A CORRELATION BETWEEN THE HARVARD STEP TEST AND THE OKLAHOMA STATE PROGRESSIVE STEP TEST

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PREFACE

Physical Fitness is a matter of current national concern. The President's Youth Fitness Council is pushing physical fitness to try to overcome the modern day living luxuries. Many aspects of this problem have been investigated in the past, but no one has made a correlation between these two tests. This study was the correlation of the Oklahoma State University Progressive Step Test with the Harvard Step Test.

This study is mainly concerned with cardio-vascular fitness. One's physical condition varies according to the demands placed upon the body. The person must be physically fit to respond to these circumstances. This could be the fitness needed by an athlete while at practice or in a game. This could be the fitness needed by a refinery worker who is doing exhaustive work or it could be the fitness needed for work around the home as well as on the job.

I thank my advisor, Dr. Aix B. Harrison for his guidance and assistance in the development of this study. Appreciation is also expressed to those who helped make this study possible, especially to those college students who participated in the study.

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CHAPTER I

INTRODUCTION

Physical Fitness is a term which has been rather difficult to define objectively. The simplest definition is: The capacity of an individual to perform a given task. Dr. Peter Karpovich, M. D. of Springfield College, Springfield, Massachusetts defines physical fitness as "a fitness to perform some specific task requiring muscular effort."[1] Dr. Bruno Balke of the University of Wisconsin states that "the best test of physical fitness would be man's ability to survive under extra-ordinary biological demands."[2]

There are several parts to Physical Fitness. Endurance is one of these areas. Endurance can be divided into two types, muscular and cardio-vascular. Authorities have agreed that endurance is the ability to continue work. This is limited by two factors: first, the willingness to work on in spite of the discomfort and pain or fatigue, and secondly, the capacity of the homeostatic mechanism to make rapid and extensive adjustment within the functioning organism.[3] This study

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[1]Peter V. Karpovich, Physiology of Muscular Activity (Philadelphia: 4th ed. W. B. Saunders Co., 1935), p. 260.

[2]Bruno Balke, "The Effect of Physical Exercise on the Metabolic Potential, A Crucial Measure of Physical Fitness," Exercise and Fitness (The Athletic Institute, Illinois, 1960), p. 73.

[3]John G. Bayless, A Metabolic Functional Capacity Test for Upper Elementary Age Boys (Unpublished Dissertation, Oklahoma State University, May, 1966, pp. 2-3.

is concerned with the cardio-vascular phase of endurance.

Much study has been done in the area of cardio-vascular fitness. Many people have done research on this problem in many different ways; however, no research was found based on the particular problem of this study, the correlation between the Harvard Step Test and the Oklahoma State University Progressive Step Test. Studies which have been made in this field of physical education have been of three types: (1) evaluating the cardio-respiratory potential for maximum aerobic energy expended, (2) muscular work and ability to recover, and (3) the amount of increase in pulse rate as a result of vigorous exercise.

There have been cardio-vascular tests conducted with adults, as well as with high school students and children. Balke's test for adult males utilized a treadmill to increase the work load. This test is generally recognized as a valid and reliable test for cardio-vascular fitness by medical doctors, physiologists and physical educators. The criterion for this test is the length of time the person can walk on a treadmill with a gradually increased work load until anaerobic work is reached.[4]

Balke has also experimented with a portable stepping device using both healthy and cardiac male subjects. He started these subjects stepping at the floor level, raising the step interval 2 cm. per minute.

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[4]Bruno Balke, pp. 73-81.

The Harvard Step Test was developed by Lucien Brouha and associates in the Harvard Fatigue Laboratories during World War II.[5] The test was constructed for the purpose of measuring the ability of the body to adapt itself to hard work and to recovery from the same. The test proved useful in classifying differences in fitness levels of young men into three groups: (least fit, fit, most fit.) On the basis of the test results it then became possible to prescribe conditioning programs based upon individual needs.[6] Original evidence of validity for the Harvard Step Test was based upon endurance in treadmill running, maximum heart rate per minute, and blood lactate level. Studies on Harvard undergraduates showed that athletes scored higher with less variable scores than did non-athletes, and increased their scores with more training; while termination of training, resulted in lower scores.

The advantages of the Harvard Step Test are: (1) the equipment necessary to administer the test is inexpensive, (2) the equipment needed is a 20 inch bench, a watch, and a metronome, (3) it is not time consuming and (4) almost anyone can administer the test. The disadvantages of this test are: (1) it is an exhaustive type test, many of the subjects cannot complete the stepping for the entire 5 minutes and (2) it is not known for sure if it actually measures cardio-vascular fitness or endurance.

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[5]Lucien Brouha, "The Step Test: A Simple Method of Measuring Physical Fitness for Muscular Work in Young Men," Research Quarterly, Vol. 14, No. 1, March, 1943.

[6]Donald K. Mathews, Measurement in Physical Education (Second Ed. Philadelphia and London: W. B. Saunders Co., 1963), p. 201.

The Oklahoma State University Progressive Step Test is a variation of the step test devised by Dr. Bruno Balke and Dr. Francis Nagle, of the Biodynamics Branch of the Federal Aviation Agency Research Center at Oklahoma City. The stepping machine was designed to be used in place of the treadmill. The test procedure was based on the same principle as that of the treadmill, but the "Stepper" is portable and relatively inexpensive. It is also easier to operate. Dr. Balke and Dr. Nagle built it for the purpose of testing endurance without having to use the treadmill. They were testing normal subjects and subjects with cardiac problems. It was necessary for them to have a machine that would start with a light work load and which could be used to gradually increase the work load to high levels. With this type of equipment, it was possible to devise a test procedure, where the subject reached a physiological level that was sub-maximal or not completely exhaustive.

Advantages of this test are: (1) a progressive work load can be attained, (2) pulse rates and blood pressures can be taken during the testing, (3) a number of tests can be administered on this device and (4) it is used to measure the same thing as the treadmill and yet is not as expensive. Some of the disadvantages of this test are: (1) it is rather expensive, (2) most schools will not have one of these steppers and (3) the tester must have knowledge of the machine and how to run it.

Statement of Problem

The purpose of this study was to determine the correlation be-

tween the Harvard Step Test and the Oklahoma State Progressive Step Test. These were given to college students from varied fields. The procedure was to compare two step tests, one utilizing a motorized stepping device and the other a 20 inch high bench.

Sub-Problems

Sub-problems were: (1) to compare the scores of the Physical Education majors and the students in another field of study on these tests and (2) to test the difference in cardio-vascular fitness between the majors and the non-majors.

Limitations of the Study

The number of subjects was limited and not a random sample, because of the fact that the administrator had to be able to have the subjects come in at their own available time.

CHAPTER II

REVIEW OF RELATED MATERIAL

Harvard Step Test

In 1942, Johnson, Brouha and Darling introduced the "Step Test" as a method of assessing one's physical fitness for strenuous exercise.[7] The test required a subject to step on a 20-inch bench at the rate of 30 steps per minute as long as he was able, or until the end of a five minute period and then the subject was asked to stop. The recovery pulse was then counted from 1-1½, 2-2½, and 3-3½ minutes after the stopping of the test.

Many studies of the Harvard Step test have been made. In one study because of the wide range of sizes in boys between the ages of 12 and 18, Gallagher and Brouha divided the boys into two groups by body surface area and two different sizes of benches were used.[8] The exercise involved in the test consisted of stepping up and down at the rate of 30 times a minute on a platform, the height of which was 18 inches for the smaller boys and 20 inches for the larger boys. The

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[7]R. E. Johnson, L. Brouha, and R. C. Darling, "A Test of Physical Fitness of Strenuous Exertion," Revue Canadienne de Biologie, Vol. 1, 1942, pp. 491.503.

[8]Lucien Brouha and Roswell J. Gallagher, "A Simple Method of Testing the Physical Fitness of Boys," Research Quarterly, Vol. 14, March, 1943, pp. 23-30.

same procedure, as that in the Harvard Step Test, was used with the exception that the test lasted for only four minutes. Everything else was the same.

These cardio-vascular tests have been correlated and related to other factors, such as (1) endurance and (2) strength. The original Harvard Step Test was validated on the basis of endurance in treadmill running, maximum heart rate per minute, and blood lactate level. In another study, Bookwalter used two forms of this test, the long form and the short form. The long form was an exercise on a 20 inch bench for as long a period as possible up to five minutes. The pulse was then counted from 1-1½, 2-2½, 3-3½ minutes after the test was stopped. The short form had the same procedure except that the pulse was taken for one 30 second period only.[9]

It was the purpose of Montoye's study to determine the relationship between the Fitness Index of the Harvard Step Test scores and several criteria of work performance.[10] Similar attempts have been made by others and their results were discussed by Montoye. He found that the number of experimental subjects in some instances was small. Furthermore, it seemed important that the subjects be conditioned to strenuous work before administering the Step Test and tests of work performance. Montoye concluded "despite the fact that work performance cannot be predicted from the Step Test scores, there is an appreciable

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[9]Thomas K. Cureton, Physical Fitness Appraisal and Guidance (C. V. Mosby Company, 1947), p. 175.

[10]Henry J. Montoye, "The Harvard Step Test," Revue Canadienne de Biologie, Vol. 4, 1952, pp. 491-99.

amount of evidence that the index does reflect the relative state of fitness of the cardio-vascular system." According to Montoye, the Fitness Index is not very closely related to one's ability to carry on strenuous work.

Montoye found the relationship between the Fitness Index and work performance in fifty college men who had participated in a strenuous conditioning program for three months.[11] Criteria of work performance consisted of a maximum number of sit-ups, a time on a half-mile run, and the duration of maximal performance on a frictional bicycle ergometer peddled at the rate of 20 miles per hour against four pounds of resistance. The computed co-efficients of correlation between the Step Test scores and the criteria were 0.285 and 0.091 respectively. These results corroborate the work of others indicating that there apparently was some slight relationship between the Fitness Index and height, weight or surface area. Although age in Montoye's study was statistically significant it was considered relatively unimportant. Montoye's conclusion was that the low correlation between the Fitness Index and measures of stature, weight and surface area was not surprising in view of the results of Bookwalter.[12]

Vera Skubic and Jean Hodgkins administered a test on the recovery pulse rates following a 3-minute step test. The data were obtained from 686 junior high school girls and 1,332 high school girls who were from 55 different secondary schools. The pulse rates were converted to

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[11] Ibid., pp. 491-499.

[12] K. W. Bookwalter, "A Study of the Brouha Step Test," Physical Education, Vol. 5, 1948, pp. 55.

cardio-vascular efficiency scores and from these, national standards were established for the 9-14 age group and for the 15-19 age group.[13]

OSU Progressive Step Test

Dr. Bruno Balke, used the treadmill to test for cardio-vascular fitness. This was done by having the subject walk on the treadmill, which was traveling at approximately 3.6 miles per hour. The slope of the treadmill was increased one percent from one working minute to the other, thus forcing adequate functional adaptations to increased energy demands.[14] The test ended when the heart or pulse rate reached 180 beats per minute. He was testing work capacity during gradually increased exercise.

Dr. Balke and R. T. Clark set up a fitness scale by which the subjects taking the Balke test could be evaluated. If the subjects stayed on the treadmill for a certain period of time, he was classified in one of the following categories:[15]

1. 5-11 minutes (very poor)
2. 12-14 minutes (poor)
3. 15-17 minutes (fair)
4. 18-20 minutes (good)
5. 21-23 minutes (very good)
6. 24-26 minutes (excellent)
7. 27-30 minutes (superior)

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[13]Vera Skubic and Jean Hodgkins, "Cardiovascular Efficiency Test Scores for Junior and Senior High School Girls in the United States," Research Quarterly, Vol. 35, No. 2, 1964, pp. 184-87.

[14]Bruno Balke, and R. T. Clark, "Cardio-Pulmonary and Metabolic Effects of Physical Training," Health and Fitness in the Modern World, (The Athletic Institute, 1961), pp. 82.

[15]Ibid., p. 84.

Dr. Balke and Dr. Nagle have also experimented with a motorized stepper using as subjects healthy and cardiac males. These researchers started the stepper at floor level and raised to 2 cm. each minute, with the top height being 40 cm.'s. This test was concluded when the subject's pulse rate reached 180 beats per minute. Dr. Balke and Dr. Nagle gave the following scale as their classification index for this step test:[16]

Minutes of Stepping	VO_2/ml/kg	Classification
11	25-30	Very Poor
14	30-35	Poor
16	35-40	Fair
20	45-50	Excellent
24	50-55	Superior

Nagle and Bedecki administered a test in which 44 subjects were given an all-out run test on a motor driven treadmill. The times for attaining heart rates of 150, 160, 170, 180 beats per minute were recorded, along with measurements of ventilation, oxygen uptake and carbon dioxide production. The correlation between heart rate times and the all-out run times increased with the heart rate. Correlation of .85 was calculated at the rate of 180 beats per minute. Using criteria established by Balke, it was demonstrated that the 180 heart rate served as a valid cut-off point in measuring circulorespiratory capacity under variable exercise stress conditions.[17]

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[16]Bruno Balke and Francis Nagle, A Personal Correspondence to Dr. A. G. Harrison, Biodynamics Branch of Federal Aviation Agency Research Center, Oklahoma City, Oct. 1964.

[17]Francis J. Nagle and Thomas G. Bedecke, "Use of the 180 Heart Rate Response as a Measure of Circulorespiratory Capacity," Research Quarterly, Vol. 34, No. 3, 1963, pp. 361-69.

Dr. A. B. Harrison has used the step test for numerous experiments on adults comprised of Oklahoma State University students and faculty. He conducted a study to determine the effects of a daily fifteen minute run on the physical fitness levels of a group of adult men. His results showed mean gains of varying sizes in all of the physical fitness items measured. The subjects showed improvements in all aspects of fitness tested, including decreases in the resting pulse rates and systolic blood pressures. They also showed weight losses in primarily fatty tissue for those who were overweight. Their mean Step Test scores increased from 6.8 minutes to 8.4 minutes, a gain of 1.6 minutes.[18]

Dr. Harrison also conducted a "Swim and Stay Fit Research Project" in which nine subjects completed a swim of 50 miles in segments of one quarter mile or more. The project covered a time period of four months. Physical Fitness tests, including the Oklahoma State Progressive Step Test, were administered before and after the program. The data collected, showed that there was a gain in all phases of fitness, with a decrease in the body weight, resting pulse and the resting systolic blood pressure.[19]

The following norms which were used for this study, were establish-

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[18]Aix B. Harrison, Effects of a Fifteen Minute Run Program on Physical Fitness of Adult Men (Unpublished Research Report, 1964).

[19]Aix B. Harrison, "Swim for Fitness," Physical Educator, Vol. 22, October, 1965, pp. 129-30.

ed by the testing of over 30 adult males at Oklahoma State University:

Minutes	Inches for Height	Fitness
10 and above	18 and above	Excellent
9	17	Very Good
8	16	Above Average
7	15	Average
6	14	Below Average
5	13	Poor
4	12	Very Poor
3	11	" "
2	10	" "
1	9	" "
0	8	" "

John Bayless, in 1965, established a progressive step test procedure for elementary school boys and administered it to approximately 30 boys. He started the stepping at 4 inches and raised it one inch every minute. Using oxygen intake measures as a criterion, he concluded that this test was a valid measure of metabolic functional capacity or endurance.[20]

A similar study on elementary school girls was conducted by Mrs. Mary Frye in 1966. She used the same procedure and concluded that the Progressive Step Test, starting at a height of four inches was a valid endurance test for elementary school girls.[21]

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[20]John G. Bayless, A Metabolic Functional Capacity Test for Upper Elementary Age Boys (Unpublished Dissertation, Oklahoma State University, 1966).

[21]Mary Frye, A Progressive Step Test for Elementary School Girls (Unpublished Masters Thesis, Oklahoma State University, 1966), 50 pages.

CHAPTER III

METHODOLOGY

The Harvard Step Test and the Oklahoma State University Progressive Step Test were administered to thirty male students at Oklahoma State University. The subjects for this study were volunteers from various fields of study, with fifteen being physical education majors and fifteen non-majors. They were all students at Oklahoma State University and were all between the ages of twenty and twenty-two. The instruments used in this test were the following: (1) a motor driven stepping machine, (2) a timer, (3) a metronome, (4) a stethoscope, (5) a sphygmomanometer, and (6) a 20 inch high bench.

The tests used were the Harvard Step Test and the Oklahoma State University Progressive Step Test. The Harvard Step Test was administered by having the subjects stand in front of a bench, 20 inches high. Emphasis was placed on the method and rhythm used in stepping. The metronome was set at 120 beats per minute. This meant that each time the metronome clicked, the subject was to have either stepped up or down with one foot. The count went as follows: left foot up, right foot up, left foot down, right foot down. This was a four count rhythm.[22] The subject was to breathe normally and straighten the

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[22]Carl E. Willgoose, Evaluation in Health Education and Physical Education (McGraw-Hill Book Company, Inc., New York-Toronto-London, 1961), p. 117.

knees completely on top of the bench. On the word "go," the subject started the stepping procedure. The subject continued the stepping procedure for five minutes or until exhausted, whichever occurred first. At the end of five minutes, the subject stopped and was immediately seated. One minute after the subject sat, the pulse rate was taken for 30 seconds and recorded. Then thirty seconds later another pulse count was taken for the same amount of time and recorded. Three minutes after the finish, the pulse rate was taken for another 30 seconds, for the final time. Thus, the pulse rate was taken every minute for three minutes. The Index of Physical Fitness was then found by putting the readings into the following formula:

$$\text{Index of P.F.} = \frac{100 \times \text{duration of exercise (seconds)}}{2 \times \text{total pulse counts in recovery}}$$

The Oklahoma State Progressive Step Test had a different procedure. The test was administered on a portable, motorized stepping device which was designed and built for this purpose by the Federal Aviation Agency, Oklahoma City, Oklahoma. The stepping platform could gradually be raised from ground level to a height of 20 inches by simply operating a toggle switch. This allowed the platform to be set at any height desired while work was being performed. In this test, the platform was raised during the last fifteen seconds of every minute during the test. It was estimated from previous tests, that an average subject would take from seven to nine minutes to complete the test. The complete testing procedure took approximately 10 minutes plus the amount of time the subject stepped. The test was administered by starting with a stepping height of 8 inches and increased one inch every minute of the exercise. The same stepping pro-

cedure was used as in the Harvard Step Test, but in this test the subject did not stop at the end of five minutes. The metronome was set at 120. This made the subject step at a rate of 30 steps per minute. The subject was to continue until his pulse rate reached 180 beats per minute. The stepping machine was raised one inch every minute until the end of the test. The pulse rate was taken every minute, but for a 15 second count. The stethoscope was taped onto the chest where the heart rate could easily be heard. The blood pressure was also taken. It was taken by taping a stethoscope over the ante-cubital space just below the elbow and was recorded every minute. This measured the raising and lowering of the systolic and diastolic blood pressures. After the pulse rate reached 180 beats per minute, the subject was told to stop and to rest. No pulse rate was taken after the finish of the stepping. The criterion measure on this test was how many minutes the subject stepped before his pulse rate reached 180 beats per minute.

There have been no norms published for this particular test. The norms used for this test were based on the findings of tests given to over 30 adult males at Oklahoma State University. The following is the table of norms:

Height in inches	Minutes	Fitness
18 and over	10 and over	Excellent
17	9	Very Good
16	8	Above Average
15	7	Average
14	6	Below Average
13	5	Poor
12	4	Very Poor
11	3	Very Poor
10	2	Very Poor
9	1	Very Poor

The scores for the two tests were correlated. Graphs were drawn comparing mean scores of the physical education majors with the mean scores of the subjects in other fields. These means were then compared by the t-ratio to test for significance of difference.

CHAPTER IV

RESULTS

This study was carried out to find the correlation between the Harvard Step Test and the Oklahoma State Progressive Step Test. It was devised to enable comparison of the scores of Physical Education Majors with those of Non-Majors on these two tests.

The number of stepping minutes attained on the Oklahoma State Progressive Step Test was correlated with the Physical Fitness Index scores on the Harvard Step Test.

The analysis of the experimental data showed that there was a significant correlation existing between the two tests. The correlation of .39 was significant at the 5% level of confidence. A significant correlation means that it is reasonable to assume that a functional relationship exists between the variables. This does not mean that the two tests were equal, but that they measured some of the same qualities. The scores for the two tests were plotted on a Scattergram for grouping and correlated using the Pearson Product Moment Correlation.

$$r = \frac{\frac{\Sigma x' y'}{n'} - (\bar{x})(\bar{y})}{(\sigma_{x_1})(\sigma_{x_2})}$$

There were 15 Physical Education Majors and 15 Non-Majors compared on the 2 tests. The mean score, on the Harvard Step Test, for

Physical Education Majors was 65.73; while the results were 61.6 for the Non-Majors. The t-ratio for the 2 groups was 1.85 on the Harvard Step Test. This is significant at the 10% level of confidence.

The investigator found, after testing the same subjects on the Oklahoma State Progressive Step Test, that the mean score for Physical Education Majors was 8.1, while the results for the Non-Majors was 7.6. The t-ratio for the two groups on this test was .54. This was not statistically significant. This low t-ratio may be due to the units of measurement in the Oklahoma State University Progressive Step Test which do not allow continuous measurement or fine discrimination. If these scores could have been computed in seconds, there might have been a significant difference.

The formula used to compute the t-ratio was:

$$T^2 = \frac{(\Sigma X_1 - \Sigma X_2)^2 (N-1)}{L_1 + L_2} \qquad L_1 = n_1 \Sigma X_1^2 - (\Sigma X_1)^2 \qquad L_2 = n_2 \Sigma X_2^2 - (\Sigma X_2)^2$$

This was used because the number of subjects in each sample was equal but not paired.[23]

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[23]A. T. Slater-Hammel, "Computational Design for Evaluating the Significance of a Difference Between Means," Research Quarterly, Vol. 36, No. 2, May, 1965, pp. 212-215.

HARVARD STEP TEST

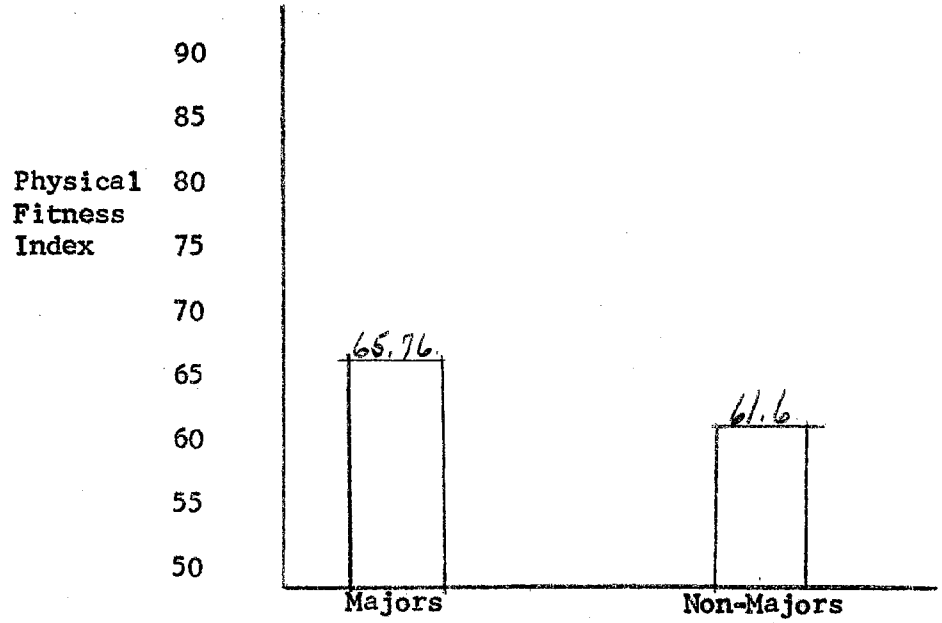

Figure 1. Group Mean

OKLAHOMA STATE PROGRESSIVE STEP TEST

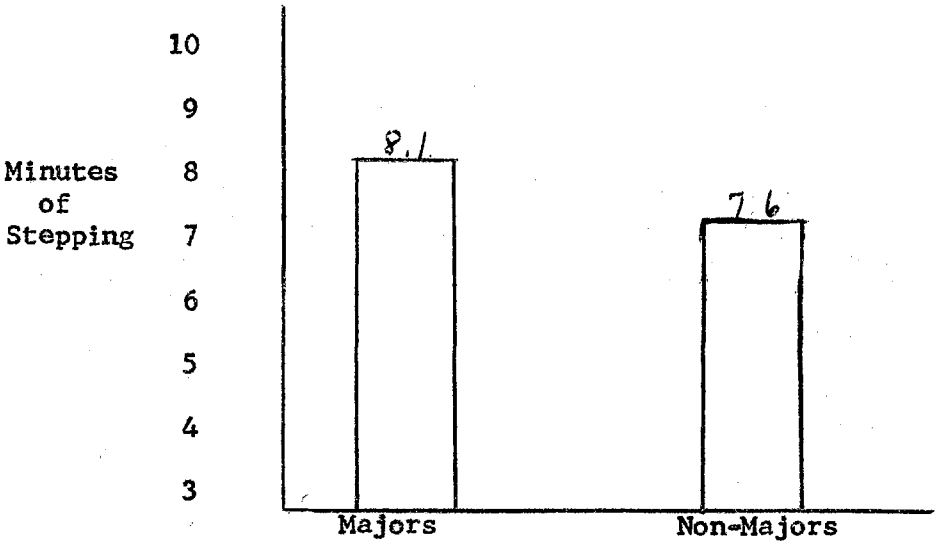

Figure 2. Group Mean

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

After this investigation the following conclusions seem warranted.

1. A comparison of the two tests showed that the correlation was .39. This is significant at the 5% level of confidence. This does not mean that the two tests were equal, but that they measured some of the same qualities incorporated in the two tests.
2. There apparently was a difference between the Physical Education Majors and Non-Majors in this study on the time that each could continue the OSU Progressive Step Test before reaching the crest load.
3. There was a significant difference at the 10% level of confidence between the Physical Education Majors and Non-Majors studied on the Harvard Step Test.
4. The mean Physical Fitness Index score on the Harvard Step Test for Physical Education Majors was 65.73, while the results were 61.6 for Non-Majors.
5. The mean score on the Oklahoma State Progressive Step Test was 8.1 minutes for Physical Education Majors, while the results were 7.6 minutes for Non-Majors

The following are recommendations for future studies.

1. Further testing in this area should be done with greater numbers of subjects for the purpose of verifying the results of this study.
2. Add more variables to the scope of this study, specific suggestions would be oxygen intake and oxygen debt figures during both of the tests.

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APPENDIX

RATE DATA

PHYSICAL EDUCATION MAJORS

	Oklahoma State Progressive Step Test			Harvard Step Test	
	Blood Pressure	Pulse Rate	Minutes	Pulse Rate After Exercise	Minutes
Subject I	124/72	24	1	90	1
	130/72	28	2	68	2
	136/72	32	3	56	3
	140/70	36	4		
	145/70	37	5		
	148/72	40	6	PFI = 70	
	152/74	42	7		
	156-70	44	8		
	160/70	45	9		
Subject II	118/80	22	1	77	1
	122/80	26	2	52	2
	126/80	30	3	46	3
	130/82	33	4		
	134/80	36	5		
	136/82	39	6	PFI = 85	
	139/82	40	7		
	144/82	42	8		
	148/80	44	9		
	152/78	45	10		
Subject III	118/80	24	1	80	1
	120/82	28	2	68	2
	132/80	33	3	52	3
	140/76	36	4		
	144/78	37	5		
	152/78	40	6	PFI = 75	
	158/78	42	7		
	162/78	45	8		
Subject IV	126/70	28	1	98	1
	134/70	34	2	94	2
	140/68	40	3	82	3
	144/68	42	4		
	148/68	44	5	PFI = 54	
	154/66	45	6		

Subject V	115/66	26	1	82	1
	118/68	32	2	58	2
	124/68	34	3	50	3
	128/70	35	4		
	129/70	37	5		
	136/70	39	6	PFI = 78	
	137/70	40	7		
	140/70	41	8		
	142/70	42	9		
	144/70	45	10		
Subject VI	126/70	28	1	98	1
	130/70	33	2	90	2
	135/74	38	3	80	3
	140/72	40	4		
	146/70	42	5	PFI = 56	
	148/70	45	6		
Subject VII	115/66	24	1	86	1
	118/68	30	2	78	2
	128/70	32	3	68	3
	136/70	35	4		
	140/70	38	5	PFI = 64	
	142/72	40	6		
	144/72	43	7		
	138/70	45	8		
Subject VIII	112/60	20	1	86	1
	118/60	24	2	70	2
	124/64	26	3	54	3
	126/64	30	4		
	129/64	34	5	PFI = 71	
	130/66	38	6		
	134/66	40	7		
	138/64	42	8		
	142/62	43	9		
	142/60	45	10		
Subject IX	116/68	20	1	94	1
	130/69	26	2	86	2
	134/69	33	3	81	3
	140/70	36	4		
	142/70	41	5	PFI = 57	
	146/70	45	6		

Subject X	118/64	20	1	86	1
	122/66	26	2	72	2
	128/66	32	3	62	3
	134/68	35	4		
	136/66	39	5	PFI = 68	
	139/65	40	6		
	142/65	42	7		
	146/64	44	8		
	146/64	45	9		
Subject XI	118/72	23	1	90	1
	124/72	28	2	82	2
	130/74	35	3	70	3
	135/72	39	4		
	139/70	40	5	PFI = 62	
	143/70	43	6		
	146/70	45	7		
Subject XII	124/68	25	1	96	1
	136/68	33	2	84	2
	140/70	37	3	78	3
	144/70	37	4		
	144/70	41	5	PFI = 62	
	149/70	42	6		
	149/70	43	7		
	144/69	45	8		
Subject XIII	118/72	22	1	94	1
	122/72	30	2	88	2
	128/70	33	3	76	3
	132/70	36	4		
	137/72	39	5	PFI = 58	
	140/72	41	6		
	142/72	44	7		
	140/70	45	8		
Subject XIV	118/72	24	1	96	1
	126/72	27	2	88	2
	133/74	30	3	77	3
	137/76	34	4		
	140/74	38	5	PFI = 57	
	144/74	41	6		
	146/72	42	7		
	148/72	44	8		
	148/72	45	9		

Subject XV	122/70	22	1	90	1
	127/72	26	2	68	2
	131/72	32	3	58	3
	136/70	36	4		
	140/68	39	5	PFI = 69	
	144/68	40	6		
	146/68	41	7		
	148/66	45	8		

NON-PHYSICAL EDUCATION MAJORS

Subject I	120/70	28	1	98	1
	126/70	32	2	85	2
	134/72	36	3	76	3
	138/70	38	4		
	142/72	42	5	PFI = 58	
	145/70	44	6		
	148/70	45	7		
Subject II	120/70	22	1	86	1
	126/74	28	2	72	2
	130/74	32	3	52	3
	133/72	36	4		
	138/72	38	5	PFI = 71	
	142/70	41	6		
	146/70	45	7		
Subject III	122/70	28	1	94	1
	130/72	34	2	88	2
	136/72	36	3	79	3
	140/70	40	4		
	144/68	42	5	PFI = 57	
	149/68	44	6		
	152/68	45	7		
Subject IV	115/60	20	1	88	1
	118/60	23	2	76	2
	125/60	28	3	68	3
	128/62	31	4		
	132/62	33	5	PFI = 64	
	132/64	33	6		
	135/64	36	7		
	137/64	38	8		
	137/62	40	9		
	140/60	45	10		

Subject V	118/70	22	1	86	1
	122/70	26	2	78	2
	128/72	28	3	72	3
	133/72	33	4		
	136/70	36	5	PFI = 63	
	140/70	38	6		
	144/68	40	7		
	148/68	42	8		
	148/68	44	9		
	150/68	45	10		
Subject VI	112/68	25	1	96	1
	120/69	34	2	84	2
	130/72	39	3	78	3
	136/70	40	4		
	140/70	43	5	PFI = 58	
	138/69	45	6		
Subject VII	115/64	22	1	92	1
	124/64	26	2	80	2
	128/66	32	3	70	3
	133/69	36	4		
	138/69	38	5	PFI = 62	
	142/68	41	6		
	142/66	45	7		
Subject VIII	124/74	26	1	102	1
	128/74	32	2	94	2
	135/77	37	3	86	3
	140/76	40	4		
	144/74	44	5	PFI = 53	
	148/74	45	6		
Subject IX	122/70	22	1	92	1
	122/70	24	2	66	2
	126/70	30	3	58	3
	130/72	34	4		
	137/74	37	5	PFI = 69	
	140/75	39	6		
	143/74	41	7		
	148/72	43	8		
	152/70	45	9		

Subject X	114/67	18	1	82	1
	128/70	24	2	74	2
	136/68	28	3	54	3
	142/69	30	4		
	144/70	34	5	PFI = 71	
	148/70	38	6		
	152/70	40	7		
	154/70	43	8		
	152/70	45	9		
Subject XI	110/68	26	1	104	1
	120/69	34	2	96	2
	128/70	38	3	88	3
	134/70	40	4		
	140/70	43	5	PFI = 52	
	138/69	45	6		
Subject XII	115/64	22	1	102	1
	122/64	28	2	98	2
	128/68	32	3	88	3
	135/69	38	4		
	139/69	42	5	PFI = 52	
	140/68	45	6		
Subject XIII	118/65	19	1	90	1
	120/65	27	2	78	2
	126/62	32	3	70	3
	132/64	33	4		
	136/65	34	5	PFI = 63	
	139/66	36	6		
	142/66	38	7		
	142/66	42	8		
	144/65	45	9		
Subject XIV	126/68	26	1	88	1
	138/70	37	2	78	2
	142/68	38	3	70	3
	144/70	38	4		
	146/72	39	5	PFI = 63	
	150/70	40	6		
	148/68	45	7		
Subject XV	118/72	24	1	88	1
	122/72	30	2	70	2
	128/70	34	3	62	3
	132/72	37	4		
	138/74	40	5	PFI = 68	
	140/70	42	6		
	142/70	43	7		
	140/70	45	8		

VITA

Glen Lee Stolhand

Candidate for the Degree of

Master of Science

Thesis: A CORRELATION BETWEEN THE HARVARD STEP TEST AND THE OKLAHOMA STATE PROGRESSIVE STEP TEST

Major Field: Health, Physical Education, and Recreation

Biographical:

Personal Data: Born at Ponca City, Oklahoma, July 1, 1943, the son of Mr. and Mrs. H. R. Stolhand.

Education: Attended school at St. Marys Catholic School in Ponca City, Oklahoma. Graduated from St. Marys in 1961. Then attended Oklahoma State University at Stillwater, Oklahoma, where I majored in Health, Physical Education, and Recreation. Received a Bachelor of Science Degree in May, 1965. Entered Graduate School at Oklahoma State University in the fall of 1966; completed requirements for Masters Degree July, 1966.

Professional Experience: Graduate Assistant at Oklahoma State University, spring of 1966; was Athletic Director of West Bennett Hall for two years; belong to the Oklahoma and National Associations of Health, Physical Education, and Recreation and also a member of the Pemm Club, which is the Physical Education major and minor club.