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CARDIOVASCULAR FITNESS GAINS IN SELECTED COLLEGE-LEVEL ACTIVITIES

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Cardiovascular Fitness Gains in Selected College-level Activities

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Cardiovascular Fitness Gains in Selected College-level Activities

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Abstract

Cardiovascular Fitness Gains in Selected College-level Activities

by Sue Davis Ward

The purpose of this dissertation was to determine the expected cardiovascular fitness gains in selected college-level activities. The study tested the following activities: aerobic dance, jazz dance, social dance, and racketball and represented students from all levels (freshmen-graduates). The study was divided into five traditional research style chapters. Diagrams and tables were included to aid in the explanation of the data for this study. Subjects were administered the Cooper Twelve-Minute Run-Walk Test as pretest and posttest measures. Analyses of the data included an unweighted means of analysis of variance (MANOVA) and an F ratio on pretest and posttest scores. In addition an F ratio and Tukey test were utilized to determine significance in groups having different instructors. The .05 level was utilized to determine significance. Results on the analyses of data revealed significance in the female aerobic dance group for distance (F prob = .000) and fitness (F prob = .018). Both are

significant at or below the .05 level. No other group represented showed significance. No significance was found on groups having different instructors.

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Chapter 1

Introduction

Public awareness of aerobic conditioning has soared in the past two decades. This awareness has resulted in an increase in the number of individuals participating and/or seeking to learn new activities. The college and university activity service program is one area where an increase in involvement in a greater number and variety of students may be measured. At a time when the college and university physical education requirement is decreasing, there has been a significant increase in the number of students enrolled in physical education courses (LaPoint, 1982). In their 1977 study, Oxendine and Roberts report that of the 667 higher education institutions responding, 98% offer activity service courses, yet only 57% require physical education credits for graduation. Many of the regular students in physical education activity courses are not those typical college students enrolled in required classes but are older students and/or ones meeting personal needs.

Because there has been increased popularity in personal, as well as social, gratification from fitness, wellness, and lifetime leisure activities, emphasis has been

placed on the cardiovascular gains which may result from participation in such activities. The college-level physical education service program should offer an opportunity for the student to improve and/or maintain the current level of fitness. In a 1980 publication Annarino suggested the following objectives and goals for a physical education activity program: (a) the maintenance of physical fitness, (b) the refinement of skills, (c) the introduction of new skills, and (d) the development of a healthful life-style. Many college students continue to become more aware of the need to involve themselves in some type of physical activity. College students are directing this awareness toward the activity service program. The increased voluntary involvement of students in activity courses, as well as those participating to meet the core curriculum requirement, makes the college and university physical education program a natural choice for a study to determine cardiovascular fitness gain.

To achieve maximum benefits from participation in a college activity course, students should be able to choose the activity which will best meet their personal needs. All activity courses do not offer the same amount and type of conditioning and skill development. An example would be the skill development and conditioning benefits gained in a soccer class as opposed to those gained in a bowling class. While skill development and conditioning of each are

important and specific to that activity, the overall value of conditioning obtained through participation in soccer is probably of greater cardiovascular value to the average healthy individual than that of bowling. Knowledge of expected cardiovascular fitness gains for different activities should aid the student or advisor in making an intelligent decision on the selection of the proper activity for the individual.

Statement of the Problem

This study was designed to determine the amount of cardiovascular fitness changes which occur in selected physical education activity courses at the college level.

Purpose of the Study

The purpose of this study was to determine students' cardiovascular fitness changes in selected physical education activity courses by administering a pretest and posttest for fitness. The data collected should be instrumental in the selection of activity courses to meet specific needs of individual students.

Limitations of the Study

The subjects in this study were limited to students enrolled in two aerobic dance classes, two jazz dance classes, one social dance class, and two racketball classes during the fall semester of 1985. Each class met two days per week for a period of 50 minutes. With the exception of one jazz dance class and one racketball class, all

instruction was conducted by the researcher. Two classes were conducted by the regularly-assigned instructors.

Definitions of Terms

Activity service program--instructional physical education courses such as golf, tennis, or bowling equivalent to (in most cases) one semester hour of credit each. These courses are designed to prepare students for future participation in the activity.

Aerobic--with oxygen.

Aerobic conditioning--the physical state of the body obtained as a result of the use or increased use of the cardiovascular system.

Cardiovascular fitness--the degree or level of fitness of the heart, lungs, and circulatory system in its utilization of oxygen throughout the body.

Cardiovascular gain--the increase in the ability of the cardiovascular system to utilize oxygen more efficiently for a greater length of time.

Conditioning--the physical state of the body which is the result of the use or nonuse of the body for work or play.

Fitness--the state which is characteristic of the degree to which a person is able to function, an individual matter. Fitness implies the ability of people to live most effectively with their potential. The ability to function depends upon a person's physical,

mental, emotional, social, and spiritual components of fitness. All of these are related to one another and are mutually interdependent (AAHPER, 1958).

Kcal or Kilocalorie--a measurement of the use of oxygen as associated with the production of heat (energy) in the body. One liter of oxygen is associated with the production of about five calories of heat (Morehouse & Miller, 1963).

Lifetime leisure activity--those activities in which one participates by choice for personal enjoyment, socialization, or maintenance of physical fitness.

Physical education requirement/core curriculum requirement--that part of the curriculum required as general education requirements in the physical education program for graduation.

Skill development--the acquisition of motor patterns necessary to execute various desire responses to stimuli (i.e., the correct motor pattern of executing a free throw in basketball).

Typical college student--the student falling between 18 and 22 years of age.

Wellness--a state of total health of the individual including the physical, mental, emotional, and social aspects.

Hypotheses

This study investigated the following hypotheses:

1. There will be no significant difference between the identified activities in the level of cardiovascular fitness in the pretest or posttest scores.

2. There will be no significant difference in the level of cardiovascular fitness gain between classes having different instructors in the pretests or posttests.

3. There will be no significant difference between the identified activities in the level of cardiovascular fitness gain pretest to posttest.

Chapter 2

Review of Related Literature

A review of the literature on expected cardiovascular fitness gains in college-level activity classes produced a limited amount of information specific to the topic. However, the review revealed a substantial amount of literature which supports the idea that activities other than running, walking, swimming, cycling, or nordic skiing elicit a training effect. The review is divided into two sections: (a) research on the objectives, aims, and status of physical education activity programs at four-year institutions; and (b) different types of activity, conditioning, and training programs which elicit cardiovascular changes.

Objectives, Aims, and Status of Activity Programs

In 1971 and 1972 Oxendine (1972) conducted a study on the status of general instruction programs of physical education in four-year institutions by use of a questionnaire. The questionnaire was mailed out to 1,143 institutions, and 69% were returned and used in the analysis of data.

Basically, the study revealed the following: 95% of the responding institutions offered physical education to the general college student; 74% of these institutions required physical education for credit to graduate; there had been a 10 to 15% decrease in the number of institutions requiring physical education over the previous four years; the majority of the institutions required physical education for a two-year period; of the institutions where the requirement had been eliminated, approximately one-fourth of the student population elected to take activity courses; there was an increase in lifetime sports and a decrease in team sports; and there was an increase in participation in coeducational activities. Institutions expressed satisfaction with the elimination of the physical education requirement citing improved programs and attitudes on the part of the students electing to take the courses.

In 1977 the National Association for Sports and Physical Education (NASPE) sponsored a status report on the General Instruction Program in physical education at four-year colleges and universities. This report (NASPE, 1978) was an update of an earlier report by Oxendine and was submitted with the help of Jean Roberts to NASPE (1967). A four-page questionnaire concerning course offerings, requirements, elective patterns, innovations, sex patterns, and other trends was formulated and mailed to 1,121 institutions which set the following criteria: (a) a

four-year institution; (b) having undergraduate enrollment of 500 or more students; (c) accredited by the regional accrediting agency; and (c) classified as a college, university, or institution of higher learning. Sixty percent of the questionnaires were completed, returned, and included in the analysis of data. This report revealed significant shifts occurring in the physical education course offerings at institutions. Activities showing the greatest increase of student population were individual sports, dual sports, outdoor skills, and basic movement and fitness activities. Team sports as a part of the curricula had shown a sharp decline. Course offerings, at this time, were almost evenly balanced between aquatics, basic movement and fitness, dance and rhythm, individual sports, and team activities. The most successful new courses added in the previous years were: (a) various forms of fitness activities (i.e., jogging, aerobics, etc.), (b) outdoor activities (backpacking, rock climbing, orienteering, and survival skills), (c) racket sports (hand, paddle, racketball, and squash), (d) all forms of dance, (e) winter sports (downhill and cross-country skiing), and (f) skin and scuba diving.

At the time of the study (NASPE, 1978), more than one-third of the students elected to take physical education courses. In institutions where the physical education requirement had recently been eliminated, more than half

reported current enrollments between 80% and 100% of the enrollment the last year of the requirement. One-fourth of the institutions reported enrollments dropping below 40%. Institutions with elective programs reported an equal number of men and women registered for physical education courses regardless of size or the fact that it was a public or private school.

A 1980 study of 909 Florida State University students who voluntarily completed a questionnaire on the importance of the top 24 stated objectives of physical education service courses (Soudan & Everett, 1981) found that keeping in good health and physical condition, getting regular exercise, having fun, and improving self-confidence were the most important of the objectives listed. The least important objectives were providing vocational preparation, understanding the mechanical principles of movement and the effects of exercise on the human body, and developing skill in various sports.

A 1982 study by LaPoint cited the following as aims for physical education activity programs at the college level: (a) maintenance of physical fitness, (b) refinement of skills, (c) introduction of new skills, and (d) development of healthy lifestyles. LaPoint listed innovative activity courses such as aerobic dance, weight lifting, and adventure programs as courses offered which may help students reach these goals.

Activity, Conditioning, and Training Programs

Based on the increasing numbers of persons becoming involved in endurance training activities, the American College of Sports Medicine (1978) made the following recommendations for the quantity and quality of development and maintenance of cardiorespiratory fitness and body composition in the healthy adult:

1. Frequency of training: three to five days per week.

2. Intensity of training: 60 to 90% of maximum heart rate reserve or 50 to 85% of maximum oxygen uptake (VO2 max).

3. Duration of training: 15 to 60 minutes of continuous aerobic activity. Duration is dependent on the intensity of the activity; thus lower-intensity activity should be conducted over a longer period of time. Because of the importance of the total fitness effect and the fact that it is more readily attained in longer-duration programs, and because potential hazards and compliance problems associated with high-intensity activity, lower- to moderate-intensity activity of longer duration is recommended for the non-athletic adult.

4. Mode of activity: Any activity that uses large muscle groups, that can be maintained continuously, and is rhythmic and aerobic in nature,

> for example, running-jogging, walking-hiking, swimming, skating, bicycling, rowing, cross-country skiing, rope skipping, and various endurance game activities. (p. 39)

Cardiovascular Fitness as Related to Selected Activities

A 1983 study (Mulder & Allsen) was conducted to assess the effectiveness of the undergraduate physical education program at Brigham Young University. The purpose of the study was to determine the effect of the Fitness for Life program on male and female students' body composition and cardiovascular endurance. The program was a self-directed eight-week study. Analysis of the data collected revealed a significant difference between treatments, sex, and interaction between treatment and sex for maximum oxygen uptake and 1.5 mile run time. Results indicated that the nonsupervised, self-directed physical education program can bring about cardiovascular endurance changes. An earlier study at Brigham Young University (Baker, 1976) found similar results.

In 1977 a study was conducted by Watson and O'Donovan on the effect of five weeks of controlled interval training on youths of diverse pretraining conditioning. The training program consisted of 200 meter interval training (i.e., 200 meter sprints). The researchers found that five weeks of training had no significant effect on percentage of fat or body weight but physical work capacity (pwc) was

increased significantly. An earlier study (Eiserman & Golding, 1975) on 16 females (eight girls, eight women) for 14 weeks found a significant increase in VO2 max. The exercise program consisted of running and bench stepping. The study also showed that the most rapid rates of improvement occurred during the first two weeks. Percent of body fat or body weight were not significant factors in this study.

In a study of overweight college women participating in a program of moderate exercise with diet control not monitored, Moody, Kollias, and Buskirk (1969) found that total body fat decreased and fat-free weight increased. The format of the exercise program included treadmill walking (three mph) and treadmill running (five mph) six days per week for eight weeks. Because the calculated loss of body fat from the skinfold measurements exceeded the caloric value of the exercise program, the researchers felt that the skinfold method alone was an inappropriate determinant of body fat for obese women. Also noted was a need of monitoring caloric intake to insure that subjects continue receiving the same amount of calories as before the study.

A similar study was conducted (Flint, Drinkwater, & Horvath, 1974) on seven females for a six-week period which included workouts of 30 minutes, three times per week. The training program consisted only of treadmill walking where the target heart rate (THR) was maintained at 75% to 80% of

heart rate (HR) maximum by adjusting the grade of the treadmill. As a result of training, a 12% increase of maximum aerobic capacity was achieved.

Another study (Deitrick & Ruhling, 1978) addressed the issue of short duration, high intensity aerobic training and retrogression. Because the attrition rate for long duration exercise programs was greater than short duration exercise programs, a study was conducted to determine the training effect and retrogression of the short duration, high intensity aerobic training program. The training program consisted of treadmill walking which kept the subjects' heartbeat between 150 and 160 beats per minute (b.min-1, 76%-82% max HR) for a period of 10 minutes. The heart rate was monitored during the first minute of recovery and every minute afterwards until the rate reached 150 b.min. Blood pressure also was taken during the first and last minute of recovery.

The results of the study showed that aerobic capacity may be improved significantly by short duration, high intensity aerobic training and that retrogression occurred during the 10th day of the study. Also noted was the subjects' greater capacity for work in the last week of the study without a significant difference in heart rate. This study supports Cureton's (1974) hypothesis that the main factor in influencing changes in cardiovascular fitness is the relative and absolute intensity of the training

workload. In other studies (Olree, 1969; Tooshi, 1971; Wilmore, Royce, Girandola, Katch, & Katch, 1970) significant improvements have been reported on subjects after six to 10 training sessions. In a study by Shepard (1969) the conclusion was drawn that training is only marginally influenced by its duration. Shepard's (1969) conclusion also supports the Dietrick and Ruhing study. Basically, the study revealed that an exercise program of short duration and high intensity could be beneficial in attaining a good level of fitness in healthy yet cardiovascularly unfit subjects.

Some activities which are not traditionally thought of as aerobic are discussed in the next few paragraphs. These activities are included in order to bring into focus a broadened scope of activity possibilities for cardiovascular fitness gain.

In a study (Connor, 1978) where set and interval weight training systems were measured on muscular strength, cardiovascular endurance, and selected anthropometric measures of college men, the following conclusions were drawn. Both the set and interval systems were found to elicit significant increases in strength, cardiovascular endurance, and anthropometric measures during the nine-week training period. The interval system seemed to produce equally significant or greater increases in the area measured. Because the interval circuit system requires 70% less workout time, the

interval system may prove to be the better system when time is limited.

In studies conducted in 1979 (Hilyer & Mitchel) and 1982 (James, Ellsworth, & Olhmen), weight training was determined to significantly affect the self-concept of the subjects in the study.

Another area traditionally not thought of as aerobic is dance such as ballet, jazz, or modern (Rimmer & Rosentsweig, 1981-82). Because dance is thought of as part of the arts, very little thought is given to dance as a mode to improve cardiovascular fitness. In a 1982 study, Rimmer and Rosentsweig attempted to answer the question, "Are highly trained dancers equal to championship athletes in oxygen consumption tests?" In an attempt to assess the course work in dance as a means for improving aerobic fitness, a study was designed to measure the maximum oxygen consumption of eight highly trained female dance majors. To be considered trained each dancer would be dancing at least three hours per day, three to five days per week for the past six months and had danced a minimum of 10 hours per week for the previous five years. The study revealed that dancers had a maximum aerobic capacity comparable to highly trained athletes. Their aerobic capacity was slightly higher than championship swimmers. Thus, results indicated highly trained dancers are highly trained aerobic athletes.

Jette and Inglis (1975) conducted a study on the energy cost of square dancing. Four middle-aged couples, who were veteran members of a square dancing club, were tested while doing two popular western square dance routines. One routine was relatively fast moving and the other routine a more deliberate and slow type of dance. The results indicate the energy cost for a typical evening (75 minutes of 3 hours) for a 70-kg male is 425 kcal and for 60-kg female is 390 kcal.

In a 1983 study (Milburn & Butts), aerobic dance and jogging in college females were compared to determine training responses. In a seven-week study, four days per week, 30 minutes per day at an intensity representing 83% to 84% of the subjects' initial maximum heart rate, 15 dancers and 19 joggers were monitored. A control group of 12 was also included in the study. Results indicated when intensity, frequency, and duration were similar, both aerobic dance and jogging were equally effective in eliciting improvement in cardiovascular endurance.

A 1975 study (Foster) was conducted during an Aerobic Dance Workshop (Jacki Sorensen's Aerobic Dancing, Inc.) held on the campus of the University of Texas at Austin. Four female subjects volunteered to perform one of the routines as oxygen consumption was monitored by using a modified Douglas bag procedure. Results of the investigation suggested that aerobic dancing, performed three times

per week for one hour is an effective mode of cardiovascular fitness training. Earlier data (Weber, 1974) indicated that aerobic dancing will elicit oxygen consumption of approximately 30 ml/kg/min for periods of five to 12 minutes. The 70% to 80% maximum VO2 observed in the Foster study fulfills most criteria for exercise intensity. Based on Weber's findings, exercise could be maintained for at least 30 minutes which would exceed accepted minimums for exercise duration. Therefore, aerobic dancing could elicit a cardiorespiratory training effect and thus should be an acceptable alternative to other modes of training.

A later study (Igbanugo & Gutin, 1977) investigated the energy cost of three intensities of aerobic dance (high, medium, and low) of four graduate students. All subjects danced two- to three-minute routines with six 15- to 90-second recovery intervals of continuous walking. The energy expenditure for the low intensity routine was similar to walking on a level surface. The medium intensity was similar to playing tennis. The high intensity was similar to playing hockey. Thus, it was concluded that aerobic dance can be useful for cardiorespiratory training and rehabilitation as well as for weight reduction and maintenance.

Vaccaro and Clinton (1981) conducted a study on aerobic dance. Based on the great number of students (45,000) and the statement of Jacki Sorensen that aerobic dance is useful

in developing cardiorespiratory endurance (1973), a 10-week study (three days per week, 45 minutes per session) was conducted. The study was designed to examine the effect of the conditioning program on body composition and maximum oxygen uptake on college women. Pretests and posttests were conducted to assess body composition and V02 max. The program did not, however, alter the percent body fat of the subjects.

In a study comparing the effects of jogging, rope jumping, and aerobic dance on the body composition and maximum oxygen uptake (Durrant, 1975), pretests and post-tests were administered to 101 college females. This number included a group representing each of the three activities and a control group. An analysis of variance was used to determine the results of the data. Results indicated that there were no significant differences between the treatment groups but there was a significant difference between the treatment groups and the control group. There were significant differences in lean body mass between groups, but no significant differences in body composition.

Several research studies and their findings are presented in the article, "Does Aerobic Dance Offer More Fun Than Fitness?" (Legwold, 1978). One source, Metcalf, in explaining the 258 b.min-1 heart rate of a 38-year-old subject was quoted as saying, "We think the intensity of the aerobic dance is masked by the music" (Legwold, 1978,

p. 148). Another researcher, Zuti, commenting on the low injury rate of aerobic dance participants, was quoted as saying,

> It's a low-risk population when it comes to heart disease. Typically, a class is made up of young women who are concerned about keeping their figures. And there is the non-competitive aspect in aerobic dance that you don't find elsewhere. Once you start jogging you want to go out and beat your associate. Aerobic dance has been around long enough now that if it were dangerous we would know. (Legwold, 1978, p. 151)

Chapter 3

Methods and Procedures

The methods and procedures described in this chapter were used to determine relevant information to the statement of the problem of this study. The following paragraphs include information describing the subjects, treatment, and data collection.

Field Experience

To familiarize the investigator with the methods and procedures of the Cooper Twelve-Minute Run-Walk Test, pre-tests and posttests were administered to various activity classes over a two-year period prior to the actual study. The activities included aerobic dance, jazz dance, social dance, folk and square dance, swimming, and racketball. In each case the researcher was the instructor. The number of subjects ranged from 16 to 60 per class with a mixture of male and female students. Freshmen, sophomores, juniors, seniors, and several graduate students were represented in these numbers. Classes met two days per week for a period of 50 minutes per class. Results of the data collected were used to help individual students set personal fitness goals

as well as to determine the amount of cardiovascular fitness gains for the semester.

During the first class meeting, students were oriented toward the methods, procedures, and purpose of the test. The Cooper Twelve-Minute Run-Walk Test was administered during the second scheduled class meeting. The traditional method of instruction was utilized beginning the third scheduled class meeting. The posttest was administered at the end of the treatment period.

Administration of the Cooper Twelve-Minute Run-Walk over the two-year period resulted in the personal development of the investigator as researcher in economy of time, accuracy of recording and calculating scores, and training of research assistants.

Subjects

For this study, all students in the following sections of physical education service classes at Middle Tennessee State University in the fall semester of 1985 participated as subjects; 1150 (HPER 102, Social Dance); 1198, 1199 (HPER 117, Racketball); 1206, 1209 (HPER 119, Aerobic Dance); and 1254, 1265 (HPER 218, Jazz Dance). Each of these classes consisted of both male and female students on the beginning level. The aforementioned activities were open to all Middle Tennessee State University students. The number of students ranged from 16 to 45 per class with a total of 141.

In the first class meeting the students were oriented as to the nature and purpose of the study with a full explanation of the testing procedure. The students were informed of their participation in the study and that their involvement would in no way be reflected in their grades. Each class member operated under a contract during the semester. The contract called for participation in both pretests and postests, participation in regular class meetings, and participation in the normal skills tests associated with that activity. Any student objecting to participation in the study was asked to inform the researcher but extended the same rights and privileges as those choosing to participate. These students completed all parts of the contract with the exception of the pretest and posttest.

Testing Procedure

Four research assistants were trained in the administration and data collection of the Cooper Twelve-Minute Run-Walk. Each test was administered by the researcher and one assistant during the second scheduled class meeting of the fall of 1985. The test was administered to all volunteer subjects during six separate sessions. Care was taken to insure that as many variables as possible remained consistent throughout the testing procedure for every session.

The test was conducted on an indoor, six-lane track where six laps on the outside lane equaled one mile. Orange cones were placed every 40 yards in the third lane labeled A, B, C, D, E, F, and Start/Finish (see Diagram 1).

Each subject tested was given a three-inch by five-inch index card with a number assigned identifying the nature of the class, the time of the class meeting (in Roman numerals) and an identification number. Example: AD III 22 is Aerobic Dance, Three o'clock, subject number 22 (see Diagram 2). Also placed on the index card was a strip of masking tape with a corresponding number which could easily be removed from the card.

Listed below are test procedure instructions that were given to the subjects prior to testing:

1. Each subject will have a partner.

2. One partner will run while the other partner counts the runner's laps.

3. The partner running will remove the tape from the index card with the identification number and place it on his/her clothing for the run.

4. The partner counting will hold the runner's index card and record each lap as the runner passes the Start/ Finish cone, placing one vertical mark for each lap completed (i.e., 𝍸 =5).

5. The runner will hear three whistles: Whistle #1 will start time and runners. Whistle #2 will serve as a

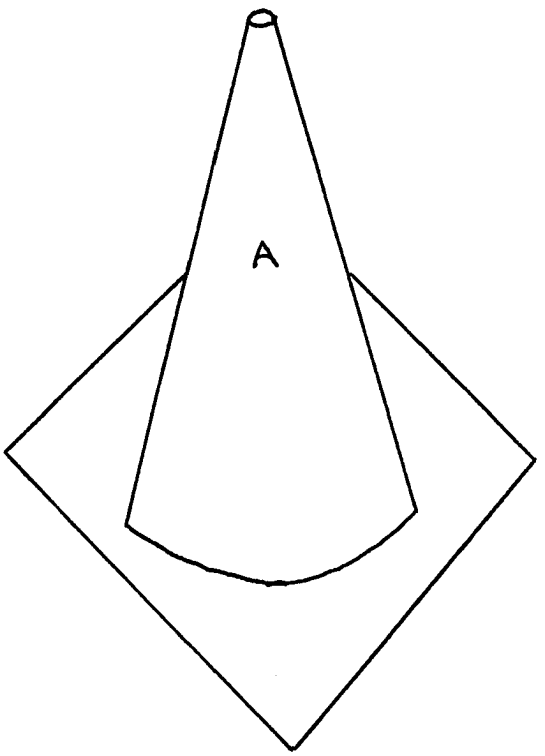

Diagram 1

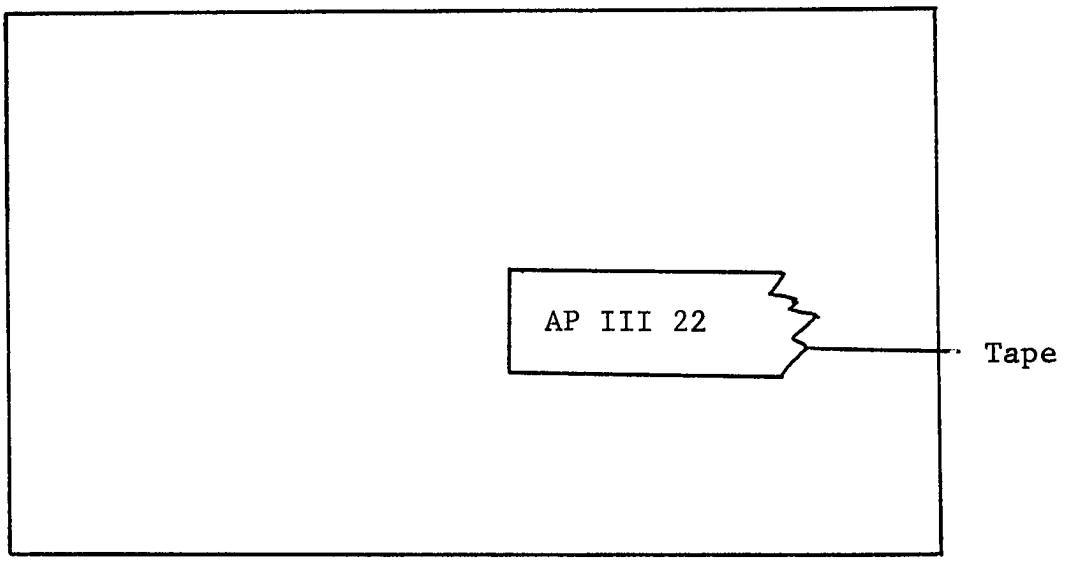

Diagram 2

one-minute warning at the beginning of the 11th minute. This whistle also serves to alert the runner to remove the tape with the identification number and become aware of the cone to which he/she is closest. Whistle #3 stops time and runner's progress. The runner stops long enough to put the tape with his/her identification number on the track (third lane) and mentally note the cone to which he/she is closest.

6. Runners will then continue to walk at least one lap for proper cool down.

7. Runners will report the cone letter to which he/she was closest at whistle #3 to his/her partner who will record the letter on the runner's card.

8. When the cool down is completed, partners will exchange places and the procedure will be repeated.

Scores were reported and recorded in terms of laps completed, plus cone letter reported. Both the researcher and the assistant were equipped with stopwatches and whistles which were started simultaneously at the Start/ Finish line. Once the test was underway, the assistant, walking on the outside of the sixth outer lane, moved to the opposite side of the track to insure that all runners could hear whistles #2 and #3. When the test was completed and the cool-down process was in progress, the assistant, equipped with a master copy of the identification numbers, began retrieving tapes. As each tape was retrieved, the assistant recorded the location of the tape in terms of

cone letter on the master copy. This procedure was included to insure consistency of cone letter reporting. The construction of the multipurpose facility being used necessitated this inclusion due to the obstructed vision of the researcher from the Start/Finish line.

Norms for the test were taken from standards for Cooper's Twelve-Minute Test for Men and Cooper's Twelve-Minute Test for Women (1968). Each standard includes five classifications ranging from very poor to excellent (see Tables 1 and 2). The women's table only is divided into age groups. Because the age group on the women's table introduces additional variables, a simpler third table was included (see Table 3). This table includes a sixth classification of superior for college-age men and women. The simplicity of Table 3 facilitates the analysis of data by reducing the number of variables.

Upon collection of the data, the researcher transcribed the total lap number and cone letter into mileage distance covered for each subject. This raw score was entered into the appropriate column on the master copy to be used later in the analysis of the data. The master copy lists only the subject's identification number. No names were recorded on the master list.

The posttest was conducted at the end of the 12-week treatment period. The length of the treatment period was

Table 1

Standards for Cooper's Twelve-Minute Test for Men

	Fitness Category	Distance Covered	Estimated Max Oxygen Consumption (in milliliters/min)
I	Very Poor	less than 1.0 mi	28.0 ml or less
II	Poor	1.0 to 1.24 mi	28.1 to 34 ml
III	Fair	1.25 to 1.49 mi	34.1 to 42 ml
IV	Good	1.50 to 1.74 mi	42.1 to 52 ml
V	Excellent	1.75 mi or less	52.1 ml or more

Note. From Measurement in Physical Education (p. 279) by D. K. Mathews, 1978, Philadelphia: W. B. Saunders Co. by the International Copyright Union. Reprinted by permission.

Table 2

Guidelines for Cooper's Twelve-Minute Test for Women

Age Groups (Years)

Classification	Under 30	30-39	40-49	50 and Up
Very Poor Under:	.95	.85	.75	.65
Poor	.95-1.14	.85-1.04	.75- .94	.65- .84
Fair	1.15-1.34	1.05.1.24	.95-1.04	.85-1.04
Good	1.35-1.64	1.25-1.54	1.15-1.44	1.05-1.34
Excellent	Over 1.64	Over 1.54	Over 1.44	Over 1.34

Note. From Measurement in Physical Education (p. 279) by D. K. Mathews, 1978, Philadelphia: W. B. Saunders Co. by the International Copyright Union. Reprinted by permission.

Table 3

Scoring for Twelve-Minute Running Test for College Men and Women

Category	Men (Distance)	Women (Distance)
Superior	More than 2.25 mi	More than 1.90 mi
Excellent	2.00 to 2.24 mi	1.65 to 1.89 mi
Good	1.75 to 1.99 mi	1.40 to 1.64 mi
Fair	1.50 to 1.74 mi	1.15 to 1.39 mi
Poor	1.25 to 1.49 mi	.90 to 1.14 mi
Very Poor	Less than 1.25 mi	Less than .90 mi

Note. From A Practical Approach to Measurement in Physical Education, 2nd Ed. (p. 210) by H. M. Barrow and R. McGee, Philadelphia: Lea and Febiger. Copyright 1971 by the International Copyright Union. Reprinted by permission.

limited by the structure of the semester. Testing procedures were the same for the pretest and posttest.

Chapter 4

Analysis of Data

An analysis of variance for unweighted means was used to interpret the data and determine the results of said data in this study. An F ratio was computed for pretest and posttest scores on the Cooper Twelve-Minute Run-Walk Test to determine significance. Because different instructors were used, an F ratio and Tukey were computed to determine the effect of instructors upon the groups.

The hypotheses tested in this study were as follows:

Hypothesis 1. There will be no significant difference between the identified activities in the level of cardiovascular fitness in the pretest or posttest scores.

Hypothesis 2. There will be no significant difference in the level of cardiovascular fitness gain between classes having different instructors in the pretests or posttests.

Hypothesis 3. There will be no significant difference between the identified activities in the level of cardiovascular fitness gain pretest to posttest.

The hypotheses of this investigation were stated to determine the changes in pretest and posttest scores of

distance and cardiovascular fitness gains for the different groups. An unweighted means of analysis of variance (MANOVA) was utilized to determine if there were a significant difference at the .05 level between and among the groups as a result of the treatment.

At the beginning of the study, each group was administered the Twelve-Minute Run-Walk as a pretest. The investigator collected and analyzed the data for the study with the assistance of the Honeywell CP-6, SPSS-X system at the Middle Tennessee State University Computer Center.

Table 4

Table 4 represents pretest to posttest distance scores for males in each group. The pretest mean score of males for distance in the aerobic dance group was 1.48000 and the standard deviation was .04899. The mean score for the post-test was 1.51750 and the standard deviation was .08180 with a pretest/posttest difference of 0.04.

The male group representing jazz dance pretest score was 1.47000 and the standard deviation was .22627. The mean score for the posttest score was 1.48500 and the standard deviation was .02121 with a pretest/posttest difference of 0.02.

The male social dance group had a pretest mean score of 1.56833 and a standard deviation of .17105. The posttest mean score was 1.53667 and the standard devistion was .30151 with a pretest/posttest difference of 0.03.

Table 4

Pretest and Posttest Scores for Distance--Males

Group	N	X	SD	X	SD	X Diff.
Aerobic Dance	4	1.48000	.04899	1.51750	.08180	0.04
Jazz Dance	2	1.47000	.22627	1.48500	.02121	0.02
Social Dance	6	1.56833	.17105	1.53667	.30151	-0.03
Racketball	13	1.51000	.22279	1.48923	.24875	-0.02

The pretest mean score for males in the racketball group was 1.51000 and the standard deviation was .22279. The mean posttest score was 1.48923 and the standard deviation was .24875 with a pretest/posttest difference of 0.02.

Table 5

Table 5 presents pretest to posttest fitness scores for males in each group. The pretest mean score for males for fitness level gain in the aerobic dance group was 2.50000 and the standard deviation was .57735. The mean score for the posttest was 3.25000 and the standard deviation was .50000 with a pretest/posttest difference of 0.75.

The pretest mean score of males for fitness in the jazz dance group was 2.50000 and the standard deviation was .70711. The mean score for the posttest was 2.50000 and the standard deviation was .70711 with a pretest/posttest difference of 0.00.

The social dance pretest mean score was 2.83333 and the standard deviation was .75277. The mean score for the post-test was 2.66607 and the standard deviation was 1.36636 with pretest/posttest difference of 0.17.

The racketball pretest mean score was 2.76923 with a standard deviation of .72501. The mean score for the post-test was 2.69231 and the standard deviation was 1.10940 with a pretest/posttest difference of 0.08.

Table 5

Pretest and Posttest Scores for Fitness--Males

Group	N	X	SD	X	SD	X Diff.
Aerobic Dance	4	2.50000	.57735	3.25000	.50000	0.75
Jazz Dance	2	2.50000	.70711	2.50000	.70711	0.00
Social Dance	6	2.83333	.75277	2.66667	1.36626	0.17
Racketball	13	2.76923	.72501	2.69231	1.10940	0.08

Table 6

Table 6 represents the pretest and posttest scores for females for distance. The pretest mean score of females for the aerobic dance group was 1.09270 and the standard deviation was .15814. The mean score for the posttest was 1.16698 and the standard deviation was .16750 with a pretest/posttest difference of 0.07.

The female group representing jazz dance revealed a pretest mean score of 1.09179 and a standard deviation of .23616. The posttest mean score was 1.05071 and the standard deviation was .23198 with a pretest/posttest difference of 0.04.

The female social dance group pretest mean score was 1.05133 and the standard deviation was .17382. The posttest mean score was 1.07867 and the standard deviation was .23336 with a pretest/posttest difference of 0.03.

The pretest mean score of females in the racketball group was 1.14800 and the standard deviation was .17364. The posttest mean score was 1.19200 and the standard deviation was .22145 with a pretest/posttest difference of 0.04.

Table 7

Table 7 represents the pretest and posttest scores for females for fitness. The pretest mean score of females for fitness level gain in the aerobic dance group was 2.28571 and the standard deviation was .70548. The posttest mean

Table 6

Pretest and Posttest Scores for Distance--Females

Group	N	X	SD	X	SD	X Diff.
Aerobic Dance	63	1.09270	.15814	1.16698	.16750	0.07
Jazz Dance	28	1.09179	.23616	1.05071	.23198	-0.04
Social Dance	15	1.05133	.17382	1.07867	.23336	0.03
Racketball	10	1.14800	.17364	1.19200	.22145	0.04

Table 7

Pretest and Posttest Scores for Fitness--Females

Group	N	X	SD	X	SD	SD Diff.
Aerobic Dance	63	2.28571	.70548	2.52381	.85868	0.24
Jazz Dance	28	2.28571	1.04906	2.03571	1.10494	-0.25
Social Dance	15	2.13333	.63994	2.20000	.86189	0.07
Racketball	10	2.50000	.84984	2.50000	.97183	0.00

score was 2.52381 and the standard deviation was .85868 with a pretest/posttest difference of 0.24.

The mean score of the jazz dance group was 2.28571 with a standard deviation of 1.04906. The posttest mean score was 2.03571 and the standard deviation was 1.10494 with a pretest/posttest difference of 0.25.

The social dance mean score was 2.13333 and the standard deviation was .63994. The posttest mean score was 2.20000 and the standard deviation was .86189 with a pretest/posttest difference of 0.07.

The mean score for the racketball group was 2.50000 and the standard deviation was .84984. The posttest mean score was 2.50000 and the standard deviation was .97183 with a pretest/posttest difference of 0.00.

Table 8

Table 8 represents the significance of F in regard to distance covered for males in each group. The sum of the squares for the male aerobic dance group within cells score was .00624 with three degrees of freedom and the mean of the squares was .00208. The sum of the squares for distance was .00281 with one degree of freedom and the mean of the squares was .00281. F was equal to 1.35271 and therefore there was no significance of F with a score of .329.

The sum of the squares for the male jazz dance group within cell score was .02103 with one degree of freedom and the mean of the squares was .02103. The sum of the squares

Table 8

MANOVA: Distance--Males

	Group	N	SS	df	MS	F	F Prob
Within Cell	Aerobic Dance	4	.00624	3	.00208		
Distance			.00281	1	.00281	1.35271	.329
Within Cell	Jazz Dance	2	.02102	1	.02103		
Distance			.00023	1	.00023	.01070	.934
Within Cell	Social Dance	6	.06014	5	.01203		
Distance			.00301	1	.00301	.25010	.638
Within Cell	Racketball	3	.31075	12	.02590		
Distance			.00280	1	.00280	.10828	.748

for distance was .00023 with one degree of freedom and the mean of the squares was .00023. F was equal to .01070 and therefore there was no significance of F with a score of .934.

The sum of the squares for the male social dance group within cell score was .06014 with five degrees of freedom and a mean score of .01203. The sum of the squares for distance was .00301 with one degree of freedom and the mean of the squares was .00301. F was equal to .25010 and therefore there was no significance of F with a score of .638.

The sum of the squares for the male racketball group within cells score was .31075 with 12 degrees of freedom and the mean of the squares was .02590. The sum of the squares for distance was .00280 with one degree of freedom and the mean of the squares was .00280. F was equal to .10828 and therefore F was not significant with a score of .748.

Table 9

Table 9 shows the significance of F in regard to cardiovascular fitness gains for males in each group. The sum of the squares for the male aerobic dance group within cells score was 1.37500 with three degrees of freedom and the mean of the squares was .45833. The sum of the squares for fitness was 1.12500 with one degree of freedom and the mean of the squares was 1.12500. F was equal to 2.45455 and therefore F was not significant with a score of .215.

Table 9

MANOVA: Fitness--Males

	Group	N	SS	df	MS	F	F Prob
Within Cell	Aerobic Dance	4	1.37500	3	.45833		
Fitness			1.2500	1	1.12500	2.45455	.215
Within Cell	Jazz Dance	2	0.0	1	0.0		
Fitness			0.0	1	0.0		
Within Cell	Social Dance	6	1.41667	5	.28333		
Fitness			.08333	1	.08333	.29412	.611
Within Cell	Racketball	13	7.46154	12	.62179		
Fitness			.03846	1	.03846		.808

Scores reported for the male jazz dance group could show no significance due to the small number of subjects (2) but were included to maintain the continuity of the reporting style.

The sum of the squares of the male social dance group within cells score was 1.41667 with five degrees of freedom and the mean of the squares was .29412. The sum of the squares for fitness was .08333 with one degree of freedom and the mean of the squares was .08333. F was equal to .29412 and therefore F was not significant with a score of .611.

The sum of the squares for the male racketball group within cells score was 8.46154 with 12 degrees of freedom and the mean of the squares was .62179. The sum of the squares for fitness was .03846 with one degree of freedom and the mean of the squares was .03846. F was equal to .06186 and therefore F was not significant with a score of .808.

Table 10

Table 10 shows the significance of F in regard to distance for females in each group. The sum of the squares for the female aerobic dance group within cells score was .67357 with 62 degrees of freedom and the mean of the squares was .01086. The sum of the squares for distance was .17383 with one degree of freedom and the mean of the squares was .17380. F was equal to 16.00034 and therefore

Table 10

MANOVA: Distance--Females

	Group	N	SS	df	MS	F	F Prob
Within Cell	Aerobic Dance	63	.67357	62	.01086		
Distance			.17383	1	.17380	16.00034	.000
Within Cell	Jazz Dance	28	.76603	27	.02837		
Distance			.02362	1	.02362	.83238	.370
Within Cell	Social Dance	15	.42815	14	.03058		
Distance			.00560	1	.00560	.18322	.675
Within Cell	Racketball	10	.10302	9	.01145		
Distance			.00968	1	.00968	.84566	.382

was significant with a score of .000 at the .01 level of significance.

The sum of the squares for the female jazz dance group within cells score was .76603 with 27 degrees of freedom and the mean of the squares was .02837. The sum of the squares for distance was .02362 with one degree of freedom and the mean of the squares was .02362. F was equal to .83238 and therefore F was not significant with a score of .370.

The sum of the squares for the female social dance group within cells score was .42815 with 14 degrees of freedom and the mean of the squares was .03058. The sum of the squares was .00560 with one degree of freedom and the mean of the squares was .00560. F was equal to .18322 and therefore F was not significant with a score of .675.

The sum of the squares for the female racketball group within cells score was .10302 with nine degrees of freedom and the mean of the squares was .01145. The sum of the squares for distance was .00968 with one degree of freedom and the square of the mean was .00968. F was equal to .84566 and therefore F was not significant with a score of .382.

Table 11

Table 11 shows the significance of F in regard to fitness for females in each group. The sum of the squares for the female aerobic dance group within cells score was 18.71429 with 62 degrees of freedom and the mean of the

Table 11

MANOVA: Fitness--Females

	Group	N	SS	df	MS	F	F Prob
Within Cell	Aerobic Dance	63	18.71429	62	.30184		
Fitness			1.78571			5.91603	.018
Within Cell	Jazz Dance	28	15.62500	27	.57870		
Fitness			.87500	1	.87500	1.51200	.229
Within Cell	Social Dance	15	6.46667	14	.46190		
Fitness			.03333	1	.03333	.07216	.792
Within Cell	Racketball	10	1.00000	9	.11111		
Fitness			0.0	1	0.0		1.000

squares was .30184. The sum of the squares for fitness was 1.78571 with one degree of freedom and the mean of the squares was 1.78571. F was equal to 5.91603 and therefore was significant with a score of .018 at the .05 level of significance.

The sum of the squares for the female jazz dance group within cells score was 15.62500 with 27 degrees of freedom and the mean of the squares was .57870. The sum of the squares for fitness was .87500 with one degree of freedom and the mean of the squares was .8750. F was equal to 1.51200 and therefore not significant with a score of .229.

The sum of the squares for the female social dance group within cells score was 6.46667 with 14 degrees of freedom and the mean of the squares was .46190. The sum of the squares for fitness was .03333 with one degree of freedom and the mean of the squares was .03333. F was equal to .07216 and therefore not significant with a score of .729.

The sum of the squares for the female racketball group within cells score was 1.00000 with nine degrees of freedom and the mean of the squares was .11111. The sum of the squares for fitness was 0.0 with one degree of freedom and the mean of the squares was 0.0. F was equal to 0.0 and therefore not significant with a score of 1.000.

The analysis of the data shows significance for the female aerobic dance group in toth distance (F prob = .000) and fitness (F prob = .018). No other group represented

showed significance in distance or fitness. As stated in this study, both hypotheses one and two hold true. Hypothesis three, however, proves to be null with significance in the female aerobic dance group.

Table 12

Table 12 is an ANOVA (F ratio) on groups having different instructors. The sum of the square for groups with different instructors within cells score was 1.21298 with 49 degrees of freedom and a mean of the squares of .02475. The sum of the squares for distance was .00851 with one degree of freedom and the mean of the squares was .00851. F was equal to .34394 and the significance of F was .560. The sum of the squares of the group by distance was .01565 with three degrees of freedom and the mean of the squares was .00522. F was equal to .21079 and therefore F was not significant with a score of .888.

Table 13

Table 13 shows the pretest distance for males in groups having different instructors. The sum of the squares between for the male group was .0777 with two degrees of freedom and the mean of the squares was .0388. The F ratio was equal to .815 and the F probability was equal to .4658 and therefore was not significant.

The sum of the squares within group score was .5719 with 12 degrees of freedom and the mean of the squares was

Table 12

ANOVA: Distance--Groups with Different Instructors

Source	SS	df	MS	F	F Prob
Within Cell	1.21298	49	.02475		
Distance	.00851	1	.00851	.34394	.560
Group by Distance	.01565	3	.00522	.21079	.888

Table 13

Tukey: Pretest Distance for Males with Different Instructors

Source	df	SS	MS	F Ratio	F Prob
Between Group	2	.0777	.0388	.815	.4658
Within Group	12	.5719	.0477		
Total	14	.6496			

.0477. The total sum of the squares was .6496 with 14 degrees of freedom.

Table 14

Table 14 shows the posttest distance for males in groups having different instructors. The sum of the squares between for the male group was .0962 with two degrees of freedom and the mean of the squares was .0481. The F ratio was equal to .892 and the F probability was .4354 and therefore was not significant.

The sum of the squares within group score was .6468 with 12 degrees of freedom and the mean of the squares was .0539. The total sum of the squares was .7430 with 14 degrees of freedom.

Table 15

Table 15 shows the pretest distance for females in groups having different instructors. The sum of the squares between for the female group was .1776 with three degrees of freedom and the mean of the squares was .0592. The F ratio was equal to 1.240 and the F probability was equal to .3103 and therefore was not significant.

The sum of the squares within group score was 1.6229 with 34 degrees of freedom and the mean of the squares was .0477. The total sum of the squares for females was 1.8005 with 37 degrees of freedom.

Table 14

Tukey: Posttest Distance for Males with Different Instructors

Source	df	SS	MS	F Ratio	F Prob
Between Group	2	.0777	.0388	.815	.4658
Within Group	12	.5719	.0477		
Total	14	.6496			

Table 15

Tukey: Pretest Distance for Females with Different Instructors

Source	df	SS	MS	F Ratio	F Prob
Between Group	3	.1776	.0592	1.240	.3103
Within Group	34	1.6229	.0477		
Total	37	1.8005			

Table 16

Table 16 shows the posttest distance for females in groups having different instructors. The sum of the squares between for the female group was .2286 with three degrees of freedom and the mean of the squares was .0762. The F ratio was equal to 1.429 and the F probability was equal to .2513 and therefore was not significant.

The sum of the squares within group score was 1.8128 with 34 degrees of freedom and the mean of the squares was .0533. The total sum of the squares was 2.0414 with 37 degrees of freedom. An analysis of the data revealed that no two groups with different instructors were significantly different at the .05 level.

Table 16

Tukey: Posttest Distance for Females with Different Instructors

Source	df	SS	MS	F Ratio	F Prob
Between Group	3	.2286	.0762	1.429	.2513
Within Group	34	1.8128	.0533		
Total	37	2.0414			

Chapter 5

Summary, Conclusions, Observations, and Recommendations

Summary

The purpose of this study was to determine the cardiovascular fitness gains of students in selected activities on the college level. The sample for this study consisted of two aerobic dance classes, two jazz dance classes, one social dance class, and two racketball classes of the physical education service program at Middle Tennessee State University in the fall semester of 1985. Each class ranged in subject number from 16 to 45. In all but two classes the researcher and instructor were the same person. The instructor for these two classes was the regularly assigned instructor. The experimental period lasted 12 weeks. Improvement in cardiovascular fitness level was determined by pretest and posttest scores on the Cooper Twelve-Minute Run-Walk Test. The .05 level was utilized to determine significance for the statistical analysis of data for this study.

A general unweighted means of analysis of variance (MANOVA) was used to determine if there was significance

between and among groups in the study. A pooled F ratio and a Tukey test were run on groups having different instructors (jazz dance and racketball) to determine significance of instruction.

Statistical analyses of the data revealed that there were significant gains in cardiovascular fitness levels and in distance gains at the .05 level of significance for the female aerobic dance group only. The jazz dance, social dance, and racketball groups showed no significant gains. Analyses also revealed that there were no significant differences in groups having different instructors.

Conclusions

Statistical treatment of the data showed that there were significant gains in cardiovascular fitness levels and in distance gains for the female aerobic dance group over a 12-week treatment period meeting two 50-minute workout sessions each week. There were no significant gains in cardiovascular fitness levels or in distance gains in jazz dance, social dance, or racketball for the 12-week period meeting two 50-minute sessions each week. There was no significant difference in the outcome of fitness level of subjects within groups having different instructors.

As established in chapter 2, many sources recommend three 50-minute workouts per week at 75%-85% max HR to elicit a training effect to improve the cardiovascular fitness level. Even sources on aerobic dance recommend

three days per week workout to elicit a training effect. Why, then, has this study shown significance in the aerobic dance group with only two weekly workouts? Why, too, is this significance limited only to the females representing the group? Perhaps the answers do not lie in the data collected in the formal investigation but in the popularity and seemingly quick results of aerobic dance itself.

Since the beginning of aerobic dance in the late 1960s (Sorensen, 1973), its popularity has grown tremendously. Originally, aerobic dance appealed and was acceptable more for the female than the male. In the past several years, however, many men have developed an interest in and respect for aerobic dance due, in part, to the benefits gained through participation. Though more men do participate in aerobic dance today, as attested by the numbers in this study, the majority of participants remain female.

On the basis of the findings of the analyses on the data for this study, the following conclusions were made:

1. A 12-week program of aerobic dance with two 50-minute treatments per week can produce a significant improvement in the cardiovascular fitness level of the subject.

2. Jazz dance, social dance, and racketball did not reveal significant increases of the cardiovascular fitness level of the subjects.

3. The difference in instructors in the jazz dance group and the racketball group proved not to be a significant factor in this study.

Observations

The observations made by the researcher during the experimental period were as follows:

1. With the exception of racketball, participation was stronger in number by the female subjects representing each group. There was equal participation in numbers by males and females in the racketball group.

2. Of the groups not showing significance in cardiovascular fitness level gains, the jazz dance group came the closest to significance with a score of .229. Addition of a third 50-minute workout per week may produce the significant cardiovascular fitness increase sought in this study.

3. The racketball class did not show significance. It is the researcher's belief, however, that the same pretest/posttest and treatment on an advanced level of racketball may produce similar levels of significance as those sought in this study. A beginner class spends much time in drill situations leaving little time for uninterrupted play. Additionally, the inclusion of a third 50-minute workout session to the beginner level may also produce significance.

4. The greater number of subjects in the aerobic dance group may have enhanced the significance of that group.

5. The accepted male stereotype behavior may explain the difference in significance in male and female subjects in the aerobic dance group.

6. Having different instructors within the representative groups produced no significance upon the outcome of the fitness testing. Therefore, different instructors, using comparable teaching techniques, will produce comparable results in fitness gains.

Recommendations

Based on the findings of this study, it is recommended that:

1. The study be carried out over an extended length of time (five years) on all service program activities offered at the college level to obtain a more complete log of expected cardiovascular gain.

2. The study should be conducted at higher education institutions of different types (i.e., small private institutions, church affiliated institutions, state institutions, etc.).

3. The study should seek to obtain data on a comparable number of subjects in sex and group in order to enhance the validity of the study.

4. Studies should be conducted in situations where one additional class meeting is added for a total of three

50-minute workout sessions per week to determine if the extra session could produce significance.

5. Studies should be conducted on beginning as well as advanced levels of each activity (when offered) to determine if skill/competence in the activity will enhance cardiovascular fitness gains.

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