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Knowledge retained, cardiovascular fitness and skinfold measurements of college age females before and after a physical fitness course

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Knowledge Retained, Cardiovascular Fitness and Skinfold Measurements of College Age Females Before and After a Physical Fitness Course

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Abstract

Knowledge Retained, Cardiovascular Fitness, and Skinfold Measurements of College Age Females Before and After a Physical Fitness Course

by Laurie A. Jossey

Ninety-four female college students were involved in physical education classes during the fall and winter quarters. Forty-seven subjects served as the control group enrolled in a physical education course other than physical fitness, and 47 subjects served as the experimental group enrolled in a physical fitness course. Fitness knowledge, skinfold measurements, and cardiovascular fitness of each subject were measured at the beginning and end of the course. The data were subjected to an analysis of variance to determine if there were significant differences in mean gains between the experimental and control groups, the winter and fall academic quarters, and the morning and afternoon classes. Results revealed significance for knowledge gained for the fitness group, the afternoon group, and the winter quarter group. Results also revealed no difference in skinfold measurements between any of the groups except the fall quarter group. There was also no difference between any of the groups in cardiovascular fitness. The .05 level was utilized to determine significance.

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This investigation is dedicated to the author's parents, Jane and Paul, for their love and support.

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Chapter 1

Introduction

The President's Council on Physical Fitness and Sports (Newsletter, 1980) has encouraged the principle that Americans should become more physically active. Other leading organizations including the American Alliance for Health, Physical Education, Recreation, and Dance (AAHPERD) and the American Heart Association (AHA) support the principle that regular exercise should be an important habit associated with a healthy life style (AAHPERD, 1980; AHA, 1980). Data are available supporting the premise that regular exercise in combination with proper diet will result in a longer life as well as a higher level of health and the ability to function (Pollock & Blair, 1981).

In reviewing current literature, there have been few studies to date regarding physical fitness knowledge, cardiovascular fitness, and skinfold measurements before and after a college-level course in physical fitness. This lack of information prompted this investigation to compare selected health-related fitness components and knowledge prior to and after participation in a physical fitness course in college. This study will contribute knowledge to the field of study of physical fitness in college-age female students.

Statement of the Problem

The study investigated the effects of a physical fitness course on the knowledge retained, cardiovascular fitness, and skinfold measurements of college age females.

Hypotheses

The researcher formulates that there will be no difference in knowledge retained, cardiovascular fitness, and skinfold measurements between the group of students enrolled in a physical fitness course and those students not enrolled in a physical fitness course. The researcher also formulates the hypothesis that there will be no difference in knowledge retained, skinfold measurements, and cardiovascular fitness of those students enrolled in different academic quarters or at different times of the day.

Definitions of Terms

Cardiovascular fitness--the ability of the heart, blood vessels, blood, and respiratory system to supply fuel, especially oxygen, to the muscles during sustained exercise (Corbin & Lindsey, 1985).

Heart rate--the number of heart beats per minute (Dintiman, Stone, Pennington, & Davis, 1984).

Physical Education 100A--a course designed to introduce new students to selected concepts and principles relative to the field of physical fitness.

Physical fitness--the entire human organism's ability to function efficiently and effectively. It is composed of

at least 11 different components. Physical fitness also includes the individual's ability to enjoy leisure time, to be healthy, to resist hypokinetic disease, and to meet emergency demands (Corbin & Lindsey, 1985).

Skinfold--two thicknesses of skin and the amount of fat that lies just under the skin. At certain locations of the body, the thickness of the skinfolds can be measured to obtain a good estimate of the fatness of the total body (Corbin & Lindsey, 1985).

Recovery time--that time following a period of exercise after which the heart rate returns to normal (Hockey, 1981).

Lange skinfold caliper--an instrument designed to exert a pressure on the caliper face of 10 grams per square millimeter that measures the skinfold (Lohman & Pollock, 1981).

Step test--a cardiovascular fitness test. Stepping on and off a bench or step for a period of 3 min at a cadence of 24 steps per min. After stepping for 3 min, the subjects sit on the bench and locate their pulse. The pulse is counted for 15 sec and multiplied by four which results in the heart rate per min (Hoeger, 1986).

Basic Assumptions

1. The subjects will perform their best and try to score well on the knowledge test and the step test.

2. The knowledge test will accurately measure the physical fitness knowledge of female college students.

3. The step test is an accurate measure of evaluating cardiovascular fitness of female college students.

4. The skinfold caliper accurately measures the skinfolds of female college students.

Limitations

1. The physical fitness class and the control group will not be tested at the same time of day.

2. The physical fitness class and the control group will not all meet on the same days of the week.

3. Results of this study will be generalized to this particular group of subjects (college age females).

Delimitations

The study consisted of 94 female college students enrolled in physical education classes at Tift College during the fall and winter quarters. The variables of the study will be knowledge retained, cardiovascular fitness, and skinfold measurements.

Significance of the Study

Research suggests that college and university physical fitness courses have not been adequately evaluated as to their effectiveness (Laurie, 1981). It is important to carefully analyze and evaluate students' progress in these courses to focus on the health-related benefits that

students can derive from physical fitness courses (Laurie, 1981).

There is a need for good physical fitness and its accompanying mental and physical health in our modern society (Corbin & Lindsey, 1985). Recent statistics indicate that adult women are less active than adult men, although the benefits of exercise are similar to those for men (Corbin & Lindsey, 1985).

With the current data and supporting positive results of physical fitness, it is important that the outcomes of physical fitness courses be analyzed (Pollock & Blair, 1981). By comparing physical fitness knowledge, cardiovascular fitness levels, and skinfold measurements both before and after a course in the foundations of physical fitness, knowledge can then be applied to evaluate the course content. This study will contribute knowledge to the field of study in physical fitness in college females.

Review of Literature

Pollock and Blair (1981) report that the AAHPERD, the AHA, and the President's Council on Physical Fitness have encouraged and supported the ideas and principles that our nation should become more physically active. They further state that convincing evidence exists suggesting that regular exercise in combination with abstention from smoking, nutritional precautions, moderation in the use of alcohol, relaxation and stress management, and safety

consciousness can result in less morbidity and mortality as well as a higher level of general health and functional ability (Pollock & Blair, 1981).

The same authors further suggest that those components necessary for developing and maintaining optimal fitness include cardiovascular fitness and body composition along with others. Recent surveys suggest that Americans are changing their life styles. There seems to be an increase in physical activity as well as a reduction in smoking and blood fats. It has been suggested that these changes will contribute to a lower risk for coronary heart disease (Pollock & Blair, 1981).

LaPoint (1981) states that more colleges and universities are now offering courses in physical fitness. He suggests that one rationale for these increased offerings is that students are able to maintain physical fitness. College students have also become increasingly aware of a need to participate in some type of physical activity. Students are also better able to cope with daily stressful situations through education in physical fitness courses (LaPoint, 1981).

Research suggests that colleges and universities have been teaching fitness courses in physical education for a number of years (Laurie, 1981). Laurie (1981) further states that there have been few studies conducted to evaluate the effectiveness of these programs. Laurie (1981)

conducted such a study to determine the attitudes, knowledge, and self-reported behavior of students who were enrolled in a physical fitness course.

In this particular study, the first objective was to determine if the students' confidence in their ability to plan and execute their exercise programs was changed after the course in physical fitness. Reports show that the students did gain in their confidence to evaluate their personal fitness and plan their programs (Laurie, 1981). A second research objective of this same study was to determine if the knowledge changed after the course in physical fitness. The results of this test showed that the students had learned the information necessary to make decisions at the completion of the course in physical fitness. The study also indicated that students had a misplaced confidence in their ability to plan their own fitness programs (Laurie, 1981). This study was done as the first part of a longitudinal study.

Plowman (1981) reports that the AAHPERD first developed physical fitness tests based on developed norms. This test introduced a new and different philosophical rationale in emphasizing that a person does not have to be an athlete to be physically fit. This test was recognized as a continuum with no single definition of physical fitness being mandated for all individuals. There were also different stages for the same individual for different stages of a person's life.

The minimum fitness levels were established as those which were compatible with optimal health (Plowman, 1981).

A part of the above mentioned AAHPERD test battery included the incorporation of skinfold measurements in an effort to assess the degree of fatness in school children. Lohman and Pollock (1981) refer to several critical factors in the selection of skinfold calipers and also stress the importance of experienced professionals in the use of these calipers.

While most skinfold calipers are now available at low prices, only a limited number of these inexpensive calipers have been tested. Lohman and Pollock (1981) suggest that it has not been well documented that a professional person testing with these inexpensive calipers can obtain satisfactory results. The Harpenden and Lange skinfold calipers will have an advantage in that they are able to exert a constant force on the skinfold site, no matter what the thickness of the student's skinfold might be. These types of calipers are generally more expensive, but this constant pressure will provide a more accurate measurement. The Lange skinfold calipers are recommended for use in health-related fitness tests for interpretation of skinfolds. These were the type of calipers used by the AAHPERD in developing norms for their tests (Lohman & Pollock, 1981).

Skinfold calipers that do not yield a constant pressure that is independent of skinfold thickness are not recommended for use in body measurements according to Lohman and Pollock (1981). Well designed and durable calipers such as the Lange appear to offer a better approach to a meaningful interpretation of skinfold measurements in comparison with the national norms (Lohman & Pollock, 1981).

Cardiovascular fitness is defined as the ability of the heart, blood vessels, blood, and respiratory system to supply fuel, especially oxygen, to the muscles during sustained exercise (Corbin & Lindsey, 1985). Bucher and Prentice (1985) suggest that of all the components of physical fitness, none is more important to the college age student than is the cardiovascular fitness.

Heart rate is the number of times that the heart beats per minute (Dintiman et al., 1984). The heart rate is caused by the impact of the blood against the arteries as the heart muscle contracts (Hockey, 1981). The recovery time can be defined as that time following a period of exercise after which a person's heart rate returns to normal. As a person's conditioning level improves, heart rate and breathing rate return to their normal resting levels much sooner (Hockey, 1981).

In further defining cardiovascular endurance, Hoeger (1986) suggests that during prolonged physical activity, an individual with a higher level of cardiovascular fitness is

able to deliver the oxygen to the parts of the body with relative ease. Those persons with a relatively low level of cardiovascular fitness must work harder to accomplish the same task. The heart is used as a pump to supply oxygen to the tissues. A higher capacity to deliver this oxygen will indicate a more efficient cardiovascular system (Hoeger, 1986).

In situations where a person with an unconditioned heart and cardiovascular system performs heavy work or is under undue stress, the heart may not be able to sustain itself in delivering the oxygen (Hoeger, 1986). By regular participation in cardiovascular endurance activities, a person can achieve and maintain optimal cardiovascular fitness (Hoeger, 1986).

Corbin and Lindsey (1985) suggest that cardiovascular fitness can best be determined by measuring the maximal amount of oxygen that the human body is able to use per minute of physical activity. The value that is commonly used to express this measure is liters per minute and milliliters per kilogram per minute (Hoeger, 1986). The most precise method of determining this maximal oxygen uptake is through direct analysis of gas. This can be accomplished by using a metabolic cart that establishes the amount of oxygen consumption during exercise. This sophisticated technique requires costly equipment and experienced personnel for its administration. As a result,

several alternate techniques have been developed that will accurately estimate the maximal oxygen uptake and require little equipment or expense (Corbin & Lindsey, 1985).

One of these methods is the step test. The step test requires little time and equipment and uses submaximal workloads to assess a student's cardiovascular fitness level (Hoeger, 1986). This method of testing is recommended for areas with limited resources or funding (Hoeger, 1986).

Chapter 2

Methods

To determine the effects of a physical fitness class on knowledge retained, cardiovascular fitness, and skinfold measurements, this study utilized pretest and posttest design. An analysis of variance was computed to determine the difference between the subjects in the physical fitness class and the control group. An analysis of variance was also computed to determine the difference between students enrolled during different academic quarters and in terms of the time of the day in which the classes met.

Subjects

The subjects used in this study were 94 female freshman and sophomore students enrolled in physical education courses at Tift College. All students at Tift College are required to complete a minimum of five courses in physical education for degree requirements. There is no professional preparation program for physical education majors at Tift College.

Forty-seven of the subjects were students enrolled in Physical Education 100A, the Foundations of Physical Fitness. Forty-seven of the subjects were students enrolled in physical education classes other than Physical Education 100A and had not previously completed the course. All

subjects were enrolled during the fall and winter academic quarters.

The rights of the students were protected by the signing of permission provided by the investigator. Permission to conduct the study was obtained from the Dean of the College. The student permission letter is found in Appendix A. The institution permission letter is found in Appendix B.

Procedures

The procedures section is divided into three areas: the knowledge test, the cardiovascular test, and the skinfold measurements. All subjects were tested during the first class session and the last class session in which they were enrolled. All classes in physical education met 2 days per week for an academic quarter consisting of 12 weeks. Each class session was 55 min in length. The subjects were enrolled during the fall and winter quarters of 1986-1987. The investigator administered all tests used in this study.

Knowledge. A written test was used to measure the students' knowledge in the area of physical fitness. The test was devised for pretest and posttest administration. There were 100 multiple choice items on the test. These questions were randomly selected from the Instructor's Manual provided for the textbook Concepts of Physical Fitness with Laboratories by Charles Corbin and Ruth Lindsey (1985). The subjects identified their exams by using their

campus identification number. These numbers were then given a number of 1 through 94 to identify the subjects on the knowledge exam. A copy of this test can be found in Appendix C.

The knowledge tests were administered during the first and last class session in all of the classes that were tested. The number of correct answers was recorded for each subject. The investigator administered all of the written knowledge tests.

Cardiovascular fitness. Cardiovascular fitness was measured by using the step test. The recovery rates of the subjects were used to estimate the maximal oxygen uptake through the use of predicting equations (Hoeger, 1986).

The step test was conducted using a gymnasium bleacher 16¼ in. in height. The procedures of the test were explained to the subjects prior to the test. The proper method for stepping was demonstrated. The subjects were shown the proper procedure for counting their pulse to determine their heart rate using the pulse located at the carotid artery. The proper method of stepping showed that the subjects should step onto the bleacher with the right foot, up with the left foot, step down with the right foot, and then down with the left foot. A metronome was used to ensure that the cadence remained the same. The investigator maintained the cadence by setting the metronome to 88 beats per min. This ensured that there were 22 step ups per min (Hoeger, 1986).

The step test was performed for a period of 3 min. The test began with the command "go" given by the investigator. Using a stopwatch to time the test for 3 min, the investigator stopped the test with the command "stop." Subjects then were instructed to take their pulse for a period of 15 sec from 5 to 20 sec into recovery. The heart rate was converted to beats per min by multiplying the subjects' 15-sec heart rate by four (Hoeger, 1986).

The maximal oxygen uptake was determined in milliliters per kilogram per minute by using the following equation: maximal oxygen uptake = 65.81 - (0 1847 x recovery heart rate in beats per minute) (McArdle, 1981).

The step test is based on the premise that during submaximal work task, a person with a higher cardiovascular fitness level will have a smaller increase in heart rate. It is also based on the premise that the heart rate will return to normal much faster in persons with a higher cardiovascular fitness level than in those persons with a lower level of cardiovascular endurance (Hoeger, 1986). The investigator supervised each of the step tests for all 94 students.

Skinfold measurements. The Lange skinfold caliper was used to assess the subjects' skinfold measurements. This technique involved the measurement of the subcutaneous layer of fat at the surface of the body. Using the caliper, the subjects' skinfold measurements were recorded at the

triceps, the iliac crest, and the thigh (Hoeger, 1986). All measurements were taken on the right side of the body with the subject standing as suggested by Hoeger (1986).

The anatomical landmarks that were used for measurements were the triceps, the iliac crest, and the thigh. The triceps were measured at the vertical fold on the back of the upper arm, halfway between the shoulder and the elbow. The iliac crest was measured in a diagonal fold above the crest of the ilium on the side of the hip. The thigh measurement was taken at the vertical fold on the front of the thigh midway between the knee and the hip (Hoeger, 1986).

Each site was measured by grasping a double thickness of skin firmly with the thumb and the forefinger, pulling the skinfold away from the muscular tissue. The calipers were held perpendicular to the fold. The measurements were taken about ½ of an inch below the finger hold. Each site was measured a total of three times by the investigator to ensure accuracy. The final value recorded was the average of the two closest readings. The values were calculated to the nearest .1 to .5 mm (Hoeger, 1986).

After measuring each of the three skinfold sites, the sum of the three were calculated and recorded for each subject. The investigator performed all of the skinfold measurements for each subject.

Statistical Analysis

The data from the knowledge test, the cardiovascular test, and the sum of the three skinfolds were analyzed using the analysis of variance to determine if a difference existed between the two groups, between pretest and posttest results, between fall and winter academic quarters, and between morning and afternoon classes. If a significant F ratio is obtained, the Sheffé test was computed to identify the group differences. The .05 level of significance will be used.

Chapter 3

Results

In determining the effects of a physical fitness class on knowledge retained, skinfold measurements, and cardiovascular fitness, this investigation utilized the pretest and posttest control group design. Ninety-four female freshman and sophomore students were utilized as subjects. All subjects were enrolled in physical education courses at Tift College during the fall and winter quarters of 1986-87. Forty-seven subjects who were enrolled in Physical Education 100A (P.E. 100A; Foundations of Physical Fitness) served as the experimental group, and 47 subjects who were enrolled in other physical education courses and had not previously enrolled in the P.E. 100A course served as the control group. The physical fitness classes met both in the morning and in the afternoon.

An analysis of variance (MANOVA) was computed for pretest and posttest scores on the knowledge, the skinfold measurements, and the cardiovascular fitness to determine if there was a difference between the aforementioned variables for those subjects enrolled in the fitness course and the control group. The investigator hypothesized that there would be no difference in the knowledge, the skinfold measurements, and the cardiovascular fitness between the

subjects enrolled in the fitness course and the control group. It was also hypothesized that there would be no difference in knowledge, skinfold measurements, and cardiovascular fitness of those subjects enrolled in different academic quarters or at different times of the day.

At the beginning of this investigation, each group was administered the knowledge test, the cardiovascular test, and skinfold measures were taken. These same tests were administered again at the conclusion of the academic quarter for which the subjects were being tested. The investigator collected and analyzed the data through the use of the Honeywell CP-6, SPSS-X system computer at Middle Tennessee State University.

Knowledge

A multiple choice, written test was utilized to measure the subjects' knowledge in the area of physical fitness. This test consisted of 100 items and the number of correct responses was recorded for each subject. This test was administered during the first class session and the final class session for each of the classes. The pretest to posttest mean scores for the knowledge test in the fitness and the control group are presented in Table 1. The pretest mean score in the fitness group was 39.02 with a standard deviation of 12.99. The mean score for the fitness group posttest was 69.23 with a standard deviation of 11.77. The pretest mean score for the control group was 33.38 with a

Table 1

Means and Standard Deviations for Fitness Knowledge Scores

		Pretest		Posttest	
Group	N	$\bar{X}$	SD	$\bar{X}$	SD
Fitness	47	39.02	12.99	69.23	11.77
Control	47	33.38	10.75	32.55	9.87

standard deviation of 10.75. The mean score for the posttest for the control group was 32.55 with a standard deviation of 9.87.

The significance of the F ratio is represented in Table 2. The F ratio for knowledge between the fitness group and the control group was 107.25. This F ratio was significant at the .005 level, indicating that those subjects enrolled in the fitness classes (P.E. 100A) increased their knowledge in the area of fitness over those students not enrolled in P.E. 100A.

Descriptive data and the F ratio for the morning and the afternoon groups for the knowledge pretests and posttests are found in Tables 3 and 4. The morning group's pretest and postest means and standard deviations were 35.22 (12.32) and 46.72 (20.73), respectively, whereas the pretest posttest means and standard deviations for the afternoon group were 41.00 (10.56) and 71.25 (9.11), respectively. The F ratio for the difference between the knowledge tests in the morning and afternoon groups was 14.46, significant at the .005 level, indicating that subjects enrolled in the afternoon classes scored significantly higher on the posttest knowledge test than did those subjects enrolled in the morning classes.

Descriptive data and the F ratio for the fall and winter academic quarter groups for the pretest and posttest knowledge test are found in Tables 5 and 6. The fall

Table 2

Analysis of Variance for Knowledge Scores

Source	df	MS	F	p
Group	1	21043.19681	107.25	.001
Error	92	196.20513		

Table 3

Means and Standard Deviations for Knowledge: Time of Day

Group	N	$\bar{X}$	SD
Pre-morning	78	35.22	12.32
Pre-afternoon	16	41.00	10.56
Post-morning	78	46.72	20.78
Post-afternoon	16	71.25	9.11

Table 4

Analysis of Variance for Knowledge: Time of Day

Source	df	MS	F	p
Time Day/				
Written Group	1	2333.77660	14.46	.0001
Error	92	161.35054		

Table 5

Means and Standard Deviations for Knowledge: Time of Year

Group	N	$\bar{X}$	SD
Pre-fall	41	36.24	11.68
Pre-winter	53	36.16	12.66
Post-fall	41	61.00	20.16
Post-winter	53	43.07	19.00

Table 6

Analysis of Variance for Knowledge: Time of Year

Source	df	MS	F	p
Time Year/				
Written Group	1	3682.98	25.10	0.0
Error	92	146.68		

quarter group's pretest and posttest means and standard deviations were 36.24 (11.68) and 61.00 (20.16), respectively, whereas the pretest and posttest means and standard deviations for the winter quarter group were 36.16 (12.16) and 43.07 (19.00), respectively. The F ratio (25.10, p > .005) realized from the knowledge test scores of the fall and winter quarter classes indicated a significant difference in knowledge retained by the fall quarter classes over the winter quarter classes.

Skinfold Measurements

The skinfold measurements were obtained by measuring the three skinfold sites on each subject. The anatomical landmarks that were used were the triceps, the iliac crest, and the thigh. Each site was measured three times by the investigator and the final value that was recorded was the average of the two closest readings. The sum of the skinfold measurements was used in analyzing differences between groups.

The pretest to posttest means and standard deviations for the skinfold measurements for the fitness group (see Table 7) were 33.40 (8.75) and 31.62 (9.77), respectively, whereas those for the control group were 28.57 (6.95) and 30.23 (7.19), respectively. The result of the F ratio is represented in Table 8. This F ratio for the difference between the fitness group and control group for the skinfold measurements was 3.51. This indicates that

Table 7

Means and Standard Deviations for Skinfold Measurements

		Pretest		Posttest	
Group	N	$\bar{X}$	SD	$\bar{X}$	SD
Fitness	47	33.40	8.75	31.62	9.77
Control	47	28.57	6.95	30.23	7.19

Table 8

Analysis of Variance for Skinfold Measurements

Source	df	MS	F	p
Group	1	453.53	3.51	.064
Error	92	129.03		

there was no difference at the .005 level, indicating no difference in the skinfold measurements between the fitness and the control groups.

The pretest to posttest mean scores and the F ratio for the skinfold measurements between the morning and the afternoon groups are presented in Tables 9 and 10. This indicates that the morning group pretest to posttest means and standard deviations were 30.95 (8.96) and 31.15 (9.04), respectively, whereas the afternoon means and standard deviations were 31.19 (5.59) and 29.81 (5.73), respectively. The F ratio (1.99) indicated that the difference between the skinfold measurements of those subjects enrolled in the morning and afternoon courses was not significant at the .05 level.

Tables 11 and 12 represent the pretest and posttest means and the F ratio for the skinfold measurements for both groups between the fall and winter academic quarters. The fall classes' skinfold pretest had a mean score of 33.58 with a standard deviation of 9.11, while the winter classes' skinfold pretest had a mean of 28.98 with a standard deviation of 6.90. The posttest for the fall quarter classes had a mean score of 32.43 with a standard deviation of 9.72. The winter classes' posttest had a mean of 29.75 with a standard deviation of 7.42. In regard to the difference between the skinfold measurements for both groups of the fall and winter quarters, the F ratio

Table 9

Means and Standard Deviations for Skinfold Measurements: Time of Day

Group	N	$\bar{X}$	SD
Pre-morning	78	30.95	8.69
Pre-afternoon	16	31.19	5.59
Post-morning	78	31.15	9.04
Post-afternoon	16	29.81	5.73

Table 10

Analysis of Variance for Skinfold Measurements: Time of Day

Source	df	MS	F	p
Time Day/ Skinfold	1	8.069	.06028	.807
Error	92	133.875		

Table 11

Means and Standard Deviations for Skinfold Measurements: Time of Year

Group	N	$\bar{X}$	SD
Pre-fall	41	33.58	9.11
Pre-winter	53	28.98	6.90
Post-fall	41	32.43	9.72
Post-winter	53	29.75	7.42

Table 12

Analysis of Variance for Skinfold Measurements: Time of Year

Source	df	MS	F	p
Time Year/ Skinfold	1	42.60	5.29	.024
Within Cells	92	8.04568		

(5.29, p > .02) indicated that there was a significant difference between the scores of those students enrolled in the fall quarter courses and the scores of those students enrolled in the winter quarter courses. The students enrolled in the fall quarter courses had a decrease in their skinfold measurements, while those students enrolled during winter quarter had no significant change in their skinfold measurements.

Cardiovascular Fitness

Cardiovascular fitness was measured through the utilization of the step test (Hoeger, 1986). The investigator recorded the subjects' heart rates and then determined the maximal oxygen uptake using an equation developed by McArdle (1981). The results were recorded for each subject at the beginning and the end of each course for which the subjects were enrolled.

The F ratios for the cardiovascular fitness of the two groups' pretest to posttest are found in Tables 13 and 14. The fitness groups' pretest to posttest means and standard deviations were 37.64 (6.73) and 37.81 (5.91), respectively. Means and standard deviations for the control group in the pretest to posttest were 37.39 (5.15) and 38.53 (7.66), respectively. The F ratio (.036) reveals no significant difference in cardiovascular fitness between the two groups at the .05 level.

Table 13

Means and Standard Deviations for Step Test Scores

Group	N	Pretest $\bar{X}$	SD	Posttest $\bar{X}$	SD
Fitness	47	37.64	6.73	37.81	5.91
Control	47	37.39	5.15	38.53	7.66

Table 14

Analysis of Variance for Step Test Scores

Source	df	MS	F	p
Group	1	2.558	.036	.850
Error	92	71.067		

Tables 15 and 16 represent the pretest and posttest scores for cardiovascular fitness for both groups between the morning and the afternoon classes. The morning group's pretest and posttest means and standard deviations were 37.63 (5.97) and 38.44 (6.89), respectively, while the pretest and posttest means and standard deviations for the afternoon group were 36.95 (6.05) and 36.86 (6.45), respectively. The F ratio (.46) indicates that there is no significant difference between the morning classes and the afternoon classes in relation to cardiovascular fitness.

The pretest to posttest mean scores for the cardiovascular fitness between the fall and winter quarters are found in Table 17. The two fall quarter groups' pretest and postest means and standard deviations were 38.49 (6.75) and 38.89 (6.81), respectively, while those for winter quarter were 36.76 (5.20) and 37.62 (6.82), respectively. Table 18 indicates that the F ratio (.20) shows no significant difference between the fall and winter quarter groups in regard to cardiovascular fitness.

Table 15

Means and Standard Deviations for Step Test: Time of Day

Group	N	$\bar{X}$	SD
Pre-morning	78	37.63	5.97
Pre-afternoon	16	36.95	6.05
Post-morning	78	38.44	6.89
Post-afternoon	16	36.86	6.45

Table 16

Analysis of Variance for Step Test: Time of Day

Source	df	MS	F	p
Time day/				
Step Test	1	33.908	.497	.490
Error	92	70.727		

Table 17

Means and Standard Deviations for Step Test: Time of Year

Group	N	$\bar{X}$	SD
Pre-fall	41	38.49	6.75
Pre-winter	53	36.76	5.20
Post-fall	41	38.89	6.81
Post-winter	53	37.62	6.82

Table 18

Analysis of Variance for Step Test: Time of Year

Source	df	MS	F	p
Time year/				
Step Test	1	2.43	.20	.650
Error	92	11.716		

Chapter 4

Discussion

The purpose of this investigation was to determine the fitness knowledge, skinfold measurements, and the cardiovascular fitness of students before and after a college level course in the foundations of physical fitness. Knowledge was measured by using a 100-item multiple choice test that was administered before and after a course in the foundations of physical fitness. Skinfold measurements were taken at three sites on each subject and the sum of the measurements was recorded for the score. The cardiovascular fitness was determined by the step test.

The investigation consisted of a total of 94 students enrolled in physical education classes at Tift College during the fall and winter quarters. Forty-seven of the subjects were enrolled in P.E. 100A (the Foundations of Physical Fitness), while 47 subjects were enrolled in other physical education courses and had not previously completed the P.E. 100A course.

Pollock and Blair (1981) suggest that the outcomes of physical fitness courses should be analyzed. While many colleges and universities offer classes in physical fitness, there have been few that have been analyzed. This

investigation indicates that those subjects enrolled in the physical fitness course improved significantly in the area of fitness knowledge. Recent surveys indicate that Americans are changing their life styles in an effort to lower their risk of coronary heart disease (Pollock & Blair, 1981). It is further suggested that this change in life style can be attributed to an increase in the physical fitness knowledge of most Americans.

More colleges and universities are offering courses in physical fitness according to LaPoint (1981). College students are more aware of the need to participate in regular physical activity. While more colleges and universities are offering the courses, there have been few studies to date that evaluate the effectiveness of these courses (Laurie, 1981). Studies that have been reported include the investigating of students' confidence in abilities to plan and execute their own programs of physical activity. This aforementioned study reported that students did gain in their confidence to plan and organize their physical fitness programs (Laurie, 1981).

Another objective of the study by Laurie (1981) was to determine if students' knowledge changed after a course in physical fitness. These results indicated that the students did learn the information necessary to make decisions after completing a course in physical fitness (Laurie, 1981).

Statistical analyses of the data contained in this investigation in the area of knowledge reveals that there were significant gains in knowledge between the two groups. Those subjects enrolled in the fitness course improved significantly over those subjects in the control group. The data also indicate that those subjects who were tested in the afternoon showed a significant difference in their knowledge scores as compared with subjects who were tested in the morning. There is also a significant difference between those students tested during the fall quarter and the winter quarter. Those students enrolled during the winter quarter had significant gains in knowledge over the fall quarter students.

In the area of skinfold measurements, the statistical analyses of the data indicate that there is no significant difference between the fitness group and the control group. Analyses also indicate no difference in skinfold measurements between the morning and afternoon groups. A significant difference is indicated between the fall and winter quarter groups. Those subjects enrolled during the fall quarter had significant improvements in skinfold measurements.

Statistical analyses of the data in the area of cardiovascular fitness indicate that there were no significant differences between the fitness and the control group,

between the fall and winter quarter groups, or between the morning and the afternoon groups.

On the basis of the findings of the analyses of the data, the investigator concludes the following:

1. A course in the foundations of physical fitness can produce significant improvement in the fitness knowledge of the subjects.

2. Students enrolled in afternoon classes in physical education showed significant improvement in fitness knowledge as compared with students enrolled during morning courses.

3. Students enrolled in physical education courses during the fall quarter showed significant increases in fitness knowledge as compared with students enrolled during the winter quarter.

4. Students enrolled during the fall quarter showed significant differences in skinfold measurements as compared with students enrolled during the winter quarter.

An observation made by the investigator indicates that a course in the foundations of physical fitness would significantly increase the fitness knowledge of those students enrolled in the course. However, skinfold measurement on cardiovascular fitness would not necessarily improve. It is also observed that students enrolled in the afternoon classes scored higher than those students enrolled in morning classes. This can perhaps be attributed to the

fact that all 47 of the subjects who were tested in the control group were enrolled in morning classes, while 30 of whose in the fitness group were enrolled in afternoon classes.

Another observation is that the better scores for the fall quarter groups might be explained by noting that 33 students in the fitness group were enrolled in fall quarter courses as compared with 8 for the control group. The larger number could indicate that the scores could be significantly different.

Based on the findings of this investigation, it is recommended that this study be carried out over an extended length of time to obtain a more complete compilation of the benefits of a college level physical fitness course. It is also recommended that this study be conducted at coeducational and state institutions of higher education. This would enhance the validity of the investigation.

It is recommended that other tests for cardiovascular fitness be utilized in other studies. This would also enhance the validity of the investigation.

Laurie (1981) has suggested that colleges and universities have been teaching foundations of physical fitness for years, but that these programs have not been carefully evaluated. This investigation has suggested that this evaluation is necessary and should be utilized by

those teachers of a fitness course so that the results of the course can be compared to the objectives of the course.

Appendixes

Appendix A

Student Permission Letter

TIFT COLLEGE
Chartered 1849
Forsyth, Georgia 31029-2318

Division of Education &
Human Services

DOCTORAL DISSERTATION

COLLECTION OF DATA - VOLUNTARY

The undersigned agrees to participate in a doctoral dissertation study for Laurie Jossey, doctoral candidate at Middle Tennessee State University. Participation will include the taking of a written knowledge test, a skinfold measurement, and a cardiovascular test, all to be conducted before and after the course in Physical Education 100A at Tift College of Mercer University. This participation is voluntary and will not affect the letter grade that is earned for the course. Names will be confidential and will not be reported in the final document.

PRINT FULL NAME _____ DATE _____

SIGNATURE _____ INSTRUCTOR'S INITIALS _____

Appendix B

Institution Permission Letter

TIFT COLLEGE
Chartered 1849
Forsyth, Georgia 31029-2318

Division of Education &
Human Services

August 8, 1986

Dr. Robert L. Richardson, Dean
Tift College of Mercer University
Box S-4
Forsyth, GA 31029

Dear Dr. Richardson,

The purpose of this letter is to request the College's permission to utilize the results of a fitness knowledge test, and a cardiovascular endurance test administered to Tift College students before and after enrolling in Physical Education 100A (Foundations of Physical Fitness) during the fall quarter, 1986. This data will be used for statistical analysis for a doctoral dissertation that I am completing for the Doctor of Arts degree from Middle Tennessee State University.

The rights of the students will be protected by using their student identification numbers as listed in the Office of the Registrar when the tests are administered. Students' names will not be reported in the final document. Each student will be referred to with a sequential numerical digit.

The results of these assessments will not be used in determining the final grade for the student for the course. Participation will be on a voluntary basis. The attached form will be completed by all students who volunteer to participate in the study.

The name of the College will be used in the final document and will be published. Please advise if permission is granted for me to conduct this study during the fall quarter of 1986. Thank you for your time and cooperation in this matter.

Sincerely,

/s/
Laurie A. Jossey
Assistant Professor
Tift College of Mercer University

O.K.
/s/
RLR

cc: Evelyn Bugg, Registrar
Dr. William Powell,
Division Chair

Appendix C

Knowledge Exam

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