THE EFFECT OF VARYING AMOUNTS OF CALISTHENICS ON PHYSICAL FITNESS IMPROVEMENT

BY

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CHAPTER I

THE PROBLEM, ITS LIMITATIONS, AND DEFINITIONS OF TERMS USED

Much concern has been expressed over the poor physical fitness condition of our youth. The President's Council on Physical Fitness emphasized the need for fifteen minutes of vigorous exercise per day. Many physical educators felt obligated to provide this fifteen minutes per day during their physical education classes, knowing that this would be the only exercise for many of the students. This infringement upon class time, which had previously been used to acquire other objectives, caused mixed emotions and stimulated the author to complete the following study.

I. THE PROBLEM

Statement of the problem. The purpose of this investigation was to discover which of the proposed conditioning programs would yield the most significant improvement of physical fitness: Group A, the control group, had no calisthenics; Group B had eight minutes of calisthenics; and Group C had fifteen minutes of calisthenics.

The hypothesis was that Group B would show improvement comparable to Group C and that both B and C would show a significant improvement over Group A.

Need for this study. Exponents of physical education have held that one of the major objectives of the discipline is to improve physical fitness; however, since there are other objectives, the time allotted to the achieving of physical fitness through the use of calisthenics is contended. This contention has definite historic overtones. Both the German and the Swedish systems of gymnastics were tried and rejected in America, as being alien to the American desire of individual freedom guaranteed in the Bill of Rights. Historically calisthenics have been used to develop fitness concurrently with mass discipline, an objective commonly associated with the military.

Most schools have forty-five or fifty minute class periods. Because of the activity involved in physical education classes, gym uniforms and showers are usually required, thus curtailing the actual amount of instructional time and necessitating careful planning if educational objectives are to be achieved. This study has attempted to determine if an eight-minute allotment would produce results comparable to that of a fifteen-minute period.

II. LIMITATIONS

The freshmen, sophomore, and junior high school girls and boys at Shenandoah Valley Academy, New Market, Virginia, were the subjects of this study.

A definite limitation was the fact that the students were assigned to one of the six physical education periods

per day according to the free period in their schedule. Thus there were freshmen, sophomores, and juniors in several of the physical education classes.

The attributes of speed, agility, muscular endurance, and power were arbitrarily selected as the essential components for the evaluation of physical fitness.

Dividing each class into three groups created a situation in which the students in the calisthenic program felt mistreated. This produced a psychological barrier to wholehearted participation.

Having two instructors made it necessary for careful planning to insure that the mechanics of the experiment were the same for all subjects.

III. DEFINITION OF TERMS USED

Physical fitness: The ability to perform effectively and efficiently everyday activities with whatever intensity may be required, to be able to meet emergencies as they arise, and to have a reserve of energy to enjoy leisure-time living.

Muscular endurance: The ability to continue successive muscular exertions such as chinning, dipping, sit-ups, leg lifts, and push-ups.

Muscular power: The ability to release maximum force in the shortest period of time such as is employed in the vertical jump and standing broad jump.

Speed: The ability to make rapid, repetitive move-

ments of the kind needed in the fifty-yard dash.

Agility: The ability to change body position or direction quickly as is required for the shuttle-run and squat thrusts.

Calisthenics: The ability to do physical exercises without apparatus.

High School: To include grades nine through twelve.

CHAPTER II

REVIEW OF LITERATURE

There is a vast amount of material published in regard to physical fitness and it is indicative of current emphasis, interest, and problems. Following is a review of literature as it relates to the problem being discussed in this paper.

I. ATTEMPTS TO DEFINE PHYSICAL FITNESS

The review of literature revealed many widely differing interpretations of the term "physical fitness." Its meaning was vague, connotations were numerous and diverse, and most attempts to describe it had certain admitted limitations. Actually, the term appeared to defy precise definition.

Jenss and Souther observed that "fitness is rather elusive of definition and difficult to determine."[1] In a survey reported by Bucher,[2] the students at various levels of education acquired different understandings and used different terminology to define physical fitness. Mohr

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1. Rachel M. Jenss and Susan P. Souther, "Methods of Assessing the Physical Fitness of Children," U.S. Department of Labor, Bureau Publication No. 263 (Washington: Government Printing Office, 1940), p. 121.

2. Charles A. Bucher, Foundations of Physical Education (St. Louis: The C. V. Mosby Company, 1968), pp. 456-458.

summarized her findings as follows:

> The many definitions of physical fitness may be simplified to the following statement: Physical fitness is the ability to make an adequate adjustment, physical as well as emotional, to the demands of everyday living.[3]

Brassfield concurs with Mohr in that he emphasizes "the ability . . . to adjust to one's environment."[4]

The Baruch Committee on Physical Medicine appointed a subcommittee on physical fitness to define physical fitness. This subcommittee, under the chairmanship of Professor R. C. Darling of the College of Physicians and Surgeons, Columbia University, explained it as follows:

> Physical fitness describes the functional capacity of the individual for a task. It has no real meaning unless the task or job for which fitness is to be judged is specified. . . . Since physical fitness is often governed by psychological factors which overshadow the physical competence of the body, it is important for the physician to evaluate the total individual with the help of the psychiatrist when necessary.[5]

The American Association for Health, Physical Education, and Recreation felt it necessary to redefine the term fitness prior to their National Fitness Conference in Washington, D.C., 1956. They declared it to be:

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3. Dorothy R. Mohr, "The Measurements of Certain Aspects of the Physical Fitness of College Women," The Research Quarterly, 15:340, October, 1944.

4. Charles R. Brassfield, "Some Physiological Aspects of Physical Fitness," The Research Quarterly, 14:106, March, 1943.

5. Robert C. Darling, et al., "Physical Fitness--Report of the Subcommittee of the Baruch Committee on Physical Medicine," Journal of the American Medical Association, 136:764, November, 1948.

> That state which characterizes the degree to which the person is able to function. Fitness is an individual matter. It implies the ability of each person to live most effectively within his potentialities. Ability to function depends upon the physical, mental, emotional, social, and spiritual components of fitness, all of which are related to each other and are mutually interdependent. . . . Fitness is a dynamic, constantly changing quality, the development of which should be continuous and satisfying from early infancy through maturity so that the inherent potentialities of each person can be realized. . . . For each individual at each developmental stage, there is a desirable level of total fitness to be sought according to that person's role in life.[6]

Gallagher and Brouha define physical fitness as: "The ability to perform hard work in an efficient manner."[7] Brown conceived physical fitness as "the general fitness of the various systems of the body."[8] Bucher's concept of fitness is:

> The term physical fitness implies soundness of such body organs as the heart and lungs, a human mechanism that performs efficiently under exercise or work conditions (such as having sufficient stamina and strength to engage in vigorous physical activity), and a reasonable measure of skill in the performance of selected physical activities.[9]

Dean describes it as being "that state or condition of being

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6. "Fitness for Youth," Journal of Health, Physical Education and Recreation, 27:8-9, December, 1956.

7. J. Roswell Gallagher and Lucien Brouha, "A Simple Method of Testing the Physical Fitness of Boys," The Research Quarterly, 14:23, July, 1943.

8. Howard Steven Brown, "A Comparative Study of Motor Fitness Tests," The Research Quarterly, 25:8, March, 1954.

9. Charles A. Bucher, Foundations of Physical Education (St. Louis: The C. V. Mosby Company, 1968), pp. 461-62.

which makes it possible for an individual to live a full and vigorous life."[10] Cureton's definition of physical fitness is:

> Physical fitness means a great deal more than the freedom from sickness or passing a medical inspection without a positive prescription for a disability. In addition to freedom from germinal or chronic disease, possessing good teeth . . . physical fitness means the ability to handle the body well and the capacity to work hard over a long period of time without diminished efficiency.[11]

Smith[12] advances the concept that physical fitness is, in a broad sense, good health. Karl and Carolyn Bookwalter present a timely and comprehensive discussion of fitness as it relates to secondary school youth. The concept of total fitness is said to consist of emotional, mental, and social fitness, as well as the physical characteristics. Their conception of physical fitness is as follows:

> Physical fitness means a well nourished organism free from sickness or disease; plus good teeth; good hearing; good eyesight; good muscular development and muscle tone; good posture; good proportions for age and sex (in accord with one's heredity); normal bones and joints for growth level; fit heart and circulatory system; fit digestive system; . . . and good fundamental motor abilities.[13]

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10. Cyril F. Dean, "A Historical Study of Physical Fitness in the United States 1790 Through 1961," (unpublished Doctoral dissertation, George Peabody College for Teachers, Nashville, 1964), p. 13.

11. Thomas K. Cureton, "What Is Physical Fitness?" Journal of Health, Physical Education and Recreation, 27:8-9, March, 1956.

12. J. W. Smith, "Schools and Physical Fitness," Michigan Educational Journal, 20:142-143, June, 1949.

13. Karl W. and Carolyn W. Bookwalter (eds.), Fitness for Secondary School Youth, American Association for Health, Physical Education and Recreation (Washington: Government Printing Office, 1956), p. 16.

Clarke's impression of physical fitness is: "The ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure time pursuits and to meet unforseen emergencies."[14]

It would seem that with all this effort and research an acceptable working definition could have been achieved; but, even today, fitness still remains an abstract term.

II. MEASURABLE COMPONENTS OF PHYSICAL FITNESS

Gallagher and Brouha[15] maintain that there are basically three approaches to fitness appraisal. First, there is static or medical fitness which relates to the soundness or function of the body organs. Second, there is a functional or dynamic fitness which is indicated by the mechanical fitness of the body in responding to varying degrees of stress. Finally, there is fitness demonstrated in the ability to perform motor skills. All three of these entail some degree of neuromuscular skill.

Kendall[16] lists the components of physical fitness as muscular power, endurance, strength, coordination, agility, speed, flexibility, and balance. She is supported by

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14. H. Harrison Clarke, Application of Measurement to Health and Physical Education (Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1967), p. 14.

15. J. Roswell Gallagher and Lucien Brouha, "Physical Fitness, Its Evaluation and Significance," Journal of the American Medical Association, 125:834-838, July, 1944.

16. Florence P. Kendall, "A Criticism of Current Tests and Exercises for Physical Fitness," Physical Therapy, 45:187, March, 1965.

Larson,[17] Hunsicker,[18] Nicks and Fleishman,[19] Campney and Wehr.[20] Bookwalter,[21] in his study, revealed that the qualities most frequently measured as factors of physical fitness are velocity, agility, endurance, strength, and motor ability.

Johnson, Updyke, Stolberg, and Schaefer[22] felt that coordination, agility, and balance belong to the concept of motor fitness rather than to physical fitness. They add circulo-respiratory capacity to muscular endurance, muscular strength, and flexibility as concepts of physical fitness. Larson[23] includes resistance to disease, nutritional status, body build, and motor skills as components of physical fitness.

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17. Leonard A. Larson, "Some Findings Resulting from the Army Air Forces Physical Training Program," The Research Quarterly, 17:144, March, 1946.

18. Paul Hunsicker, "What About Testing?" National Education Association Journal, 51:36, February, 1962.

19. Delmar C. Nicks and Edwin A. Fleishman, "What Do Physical Fitness Tests Measure? -- A Review of Factor Analytic Studies," Education and Psychological Measurement, 22:77-95, April, 1962.

20. Harry K. Campney and Richard W. Wehr, "Effects of Calisthenics on Selected Components of Physical Fitness," The Research Quarterly, 36:393, December, 1965.

21. Karl W. Bookwalter, "What Is a Physical Fitness Program for Boys?" The Research Quarterly, 15:240, May, 1944.

22. Perry B. Johnson, Wynn F. Updyke, Donald C. Stolberg, and Maryelen Schaefer, Physical Education - A Problem-Solving Approach to Health and Fitness (New York: Holt, Rinehart, and Winston, 1966), pp. 20-26.

23. Leonard A. Larson, "Defining Physical Fitness," Journal of Health, Physical Education and Recreation, 13:18, January, 1942.

According to McCloy,[24] physical fitness involves being free from sickness and disease, having enough strength to perform easily the daily tasks, maintaining both muscular and cardiovascular endurance, demonstrating motor efficiency skills, and being both flexible and agile. Steinhaus[25] contends that nothing less than total fitness is needed for the survival of our nation. Although the implication for the physical aspect is readily apparent, his concept of physical fitness is enlarged to include the mental, emotional, and social aspects of fitness.

Related Research. Wilbur[26] compared two programs of physical education, the apparatus method and the sports method, to determine physical fitness improvement. The apparatus method was a formalized program consisting of equal amounts of work on pieces of equipment: tumbling mats, parallel bars, horizontal ladder, ropes, horizontal bars, side horse, Swedish vaulting box, and the rings. The sports method included boxing, track and field, swimming, wrestling, and soccer. He found that the sports method was superior to the apparatus method for improving physical fitness.

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24. Charles H. McCloy, "Militant Physical Fitness and Physical Education," Journal of Health, Physical Education and Recreation, 14:314, October, 1943.

25. Arthur H. Steinhaus, "Fitness and How We May Obtain It," Journal of Health, Physical Education and Recreation, 14:427, December, 1943.

26. Ernest A. Wilbur, "A Comparative Study of Physical Fitness Indices as Measured by Two Programs of Physical Education: The Sports Method and the Apparatus Method," The Research Quarterly, 14:326, December, 1943.

MacKenzie[27] supported Wilbur, finding that fitness depended more on the instructors' methods in controlling the student activities than on the specific sport. Landiss[28] discovered that tumbling and gymnastics improved physical fitness as much as a conditioning program.

Fabricius[29] conducted an experiment which revealed that just three minutes and nine seconds of added calisthenics significantly improved the physical fitness of the experimental group above that of the control group. Hilsendager[30] contrasted a calisthenic and a non-calisthenic physical education program. He discovered that ten minutes of calisthenics significantly improved the standing broad jump, squat thrusts, and sit-ups more than touch football, volleyball, or basketball. It was interesting to note that there was no significant difference between calisthenics and handball.

Sills[31] compared freshman students doing special

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27. Donald H. MacKenzie, "Effects of Various Physical Activities on Physical Fitness of University Men," The Research Quarterly, 6:125, March, 1935.

28. Carl W. Landiss, "Influences of Physical Education Activities on Motor Ability and Physical Fitness of Yale Freshmen," The Research Quarterly, 26:295, October, 1955.

29. Helen Fabricius, "Effect of Added Calisthenics on the Physical Fitness of Fourth Grade Boys and Girls," The Research Quarterly, 35:135, March, 1964.

30. Donald Hilsendager, "Comparison of a Calisthenic and a Non-Calisthenic Physical Education Program," The Research Quarterly, 37:748, December, 1966.

31. Frank D. Sills, "Special Conditioning Exercises for Students with Low Scores on Physical Fitness Tests," The Research Quarterly, 25:333, October, 1954.

conditioning exercises with randomly selected freshmen students from the regular physical education classes. Both groups gained considerably in physical fitness, but the special conditioning group far exceeded the regular class members.

Hughes[32] found that training for four and one-half hours per week for sixteen weeks produced an acceptable physical condition; however, three hours of training per week for sixteen weeks produced only sixty-nine per cent as much gain as did four and one-half hours per week.

DeVries and Bartlett,[33] Kusinitz and Keeney,[34] Banister,[35] and Campbell[36] found that different types of weight training definitely contributed to the improvement of physical fitness.

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32. Byron O. Hughes, "Test Results of the University of Michigan Physical Conditioning Program June 15 to September 26, 1942," The Research Quarterly, 13:498, October, 1942.

33. Herbert A. DeVries and Kenneth T. Bartlett, "Effect of a Minimal Time Conditioning Program upon Selected Motor Fitness Measures of College Men," Journal of the Association for Physical and Mental Rehabilitation, 16:99, August, 1962.

34. Ivan Kusinitz and Clifford E. Keeney, "Effects of Progressive Weight Training on Health and Physical Fitness of Adolescent Boys," The Research Quarterly, 29:294-301, May, 1958.

35. E. W. Banister, "A Comparison of Fitness Training Methods in a School Program," The Research Quarterly, 36:294, December, 1965.

36. Robert L. Campbell, "Effects of Supplemental Weight Training on the Physical Fitness of Athletic Squads," The Research Quarterly, 33:343, October, 1963.

A study by Sloan[37] on the effect of training on physical fitness of women showed an increase in physical fitness.

Rosenstein and Frost[38] found that the amount of activity outside of class had no effect on the physical fitness of high school boys and girls. However, a report by Whittle[39] showed that twelve-year-old boys who participated in large amounts of physical activity outside of class were superior to those who participated very little outside of class. The findings of Drowatzky and Madary[40] coincided with those of Whittle. They found that boys in grades four through twelve who participated outside of regular physical education classes were significantly more fit than those who did not participate.

Taddonio[41] compared the physical fitness of two

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37. A. W. Sloan, "Effect of Training on Physical Fitness of Women," Journal of Applied Physiology, 16:226, January, 1961.

38. Irwin Rosenstein and Reuben B. Frost, "Physical Fitness of Senior High School Boys and Girls Participating in Selected Physical Education Programs in New York State," The Research Quarterly, 35:403, December, 1964.

39. H. Douglas Whittle, "Effects of Elementary School Physical Education upon Aspects of Physical, Motor, and Personality Development," The Research Quarterly, 32:249, October, 1961.

40. John N. Drowatzky and Charles J. Madary, "Evaluation of Physical and Motor Fitness of Boys and Girls in Coos Bay, Oregon, Schools." The Research Quarterly, 37:32, March, 1966.

41. Dominick A. Taddonio, "Effect of Daily Fifteen Minute Periods of Calisthenics upon the Physical Fitness of Fifth Grade Boys and Girls," The Research Quarterly, 35:135, March, 1964.

fifth-grade classes, one with a non-physical education curriculum and the other allowing fifteen minutes daily for calisthenics. There was no significant difference between the two groups. The author felt that certain test items restricted the range of scores by having maximum limits and this could have affected the results. Hansell[42] and Kistler[43] found that fifteen to twenty minutes of calisthenics and exercises improved physical fitness, and Kistler did not consider this amount of time excessive.

Zimmerman[44] compared two types of teaching situations, one group having a special physical education teacher and the other group having a regular classroom teacher. The results of the Physical Fitness Test of the American Association for Health, Physical Education and Recreation also showed that the group having the special physical education teacher performed significantly better than those having the regular classroom teacher.

Knuttgen and Steendahl[45] found that vacations, short or long, resulted in a decrease in physical fitness.

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42. George A. Hansell, "Physical Fitness Can Be Improved," Scholastic Coach, 31:58, February, 1962.

43. J. W. Kistler, "A Study of the Results of Eight Weeks of Participation in a University Physical Fitness Program for Men," The Research Quarterly, 15:23, March, 1944.

44. Helen Zimmerman, "Physical Performance of Children Taught by Special Teachers and by Classroom Teachers," The Research Quarterly, 30:356, October, 1959.

45. Howard G. Knuttgen and Kai Steendahl, "Fitness of Danish School Children During the Course of One Academic Year," The Research Quarterly, 37:276, March, 1966.

Durnin, Brockway, and Whitcher[46] used a walking training program and suggested that walking twenty kilometers a day would improve fitness in a relatively short time. Cooper[47] agreed with them but went a step further. He developed a chart telling an individual not only how far to walk, but how long it should take, and how often he should participate to maintain a minimum level of fitness. He also made charts for various methods of maintaining fitness that included running, swimming, basketball, squash, handball, cycling, and running in place.

Baker[48] made a comparison of jogging and rope skipping as a means of increasing cardiovascular efficiency. He concluded that ten minutes of rope skipping per day was as good as thirty minutes of jogging per day for the purpose of improving one's cardiovascular efficiency.

In general the literature indicated that calisthenics, the conventional physical education curriculum, and weight training programs all improved physical fitness. To further determine the effects of varying amounts of calisthenics upon the improvement of physical fitness constituted the core of the current study.

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46. J. V. G. A. Durnin, J. M. Brockway, and H. W. Whitcher, "Effects of a Short Period of Training of Varying Severity on Some Measurements of Physical Fitness," Journal of Applied Physiology, 15:161-165, February, 1960.

47. Kenneth H. Cooper, "How to Feel Fit at Any Age," The Reader's Digest, March, 1968, pp. 79-87.

48. John A. Baker, "Comparison of Rope Skipping and Jogging as Methods of Improving Cardiovascular Efficiency of College Men," The Research Quarterly, 39:240, May, 1968.

CHAPTER III

SOURCES OF DATA AND PROCEDURE

Sources of data. The subjects were the boys and girls enrolled in physical education classes at Shenandoah Valley Academy, New Market, Virginia, a private denominational school with the majority of the students coming from the states of Virginia and Maryland.

Originally the classes contained a total of 190 students; however, because of withdrawals and absences, some of the subjects had to be removed from the study. This resulted in a total of 160 subjects: 20 freshman boys, 22 freshman girls, 25 sophomore boys, 27 sophomore girls, 35 junior boys, and 34 junior girls.

Method of procedure. Each class was divided at random into three groups, Group A being the control group, and Groups B and C being the experimental groups. All the subjects participated in a regular physical education class program in addition to their treatment. The control group participated in the day's activity while the experimental groups were completing their required amount of calisthenics.

Groups A, B, and C of the boys and Groups B and C of the girls were enrolled in the author's classes. Group A of the girls were enrolled in the classes taught by the lady instructor.

Each group was pre-tested and post-tested, using the Virginia State Physical Fitness Test to measure the components of physical fitness as previously defined.

The subjects were given three class periods of orientation and then pre-tested. Afterward the physical education classes met for two forty-three minute class periods per week.

The calisthenics used were the ten listed in the publications Vim and Vigor prepared by the President's Council on Physical Fitness. Jumping jacks, running laps, and a special flexibility exercise were added to those mentioned above. The special flexibility exercise involved sitting on the floor with legs extended in front and to the side, trying to touch the head to the floor between the legs.

After completing ten weeks of the experiment, the subjects were post-tested and the results recorded.

Method of data analysis. The method of data analysis was a one-way analysis of variance with unequal N.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

Comparisons between Groups A, B, and C were made by testing the significance of the variance within and between the post-test mean scores. The F test was used to determine significance at the .10 level.

A series of seven one-way analysis of variance with unequal N were run and the results tabulated. The first analysis of variance was run between sexes. The results showed a highly significant F value at the .01 level in all four of the post-test mean scores. The results were as expected and simply show that there is a significant difference between the sexes in the areas tested.

The second analysis of variance was run between classes. The freshman, sophomore, and junior classes were treated as entities (boys and girls grouped together in their respective classes) with no significant differences being found on the post-test mean scores. The results were clouded by the fact that both sexes were included in the analysis. According to Seymour,[49] fifteen-, sixteen-, and seventeen-year old boys should be included in a single category when using the physical fitness index to determine physical

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49. Emery W. Seymour, "Follow-up Study on Simplification of the Strength and Physical Fitness Indexes," The Research Quarterly, 31:208, May, 1960.

fitness. From the results of his study, we should not expect a significant difference between the sophomores and juniors; however, it is possible that we could expect a significant difference between the freshman scores and those of the sophomores and juniors.

The third analysis of variance was run between the treatment groups. Groups A, B, and C were analyzed and the results showed no significant difference. These results also were clouded by the fact that both sexes were represented in all three groups.

The fourth analysis of variance was run between sex and class. The boys and girls were divided by sex into their respective classes. Thus, any significant value of F was due to the variance between the freshmen, sophomore, and junior class girls. However, they showed a significant difference between the freshman, sophomore, and junior class boys in the shuttle-run, the sixty-yard dash, and the standing broad jump. (See Tables I, II, and III.) There was no significant difference between the boys classes in sit-ups.

TABLE I

ANALYSIS OF VARIANCE OF THE FRESHMAN, SOPHOMORE, AND JUNIOR CLASS BOYS POST-TEST SHUTTLE-RUN MEAN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatment	2	2.36	1.18	3.47[a]
Error	74	25.5	.34	
Total	76			

[a]Significant at the .05 level.

TABLE II

ANALYSIS OF VARIANCE OF THE FRESHMAN, SOPHOMORE, AND JUNIOR CLASS BOYS OF THE POST-TEST SIXTY-YARD DASH MEAN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatment	2	4.08	2.04	5.37[a]
Error	74	28.0	.38	
Total	76			

[a]Significant at the .01 level.

TABLE III

ANALYSIS OF VARIANCE OF THE FRESHMAN, SOPHOMORE, AND JUNIOR CLASS BOYS OF THE POST-TEST STANDING BROAD JUMP MEAN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatment	2	4.82	2.41	4.30[a]
Error	74	41.6	.56	
Total	76			

[a]Significant at the .05 level.

The fifth analysis of variance was run between sex and treatment. The sexes were divided into their respective groups, A, B, and C; thus, any significant value of F was attributed to the specific treatment. Tables IV through XI show the results of the analysis of variance of the post-test mean scores.

TABLE IV

ANALYSIS OF VARIANCE OF THE GIRLS POST-TEST SHUTTLE-RUN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatments (between)	2	1.396	.698	.59
Error (within)	80	93.991	1.175	
Total	82			

TABLE V

ANALYSIS OF VARIANCE OF THE
GIRLS POST-TEST SIXTY-YARD DASH SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatments (Between)	2	.659	.3295	.33
Error (within)	80	80.061	1.001	
Total	82			

TABLE VI

ANALYSIS OF VARIANCE OF THE
GIRLS POST-TEST SIT-UP SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatments (between)	2	2,347.69	1,173.85	2.48[a]
Error (within)	80	37,806.357	472.58	
Total	82			

[a]Significant at the .10 level.

TABLE VII

ANALYSIS OF VARIANCE OF THE
GIRLS POST-TEST STANDING BROAD JUMP SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatments (between)	2	2.356	1.178	2.10
Error (within)	80	44.775	.560	
Total	82			

TABLE VIII

ANALYSIS OF VARIANCE OF THE
BOYS POST-TEST SHUTTLE-RUN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatments (between)	2	1.386	.693	1.89
Error (within)	74	27.000	.365	
Total	76			

TABLE IX

ANALYSIS OF VARIANCE OF THE
BOYS POST-TEST SIXTY-YARD DASH SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatments (between)	2	1.539	.7695	1.80
Error (within)	74	31.607	.427	
Total	76			

TABLE X

ANALYSIS OF VARIANCE OF THE
BOYS POST-TEST SIT-UP SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatments (between)	2	228.718	114.359	.07
Error (within)	74	114,780.178	1,551.081	
Total	76			

TABLE XI

ANALYSIS OF VARIANCE OF THE
BOYS POST-TEST STANDING BROAD JUMP SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatments (between)	2	.373	.1865	.30
Error (within)	74	46.343	.626	
Total	76			

Table VI shows the significance of the treatment effect on the sit-ups among the girls. This was the only test in this analysis that revealed significance. It was interesting to note that Tables VII, VIII, and IX approached significance. Some of the possibilities as to why they were not significant are discussed later.

The sixth analysis of variance was run between classes and treatment. No significant difference was found between the freshmen, sophomore, and juniors in Groups A, B, and C. Once again the results are clouded by the fact that both sexes were grouped together in all three groups.

The seventh analysis of variance was run between sex, class, and treatment. This test divided all the subjects into Groups A, B, and C, according to their sex and class. Thus, all the freshman girls were divided into Groups A, B, and C, all the freshman boys divided into Groups A, B, and C, etc. This enabled us to credit, for any significant value of F, the treatment effect between the groups

according to their sex and class.

Between the post-test shuttle-run mean scores there were no significant differences of the treatment effects on the freshman, sophomore, and junior girls, or the sophomore and junior boys. Table XII shows the treatment effect on the freshman boys which is significant at the .05 level.

TABLE XII

ANALYSIS OF VARIANCE OF THE FRESHMAN BOYS POST-TEST SHUTTLE-RUN MEAN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatment	2	2.517	1.2585	4.99
Error	17	4.276	.252	
Total	19			

In the sixty-yard dash, the freshman boys were the only ones to show a significant treatment effect, as is shown in Table XIII. The F value is significant at the .10 level.

TABLE XIII

ANALYSIS OF VARIANCE OF
FRESHMAN BOYS POST-TEST SIXTY-YARD DASH MEAN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatment	2	2.784	1.392	3.50
Error	17	6.761	.398	
Total	19			

Tables XIV and XV show a significant treatment effect on the junior girls in sit-ups and standing broad jump respectively. The other groups showed no significant treatment effects in the sit-up and standing broad jump tests.

TABLE XIV

ANALYSIS OF VARIANCE OF
JUNIOR GIRLS POST-TEST SIT-UP MEAN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatment	2	1,245.9	622.95	3.79[a]
Error	31	5,089.5	164.177	
Total	33			

[a]Significant at the .05 level.

TABLE XV

ANALYSIS OF VARIANCE OF JUNIOR GIRLS POST-TEST STANDING BROAD JUMP MEAN SCORES

Source of Variation	DF	Sum of Squares	Mean Square	F
Treatment	2	3.368	1.684	2.56[a]
Error	31	20.375	.657	
Total	33			

[a]Significant at the .10 level.

Discussion. The results did not show that eight and fifteen minutes of calisthenics improved physical fitness significantly more than a non-calisthenic program. However, it was interesting to note the differences between means of the pre-test and post-test scores, when an analysis of variance was run between the three treatment groups, A, B, and C.

Table XVI shows that Groups A, B, and C declined in the shuttle-run, but improved in running the sixty-yard dash, with Groups A and C showing a larger improvement than Group B. The sit-up test revealed that Group B improved a greater amount than Groups A or C. The standing broad jump test showed that Group C were the only ones to exhibit a noticeable increase.

TABLE XVI

DIFFERENCES OF MEANS

	Pre-test Means			Post-test Means			Differences of Means		
	A	B	C	A	B	C	A	B	C
Shuttle	10.85	10.93	10.65	10.86	11.12	10.79	-.01	-.19	-.10
Dash	9.53	9.69	9.61	9.28	9.61	9.25	+.25	+.08	+.36
Sit-ups	44.52	41.74	41.86	56.09	59.70	53.84	11.57	17.96	11.98
Standing Broad Jump	5.43	5.35	5.40	5.41	5.32	5.57	+.02	+.03	+.17

The fact that there were not more statistically significant data could have been due to administering the post-test shortly after Thanksgiving vacation. In all probability the subjects did not have enough time to regain the fitness that was lost during the holidays.

Another factor that could have influenced the data was the time of day. The subjects were enrolled in classes that met early morning, mid-morning, just before the noon meal, immediately after the noon meal, mid-afternoon, and late afternoon. Psychologically and physiologically one does not feel like doing sit-ups or running the sixty-yard dash on a full stomach.

Further studies are needed which consider factors such as: amounts of time spent in physical activity outside of physical education classes, the time of day, and the number of times a class can meet per week.

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

The four tests that produced significant results were the ones between sex, sex and class, sex and treatment, and sex, class, and treatment. The one between the sexes was obvious and expected. The results of the analysis of variance between sex and class revealed a significant difference between the freshman, sophomore, and junior class boys in the shuttle-run, sixty-yard dash, and the standing broad jump.

The analysis of variance between sex and treatment showed a significant difference between treatment effects on sit-ups among the girls. This was due to the treatment and it was pointed out that Groups A, B, and C all improved in sit-ups, but that Group B improved a greater amount than Groups A and C.

The analysis of variance between sex, class, and treatment showed significant treatment effects among junior girls in the standing broad jump and sit-ups, and among freshman boys in the sixty-yard dash and the shuttle-run. It was interesting to note the action and effect of the individual groups. Group C improved the standing broad jump in the junior girls while Groups A and B declined. In the sit-up

test, all three groups improved, but Group B improved more than Groups A and C. Among the freshman boys running the sixty-yard dash, all three groups improved, but Groups B and C improved a greater amount than Group A. In the shuttle-run, Group C improved, while Groups A and B declined.

II. CONCLUSIONS

From the results of this study, the following conclusions were reached:

1. That fifteen minutes of calisthenics improved the standing broad jump among the junior girls.
2. That eight and fifteen minutes of calisthenics improved sit-ups among the junior girls.
3. That eight and fifteen minutes of calisthenics improved sit-ups among all the girls.
4. That eight and fifteen minutes of calisthenics improved the freshman boys running time in the sixty-yard dash and the shuttle-run.

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