

EFFECTS OF WEIGHT TRAINING ON MOTOR ABILITY AND
PHYSICAL FITNESS FOR FRESHMAN AT KANSAS STATE UNIVERSITY

by 590

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INTRODUCTION

Prior to World War II the practice of weight training was confined largely to competitive weight lifters and to professional or amateur "strong men." Athletes in general carefully avoided the weights, as their coaches and trainers solemnly warned them that their use would make a man muscle-bound, or "strain his heart," whatever this might mean. The fact that the situation is now so different resulted largely from the pioneering efforts of an Army surgeon, Thomas L. DeLorme, M. D., during World War II. Himself a weight lifter, DeLorme was instrumental in introducing the equipment and techniques of this method of training into the Army's orthopedic treatment procedures. The publication of his Progressive Resistance Exercise in 1951 marked the beginning of a whole new era in this form of exercise.

Once the use of weights was made respectable by the medical profession, the opposition of coaches and physical educators quickly evaporated. As a result, this method of training experienced a tremendous growth of public interest.¹

As a result of this growth, the medical profession has made considerable use of weight training in the rehabilitation of weakened muscles. The majority of muscle rehabilitation centers today use weight training as the basis for most of their muscle strengthening programs.²

If weight training will strengthen the weakened muscle to normalcy it made sense to physical educators and coaches that a well planned

¹Philip J. Rasch, Weight Training, (Dubuque, Iowa: William C. Brown Company Publishers, 1966), p. 1.

²Alfred Steinberg, "How to Build a Better Body," Readers Digest, 86:102-105, March, 1965.

program should make the normal muscle stronger thus contributing to a more physically capable individual.

Body strength must always be of primary concern to the physical educator, as upon it depends the individual's ability to learn physical skills, to maintain body vigor, and to resist fatigue. Moreover, endurance is based upon strength. No one can maintain prolonged muscular effort if he is physically weak and puny.

Strength is a prerequisite to the development of endurance and speed. Along with strength comes the cosmetic value of weight training.

It has been observed that the main reason many students enroll in a body building or weight lifting class is the cosmetic or esthetic value which is derived from increased size of the muscular tissue.³

Weight training properly supervised can attract many boys who would like to participate in athletics but lack the physical size, strength, and stamina needed. A youngster does not need to have athletic prowess to train with weights, but should have a desire for physical self-improvement. Increased strength and better muscle tone can usually be observed in an individual after five or six weeks of training, thus serving as an additional incentive to the boy to continue the program.⁴

There is a tendency for the quiet, shy types of young men to gravitate to this activity. As these withdrawn individuals continue their training, they may be observed picking up self-confidence.

³E. C. Davis and G. A. Logan, Muscular Activity, (Dubuque, Iowa: William C. Brown Company Publishers, 1961), p. 62-64.

⁴John Lambrosa, "Weight Training for Teenagers," Recreation, 57:516, December, 1964.

Many troubled youngsters will work off aggressions on the weights and develop many good habits such as self discipline, determination, working together, planning of a training program, and the setting and achieving of goals. All of these values carry over and apply to living as well as sport.⁵

PURPOSE OF THE STUDY

While the weight training image has gained much status in athletics and the majors physical education program there are many who still question its importance to the physical well being of the average college student. The purpose of this study was to illustrate how much improvement can be attained through a well planned, well supervised weight training program.

PROCEDURE OF STUDY

The group used in this study were all freshmen enrolled in basic physical education at Kansas State University. The young men varied greatly in physical size, strength, and abilities. The subjects in the study were given a battery of tests, placed on a vigorous weight training program for ten weeks, and retested at the end of the semester. One hundred students are represented in this study.

The first two class meetings were used to administer the Barrow's Motor Ability Test, which consists of three skills: The zig zag run, the standing long jump, and the medicine ball put.⁶

⁵Robert Cook, "Recreation Weight Training," Recreation, 57:30-31, January, 1964.

⁶Harold M. Barrow, "Test of Motor Ability for College Men," Research Quarterly, October, 1954, 25:253.

Each students efforts were recorded and scored according to norms established by Barrow.⁷ The procedures and norms used are as follows:

ZIG ZAG RUN

Each student was permitted one trial. He started at point X and ran through the prescribed course three times. His time was recorded to the nearest tenth of a second. This was to be run as fast as possible.

Figure 1 illustrates course followed.

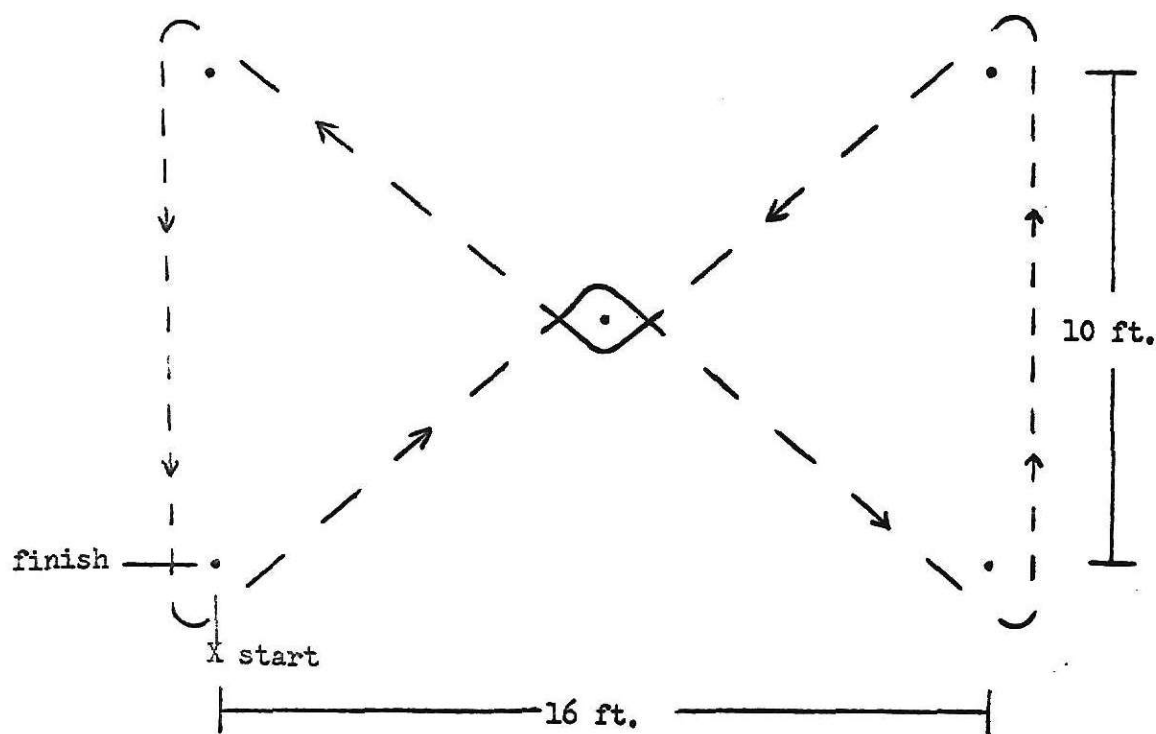


FIGURE 1.

Table 1 gives norms used for zig zag run.

⁷Ibid.

TABLE I
NORMS USED FOR ZIG ZAG RUN

Time/Sec.	Score	Time/Sec.	Score	Time/Sec.	Score
17.5	100	22.7	66	27.8	33
17.6	99	22.8-22.9	65	27.9-28.0	32
17.7-17.8	98	23.0	64	28.1	31
17.9	97	23.1-23.2	63	28.2-28.3	30
18.0-18.1	96	23.3	62	28.4-28.5	29
18.2	95	23.4-23.5	61	28.6	28
18.3-18.4	94	23.6	60	28.7-28.8	27
18.5	93	23.7-23.8	59	28.9	26
18.6-18.7	92	23.9	58	29.0-29.1	25
18.8	91	24.0-24.1	57	29.2	24
18.9-19.0	90	24.2	56	29.3-29.4	23
19.1	89	24.3-24.4	55	29.5	22
19.2-19.3	88	24.5-24.6	54	29.6-29.7	21
19.4	87	24.7	53	29.8-29.9	20
19.5-19.6	86	24.8-24.9	52	30.0	19
19.7	85	25.0	51	30.1-30.2	18
19.8-19.9	84	25.1-25.2	50	30.3	17
20.0-20.1	83	25.3-25.4	49	30.4-30.5	16
20.2	82	25.5	48	30.6	15
20.3-20.4	81	25.6-25.7	47	30.7-30.8	14
20.5	80	25.8	46	30.9	13
20.6-20.7	79	25.9-26.0	45	31.0-31.1	12
20.8-20.9	78	26.1	44	31.2	11
21.0	77	26.2-26.3	43	31.3-31.5	10
21.1-21.2	76	26.4	42	31.5	9
21.3	75	26.5-26.6	41	31.6-31.7	8
21.4-21.5	74	26.7	40	31.8	7
21.6	73	26.8-26.9	39	31.9-32.0	6
21.7-21.8	72	27.0-27.1	38	32.1	5
21.9	71	27.2	37	32.2-32.3	4
22.0-22.1	70	27.3-27.4	36	32.4-32.5	3
22.2	69	27.5	35	32.6	2
22.3-22.4	68	27.6-27.7	34	32.7-32.8	1
22.5-22.6	67				

STANDING LONG JUMP

Each student was permitted one practice jump and three trials. The distance of the best trial, measured to the nearest inch, was recorded. Point of jump was marked at the landing point nearest the take off line. Table II gives norms used for standing long jump.

TABLE II
NORMS USED FOR STANDING LONG JUMP

Distance	Score	Distance	Score	Distance	Score	Distance	Score
11'1"	100	9'3"	75	7'7"	50	5'11"	25
11'0"	99	9'2"	74	7'6"	49	5'10"	24
10'11"	98	9'1"	73	7'5"	48	5'9"	23
10'10"	97		72		47	5'8"	22
10'9"	96	9'0"	71	7'4"	46		21
10'8"	95	8'11"	70	7'3"	45	5'7"	20
10'7"	94	8'10"	69	7'2"	44	5'6"	19
10'6"	93	8'9"	68	7'1"	43	5'5"	18
10'5"	92		67		42		17
10'4"	91	8'8"	66	7'0"	41	5'4"	16
10'3"	90	8'7"	65	6'11"	40	5'3"	15
10'2"	89	8'6"	64	6'10"	39	5'2"	14
	88	8'5"	63	6'9"	38	5'1"	13
10'1"	87		62		37		12
10'0"	86	8'4"	61	6'8"	36	5'0"	11
9'11"	85	8'3"	60	6'7"	35	4'11"	10
9'10"	84	8'2"	59	6'6"	34	4'10"	9
	83	8'1"	58	6'5"	33	4'9"	8
9'9"	82		57		32		7
9'8"	81	8'0"	56	6'4"	31	4'8"	6
9'7"	80	7'11"	55	6'3"	30	4'7"	5
9'6"	79	7'10"	54	6'2"	29	4'6"	4
9'5"	78	7'9"	53	6'1"	28	4'5"	3
	77		52		27		2
9'4"	76	7'8"	51	6'0"	26	4'4"	1

MEDICINE BALL PUT

Each student was permitted one practice put and three trial puts. The distance of the best trial, measured to the nearest half foot, was recorded. A six pound medicine was used in this event. The ball was to be pushed, not thrown. Table III gives norms used for medicine ball put.

TABLE III
NORMS USED FOR MEDICINE BALL PUT

Distance	Score	Distance	Score	Distance	Score	Distance	Score
72'	100	56-56.5'	75	40'	50	24'	25
71.5'	99	55.5'	74	39.5'	49	23.5'	24
70.5-71'	98	55'	73	38.5-39'	48	22.5-23'	23
70'	97	54.5'	72	38'	47	22'	22
69.5'	96	53.5-54'	71	37.5'	46	21.5'	21
69'	95	53'	70	37'	45	21'	20
68-68.5'	94	52.5'	69	36-36.5'	44	20-20.5'	19
67.5'	93	51.5-52'	68	35.5'	43	19.5'	18
67'	92	51'	67	35'	42	19'	17
66.5'	91	50.5'	66	34.5'	41	18.5'	16
65.6-66'	90	50'	65	33.5-34'	40	17.5-18'	15
65'	89	49-49.5'	64	33'	39	17'	14
64.5'	88	48.5'	63	32.5'	38	16.5'	13
64'	87	48'	62	32'	37	15.5-16'	12
63-63.5'	86	47-47.5'	61	31-31.5'	36	15'	11
62.5'	85	46.5'	60	30.5'	35	14.5'	10
62'	84	46'	59	30'	34	14'	9
61.5'	83	45.5'	58	29-29.5'	33	13.5'	8
60.5-61'	82	44.5-45'	57	28.5'	32	12.5-13'	7
60'	81	44'	56	28'	31	12'	6
59.5'	80	43.5'	55	27.5'	30	11.5'	5
59'	79	42.5-43'	54	26.5-27'	29	10.4-11'	4
58-58.5'	78	42'	53	26'	28	10'	3
57.5'	77	41.5'	52	25.5'	27	9.5'	2
57'	76	40.5-41'	51	24.5-25'	26	9'	1

The third class period was used to measure each student anatomically. A plastic measuring tape was used to measure the neck, chest, right and left bicep, right and left forearm, and the waist. No measurements were made in regards to the lower body although the training program did include some leg exercise. The subjects body weight was also recorded at this time. For the sake of conciseness only the body weight, chest, bicep, and forearm measurements were used in this study.

On the fourth day each student was given tests relative to body strength and endurance. A standard barbell was loaded with 75 pounds of weight and each student was instructed to perform one repetition of the bench press.

The bench press is performed lying on a bench, the barbell was handed to the student so that it was directly above his chest, the bar was grasped in an overhand grip. The bar was then lowered to the chest, the repetition was completed when the bar was pushed to arms length over the chest or the starting position.

If successful with the 75 pound weight he was given the opportunity to try a heavier weight. This was continued until each student achieved his individual maximum.

After completing the bench press portion of the test, each student was tested in the olympic press in the same manner to achieve a maximum effort.

The olympic press was performed in a standing position, the barbell grasped in an overhand grip at the chest, from the chest the weight was then pushed to an overhead position until the elbows assume a locked

position. In this lift each student was instructed to perform the press with no body movement, knees locked throughout the press. The maximum single effort in these two exercises were referred to as their power index.

On the fifth and final day of testing each student was tested for weight training endurance. A barbell with 100 pounds was used for the bench press, each student performed as many repetitions as possible with this weight.

Upon completion of the bench press, the olympic press was then performed for repetitions with 75 pounds. The maximum number of repetitions was referred to as their endurance index.

THE TRAINING PROGRAM

On the sixth day the students were given instructions for their training program which was as follows:

1. The bench press -- As described in Procedure of Study.
2. The olympic press -- As described in Procedure of Study.
3. The barbell curl -- This exercise was performed in standing position. The bar was grasped in an underhand grip with arms hanging fully extended at sides, hands about shoulder width apart. The weight was then moved to a position at the chest, just under the neck. The effort was to be made by biceps only, body swing not permitted.
4. Upright rowing.-- The barbell was grasped using the overhand grip, use a narrow grip and pull the bar up to just below the chin. In performing this exercise properly, it was very important to keep the elbows in a high position. When the

repetition has been completed the elbows should be in a position well above shoulder level.

5. Tricep press -- The barbell was grasped in the over-hand narrow grip, the bar was then brought to a position behind the neck with the elbows held high. The upper arms should maintain a constant high position, the bar was then raised to the overhead position by moving only the lower arm or forearm.
6. The half squat -- With a heavily loaded barbell resting on the shoulder, the student lowers himself to a position such that the thigh was parallel to the floor. The exercise was completed when the student returned to a standing position. Effort should be made to keep the upper body in an upright position throughout the lift, too much body lean may result in an unnecessary strain on the lower back.
7. Bent-leg sit ups -- On either a flat surface or an incline board, with or without a weight held behind the neck, student secures feet and lies in a prone position with knees raised, hands behind head, then pulls upper body to point where there was no longer a strain on the abdomen. The upper body is then lowered to approximately four inches above the starting surface, this completes the repetition. The student at no time was allowed to make contact with starting surface until prescribed repetitions were completed, this assures constant flexion of the abdominal area.
8. Leg lifts -- On either a flat surface or an incline board, with or without weight attached to feet, student raised legs

to a perpendicular position, then lowered legs to approximately four inches above starting surface, this completed the repetition. The student was at no time to allow legs to make contact with starting surface until completion of prescribed repetitions. This assures constant flexion of the abdominal muscles.

Each student was instructed to perform each of these exercises in sets of two, a set being the performance of a recommended number of repetitions. The recommended number of repetitions being no less than five and no more than ten for any of these exercises. The first set of each exercise was to be performed with a weight which could be handled for seven to ten repetitions, the second set was to be heavier, allowing only five to seven repetitions. The determination of amount of weight was left to the individual, not the instructor. If progress was to be made each student was to extend himself every set for a maximum effort, never quit on an easy repetition.

This program was followed twice a week, either Monday and Wednesday, or Tuesday and Thursday, for ten weeks of the semester. All students were encouraged to work out a third time each week, no effort was made to check the frequency of additional work.

RESULTS OF TESTS

Table of measurement before and after training program is shown in Table IV on following pages.

TABLE IV

TABLE OF MEASUREMENT BEFORE AND AFTER TRAINING PROGRAM

	WEIGHT (Gain or Loss)	CHEST (Gain or Loss)	BICEP (Gain or Loss)	FOREARM (Gain or Loss)
1.	169--172 (3)	42.25 - 44.00 (1.75)	12.50 - 13.00 (.50)	11.25 - 11.75 (.50)
2.	203 - 210 (7)	43.75 - 44.25 (.50)	15.00 - 14.75 (-.25)	12.50 - 12.75 (.25)
3.	155 - 163 (8)	39.25 - 40.50 (1.25)	12.75 - 13.00 (.25)	11.75 - 12.00 (.25)
4.	184 - 182 (-2)	42.00 - 43.25 (1.25)	13.50 - 14.00 (.50)	12.50 - 12.50 (.00)
5.	155 - 157 (2)	39.25 - 41.50 (2.25)	12.75 - 13.00 (.25)	11.50 - 12.00 (.50)
6.	256 - 256 (0)	47.75 - 48.50 (.75)	16.50 - 16.50 (.00)	13.25 - 13.50 (.25)
7.	173 - 175 (2)	40.75 - 41.75 (1.00)	13.75 - 14.00 (.25)	12.00 - 12.75 (.75)
8.	142 - 150 (8)	37.50 - 40.00 (2.50)	11.00 - 12.25 (1.25)	10.75 - 11.00 (.25)
9.	164 - 170 (7)	39.75 - 41.50 (1.75)	13.75 - 14.00 (.25)	12.75 - 13.50 (.75)
10.	153 - 165 (12)	39.25 - 40.75 (1.50)	11.75 - 12.50 (.75)	10.75 - 12.00 (1.25)
11.	155 - 158 (3)	38.50 - 40.00 (1.50)	12.75 - 13.00 (.25)	11.50 - 12.25 (.75)
12.	134 - 139 (5)	36.25 - 37.50 (1.25)	11.50 - 11.75 (.25)	10.25 - 11.00 (.75)
13.	140 - 144 (4)	36.75 - 37.75 (1.00)	10.00 - 11.00 (1.00)	9.75 - 10.75 (1.00)
14.	157 - 170 (13)	39.00 - 40.00 (1.00)	12.00 - 12.25 (.25)	11.25 - 11.50 (.25)
15.	226 - 218 (-8)	46.50 - 48.00 (1.50)	15.00 - 15.50 (.50)	13.00 - 13.00 (.00)
16.	152 - 157 (5)	39.25 - 39.75 (.50)	12.25 - 12.00 (-.25)	11.25 - 11.50 (.25)
17.	121 - 130 (9)	34.50 - 36.00 (1.50)	11.75 - 12.25 (.50)	11.00 - 11.00 (.00)
18.	169 - 167 (-2)	43.25 - 44.00 (.75)	13.50 - 14.50 (1.00)	12.50 - 12.75 (.25)
19.	157 - 166 (9)	38.50 - 40.00 (1.50)	12.50 - 13.25 (.75)	11.50 - 12.25 (.75)
20.	141 - 145 (4)	39.50 - 40.25 (.75)	12.00 - 12.75 (.75)	11.00 - 11.50 (.50)
21.	135 - 138 (3)	37.50 - 39.00 (1.50)	12.00 - 12.50 (.50)	11.75 - 12.00 (.25)
22.	167 - 168 (1)	41.50 - 42.75 (1.25)	12.50 - 13.25 (.75)	11.00 - 11.75 (.75)
23.	140 - 144 (4)	35.00 - 35.50 (.50)	11.50 - 11.75 (.25)	10.75 - 11.00 (.25)
24.	176 - 190 (14)	39.75 - 42.00 (2.25)	12.50 - 13.75 (1.25)	11.25 - 11.75 (.50)
25.	175 - 175 (0)	39.50 - 40.25 (.75)	13.50 - 14.00 (.50)	12.25 - 12.50 (.25)

TABLE IV (CONT.)
TABLE OF MEASUREMENT BEFORE AND AFTER TRAINING PROGRAM

	WEIGHT (Gain or Loss)	CHEST (Gain or Loss)	BICEP (Gain or Loss)	FOREARM (Gain or Loss)
26.	167 - 163 (-4)	40.25 - 39.50 (-.75)	13.25 - 13.00 (-.25)	12.50 - 12.50 (.00)
27.	150 - 155 (5)	39.25 - 40.00 (.75)	12.75 - 13.25 (.50)	12.00 - 12.00 (.00)
28.	140 - 143 (3)	37.75 - 38.50 (.75)	13.00 - 13.50 (.50)	12.00 - 12.25 (.25)
29.	153 - 159 (6)	38.50 - 40.00 (1.50)	12.50 - 13.00 (.50)	11.75 - 12.00 (.25)
30.	136 - 137 (1)	36.75 - 37.50 (.75)	11.50 - 12.00 (.50)	10.75 - 11.50 (.75)
31.	189 - 192 (3)	42.75 - 43.75 (1.00)	12.75 - 13.50 (.75)	12.50 - 12.75 (.25)
32.	149 - 152 (3)	38.50 - 39.00 (.50)	12.25 - 13.00 (.75)	11.00 - 11.50 (.50)
33.	154 - 150 (-4)	38.50 - 38.00 (-.50)	12.00 - 12.00 (.00)	11.75 - 12.00 (.25)
34.	167 - 172 (5)	41.25 - 42.00 (.75)	13.00 - 13.75 (.75)	11.50 - 11.75 (.25)
35.	133 - 130 (-3)	36.50 - 37.00 (.50)	12.00 - 12.25 (.25)	11.50 - 12.00 (.50)
36.	135 - 135 (0)	36.00 - 37.00 (1.00)	10.25 - 10.50 (.25)	10.25 - 10.75 (.50)
37.	165 - 170 (5)	39.25 - 39.25 (.00)	13.00 - 13.25 (.25)	12.75 - 12.75 (.00)
38.	140 - 145 (5)	36.75 - 37.75 (1.00)	12.00 - 12.75 (.75)	10.75 - 11.25 (.50)
39.	208 - 212 (4)	45.50 - 46.00 (.50)	14.50 - 15.00 (.50)	13.00 - 13.75 (.75)
40.	203 - 195 (-8)	41.25 - 42.00 (.75)	14.00 - 14.25 (.25)	12.75 - 13.00 (.25)
41.	156 - 164 (8)	40.25 - 41.75 (1.50)	12.50 - 13.25 (.75)	11.75 - 13.00 (1.25)
42.	177 - 175 (-3)	40.50 - 41.00 (.50)	12.25 - 13.00 (.75)	11.25 - 11.50 (.25)
43.	142 - 140 (-2)	37.00 - 38.00 (1.00)	11.75 - 12.00 (.25)	11.25 - 11.25 (.00)
44.	140 - 138 (-2)	38.25 - 39.50 (1.25)	12.50 - 13.00 (.50)	11.50 - 12.25 (.75)
45.	157 - 154 (-3)	40.00 - 40.75 (.75)	13.25 - 14.00 (.75)	11.50 - 12.25 (.75)
46.	130 - 132 (2)	36.25 - 38.00 (1.75)	13.00 - 13.25 (.25)	11.75 - 12.25 (.50)
47.	188 - 190 (2)	42.50 - 44.00 (1.50)	13.75 - 14.25 (.50)	12.00 - 12.75 (.75)
48.	201 - 195 (-6)	42.75 - 43.00 (.25)	13.50 - 13.50 (.00)	12.00 - 11.75 (-.25)
49.	139 - 140 (1)	36.00 - 36.25 (.25)	12.00 - 12.50 (.50)	11.25 - 11.75 (.50)
50.	252 - 252 (0)	47.75 - 48.00 (.25)	15.75 - 16.25 (.50)	13.75 - 14.00 (.25)

TABLE IV (CONT.)

TABLE OF MEASUREMENT BEFORE AND AFTER TRAINING PROGRAM

	WEIGHT (Gain or Loss)	CHEST (Gain or Loss)	BICEP (Gain or Loss)	FOREARM (Gain or Loss)
51.	132 - 134 (2)	36.00 - 37.50 (1.50)	10.50 - 12.00 (1.50)	10.00 - 11.00 (1.00)
52.	175 - 187 (12)	40.75 - 43.25 (2.50)	13.00 - 14.00 (1.00)	12.00 - 12.75 (.75)
53.	163 - 168 (5)	41.50 - 43.50 (2.00)	12.75 - 13.50 (.75)	12.25 - 13.00 (.75)
54.	179 - 190 (11)	41.25 - 43.00 (1.75)	13.00 - 14.00 (1.00)	11.25 - 12.25 (1.00)
55.	167 - 172 (5)	40.00 - 41.25 (1.25)	12.25 - 13.50 (1.25)	11.25 - 12.00 (.75)
56.	160 - 164 (4)	40.00 - 40.75 (.75)	13.00 - 13.50 (.50)	11.75 - 12.25 (.50)
57.	144 - 150 (6)	36.25 - 36.75 (.50)	12.00 - 12.75 (.75)	11.00 - 11.25 (.25)
58.	146 - 152 (6)	38.50 - 39.00 (.50)	12.00 - 12.50 (.50)	10.75 - 11.00 (.25)
59.	158 - 158 (0)	40.00 - 40.00 (.00)	12.75 - 13.00 (.25)	11.75 - 12.50 (.75)
60.	164 - 166 (2)	36.00 - 37.00 (.00)	12.25 - 12.50 (.25)	11.00 - 11.25 (.25)
61.	136 - 140 (4)	38.50 - 39.25 (.75)	11.75 - 12.25 (.50)	11.00 - 11.25 (.25)
62.	170 - 167 (-3)	41.25 - 41.75 (.50)	13.00 - 13.50 (.50)	11.50 - 12.00 (.50)
63.	182 - 194 (12)	40.75 - 42.50 (1.75)	13.25 - 14.00 (.75)	12.25 - 12.75 (.50)
64.	151 - 157 (6)	37.50 - 38.50 (1.00)	12.25 - 12.50 (.25)	10.75 - 11.50 (.75)
65.	147 - 157 (10)	37.00 - 38.50 (1.50)	12.25 - 13.25 (1.00)	11.50 - 12.00 (.50)
66.	175 - 169 (-6)	38.25 - 38.75 (.50)	12.75 - 13.00 (.25)	11.25 - 12.25 (1.00)
67.	185 - 185 (0)	42.75 - 43.00 (.25)	13.00 - 13.50 (.50)	12.00 - 12.25 (.25)
68.	137 - 140 (3)	38.00 - 39.75 (1.75)	10.50 - 10.75 (.25)	9.75 - 10.50 (.75)
69.	144 - 147 (3)	38.00 - 38.75 (.75)	12.00 - 12.50 (.50)	10.75 - 11.00 (.25)
70.	134 - 137 (3)	36.50 - 38.25 (1.75)	10.75 - 11.50 (.75)	10.75 - 11.00 (.25)
71.	171 - 174 (3)	41.00 - 42.25 (1.25)	12.75 - 13.25 (.50)	12.25 - 12.50 (.25)
72.	186 - 194 (8)	41.25 - 42.50 (1.25)	13.25 - 13.75 (.50)	11.75 - 12.50 (.75)
73.	140 - 146 (6)	35.75 - 36.50 (.75)	11.00 - 11.75 (.75)	10.25 - 11.00 (.75)
74.	153 - 149 (-4)	40.00 - 39.50 (-.50)	13.50 - 13.75 (.25)	12.00 - 12.00 (.00)
75.	155 - 159 (4)	39.00 - 40.00 (1.00)	12.75 - 13.00 (.25)	11.50 - 12.25 (.75)

TABLE IV (CONT.)

TABLE OF MEASUREMENT BEFORE AND AFTER TRAINING PROGRAM

	WEIGHT (Gain or Loss)	CHEST (Gain or Loss)	BICEP (Gain or Loss)	FOREARM (Gain or Loss)
76.	165 - 168 (3)	40.00 - 41.25 (1.25)	13.00 - 13.75 (.75)	12.25 - 13.00 (.75)
77.	187 - 193 (6)	43.25 - 43.75 (.50)	13.25 - 14.00 (.75)	12.25 - 12.50 (.25)
78.	155 - 155 (0)	39.25 - 40.00 (.75)	12.00 - 12.25 (.25)	10.75 - 11.50 (.75)
79.	169 - 172 (3)	39.75 - 40.25 (.50)	12.25 - 13.00 (.75)	12.00 - 12.75 (.75)
80.	193 - 200 (7)	40.25 - 41.50 (1.25)	14.00 - 15.25 (1.25)	12.00 - 12.50 (.50)
81.	180 - 185 (5)	42.75 - 43.25 (.50)	14.25 - 15.00 (.75)	12.50 - 13.00 (.50)
82.	137 - 139 (2)	37.00 - 37.50 (.50)	12.25 - 13.25 (1.00)	11.00 - 12.00 (1.00)
83.	128 - 132 (4)	36.25 - 37.00 (.75)	11.00 - 11.25 (.25)	10.75 - 11.00 (.25)
84.	173 - 184 (11)	41.00 - 42.75 (1.75)	12.50 - 14.00 (1.50)	11.25 - 12.50 (1.25)
85.	162 - 165 (3)	41.75 - 42.75 (1.00)	13.25 - 14.00 (.75)	12.00 - 12.75 (.75)
86.	136 - 137 (1)	36.25 - 36.00 (-.25)	12.00 - 12.75 (.75)	11.25 - 11.75 (.50)
87.	121 - 127 (6)	37.75 - 38.25 (.50)	11.25 - 12.00 (.75)	11.00 - 11.50 (.50)
88.	164 - 167 (3)	42.25 - 42.00 (-.25)	12.50 - 13.25 (.75)	12.00 - 12.00 (.00)
89.	131 - 142 (11)	37.25 - 38.25 (1.00)	11.50 - 12.00 (.50)	10.50 - 11.25 (.75)
90.	170 - 170 (0)	40.50 - 41.50 (1.00)	13.25 - 13.50 (.25)	11.75 - 12.50 (.75)
91.	120 - 126 (6)	38.25 - 39.25 (1.00)	11.50 - 12.00 (.50)	10.25 - 10.75 (.50)
92.	141 - 149 (8)	38.00 - 39.25 (1.25)	12.00 - 12.75 (.75)	11.00 - 11.50 (.50)
93.	147 - 150 (3)	38.00 - 38.75 (.75)	12.75 - 13.25 (.50)	11.75 - 12.00 (.25)
94.	140 - 145 (5)	38.75 - 39.00 (.25)	11.75 - 12.25 (.50)	10.75 - 11.50 (.75)
95.	158 - 160 (2)	39.75 - 40.75 (1.00)	13.00 - 13.50 (.50)	12.00 - 12.50 (.50)
96.	166 - 170 (4)	38.75 - 39.00 (.25)	11.50 - 12.00 (.50)	11.50 - 12.25 (.75)
97.	175 - 170 (-5)	42.25 - 43.50 (1.25)	13.50 - 14.00 (.50)	13.00 - 13.50 (.50)
98.	140 - 145 (5)	36.50 - 37.25 (.75)	11.75 - 12.00 (.25)	10.00 - 10.25 (.25)
99.	155 - 157 (2)	39.25 - 41.50 (2.25)	12.75 - 13.00 (.25)	11.50 - 12.00 (.50)
100.	153 - 165 (12)	39.25 - 40.75 (1.50)	11.75 - 12.50 (.75)	10.75 - 12.00 (1.25)
Total --	Plus 338 Pounds	Plus 96.50 Inches	Plus 54.25 Inches	Plus 49.25 Inches
Average-	Plus 3.38 Pounds	Plus .965 Inches	Plus .5425 Inches	Plus .4925 Inches

Results of Measurement Before and After Weight Training Program

In the body weight portion, of the one hundred subjects, seventy-six experienced an increase in body weight, sixteen a weight loss and eight no change. Before the program the body weight varied from a low of 120 pounds to a high of 256 pounds. After the program the range was from 126 pounds to 256 pounds. The greatest gain was fourteen pounds, from 176 pounds to 190 pounds, the greatest loss from 226 pounds to 218 pounds, a loss of eight pounds. The average for the group was a gain of 3.38 pounds per individual. No attempt was made in the program to control weight only to rearrange it. The program used with maximum poundages and medium repetitions tends to compliment both the student desiring to gain weight and those wishing to lose weight.

The chest was measured in an expanded position with a deep breath prior to measurement. The smallest chest measurement in the beginning was 34.5 inches, the largest two students with 47.75 inches. After the program the smallest was 35.5 inches, the largest 48.5 inches. Two individuals made gains of 2.5 inches, from 40.75 inches to 43.25 inches, and 37.5 inches to 40 inches. The greatest loss was .75 inches, from 40.25 inches to 39.5 inches. The average for the group fell just short of an inch gain, .965 inches. Ninety-three per cent made an increase, five per cent a decrease, and two per cent remained the same. Fifty-three individuals made gains of an inch or more.

The bicep was measured in a flexed position across highest peak of bicep and thickest part of tricep. Throughout the program, the arm received the greatest amount of work, the measurements reflect this fact.

The smallest bicep measurement before training was 10 inches, after training 10.5 inches. The largest bicep was 16.5 inches in the beginning and 16.5 inches after training. Two students made gains of 1.5 inches, from 12.5 to 14 inches and 10.5 to 12 inches. Only three students showed a decrease in size, all losses of .25 inches. The mean figure was an increase of .5425 or over one-half inch improvement. Ninety-four increased in size, three decreases, and three no change. Eleven made gains of an inch or more, thirty-eight .75 inches or more. While the extremes leave much to be desired, the other figures are dramatic improvements.

As a result of the extra effort on arm development, the forearm also experienced unusual gains. Two students at 9.75 inches represent the low and 13.75 inches represented the high in the beginning. After the program the low was 10.25, the high 14 inches. Four individuals made gains of 1.25 inches, the only student experiencing a loss was from 12 inches to 11.75 inches, a loss of .25 inches. The mean figure was an outstanding .4925 inches, nearly a half-inch in only ten weeks. Ninety per cent increased, one per cent decrease, and nine per cent no change. This progress was made in spite of the fact that no exercise was included specifically for the forearm development.

Table of measurement before and after the training program for power strength and endurance strength in the bench press and olympic press is shown in Table V on following pages.

TABLE V
MEASUREMENT OF BENCH PRESS AND OLYMPIC PRESS FOR POWER STRENGTH
AND ENDURANCE STRENGTH BEFORE AND AFTER TRAINING PROGRAM

	BENCH PRESS POWER (Gain or Loss)	OLYMPIC PRESS POWER (Gain or Loss)	BENCH PRESS 100 Pounds ENDURANCE (Gain or Loss)	OLYMPIC PRESS 75 Pounds ENDURANCE (Gain or Loss)
1.	135 - 180 (45)	125 - 165 (40)	9 - 21 (12)	15 - 31 (16)
2.	165 - 185 (20)	125 - 140 (15)	15 - 25 (10)	21 - 22 (1)
3.	145 - 155 (10)	120 - 120 (0)	10 - 17 (7)	13 - 18 (5)
4.	135 - 160 (25)	125 - 140 (15)	15 - 22 (7)	18 - 25 (7)
5.	155 - 200 (45)	110 - 120 (10)	15 - 25 (10)	10 - 16 (6)
6.	175 - 200 (25)	175 - 185 (10)	20 - 25 (5)	22 - 33 (11)
7.	165 - 195 (30)	135 - 150 (15)	11 - 26 (15)	16 - 23 (7)
8.	105 - 130 (25)	100 - 105 (5)	3 - 6 (3)	6 - 12 (6)
9.	165 - 195 (30)	140 - 155 (15)	19 - 25 (6)	22 - 32 (10)
10.	130 - 145 (15)	105 - 120 (15)	10 - 15 (5)	10 - 15 (5)
11.	135 - 170 (35)	105 - 120 (15)	10 - 15 (5)	13 - 16 (3)
12.	130 - 160 (30)	95 - 115 (20)	9 - 17 (8)	10 - 16 (6)
13.	85 - 100 (15)	50 - 80 (30)	0 - 1 (1)	0 - 5 (5)
14.	135 - 170 (35)	115 - 145 (30)	10 - 20 (10)	15 - 18 (3)
15.	165 - 205 (40)	125 - 140 (15)	11 - 25 (14)	15 - 25 (10)
16.	110 - 130 (20)	90 - 110 (20)	5 - 9 (4)	5 - 11 (6)
17.	115 - 130 (15)	95 - 115 (20)	5 - 9 (4)	9 - 15 (6)
18.	145 - 180 (35)	125 - 140 (15)	11 - 17 (6)	16 - 18 (2)
19.	145 - 165 (20)	115 - 135 (20)	12 - 19 (7)	15 - 23 (8)
20.	115 - 120 (5)	100 - 100 (0)	4 - 11 (7)	8 - 12 (4)
21.	115 - 130 (15)	105 - 115 (10)	6 - 9 (3)	11 - 15 (4)
22.	160 - 190 (30)	120 - 135 (15)	25 - 27 (2)	13 - 19 (6)
23.	75 - 105 (30)	75 - 75 (0)	0 - 1 (1)	1 - 2 (1)
24.	95 - 130 (35)	85 - 115 (30)	0 - 11 (11)	8 - 16 (8)
25.	125 - 155 (30)	105 - 130 (25)	9 - 17 (8)	15 - 19 (4)

TABLE V (CONT.)
MEASUREMENT OF BENCH PRESS AND OLYMPIC PRESS FOR POWER STRENGTH
AND ENDURANCE STRENGTH BEFORE AND AFTER TRAINING PROGRAM

	BENCH PRESS POWER (Gain or Loss)	OLYMPIC PRESS PRESS (Gain or Loss)	BENCH PRESS 100 Pounds ENDURANCE (Gain or Loss)	OLYMPIC PRESS 75 Pounds ENDURANCE (Gain or Loss)
26.	130 - 150 (20)	105 - 135 (30)	6 - 13 (7)	8 - 10 (2)
27.	160 - 190 (30)	125 - 145 (20)	20 - 22 (2)	16 - 23 (7)
28.	140 - 180 (40)	115 - 130 (15)	12 - 19 (7)	11 - 17 (6)
29.	130 - 165 (35)	100 - 120 (20)	12 - 23 (11)	14 - 18 (4)
30.	125 - 150 (25)	105 - 120 (15)	9 - 17 (8)	10 - 16 (6)
31.	145 - 165 (20)	135 - 135 (0)	19 - 21 (2)	11 - 21 (10)
32.	140 - 170 (30)	130 - 150 (20)	8 - 18 (10)	16 - 21 (5)
33.	135 - 145 (10)	105 - 120 (15)	14 - 16 (2)	11 - 17 (6)
34.	190 - 220 (30)	170 - 175 (5)	30 - 36 (6)	30 - 34 (4)
35.	115 - 140 (25)	95 - 100 (5)	8 - 13 (5)	12 - 17 (5)
36.	75 - 100 (25)	75 - 85 (10)	0 - 1 (1)	4 - 4 (0)
37.	135 - 165 (30)	120 - 140 (20)	15 - 17 (2)	18 - 20 (2)
38.	130 - 165 (35)	115 - 130 (15)	8 - 17 (9)	14 - 18 (4)
39.	175 - 210 (35)	145 - 175 (30)	18 - 25 (7)	20 - 28 (8)
40.	135 - 160 (25)	105 - 115 (10)	10 - 18 (8)	14 - 17 (3)
41.	145 - 185 (40)	125 - 130 (5)	16 - 24 (8)	13 - 21 (8)
42.	115 - 150 (35)	90 - 115 (25)	11 - 19 (8)	8 - 15 (7)
43.	110 - 150 (40)	115 - 130 (15)	6 - 20 (14)	13 - 17 (4)
44.	155 - 185 (30)	130 - 145 (15)	25 - 26 (1)	21 - 24 (3)
45.	135 - 165 (30)	120 - 125 (5)	14 - 17 (3)	15 - 23 (8)
46.	155 - 175 (20)	130 - 140 (10)	17 - 17 (0)	21 - 22 (1)
47.	125 - 160 (35)	115 - 135 (20)	12 - 17 (5)	17 - 17 (0)
48.	130 - 170 (40)	95 - 120 (25)	11 - 22 (11)	10 - 17 (7)
49.	125 - 140 (15)	105 - 110 (5)	5 - 11 (6)	7 - 10 (3)
50.	180 - 220 (40)	150 - 160 (10)	25 - 26 (1)	22 - 27 (5)

TABLE V (CONT.)

MEASUREMENT OF BENCH PRESS AND OLYMPIC PRESS FOR POWER STRENGTH
AND ENDURANCE STRENGTH BEFORE AND AFTER TRAINING PROGRAM

	BENCH PRESS POWER (Gain or Loss)	OLYMPIC PRESS POWER (Gain or Loss)	BENCH PRESS 100 Pounds ENDURANCE (Gain or Loss)	OLYMPIC PRESS 75 Pounds ENDURANCE (Gain or Loss)
51.	110 - 140 (30)	95 - 105 (10)	3 - 13 (10)	4 - 11 (7)
52.	125 - 140 (15)	120 - 120 (0)	10 - 20 (10)	20 - 20 (0)
53.	145 - 175 (30)	115 - 140 (25)	11 - 21 (10)	16 - 22 (6)
54.	105 - 160 (55)	100 - 130 (30)	7 - 20 (13)	11 - 16 (5)
55.	85 - 125 (40)	175 - 190 (15)	0 - 3 (3)	1 - 5 (4)
56.	150 - 205 (55)	135 - 150 (15)	13 - 18 (5)	17 - 18 (1)
57.	125 - 145 (20)	105 - 110 (5)	3 - 15 (13)	10 - 12 (2)
58.	110 - 140 (30)	100 - 110 (10)	4 - 8 (4)	8 - 12 (4)
59.	120 - 150 (30)	105 - 115 (10)	10 - 20 (10)	17 - 20 (3)
60.	85 - 120 (35)	80 - 95 (15)	0 - 2 (2)	4 - 8 (4)
61.	105 - 165 (60)	105 - 115 (10)	5 - 12 (7)	14 - 16 (2)
62.	130 - 160 (30)	115 - 140 (25)	9 - 17 (8)	15 - 21 (6)
63.	155 - 185 (30)	125 - 145 (20)	13 - 23 (10)	15 - 22 (7)
64.	125 - 145 (20)	105 - 120 (15)	5 - 17 (12)	11 - 17 (6)
65.	105 - 150 (45)	95 - 125 (30)	3 - 17 (14)	5 - 14 (9)
66.	65 - 110 (45)	65 - 90 (25)	0 - 6 (6)	0 - 5 (5)
67.	135 - 170 (35)	115 - 140 (25)	10 - 20 (10)	15 - 21 (6)
68.	100 - 110 (10)	95 - 100 (5)	2 - 6 (4)	7 - 10 (3)
69.	125 - 155 (30)	105 - 130 (25)	6 - 15 (9)	10 - 19 (9)
70.	105 - 135 (30)	90 - 100 (10)	2 - 12 (10)	6 - 16 (10)
71.	135 - 155 (20)	120 - 130 (10)	17 - 19 (2)	17 - 17 (0)
72.	140 - 205 (65)	135 - 165 (30)	11 - 29 (18)	19 - 29 (10)
73.	105 - 135 (30)	85 - 110 (25)	3 - 13 (10)	4 - 14 (10)
74.	165 - 185 (20)	145 - 150 (5)	17 - 23 (6)	24 - 28 (4)
75.	135 - 155 (20)	115 - 135 (20)	8 - 15 (7)	14 - 15 (1)

TABLE V (CONT.)

MEASUREMENT OF BENCH PRESS AND OLYMPIC PRESS FOR POWER STRENGTH
AND ENDURANCE STRENGTH BEFORE AND AFTER TRAINING PROGRAM

	BENCH PRESS POWER (Gain or Loss)	OLYMPIC PRESS POWER (Gain or Loss)	BENCH PRESS 100 Pounds ENDURANCE (Gain or Loss)	OLYMPIC PRESS 75 Pounds ENDURANCE (Gain or Loss)
76.	125 - 160 (35)	115 - 130 (15)	8 - 19 (11)	7 - 19 (12)
77.	110 - 150 (40)	105 - 120 (15)	4 - 13 (9)	10 - 16 (6)
78.	125 - 155 (30)	100 - 115 (15)	11 - 17 (6)	9 - 14 (5)
79.	165 - 175 (10)	145 - 160 (15)	21 - 28 (7)	24 - 33 (9)
80.	115 - 130 (15)	105 - 110 (5)	6 - 7 (1)	5 - 7 (2)
81.	165 - 195 (30)	145 - 165 (20)	20 - 24 (4)	21 - 27 (6)
82.	160 - 170 (10)	115 - 130 (15)	17 - 17 (0)	13 - 18 (5)
83.	125 - 140 (15)	110 - 120 (10)	9 - 11 (2)	18 - 19 (1)
84.	125 - 155 (30)	105 - 120 (15)	11 - 21 (10)	11 - 19 (8)
85.	165 - 185 (20)	140 - 160 (20)	22 - 27 (5)	23 - 31 (8)
86.	140 - 160 (20)	115 - 125 (10)	10 - 17 (7)	16 - 17 (1)
87.	115 - 135 (20)	95 - 115 (20)	6 - 10 (4)	13 - 13 (0)
88.	125 - 135 (10)	100 - 110 (10)	6 - 10 (4)	9 - 14 (5)
89.	90 - 120 (30)	85 - 95 (10)	0 - 6 (6)	5 - 7 (2)
90.	135 - 185 (50)	125 - 135 (10)	11 - 20 (9)	17 - 23 (6)
91.	160 - 170 (10)	125 - 130 (5)	12 - 15 (3)	17 - 18 (1)
92.	125 - 160 (35)	105 - 135 (30)	6 - 18 (12)	15 - 20 (5)
93.	155 - 175 (20)	140 - 140 (0)	20 - 22 (2)	21 - 25 (4)
94.	135 - 165 (30)	105 - 120 (15)	12 - 16 (4)	11 - 17 (6)
95.	165 - 170 (5)	125 - 140 (15)	20 - 20 (0)	17 - 22 (5)
96.	125 - 145 (20)	105 - 115 (10)	8 - 16 (8)	14 - 14 (0)
97.	190 - 225 (35)	155 - 165 (10)	28 - 36 (8)	29 - 34 (5)
98.	115 - 130 (15)	90 - 110 (20)	7 - 10 (3)	8 - 13 (5)
99.	155 - 200 (45)	110 - 130 (20)	15 - 25 (10)	10 - 16 (6)
100.	130 - 145 (15)	105 - 120 (15)	10 - 15 (5)	10 - 15 (5)
Total -----	Plus 2,715 Pounds	Plus 1,530 Pounds	Plus 667 Repetitions	Plus 510 Repetitions
Average ----	Plus 27.15 Pounds	Plus 15.30 Pounds	Plus 6.67 Repetitions	Plus 5.10 Repetitions

Results of Muscle Power and Endurance Before and After Training Program

In the testing of power and endurance, the bench press was the most popular exercise. One hundred per cent of the student experienced progress in the power portion of the bench press, eighteen students made gains of 40 pounds or more. The extremes were a 65 pound bench press and two students at 190 pounds before the program, compared to 100 pounds and 225 pounds after the program. The greatest gain was from 140 pounds to 205 pounds for a gain of 65 pounds, the least improvement by two students at 5 pounds. In the beginning no student could bench press 200 pounds, after the program ten students were able to lift 200 pounds or more. The average improvement was 27.15 pounds per individual.

An olympic press of only 50 pounds represented the low in power as compared to two students at 175 pounds before the program. After training the low was 75 pounds, the high 190 pounds. The greatest improvement was from 125 pounds to 165 pounds, an increase of 40 pounds, five students experienced no gain, and no student showed a decrease. The average increase was 15.3 pounds per student, and thirty-five students made gains of 20 pounds or more.

No student experienced a decrease in repetitions in the endurance bench press testing, ninety-eight made progress, and only two made no gain. The poorest performance was recorded by seven students who could not perform a single repetition with the 100 pound weight, the greatest performance was 30 repetitions. After training five students could perform only one repetition, while two were able to do 36 repetitions. The greatest improvement was from 11 to 29, a gain of 18 repetitions, only two students made no progress. The average improvement was 6.67 repetitions per student.

In the olympic press endurance testing two students could not perform a single repetition with the 75 pounds, after the program low was 2 repetitions. The high in the beginning was 30 repetitions, two students were able to manage 34 repetitions at the end. The greatest improvement was from 15 to 31 repetitions, an increase of 16 repetitions, six made no improvement. The average improvement was 5.10 repetitions. Fifteen students could perform 20 repetitions before the training program, thirty-five could do 20 or more after the program.

It is significant that throughout the lifting portion of the testing, no student experienced a decrease in either power or endurance. This may be credited in large part to the fact that the skill was being practiced daily.

Table of measurement before and after training program for Barrow's Motor Ability Test is shown in Table VI on following pages.

TABLE VI

MEASUREMENT OF BARROWS MOTOR ABILITY BEFORE AND AFTER TRAINING PROGRAM

	STANDING LONG JUMP (Gain or Loss)	MEDICINE BALL PUT (Gain or Loss)	ZIG ZAG RUN (Gain or Loss)	MOTOR ABILITY SCORES (Gain or Loss)
1.	7'4" - 7'4" (0)	47'6" - 52'6" (5'0")	21.5 - 22.3 (.8)	190 - 183 (-7)
2.	6'8" - 6'2" (-6")	41'6" - 43'0" (1'6")	23.6 - 24.3 (.6)	148 - 139 (-9)
3.	7'3" - 6'11" (-4")	48'0" - 48'0" (0)	22.5 - 22.7 (.2)	174 - 168 (-6)
4.	7'7" - 7'1" (-6")	41'6" - 42'6" (1'0")	21.8 - 22.7 (.9)	174 - 163 (-12)
5.	6'6" - 6'2" (-4")	40'6" - 43'0" (2'6")	24.2 - 23.6 (-.6)	141 - 143 (2)
6.	6'4" - 6'4" (0)	46'0" - 53'0" (7'0")	24.9 - 23.4 (-1.5)	142 - 162 (20)
7.	6'10" - 6'11" (1")	47'6" - 52'6" (5'0")	23.1 - 21.7 (-1.4)	163 - 181 (18)
8.	7'6" - 7'8" (2")	39'0" - 41'0" (2'0")	22.8 - 22.5 (-.3)	162 - 169 (7)
9.	7'5" - 7'7" (2")	50'0" - 53'6" (3'6")	21.8 - 21.3 (-.5)	185 - 196 (11)
10.	6'8" - 6'8" (0)	40'6" - 43'0" (2'6")	23.8 - 23.8 (0)	146 - 149 (3)
11.	7'5" - 7'5" (0)	38'0" - 40'0" (2'0")	22.1 - 22.2 (.1)	165 - 167 (2)
12.	5'6" - 6'0" (6")	36'0" - 42'6" (6'6")	23.9 - 23.2 (-.7)	121 - 142 (21)
13.	7'0" - 6'8" (-4")	33'0" - 38'0" (5'0")	25.5 - 25.3 (-.2)	128 - 132 (4)
14.	7'0" - 7'6" (6")	41'6" - 45'0" (3'6")	25.5 - 24.2 (-1.3)	141 - 162 (21)
15.	5'8" - 5'9" (1")	39'0" - 44'0" (5'0")	25.5 - 24.6 (-.9)	118 - 133 (15)
16.	6'1" - 6'0" (-1")	37'0" - 39'6" (2'6")	24.3 - 22.8 (-1.5)	128 - 140 (12)
17.	6'7" - 6'6" (-1")	34'0" - 39'0" (4'0")	23.4 - 23.0 (-.4)	138 - 145 (7)
18.	5'7" - 6'5" (10")	38'6" - 40'0" (1'6")	23.9 - 24.9 (1.0)	126 - 135 (9)
19.	5'9" - 6'10" (1'1")	45'0" - 47'6" (2'6")	25.7 - 26.7 (1.0)	127 - 140 (13)
20.	6'8" - 6'6" (-2")	37'0" - 37'6" (6")	27.0 - 26.5 (-.5)	119 - 121 (2)
21.	6'10" - 7'0" (2")	45'0" - 47'6" (2'6")	27.5 - 27.0 (-.5)	131 - 150 (19)
22.	6'10" - 7'0" (2")	44'6" - 45'6" (1'0")	24.0 - 23.3 (-.7)	153 - 161 (8)
23.	6'1" - 6'3" (2")	37'0" - 35'0" (-3'0")	25.7 - 27.0 (1.3)	120 - 110 (-10)
24.	7'0" - 6'8" (-4")	49'0" - 46'0" (6'0")	22.5 - 23.5 (1.0)	143 - 141 (-2)
25.	7'3" - 7'6" (3")	40'0" - 42'0" (2'0")	23.6 - 23.0 (-.6)	155 - 166 (11)

TABLE VI (CONT.)

MEASUREMENT OF BARROWS MOTOR ABILITY BEFORE AND AFTER TRAINING PROGRAM

	STANDING LONG JUMP (Gain or Loss)	MEDICINE BALL PUT (Gain or Loss)	ZIG ZAG RUN (Gain or Loss)	MOTOR ABILITY SCORES (Gain or Loss)
26.	6' 8" - 7' 2" (6")	42'0" - 48'0" (6.0")	25.7 - 25.2 (-.5)	136 - 156 (20)
27.	7' 3" - 8' 0" (9")	46'0" - 46'0" (0)	22.6 - 21.6 (-1.0)	171 - 188 (17)
28.	6' 6" - 6'10" (4")	43'6" - 41'0" (-2'6")	24.9 - 25.2 (.3)	141 - 140 (-1)
29.	6' 0" - 7' 3" (1' 3")	38'0" - 43'0" (5'0")	23.0 - 23.5 (.5)	137 - 160 (23)
30.	7' 8" - 8' 2" (6")	40'0" - 46'0" (6'0")	22.0 - 22.6 (.6)	171 - 185 (14)
31.	6' 3" - 7' 0" (9")	48'0" - 47'0" (-1'0")	23.6 - 22.5 (-1.1)	152 - 169 (17)
32.	8' 0" - 8' 0" (0)	42'0" - 43'6" (1'6")	22.6 - 23.7 (1.1)	176 - 170 (-6)
33.	7' 0" - 7' 7" (7")	47'6" - 50'0" (2'6")	21.0 - 23.3 (2.3)	192 - 177 (-15)
34.	8' 4" - 8'11" (7")	51'0" - 57'0" (6'0")	23.0 - 21.8 (-1.2)	193 - 218 (25)
35.	6' 8" - 6' 8" (0)	35'0" - 36'0" (1'0")	23.2 - 25.0 (1.8)	142 - 131 (-11)
36.	6' 1" - 6' 8" (7")	33'0" - 36'6" (3'6")	25.1 - 24.0 (-1.1)	117 - 136 (19)
37.	7' 9" - 7' 3" (-6")	38'0" - 43'6" (5'6")	24.6 - 23.9 (-.7)	142 - 164 (22)
38.	6' 0" - 6' 3" (3")	36'0" - 41'6" (5'6")	22.7 - 22.8 (.1)	136 - 147 (11)
39.	6' 2" - 5' 6" (-8")	46'0" - 46'0" (0)	28.3 - 27.7 (-.6)	118 - 112 (-6)
40.	5' 1" - 5' 5" (4")	44'0" - 47'6" (3'6")	28.1 - 26.4 (-1.7)	100 - 121 (21)
41.	7'10" - 7' 6" (-4")	48'0" - 47'0" (-1'0")	21.4 - 21.7 (.3)	190 - 168 (-22)
42.	5' 8" - 6' 0" (4")	31'0" - 32'6" (1'6")	26.2 - 25.4 (-.8)	101 - 113 (12)
43.	6' 9" - 7' 0" (3")	38'0" - 38'6" (6")	24.2 - 23.6 (-.6)	143 - 149 (6)
44.	6' 5" - 7' 2" (9")	35'0" - 42'0" (7'0")	23.1 - 23.7 (.6)	138 - 156 (18)
45.	8' 2" - 8' 6" (4")	43'0" - 44'0" (1'0")	21.9 - 21.6 (.3)	184 - 193 (9)
46.	5' 6" - 5' 9" (3")	37'0" - 35'6" (-1'6")	25.7 - 25.5 (-.2)	111 - 114 (3)
47.	6'10" - 6' 6" (-4")	39'6" - 41'6" (2'0")	24.4 - 22.4 (-2.0)	143 - 150 (7)
48.	5' 7" - 5' 7" (0)	47'0" - 37'6" (6")	25.6 - 24.7 (-.9)	115 - 119 (4)
49.	6' 6" - 6' 4" (-2")	35'0" - 35'0" (0")	23.9 - 24.2 (.3)	135 - 130 (-5)
50.	6' 3" - 6' 6" (3")	45'0" - 42'0" (-3'0")	25.7 - 24.6 (-1.1)	134 - 141 (7)

TABLE VI (CONT.)

MEASUREMENT OF BARROWS MOTOR ABILITY BEFORE AND AFTER TRAINING PROGRAM

	STANDING LONG JUMP (Gain or Loss)	MEDICINE BALL PUT (Gain or Loss)	ZIG ZAG RUN (Gain or Loss)	MOTOR ABILITY SCORES (Gain or Loss)
51.	6' 11" - 7' 4" (5")	33' 0" - 38' 0" (5' 0")	28.3 - 27.5 (-.8)	109 - 128 (19)
52.	6' 2" - 6' 10" (8")	39' 0" - 42' 6" (3' 6")	23.2 - 22.4 (-.8)	140 - 161 (21)
53.	7' 10" - 7' 10" (0)	42' 0" - 43' 0" (1' 0")	22.1 - 23.0 (.9)	177 - 176 (-1)
54.	5' 3" - 5' 6" (3")	35' 0" - 38' 0" (3' 0")	25.1 - 26.7 (1.6)	108 - 106 (-2)
55.	5' 10" - 6' 3" (5")	36' 0" - 42' 0" (6' 0")	25.6 - 25.2 (-.4)	115 - 133 (18)
56.	7' 4" - 8' 0" (8")	36' 6" - 47' 0" (6")	22.8 - 22.6 (-.2)	171 - 184 (13)
57.	6' 0" - 7' 5" (1' 5")	40' 6" - 40' 0" (-6")	24.2 - 25.0 (.8)	134 - 149 (15)
58.	6' 9" - 8' 1" (1' 4")	39' 0" - 42' 6" (3' 6")	22.4 - 21.3 (-1.1)	154 - 185 (31)
59.	6' 11" - 7' 11" (1' 0")	44' 6" - 43' 0" (1' 6")	24.3 - 20.9 (-3.4)	152 - 187 (35)
60.	6' 6" - 6' 8" (2")	34' 0" - 38' 0" (4' 0")	25.5 - 25.3 (-.2)	124 - 132 (8)
61.	7' 9" - 7' 3" (-6")	38' 0" - 43' 6" (5' 6")	24.6 - 23.9 (-.7)	142 - 164 (22)
62.	7' 0" - 7' 4" (4")	42' 0" - 47' 6" (5' 6")	28.2 - 24.2 (-4.0)	124 - 163 (39)
63.	6' 9" - 7' 0" (3")	38' 0" - 38' 6" (6")	24.2 - 23.6 (-.6)	143 - 149 (6)
64.	6' 6" - 7' 3" (9")	44' 0" - 47' 0" (3' 0")	26.3 - 22.6 (-3.7)	133 - 173 (40)
65.	6' 9" - 7' 0" (3")	35' 0" - 43' 0" (8' 0")	25.0 - 24.2 (-.8)	132 - 142 (20)
66.	6' 0" - 7' 0" (1' 0")	35' 6" - 35' 6" (0)	24.1 - 24.0 (-.1)	126 - 141 (15)
67.	6' 6" - 6' 10" (4")	43' 6" - 41' 0" (-2' 6")	24.9 - 25.2 (.3)	141 - 140 (-1)
68.	7' 7" - 8' 6" (11")	39' 0" - 43' 6" (4' 6")	21.0 - 21.3 (.3)	175 - 194 (19)
69.	7' 0" - 8' 11" (1' 11")	37' 0" - 45' 0" (8' 0")	21.0 - 20.2 (-.8)	163 - 209 (46)
70.	5' 8" - 6' 6" (10")	36' 0" - 38' 0" (3' 0")	25.8 - 25.5 (-.3)	111 - 129 (18)
71.	6' 8" - 6' 8" (0)	40' 6" - 43' 0" (2' 6")	23.8 - 23.8 (0)	146 - 149 (3)
72.	7' 0" - 8' 3" (1' 3")	47' 0" - 46' 0" (9' 0")	23.6 - 21.4 (-2.2)	162 - 209 (47)
73.	7' 0" - 7' 3" (3")	41' 6" - 42' 0" (6")	25.7 - 21.4 (-4.3)	140 - 172 (32)
74.	7' 4" - 8' 0" (8")	46' 6" - 47' 0" (6")	22.8 - 22.6 (-.2)	171 - 184 (13)
75.	6' 11" - 7' 11" (1' 0")	44' 6" - 43' 0" (-1' 6")	24.3 - 20.9 (-3.4)	152 - 187 (35)

TABLE VI (CONT.)

MEASUREMENT OF BARROWS MOTOR ABILITY BEFORE AND AFTER TRAINING PROGRAM

	STANDING LONG JUMP	MEDICINE BALL PUT	ZIG ZAG RUN	MOTOR ABILITY SCORES
	(Gain or Loss)	(Gain or Loss)	(Gain or Loss)	(Gain or Loss)
76.	6' 7" - 7' 3" (8")	41' 6" - 41' 6" (0)	24.7 - 24.8 (-1.9)	139 - 161 (22)
77.	6' 6" - 7' 0" (6")	36' 0" - 39' 6" (3' 6")	26.3 - 25.6 (-.7)	121 - 137 (16)
78.	7' 4" - 7' 6" (2")	39' 0" - 42' 0" (3' 0")	25.1 - 24.8 (-.3)	144 - 154 (10)
79.	8' 0" - 8' 3" (3")	51' 0" - 51' 0" (0)	20.3 - 21.1 (.8)	204 - 203 (-1)
80.	5' 6" - 5' 8" (2")	38' 0" - 42' 0" (4' 0")	26.3 - 26.2 (-.1)	109 - 118 (9)
81.	6' 10" - 7' 4" (6")	47' 6" - 52' 6" (5' 0")	23.1 - 22.4 (-.7)	163 - 183 (20)
82.	7' 5" - 6' 10" (-7")	39' 0" - 39' 0" (0)	24.2 - 21.9 (-2.3)	152 - 159 (7)
83.	6' 6" - 6' 0" (1' 6")	44' 0" - 46' 0" (2' 0")	25.2 - 22.9 (-2.3)	141 - 180 (39)
84.	6' 1" - 6' 10" (9")	44' 0" - 49' 6" (5' 6")	26.7 - 25.9 (-.8)	136 - 142 (6)
85.	7' 2" - 7' 5" (3")	45' 0" - 49' 6" (4' 6")	23.5 - 21.2 (-2.3)	162 - 188 (26)
86.	7' 4" - 7' 7" (3")	41' 6" - 44' 0" (2' 6")	22.0 - 23.0 (1.0)	168 - 170 (2)
87.	7' 3" - 7' 5" (2")	33' 0" - 35' 6" (2' 6")	25.9 - 24.6 (-1.3)	129 - 141 (12)
88.	6' 4" - 6' 6" (2")	42' 0" - 38' 0" (-4' 0")	24.1 - 25.2 (1.1)	141 - 131 (-10)
89.	6' 5" - 7' 2" (9")	35' 0" - 42' 0" (7' 0")	23.1 - 23.7 (.6)	138 - 156 (18)
90.	7' 2" - 7' 0" (-2")	46' 0" - 43' 0" (-3' 0")	23.0 - 24.3 (1.3)	167 - 150 (-17)
91.	6' 10" - 7' 0" (2")	41' 6" - 43' 6" (2' 0")	27.2 - 26.2 (-1.0)	127 - 139 (12)
92.	7' 1" - 7' 0" (-1")	42' 6" - 46' 6" (4' 0")	23.4 - 24.0 (.6)	158 - 158 (0)
93.	7' 0" - 6' 9" (-3")	49' 0" - 49' 0" (0)	25.0 - 24.4 (-.6)	156 - 157 (1)
94.	7' 6" - 7' 10" (4")	38' 0" - 44' 0" (6' 0")	23.3 - 23.0 (-.3)	158 - 174 (16)
95.	7' 4" - 7' 3" (-1")	41' 0" - 40' 6" (-6")	21.7 - 22.7 (1.0)	169 - 162 (-7)
96.	6' 0" - 6' 9" (9")	40' 0" - 42' 0" (2' 0")	24.9 - 23.1 (-1.8)	128 - 154 (26)
97.	7' 7" - 7' 11" (4")	45' 0" - 47' 0" (2' 0")	22.8 - 21.8 (-1.0)	172 - 188 (16)
98.	6' 9" - 7' 0" (3")	35' 0" - 43' 0" (8' 0")	25.0 - 24.2 (-.8)	132 - 152 (20)
99.	6' 6" - 6' 2" (-4")	40' 6" - 43' 0" (2' 6")	24.2 - 23.6 (-.6)	141 - 143 (2)
100.	6' 8" - 6' 8" (0)	40' 6" - 43' 0" (2' 6")	23.8 - 23.8 (0)	146 - 149 (3)
Total	Plus 327 Inches	Plus 267.5 Feet	Minus 47.1 Seconds	Plus 1042 Points
Average	Plus 3.27 Inches	Plus 2.675 Feet	Minus .471 Seconds	Plus 10.42 Points

Results of Barrow's Motor Ability Before and After Training Program

All areas of the motor's ability testing showed considerable progress, with the zig zag run providing the least consistency. Only sixty-five students made progress, thirty-two decreased in proficiency, and three did not change. In the initial testing the slowest time was 28.3 seconds, the fastest 20.3 seconds. In final testing 27.7 seconds was the slowest and 20.2 seconds the fastest. The greatest improvement was from 25.7 to 21.4 seconds, an improvement of 4.3 seconds, the greatest was from 21 seconds to 23.3 seconds, a decrease of 2.3 seconds. The average improvement was .471 seconds, this high figure was due in large part to thirty students decreasing their time by a full second or more, including ten by 2 or more seconds.

The greatest gain in the standing long jump was from 7 feet to 8 feet 11 inches, an improvement of one foot 11 inches, a decrease from 6 feet 2 inches to 5 feet 6 inches, a loss of 8 inches represented the greatest decrease. The shortest jump in the beginning was 5 feet 1 inch, the longest 8 feet 4 inches, as compared to 5 feet 5 inches and 8 feet 11 inches by two individuals in the final testing. The average gain was 3.27 inches with seventy students showing progress, ten no change, and twenty decreasing in distance.

The shortest put with the medicine ball was 31 feet before training, the longest put was 51 feet by two students. After the training program the shortest was 32 feet 6 inches, the longest 57 feet. The greatest improvement was from 47 feet to 56 feet, an increase of 9 feet, the greatest decrease was from 42 feet to 38 feet, a loss of 4 feet. The average increase was 2.675, with twenty-five making improvements of 5 feet or more. Seventy-eight made progress, nine no change, and thirteen experienced a loss.

Eighty-one students made progress in total scoring on motor ability test, one no change, and eighteen decreased in total points. The low score prior to training was 100, after training the low score was 106. The high score before training was 204, after training program 218. An increase from 162 points to 209 points or an improvement of 47 points represented the greatest gain. A decrease from 190 points to 168 points a loss of 22 points represented the greatest decrease. The average increase for the group was 10.42 points. The figure 144 points had been designated as the dividing line at Kansas State University in the basic physical education program, those at 144 points or above considered more proficient, below that figure less proficient. In the beginning forty-two students in the study scored above 144, after ten weeks in the weight training program sixty-four scored 144 points or more.

CONCLUSIONS

The purpose of this study was to determine and illustrate through a thorough testing program how a well organized, well supervised weight training program would benefit the college student at Kansas State University.

It was apparent throughout the program that every individual experienced a measurable amount of achievement in several areas of the testing program.

The most satisfying portion of the program came through the muscle measurement portion. The students were amazed that results could be observed from the first workout. It was quite common for impromptu measuring sessions to follow the workouts throughout the program. Of course, immediately following a workout the muscles are in a "pumped up" state and measure larger than they actually are. While this may not be an accurate measurement, it provided in many instances the motivation to continue the hard work.

The second area of testing, muscle power and endurance, also provided a great deal of satisfaction to these young men. Many of the students had never competed in a physical activity before, but because of the individual nature they were able to learn to compete at their own level and at their own rate of speed. In the beginning they competed with themselves, trying to improve upon their own previous performance. Before mid-semester many of the less physically talented individuals were competing among themselves or in many instances with the more physically capable individuals.

Self-confidence is difficult to measure, but it was quite apparent that many of the students made progress in this area. This may be the greatest contribution the program can provide the participants.

While sufficient progress was apparent in the motor ability testing program, it did not quite compare with the success of the other testing areas. At no time during the semester were these events practiced, whereas lifting was practiced regularly. The excitement of improvement in the other areas also seemed to make it rather anticlimatic. The gains made may be attributed in large part to self-confidence gained through results of increased muscular size and increased strength. They knew they were stronger, therefore, they felt confident they would experience improved performance.

The greatest inconsistency was in the zig zag run which may be attributed to the fact that at no time in the program was running included. If running had been included, it is assumed that the sixty-five per cent figure of improvement would have been improved upon. Track coaches, football coaches, basketball coaches, and all other athletic teams using weight training as a supplement to their regular training programs have experienced achievement in the areas of speed, agility, and skill improvement.

Although there were obvious areas of the program which needed change, it was felt that sufficient evidence had been presented to justify an extensive weight training oriented program for all college students.

Physical educators are obligated to contribute to the improvement of all habits, attitudes, skills, and knowledge of physical activity. A well

organized, well supervised weight training program would contribute toward the achievement of these goals.

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EFFECTS OF WEIGHT TRAINING ON MOTOR ABILITY AND
PHYSICAL FITNESS FOR FRESHMAN AT KANSAS STATE UNIVERSITY

by

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AN ABSTRACT OF A MASTER'S REPORT

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MASTER OF SCIENCE

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Weight training prior to World War II was considered to be a harmful practice by athletes, coaches, and trainers. Much credit is due an army surgeon, Thomas L. DeLorme, M. D., who successfully introduced weight training into the Army's orthopedic treatment. Coaches and athletes quickly accepted this method of training once accepted by the medical profession. Their reasoning, if weight training will strengthen the weakened muscles, it must surely produce similar results with the healthy individual.

The purpose of the study was to illustrate how a well organized, well supervised weight training program would benefit the college student at Kansas State University.

One hundred freshmen students at Kansas State University were the subjects of the study. Those young men were given a battery of three tests: The Barrow's Motor Ability Test which consists of three skills, the zig zag run, the standing long jump, and the medicine ball put. Physical measurements which included body weight, chest size, bicep size, and forearm size. Power and endurance strength which included the bench press for a maximum single effort and for repetitions with a 100 pound barbell, and the olympic press for a maximum single effort and repetitions with a 75 pound barbell.

Following the testing program the students began a closely supervised, very vigorous weight training program. The students were given instruction in proper technique for the bench press, olympic press, barbell curl, upright rowing, tricep press, half squat, bent-leg sit ups, and leg lifts. Each exercise was to be performed in sets of two, the first set with a weight heavy enough to allow only seven to ten repetitions, the second set a heavier weight, allowing only five to seven repetitions. This program was followed twice a week for ten weeks.

Considerable improvement was noted throughout the final testing program for all one hundred subjects. An average gain of .965 inches per individual in chest size, .5425 inches in bicep size, and .4925 inches for the forearms were outstanding improvements. In these three measurements ninety per cent or more made gains.

In the power testing program ninety-five per cent made gains in the olympic press and one hundred per cent made progress in the bench press. The average gain in the bench press was 27.15 pounds, and the olympic press 15.3 pounds. Similar results were recorded in the endurance portion with ninety-eight per cent improvement in the bench press and ninety-four per cent in the olympic press. Average gains in repetitions were 6.67 in the bench press and 5.10 for the olympic press.

Although less spectacular, considerable improvement was noted in the motor ability testing. Gains in points scored averaged 10.42 per student with eight-one per cent making gains. Seventy per cent made progress in the standing long jump for an average gain of 3.27 inches. The medicine ball put average improvement was 2.675 feet, seventy-eight per cent making gains. Only sixty-five per cent made progress in the zig zag run. Although the percentage making improvement was low, the average improvement was .471 seconds for the group.

While this type of program made obvious contributions to the physical well being which may be measured, other areas were also affected. Among these were the establishment of interest and enthusiasm for the activity, and an increase in confidence to perform physically.

Sufficient evidence was gathered to justify an extensive weight training oriented program for college students. One can assume that a well organized, well supervised weight training program will contribute toward the improvement of habits, attitudes, skills, and knowledge of physical activity.