.75	>.50<.40
Total Score	16	153.25*	24	153.04	.21	3.28	.06	<.90

* These scores represent the summation of T-scores on Agility Run and Squat Thrust (each with a full T-score scale), plus the summation of one-third T-score scales on Pull-ups, Curl-ups, and Jump Reach, which when taken together, represent Total Strength.

found, it was concluded that the two groups could be legitimately considered equal at the beginning of the study.

II. ANALYSIS OF THE POST-TEST SCORES OF THE XBX GROUP AND THE CIRCUIT GROUP

The mean, standard deviation, and $\underline{t}$ ratio were also computed for the post-test scores of each item and the total test scores of the XBX group and the circuit group. These individuals' scores, utilized in equating the two groups at the beginning of the training period, were retained and used in comparison of the two groups.

Analysis of the post-test data (Table II) showed that the XBX group attained higher T-score means than did the circuit group on all of the test items and the total test score. The central hypothesis of the study was that the series of exercises known as XBX would produce statistically superior results if utilized in a circuit training regimen than if utilized in the XBX regimen, as shown by scores on a representative test of physical fitness. Thus, the hypothesis is one-tailed. Table II shows, however, that all the final test T-score means were greater for the XBX group than they were for the circuit group. Thus, the hypothesis is not only rejected, but tends strongly to favor the opposite group, viz., the XBX group.

TABLE II

ANALYSIS OF DIFFERENCES BETWEEN T-SCORE MEANS OF THE XBX AND CIRCUIT TRAINING GROUPS: SIGNIFICANCE OF DIFFERENCE BETWEEN FINAL TEST MEANS (ONE-TAILED TEST)

	N XBX	Mean XBX	N Circuit	Mean Circuit	Diff.	SE Diff.	df	t	Probability
Pull-Ups	20	57.45	24	53.75	3.70	2.49	42	1.48	>.10 <.05
Curl-Ups	16	60.18	24	58.87	1.31	1.49	38	.88	>.20 <.10
Jump Reach	20	55.50	20	53.25	2.25	1.83	38	1.22	>.10 <.05
Illinois Run	20	60.60	24	55.63	4.97	2.17	42	2.29	>.02 <.01
Squat Thrust	15	59.13	24	55.95	3.18	1.78	37	1.78	>.05 <.02
Total Score	16	173.93*	24	167.79*	7.14	3.01	38	2.37	>.01 <.001

* These scores represent the summation of T-scores on Agility Run and Squat Thrust (each with a full T-score scale), plus the summation of one-third T-score scales on Pull-ups, Curl-ups, and Jump Reach, which when taken together, represent Total Strength.

As shown by Table II, the t ratios for pull-ups, curl-ups, and jump reach (collectively called Total Strength) are all non-significant, but the level of significance for the pull-ups and for the jump reach closely approach the .05 level of confidence for the one-tailed hypothesis chosen for this study. T ratios for significance of difference between means on Illinois agility run and squat thrust as well as for the total score, exceeded the .05 level of confidence.

The writer had felt that the original hypothesis, as stated previously, was a legitimate and defensible one in view of the differences between the methods of conducting the exercises by the XBX program and the circuit training program. The fact that the hypothesis was not only rejected but virtually reversed, caused the writer to search for an answer as to why this occurred.

During the course of the training programs, the writer had noticed that the girls comprising the XBX group seemed to enjoy their daily exercise routine whereas those in the circuit training program did not. In addition, the girls of each group corroborated the writer's observations by parallel remarks made repeatedly over the course of the experiment. In reflecting about these observations and remarks, it occurred to the writer that such overt psychological feelings appeared to have manifested themselves in the performance differences noted in Table II. Such a possibility, while not amenable to direct statistical verification, did

seem worth some additional work in an effort to confirm the logical hypothesis born of observation.

It was decided to test separately for each of the two groups on each of the tests the 50:50 hypothesis that, as a result of training, half of each group would be expected to improve and half of each group would be expected to regress if chance alone were operating. The extent to which each group of girls (XBX and circuit) improved beyond the initial mean score on each test item and total score for their own group, as a result of the training, formed the basis for a defensible hypothesis.

Chi-square was used for this analysis. It was reasoned that if a greater proportion of XBX girls improved over their pre-test mean on a given test item than of the circuit group, this fact would tend to corroborate statistically the observation of the writer and the remarks by girls of the respective groups, as well as to help explain the dramatic reversal of the hypothesis.

Table III summarizes the data resulting from the Chi-square computations, which reveals two principal facts. First, in five of the six test items, a larger proportion of XBX girls improved beyond the XBX pre-test mean than did the circuit training girls, as noted by the comparative sizes of the Chi-square values. Only in curl-ups did the circuit training group exceed the XBX group in proportion of improvement.

TABLE III

χ^2 VALUES INDICATING COMPARATIVE MAGNITUDE OF IMPROVEMENT OVER PRE-TEST MEANS: ONE DEGREE OF FREEDOM

	XBX		Circuit	
	χ^2	Probability	χ^2	Probability
Pull-ups	5.00	>.05<.02	1.19	>.30<.20
Curl-ups	16.00	<.01	20.00	<.01
Jump Reach	.80	>.50<.30	.20	>.70<.50
Illinois Run	5.00	>.05<.02	1.19	>.30<.20
Squat Thrust	15.00	<.01	9.87	<.01
Total Score	9.00	<.01	2.66	>.20<.10

Thus, this finding lends statistical credence to the remarks of the girls of the respective groups and the observation of the writer.

Secondly, an examination of the probability values for XBX and circuit groups, which correspond to the computed Chi-square values, readily indicates that only in the case of jump reach does the computed Chi-square value fail to reach the .05 level of confidence in the case of the XBX group. Contrasted with this are the probability values for pull-ups, jump reach, Illinois run, and total score for the circuit training group, each of which fail to reach the .05 level of confidence. This also supports the observed contention that psychological factors may perhaps manifest themselves in overt performance.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter is a summary of the study, including purposes, hypothesis, procedures, and findings. Conclusions and recommendations concerning further research are also incorporated in the chapter.

I. SUMMARY

This study tested the hypothesis that circuit training was significantly more effective as a means of administering a series of calisthenic-type exercises than the Royal Canadian Air Force XBX Plan, in producing measurable gains in physical fitness elements among a selected group of junior high school girls. Subjects were two classes of ninth grade girls enrolled in Pioneer Junior High School, Wenatchee, Washington.

The Washington State Physical Fitness Test for secondary school boys and girls was selected from among a group of comparable "field" tests, utilizing several criteria against which each test was rated. Following the initial administration of this test to the two groups of twenty and twenty-four girls each in the circuit and XBX groups respectively, the subjects began a daily training program which continued for fourteen and one-half weeks and required twelve minutes of participation each day.

The circuit training group participated in the same exercises as did the XBX group, and as the exercises changed (from one chart to the next for the XBX group), they changed likewise for the circuit training group. At the conclusion of the training period, the Washington State Physical Fitness Test was re-administered to test the changes, if any, in physical fitness among the two groups.

II. CONCLUSIONS

The analysis of the data indicated that the Royal Canadian Air Force XBX Plan improved qualities of physical fitness of ninth grade girls more than did circuit training. Every mean score of the XBX group was higher than the corresponding mean score for each of the six items of the Washington State Physical Fitness Test. On those items comprising the total strength score, namely, pull-ups, curl-ups and jump reach, the t ratios failed to reach significance for a one-tailed test at the .05 level of confidence. For the Illinois run, squat thrust, and total score, however, the t ratios were all significant beyond the .05 level of confidence. Therefore, the hypothesis that circuit training would be significantly more effective than the XBX program in improving physical fitness of these girls was not tenable.

Remarks made by the girls of each group repeatedly corroborated the observation of the writer that the girls in the XBX group enjoyed their

daily routine of exercises while those girls in the circuit training group did not. This corroborated observation seemed a logical explanation for the virtual reversal of the original hypothesis.

In an attempt to lend substantive statistical support to the logic of the explanation, a Chi-square analysis of each of the test items for the XBX and circuit groups was carried out. This analysis was based on the hypothesis that if only chance were operating, half the girls of each exercise group would increase their initial test group score mean, item by item, and half would decrease. Furthermore, if the XBX group had higher Chi-square values than the circuit group in most of the test, this would lend support to the proposition that psychological factors about exercise may manifest themselves overtly in physical performance.

Upon computation of the Chi-square values, it was found that the XBX group had higher values than the circuit group in five of the six tests. Thus, while it is impossible with the data presented here to state conclusively that the hypothesis failed because the circuit girls did not like their program and the XBX girls enjoyed theirs, it is by the same token, difficult to fault the combination of data and logic presented. Girls at the age of those studied are known to be interested in personal attractiveness, figure, diet, and boys: in short, things feminine.

Boys, on the other hand, are known to be interested in things masculine, and the writer hypothesizes that among a group of boys, opposite results might well be found.

III. RECOMMENDATIONS

The writer recommends the following:

1. A similar study be conducted among seventh and eighth grade girls. It is possible that interests at earlier age levels might be different.
2. A similar study be conducted with similar-aged boys.

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APPENDIX A

ROYAL CANADIAN AIR FORCE XBX PLAN EXERCISES

APPENDIX A

CHART I

		EXERCISE											
		1	2	3	4	5	6	7	8	9	10	8A	8B
	12	9	8	10	40	26	20	28	14	14	170	18	20
L	11	9	8	10	40	24	18	26	13	14	160	17	18
	10	9	8	10	40	22	16	25	12	12	150	16	17
E	9	7	7	8	36	20	14	23	10	11	140	14	15
	8	7	7	8	36	18	12	20	9	10	125	13	14
V	7	7	7	8	36	16	12	18	8	10	115	11	12
	6	5	5	7	28	14	10	16	7	8	100	10	11
E	5	5	5	7	28	12	8	13	6	6	90	8	9
	4	5	5	7	28	10	8	10	5	6	80	7	8
L	3	3	4	5	24	8	6	8	4	4	70	6	6
	2	3	4	5	24	6	4	6	3	3	60	5	5
	1	3	4	5	24	4	4	4	3	2	50	4	3
Minutes for each Exercise		2				2	1	1	2	1	3	1	1

Recommended number of days at each level ☐

MY PROGRESS

LEVEL	STARTED	FINISHED	COMMENTS
12			
11			
10			
9			
8			
7			
6			
5			
4			
3			
2			
1			

	DATE	HEIGHT	WEIGHT	WAIST	HIPS	BUST
My Aim						
Start						
Finish						

ROYAL CANADIAN AIR FORCE XBX PLAN EXERCISES

CHART I

Exercise 1 - Toe Touching

Start. Stand erect, feet 12 inches apart, arms over head.

Bend forward to touch floor between feet. Do not try to keep knees straight. Return to starting position.

Count. Each return to starting position counts one.

Exercise 2 - Knee Raising

Start. Stand erect, hands at sides, feet together.

Raise left knee as high as possible, grasping knee and shin with hands. Pull leg toward body. Keep back straight throughout. Lower foot to floor.

Repeat with right leg. Continue by alternating legs--left then right.

Count. Left and right knee raises count one.

Exercise 3 - Lateral Bending

Start. Stand erect, feet 12 inches apart, hands at sides. Keeping back straight, bend sidewards from waist to left. Slide left hand down leg as far as possible. Return to starting position and bend to right side. Continue by alternating to left then right.

Count. Bends to the left and right count one.

Exercise 4 - Arm Circling

Start. Stand erect, feet 12 inches apart, arms at sides. Make large circles with left arm. Do one quarter of total count with forward circles and one quarter with backward circles. Repeat with right arm.

Count. A full arm circle counts one.

Exercise 5 - Partial Sit-ups

Start. Lie on back, legs straight and together, arms at sides.

Raise head and shoulders from floor until you can see your heels. Lower head to floor.

Count. Each partial sit-up counts one

Exercise 6 - Chest and Leg Raising

Start. Lie face down, arms along sides, hands under thighs, palms pressing against thighs.

Raise head, shoulders, and left leg as high as possible from floor. Keep leg straight. Lower to floor.

Repeat raising head, shoulders, and right leg.

Continue by alternating legs, left then right.

Count. Each chest and leg raise counts one.

Exercise 7 - Side Leg Raising

Start. Lie on side, legs straight, lower arm stretched over head along floor, top arm used for balance.

Raise upper leg 18 to 24 inches. Lower to starting position.

Count. Each leg raise counts one. Do half number of counts raising left leg. Roll to other side and do half number of counts raising right leg.

Exercise 8 - Push-ups

Start. Lie face down, legs straight and together, hands directly under shoulders.

Push body off floor in any way possible, keeping hands and knees in contact with floor. Sit back on heels. Lower body to floor.

Count. Each return to starting position counts one.

Exercise 9 - Leg Lifting

Start. Lie on back, legs straight and together, arms at sides, palms down.

Raise left leg until it is perpendicular to floor, or as close to this position as possible.

Lower and repeat with right leg.

Continue by alternating legs, left then right.

Count. Left plus right leg lifts count one.

Exercise 10 - Run and Hop

Start. Stand erect, feet together, arms at sides.

Starting with left leg, run in place raising feet at least four inches from floor.

(When running in place lift knees forward, do not merely kick heels backwards.)

Count. Each time left foot touches floor counts one.

After each fifty counts do ten hops.

Hops. Hopping is done so that both feet leave floor together. Try to hop at least four inches off floor each time.

Note: In all run-in-place exercises only running steps are counted towards completing exercise repetitions.

CHART II

		EXERCISE											
		1	2	3	4	5	6	7	8	9	10	8A	8B
	24	15	16	12	30	35	38	50	28	20	210	40	36
L	23	15	16	12	30	33	36	48	26	18	200	38	34
	22	15	16	12	30	31	34	46	24	18	200	36	32
E	21	13	14	11	26	29	32	44	23	16	190	33	29
	20	13	14	11	26	27	31	42	21	16	175	31	27
V	19	13	14	11	26	24	29	40	20	14	160	28	24
	18	12	12	9	20	22	27	38	18	14	150	25	22
E	17	12	12	9	20	19	24	36	16	12	150	22	20
	16	12	12	9	20	16	21	34	14	10	140	19	19
L	15	10	10	7	18	14	18	32	12	10	130	17	15
	14	10	10	7	18	11	15	30	10	8	120	14	13
	13	10	10	7	18	9	12	28	8	8	120	12	12
Minutes for each Exercise		2				2	1	1	2	1	3	1	1

Recommended number of days at each level ☐

MY PROGRESS

LEVEL	STARTED	FINISHED	COMMENTS
24			
23			
22			
21			
20			
19			
18			
17			
16			
15			
14			
13			

	DATE	HEIGHT	WEIGHT	WAIST	HIPS	BUST
My Aim						
Start						
Finish						

CHART II

Exercise 1 - Toe Touching

Start. Stand erect, feet 12 inches apart, arms over head.
Bend forward to touch floor between feet.
Bob up and down touching floor a second time.
Return to starting position.

Count. Each return to starting position counts one.

Exercise 2 - Knee Raising

Start. Stand erect, feet together, arms at sides.

Raise left knee as high as possible grasping knee and shin with hands. Pull leg against body. Keep back straight throughout. Lower foot to floor.

Repeat with right leg. Continue by alternating legs--left then right.

Count. Left and right knee raises count one.

Exercise 3 - Lateral Bending

Start. Stand erect, feet 12 inches apart, hands at sides.

Keeping back straight, bend sidewards from waist to left. Slide left hand down leg as far as possible. Bob up a few inches and press sidewards and down again.

Continue by alternating to left then right.

Count. Bends to left and right count one.

Exercise 4 - Arm Circling

Start. Stand erect, feet 12 inches apart, arms at sides.

Make large circles, with both arms at same time, backwards and around. Do half the number of repetitions making backward circles and half making forward circles.

Count. Each full arm circle counts one.

Exercise 5 - Rocking Sit-ups

Start. Lie on back, knees bent, feet on floor, arms extended over head.

Swing arms forward and at same time thrust feet forward and move to sitting position. Reach forward, trying to touch toes with fingers. Return to starting position.

Count. Each return to starting position counts one.

Exercise 6 - Chest and Leg Raising

Start. Lie face down, arms along sides, palms pressing against thighs. Raise head, shoulders, and legs as high as possible from floor. Keep legs straight. Return to starting position.

Count. Each return to starting position counts one.

Exercise 7 - Side Leg Raising

Start. Lie on side, legs straight, lower arm stretched over head along floor, top arm used for balance.

Raise upper leg until it is perpendicular to floor or as close to this position as possible. Lower to starting position.

Count. Each leg raise counts one. Do half number of counts raising left leg. Roll to other side and do half number of counts raising right leg.

Exercise 8 - Knee Push-ups

Start. Lie face down, legs straight and together, hands directly under shoulders.

Push body off floor until arms are straightened. Keep hands and knees in contact with floor. Try to keep body in straight line.

Count. Each return to starting position counts one.

Exercise 9 - Leg-overs

Start. Lie on back, legs straight and together, arms stretched sidewards at shoulder level.

Raise left leg to perpendicular. Drop it across body, and try to touch right hand with toes. Raise leg to perpendicular and return to starting position. Repeat same movements with right leg. Keep body and legs straight throughout, and shoulders on floor.

Count. Each return to starting position counts one.

Exercise 10 - Run and Stride Jumping

Start. Stand erect, feet together, arms at sides. Starting with left leg run in place raising feet at least four inches from floor.

Count. Each time left foot touches floor counts one.

After each fifty runs do ten stride jumps.

Stride Jump. Stride jump starts with feet together, arms at sides. Jump so that feet are about 18 inches apart when you land. At the same time as you jump, raise arms sidewards to shoulder height. Jump again so that feet are together and arms are at sides when you land.

CHART III

		EXERCISE											
		1	2	3	4	5	6	7	8	9	10	8A	8B
	36	15	22	18	40	42	40	60	40	20	240	32	38
L	35	15	22	18	40	41	39	60	39	20	230	30	36
	34	15	22	18	40	40	38	58	37	19	220	29	34
E	33	13	20	16	36	39	36	58	35	19	210	27	33
	32	13	20	16	36	37	36	56	34	18	200	25	31
V	31	13	20	16	36	35	34	56	32	16	200	24	30
	30	12	18	14	30	33	33	54	30	15	190	23	28
E	29	12	18	14	30	32	31	54	29	14	180	21	26
	28	12	18	14	30	31	30	52	27	12	170	20	25
L	27	10	16	12	24	29	30	52	25	11	160	19	23
	26	10	16	12	24	27	29	50	23	9	150	17	21
	25	10	16	12	24	26	28	48	22	8	140	16	20
Minutes for each Exercise		2				2	1	1	2	1	3	1	1

Recommended number of days at each level ☐

MY PROGRESS

LEVEL	STARTED	FINISHED	COMMENTS
36			
35			
34			
33			
32			
31			
30			
29			
28			
27			
26			
25			

	DATE	HEIGHT	WEIGHT	WAIST	HIPS	BUST
My Aim						
Start						
Finish						

CHART III

Exercise 1 - Toe Touching

Start. Stand erect, feet about 16 inches apart, arms over head.

Bend down to touch floor outside left foot. Bob up and down to touch floor between feet. Bob again and bend to touch floor outside right foot. Return to starting position.

Count. Each return to starting position counts one.

Exercise 2 - Knee Raising

Start. Stand erect, feet together, arms at sides.

Raise left knee as high as possible, grasping knee and shin with hands. Pull leg against body. Keep back straight throughout. Lower foot to floor. Repeat with right leg. Continue by alternating legs--left then right.

Count. Left and right knee raises count one.

Exercise 3 - Lateral Bending

Start. Stand erect, feet 12 inches apart, right arm extended over head, bent at elbow.

Keeping back straight, bend sidewards from waist to left.

Slide left hand down leg as far as possible, at the same time press to left with right arm.

Return to starting position and change arm positions. Repeat to right. Continue by alternating to left then right.

Count. Bends to left and right count one.

Exercise 4 - Arm Circling

Start. Stand erect, feet 12 inches apart, arms at sides.

Make large circles with arms in a windmill action--one arm following other and both moving at same time. Do half number of repetitions making backward circles and half making forward circles.

Count. Each full circle by both arms counts one.

Exercise 5 - Sit-ups

Start. Lie on back, legs straight and together, arms along sides.

Keeping back as straight as possible, move to a sitting position.

Slide hands along legs during this movement finally reaching forward to try to touch toes with fingers.

Return to starting position.

Count. Each return to starting position counts one.

Exercise 6 - Chest and Leg Raising

Start. Lie face down, legs straight and together, arms stretched sidewards at shoulder level.

Raise entire upper body and both legs from floor as high as possible.

Keep legs straight. Return to starting position.

Count. Each return to starting position counts one.

Exercise 7 - Side Leg Raising

Start. Lie on side, legs straight, lower arm stretched over head along floor, top arm used for balance.

Raise upper leg until it is perpendicular to floor. Lower to starting position.

Count. Each leg raise counts one. Do half number of counts raising left leg. Roll to other side and do half number of counts raising right leg.

Exercise 8 - Elbow Push-ups

Start. Lie face down, legs straight and together, elbows directly under shoulders, forearms along floor, and hands clasped together.

Raise body from floor by straightening it from head to heels.

In the up position, body is in a straight line and elbows, forearms, and toes are in contact with floor. Lower to starting position. Keep head up throughout.

Count. Each return to starting position counts one.

Exercise 9 - Leg-overs--Tuck

Start. Lie on back, legs straight and together, arms stretched sidewards at shoulder level, palms down.

Raise both legs from floor, bending at hips and knees until in a tuck position. Lower legs to left, keeping knees together and both shoulders on floor. Raise legs and lower to floor on right side. Raise until perpendicular to floor and return to starting position. Keep knees close to abdomen throughout.

Count. Each return to starting position counts one.

Exercise 10 - Run and Half-Knee Bends

Start. Stand erect, feet together, arms at sides.

Starting with left leg, run in place raising feet at least six inches off floor.

Count. Each time left foot touches floor counts one.

After each fifty counts do ten half knee bends.

Half Knee Bends. Half knee bends start with hands on hips, feet together, body erect. Bend at knees and hips, lowering body until thigh and calf form an angle of about 110 degrees. Do not bend knees past a right angle. Keep back straight. Return to starting position.

CHART IV

		EXERCISE									
		1	2	3	4	5	6	7	8	9	10
	48	15	26	15	32	48	46	58	30	16	230
L	47	15	26	15	32	45	45	56	27	15	220
	46	15	26	15	32	44	44	54	24	14	210
E	45	13	24	14	30	42	43	52	21	13	200
	44	13	24	14	30	40	42	50	19	13	190
V	43	13	24	14	30	38	40	48	16	12	175
	42	12	22	12	28	35	39	46	13	10	160
E	41	12	22	12	28	32	38	44	11	9	150
	40	12	22	12	28	30	38	40	9	8	140
L	39	10	20	10	26	29	36	38	8	7	130
	38	10	20	10	26	27	35	36	7	6	115
	37	10	20	10	26	25	34	34	6	5	100
Minutes for each Exercise		2				2	1	1	2	1	3

Recommended number of days at each level ☐

MY PROGRESS

LEVEL	STARTED	FINISHED	COMMENTS
48			
47			
46			
45			
44			
43			
42			
41			
40			
39			
38			
37			

	DATE	HEIGHT	WEIGHT	WAIST	HIPS	BUST
My Aim						
Start						
Finish						

CHART IV

Exercise 1 - Toe Touching

Start. Stand erect, feet about 16 inches apart, arms over head.

Bend down to touch floor outside left foot. Bob up and down to touch floor between feet. Bob again touching floor between feet once more. Bob and bend to touch floor outside right foot.

Return to starting position.

Count. Each return to starting position counts one.

Exercise 2 - Knee Raising

Start. Stand erect, feet together, arms at sides.

Raise left knee as high as possible, grasping knee and shin with hands.

Pull leg against body. Keep back straight throughout. Lower foot to floor.

Repeat with right leg. Continue by alternating legs--left then right.

Count. Left and right knee raises count one.

Exercise 3 - Lateral Bending

Start. Stand erect, feet 12 inches apart, right arm extended over head, bent at elbow.

Keeping back straight, bend sidewards from waist to left. Slide left hand down leg as far as possible, at same time press to left with right arm. Bob up a few inches and press to left again.

Return to starting position and change arm positions.

Repeat to right.

Continue by alternating to left then right.

Count. Bends to left and right count one.

Exercise 4 - Arm Flinging

Start. Stand erect, feet 12 inches apart, upper arms extended sidewards at shoulder level, elbows bent, outstretched fingers touching in front of chest.

Press elbows backward and upward. Do not let elbows drop. Return arms to starting position and then fling hands and arms outward, backward, and upward as far as possible.

Return to starting position.

Count. Count one after each arm fling.

Exercise 5 - Sit-ups

Start. Lie on back, legs straight and together, hands behind head.

Move to sitting position. Keep feet on floor (support may be used if necessary) and back straight. Lower body to starting position.

Count. Each return to starting position counts one.

Exercise 6 - Chest and Leg Raising

Start. Lie face down, legs straight and together, hands behind head.

Raise entire upper body and both legs from floor as high as possible. Keep legs straight. Return to starting position.

Count. Each return to starting position counts one.

Exercise 7 - Side Leg Raising

Start. With right side to floor, support weight on right hand (arm straight) and side of right foot, using left hand for assistance in balance if necessary.

Raise left leg until it is parallel with floor. Lower leg to starting position.

Count. Each leg raise counts one. Do half number of counts raising left leg. Change to other side and do half number of counts raising right leg.

Exercise 8 - Push-ups

Start. Lie face down, legs straight and together, toes turned under, hands directly under shoulders.

Push up from hands and toes until arms are fully extended.

Keep body and legs in a straight line. Return to touch chest to floor and repeat.

Count. Each time chest touches floor counts one.

Exercise 9 - Leg-overs--Straight

Start. Lie on back, legs straight and together, arms stretched sidewards at shoulder level, palms down.

Raise both legs until they are perpendicular to floor, keeping them straight and together. Lower legs to left, trying to touch left hand with toes. Raise to perpendicular and lower to right side. Raise again to perpendicular and return to starting position.

Count. Each return to starting position counts one.

Exercise 10 - Run and Semi-Squat Jumps

Start. Stand erect, feet together, arms at sides.

Starting with left leg, run in place raising feet at least six inches from floor.

Count. Each time left foot touches floor counts one.

After each fifty counts do ten semi-squat jumps.

Semi-Squat-Jumps. Drop to a half crouch position with hands on knees and arms straight. Keep back as straight as possible, one foot slightly ahead of the other. Jump to upright position with body straight and feet leaving floor. Reverse position of feet before landing, return to half crouch, and repeat.

APPENDIX B

TEST SELECTION CHART

TEST SELECTION CHART

	Validity	Reliability	Objectivity	Suitability for Local Field Use	Possession of Adequate Norms	Adequate Discrimination Between Fitness Levels	General Usefulness, Related to Age and Sex	Freedom From Sophisticated Equipment
AAHPER Test	*	*	yes	no	yes	yes	yes	yes
California State Test	*	*	yes	no	yes	yes	yes	yes
Kraus-Weber Test	*	*	yes	yes	yes	no	yes	yes
Neilson Cozen Test	*	*	yes	yes	yes	yes	yes	yes
New York State Test	yes	yes	yes	no	yes	yes	yes	yes
Oregon State Test	yes	yes	yes	no	yes	yes	yes	yes
Washington State Test	yes	yes	yes	yes	yes	yes	yes	yes

* Indicates that these items were not found in the test booklets.

APPENDIX C

WASHINGTON STATE PHYSICAL FITNESS TEST BATTERY

WASHINGTON STATE PHYSICAL EDUCATION TESTS

PULL-UPS

Equipment: One wand, with a ribbon attached which hangs six inches long, for every three students.

Test Description: The subject lies flat on her back on the floor. One student stands on either side in a forward lunge position, one facing in the direction of the subject's feet, the other in the direction of her head. They hold the wand so that it is supported by their forward thighs at the point directly above the subject's shoulders at the height of full reach. The wand is held so that the students holding it can just see the top of the ribbon and the ribbon hangs straight down. The subject grasps the wand with her hands using either grip, i.e., palms forward or palms back (1). Keeping a straight line from heels to head, the subject pulls upward until her chest touches the ribbon (ribbon moves) (2); then returns to a reclining position (1). This constitutes one pull-up. She then repeats the movement for as many times as possible. The students rotate doing the pull-ups, etc. until all have taken the test.

Caution: Make certain that the subject being tested keeps her body in a straight line, touches the ribbon with her chest, and returns to a reclining position on the floor between each pull-up. Also, make certain that the students holding the wand understand that they are not to assist the subject in any manner.

Score: The number of complete pull-ups that can be done correctly and consecutively.

CURL-UPS

Equipment: None

Test Description: The subject lies on her back with head and shoulders touching the floor, arms crossed in front of body, hands over shoulders, knees bent so that the feet are flat on the floor with the heels close to the seat (1). With the feet held flat by her partner, she comes to a sitting position touching her elbows to her knees (2), and then returns to starting position (1). This constitutes one curl-up. She repeats this movement for as many times as possible up to fifty.

Caution: The subject's feet must be kept flat on the floor and close to the seat. The head and shoulders must touch the floor each time. The elbows must touch the knees.

Score: The number of complete curl-ups up to fifty that can be done correctly and consecutively.

JUMP & REACH

Equipment: One blackboard 5' x 22" wide fastened to wall, the bottom of which should be 5' 10" from the floor; one piece of chalk, one eraser, a yardstick, and a small ladder or chair for tester.

Test Description: The subject stands facing the wall and as close to it as possible keeping the feet together and flat on the floor. She then reaches upward with both hands as far as possible. A chalk mark is made at the maximum reach at the tips of the fingers for each hand (1). A line is drawn between these two points. The subject then stands with either side to the wall. Chalk dust is placed on middle finger of hand nearest wall. The subject then bends the knees and ankles, assuming a semi-crouch position with the arms swung backward (2). Then, swinging the arms forward and upward and extending the legs and ankles, as in a basketball center jump, she jumps as high as possible touching the board at the maximum height of the jump (3).

Caution: In placing the first chalk mark on the wall, make certain that the subject is standing as close to the wall as possible with her feet together and flat on the floor and is reaching upward with both hands as high as possible. Also, the subject is to use the hand nearest the wall for marking the height of the jump, not the hand away from the wall. Bounding or double jumps are not permitted.

Score: The test is administered three times, the best mark of the three being recorded. This is the measured distance between the first chalk mark and the highest mark made on the jumps. Record to the nearest half inch.

ILLINOIS AGILITY RUN

Equipment: One stop watch, floor markings and four chairs spaced as indicated on the diagram.

Test Description: The subject lies with her stomach flat on the floor, her head at the starting line and hands at the sides of chest with the palms on the floor. On the signal "Ready Go!", the subject gets up quickly, runs to the line thirty feet from the starting line, turns, sprints to the starting line, turns left around the end chair, zig-zags back right to left around the chairs as shown in the diagram, makes a left turn around the end chair, runs to the thirty foot line, turns, sprints back over the finish line.

Caution: Emphasize the fact that the subject must touch the thirty foot line, but not the chairs.

Score: The time it takes to complete the course measured to the nearest tenth of a second; i.e., from the signal "go" until the foot crosses the finish line.

SQUAT-THRUSTS

Equipment: One stop watch

Test Description: This is a four-part exercise. At the start, the subject stands erect with the feet close together and the hands at the sides (1). In part one, the subject moves to a squat position with the hands on the floor just outside the feet and the arms straight (2). In part two, she moves to a front-leaning rest position, i.e., feet are extended backward so that the body and legs form one line being supported on the hands and feet (3). In part three, she returns to the squat position described under part one (4), and in part four returns to an erect standing position reaching up touching her partner's hand which is held at a height equal to a completely extended reach for the person being tested (5). This constitutes one complete squat-thrust movement.

One student watches the feet of the girl taking the test to make sure that she completely extends her legs. A second girl stands facing the girl taking the test and holds one hand extended upward at the point of full reach of the student taking the test (1). She counts the number of times the student slaps her hand and records her score at the end of thirty seconds. The three students rotate until all three have had three trials. The teacher with the stop watch calls for all number one's to get ready and then gives the signal, "Ready Go." At the end of thirty seconds she says "Stop!" She then has the two's get ready, take their first trial; then the three's, etc.

Caution: Make certain the subject extends the legs backward as far as possible during part two and comes to a completely erect position during part four, and makes a full reach. The partner must keep hand at full height.

Score: The number of complete squat-thrust movements completed in each thirty-second period is recorded on the edge of the score card. These figures are totaled at the completion of the third trial to give the endurance score.

FINGERS-BEHIND-BACK-TOUCH-RIGHT

Equipment: None

Test Description: The subject stands erect and places her right hand over her right shoulder extending the fingers of her right hand down her back, palm of hand toward the body. She places the back of the left hand in the small of her back and moves it upward until the fingers of the right and left hand are touching. She must hold this position for three full seconds.

Caution: Do not permit the subject to warm up before the test.

Score: Pass or fail. The subject either maintains the position for three seconds or she does not. The person administering the test counts the allotted time, 101 - 102 - 103.

FINGERS-BEHIND-BACK-TOUCH-LEFT

The movement is the same as for the fingers-behind-back-touch-right, except that the position of the hands is reversed. Otherwise, the administrative and scoring procedures are the same.

WASHINGTON STATE PHYSICAL FITNESS TEST BATTERY

GRADE 9

RATING	STRENGTH						Total Strength	AGILITY		ENDURANCE		FLEXIBILITY
	Pull-ups		Curl-ups		Jump & Reach			Illinois Run		Squat Thrusts		Floor Touch Touch Right Touch Left
	Score	Pts.	Score	Pts.	Score	Pts.		Score	Pts.	Score	Pts.	
SUPERIOR	38-40	27			18½-19	25		18.0	77	54	82	
	32-37	26			18	24		18.2-18.1	74	53	78	
	30-31	25	50	21	16½-17½	23	66-up	18.3	73	52	77	
	26-30	24						18.4	72	51	75	
	23-25	23						18.5	70	50	72	
	21-22	22						18.6	68	49	71	
										48	69	
										47	68	
			42-49	20	16	22		18.8-18.7	67	46	67	
								18.9	66			
GOOD	19-20	21	34-41	19	15 -15½	21	55-65	19.0	64	45	65	
	16-18	20	30-33	18	14 -14½	20		19.2-19.1	62	44	64	
	14-15	19			13½	19		19.4-19.3	61	43	62	
	12-13	18						19.5	60	42	61	
								19.7-19.6	59	41	59	
								19.9-19.8	58	40	58	
								20.0	56	39	56	
					12½-13	18		20.1	55	38	55	
AVERAGE	11	17	25-29	17	12	17		20.3-20.2	54	37	54	
	9-10	16	21-24	16	11 -11½	16	43-54	20.4	53	36	52	
	8	15	18-20	15	10½	15		20.5	52	35	50	Pass Three Tests
	7	14	15-17	14				20.7-20.6	51			45 Points
								20.9-20.8	50	34	48	
								21.0	48			
								21.2-21.1	47	33	46	
								21.4-21.3	46			
								21.5	45	32	45	
								21.7-21.6	44			
								21.9-21.8	43	31	43	
								22.0	42			
					9½-10	14		22.2-22.1	41	30	41	
								22.4-22.3	40			
POOR	5- 6	13	12-14	13	9	13		22.5	39	29	40	
	4	12	10-11	12	8 - 8½	12	33-42	22.6	38	28	38	Pass Two Tests
								22.9-22.7	37			30 Points
	2- 3	11	8- 9	11				23.1-23.0	36	27	37	
			5- 7	10				23.4-23.2	35	26	35	
								23.5	34	25	34	
								23.7-23.6	33			
								23.9-23.8	32	24	33	
								24.0	31	23	32	
								24.4-24.1	30	21-22	31	
								24.6-24.5	29			
VERY POOR	1	10			7 - 7½	11		25.0-24.7	28			
	0	0	3- 4	9	6 - 6½	10	32-down	25.4-25.1	27			Pass One Test
			2	8	5 - 5½	9		25.5	26	19-20	30	15 Points,
			1	6	4½	8		26.2-25.6	25	18	29	0 Test,
			0	0	4	7		26.4-26.3	24	15-17	28	0 Points
								26.5	23	13-14	27	
								26.6	22	11-12	26	
								27.5-26.7	21	10	25	
								27.9-27.6	20	9	21	
								28.0	18			

DISCRIMINATION CHART

	Raw Score	Points		
		Eighth Grade	Ninth Grade	Tenth Grade
Pull-ups				
High	20	22	21	23
Average	8	16	15	16
Low	2	12	11	12
Curl-ups				
High	44	20	20	22
Average	20	15	15	17
Low	8	11	11	13
Jump and Reach				
High	15	22	21	20
Average	11	16	16	15
Low	8	12	12	11
Illinois Run				
High	19.0	63	64	67
Average	21.1	47	48	50
Low	24.4	34	30	34
Squat Thrusts				
High	45	66	65	66
Average	34	48	48	51
Low	21	33	31	35

ADMINISTRATIVE SCORE SHEET

Name	Pull-ups	Points	Curl-ups	Points	Jump Reach	Points	Illinois Run	Points	Squat Thrusts	Points	T R Flexibility L	Points

PHYSICAL FITNESS RECORD

NAME				SCHOOL								
	7th Grade			8th Grade			9th Grade					
Height												
Weight												
Age												
	PULL-UP	CURL-UP	JUMP REACH	TOTAL STRENGTH		AGILITY RUN	SQUAT THRUSTS	FLOOR TOUCH	FLEXIBILITY	TOTAL		
7th Score												
1st Test Points												
Score												
2nd Test Points												
8th Score												
1st Test Points												
Score												
2nd Test Points												
9th Score												
1st Test Points												
Score												
2nd Test Points												

APPENDIX D

CIRCUIT TRAINING RECORD

TRAINING DOSAGE CARD

TOE TOUCH	
KNEE RAISES	
LATERAL BENDS	
ARM CIRCLES	
SIT-UPS	
CHEST AND LEG RAISE	
SIDE LEG RAISE	
ELBOW PUSH-UPS	
LEG-OVERS	
RUNNING	

CIRCUIT TRAINING RECORD

DATE	Name of Starting Exercise	Name of Finishing Exercise	Number of Repetitions of that Exercise	Number of Times Around the Circuit	Total Number of Stations Completed

APPENDIX E

QUESTIONNAIRE

QUESTIONNAIRE

Name_____
Last First

Period 1 2 Circle the correct class period.

Check the activities in which you have participated in the last four weeks. In the correct blank place the following: (1) the number of hours per day you have participated in the activity, (2) the number of days per week you have participated, and (3) the number of weeks you have participated in the activity.
DO NOT PLACE ANY NUMBERS IN THE BLANK UNDER THE WORD "TOTAL"

ACTIVITY	#hrs/day	#days/wk	#weeks	Total
Skiing				
Ice Skating				
Acrobatic Dance				
Tap Dance				
Ballet Dance				
Swimming				
"Y" Fitness Program				
Cheerleading				

Please list any other physical activities you may participate in and place the same information in the proper blank.

_____				
_____				
_____				
_____				

Do you walk to school? No _____ Yes_____

If so, how many miles _____ or blocks _____

Do you walk to catch the bus? No____ Yes _____

If so, how far?_____