THE EFFECT OF ADHESIVE ANKLE STRAPPING UPON THE MOTOR PERFORMANCE OF SELECTED MALE COLLEGE FRESHMEN BY USE OF SELECTED MOTOR ABILITY TESTS

A Thesis

Presented to

the Faculty of the Graduate School

Appalachian State Teachers College

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

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by

Paul Hinshaw

August 1959

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ACKNOWLEDGMENTS

The writer gratefully acknowledges the assistance given him by the director of his thesis committee, Professor M. L. Walters. Gratitude is also expressed to Professor R. E. Thomas and Dr. Francis Hoover, who gave of their time and assistance in the beginning and finishing of this study. Finally, the writer wishes to express his appreciation to the students of the physical education activity class at Appalachian State Teachers College, for without their co-operation this study would not have been possible.

P. H.

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CHAPTER I

INTRODUCTION

Coaches, athletes, and athletic trainers are interested in and use ankle strapping and wrapping as part of their program. Still, differences of opinion exist concerning the use of adhesive strapping. Little if any research has been done in the area of wrapping and strapping ankles. Authorities in the field of athletic training, such as Bevin, Bilik, Hanley, Pennock, and Thorndike, agree that adhesive ankle strapping, as a preventive measure, is very beneficial. Ken Rawlinson, the athletic trainer at the University of Oklahoma, said, "In fielding a team, it is necessary to do a considerable amount of protective taping."[1] He continued by saying:

> As to who should be taped, one should select his own program and then stay with it. At Oklahoma, we have only one rule in regard to protective taping--every boy must have his ankles wrapped or taped before every practice session or game. Why do we think it is important to have the ankles wrapped or taped? In a survey made at Harvard University and reported in the Journal of the American Medical Association, December 14, 1946, Dr. T. B. Quigley, James Cox, and Joseph Murphy stated that since they had started the routine use of ankle wraps (15 years), none of their athletes has suffered a complete ankle ligament rupture.[2]

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[1]Dr. D. H. O'Donoghue and Ken Rawlinson, "Prevention and Treatment of Football Injuries," Scholastic Coach, XXVI (April, 1957), Part I, p. 48.

[2]Ibid., XXVI (May, 1957), Part II, p. 18.

It is apparent from Rawlinson's statements that some feel that adhesive strapping and wrapping is necessary. Other authorities would not agree with Rawlinson.

As an athletic trainer for three years at Appalachian State Teachers College, the writer agrees with Rawlinson that adhesive strapping has some value as a protective measure.[3] The question "Does adhesive strapping have any effect upon the motor performance of an athlete?" is a pertinent one. After talking with authorities in the field the writer concluded that there appears to have been little research on this specific subject. A search of library resources failed to disclose any information on the subject.

I. THE PROBLEM

Statement of the problem. It was the purpose of this study (1) to find the significance, if any, of adhesive ankle strapping, excluding the preventive factor that is usually involved, and (2) to determine the effect, either positive, negative, or none, of a specific type of adhesive ankle strapping upon the motor performance of male college freshmen at Appalachian State Teachers College.

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[3] The writer was a member of the athletic training staff at Appalachian State Teachers College from 1956-1959.

Importance of the study. The problem seemed of foremost importance to the writer because of the lack of research in the area of ankle strapping as it relates to motor performance. There was a need for more factual information. This study attempted to give some experimental light on the controversial issue. The problem was also important to this writer because he has been an athletic trainer at Appalachian State Teachers College for a period of three years and has questioned the "laissez-faire" use of adhesive strapping. Adhesive strapping is a very important part of the athletic trainer's work. Tape is used for bandages, strapping, and occasionally for fastening athletic equipment together. The trainer is in a good position to keep the players relaxed mentally and physically. The trainer's importance to any athletic team cannot be overemphasized.

Results of this problem should be of interest to the athletic coaches throughout the United States. Are they wasting time and money advocating the adhesive ankle strapping of all their athletes, or are they benefiting greatly by the strapping by getting better motor performance from and protection for their athletes? It is a known fact that all coaches want their athletes to perform at their peak at all times.

II. DEFINITIONS OF TERMS USED

Adhesive ankle strapping. Adhesive ankle strapping is interpreted as the use of adhesive tape, one and one-half inches in width, for the purpose of wrapping and supporting the ankle. A standard adhesive strapping was devised and used in this study. The name given to the adhesive strapping is the "gibney and half figure-eight combination."

Motor performance. In looking for a workable definition of motor performance, Barrow's definition was consulted:

> Motor performance is a complex quality and is made up of many components. First, there are those physical performance factors which underlie the performance of skills. These factors include speed, ability, power, strength, and the fundamental skills. Second, there are certain structural factors which either help or hinder the individual's ability. These factors include age, weight, height, body type, and structure. Third, there are certain psychological factors which influence performance in varying degrees. These factors include interest, courage, initiative, smartness, persistence, and spirit.[4]

This study concerns itself chiefly with the first of the components, the physical. Notice must also be taken of certain mental, emotional, and social factors which have great influence on physical performance. This study, however, did not attempt to include or delimit them. The basic physical performance factors, such as ability, power, speed, and

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[4]Harold M. Barrow, Motor Ability Testing for College Men (Minneapolis: Burgess Publishing Company, 1957), p. i.

the fundamental skills of running and jumping, were the key factors in the study.

To gain more insight in the area of motor performance, the writings of Cureton, one of the foremost authorities in this area as well as the area of motor fitness, were examined. Cureton stated:

> Motor fitness is a limited phase of motor ability which emphasizes capacity for vigorous work or athletic effort. Specific aspects of emphasis are (1) endurance, (2) power, (3) strength, (4) agility, (5) flexibility, and (6) balance. It emphasizes the fundamental or gross big muscle movements or held positions dominated by muscular energy, kinesthetic sense, and suppleness of the major tissues and joints, i.e., those aspects which are fundamental to athletic or work skills rather than the higher refinements pertaining to specialized skills which require years to perfect.[5]

There are several different aspects to motor performance and fitness, as can be noted in the writings of Barrow and Cureton.

Motor ability. Barrow defined motor ability as the acquired and innate ability to perform motor skills of a general or fundamental nature exclusive of highly specialized sports or gymnastic techniques.[6]

This definition implies that development is a result of innate capacity plus diverse training and experience.

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[5]Thomas K. Cureton, Physical Fitness Appraisal and Guidance (St. Louis: The C. B. Mosby Company, 1947), p. 390.

[6]Barrow, op. cit., p. ii.

Second, any reliable measure of it must avoid specialized skills. Last, motor ability would seem to be composed of factors which are static and lasting as opposed to factors which are dynamic and changeable.

Motor ability test. According to Brace, there is no uniformity of opinion among physical educators as to what constitutes motor ability. Several tests have been proposed, but there is no evidence to prove the amount of motor ability these tests measure.[7]

Some criteria that are used for selection of motor ability tests are as follows:

1. Learning new activities easily
2. Skill in a variety of activities
3. Ease and graceful form in performance
4. Great ability in some special line

Brace indicated that by the use of these criteria motor ability tests are constructed.

Constructors of motor ability tests try to include activities that will bring into action manipulation of all the parts of the body.

With the above definitions in mind, the writer proceeded to attempt to find a workable answer to the study at hand.

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[7]David K. Brace, Measuring Motor Ability (New York: A. S. Barnes and Company, 1930), pp. 13-14.

CHAPTER II

REVIEW OF THE LITERATURE

The review of literature in the area of this problem was directed toward two main areas, motor ability and performance, and the ankle and adhesive ankle strapping. All available literature was reviewed.

I. LITERATURE RELATED TO THE AREA OF MOTOR ABILITY AND MOTOR PERFORMANCE

For studies related to motor ability and performance, the writer reviewed books, periodical articles, pamphlets, and articles in journals, written by such authorities as Barrow, Clarke, Brace, Rogers, McCloy, Larson, and Yocom.

Rogers, in his study of physical capacity tests, had the following to say concerning the accuracy of testing techniques:

> Whoever embarks upon a program of education must assume the burden of defining goals and utilizing measuring processes to determine both the status and progress of pupils toward the desired objectives. Moreover, the more definite the goals the more valid and reliable may be the measurements. The greater the accuracy of measurement the more surely and rapidly will the educator succeed in his work. Measurement thus becomes an indispensable technique of education; and education takes on a scientific aspect and is deserving of increased public support as measurements become more accurate as well as more appropriate.[1]

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[1]Frederick Rand Rogers, Physical Capacity Tests (New York: A. S. Barnes and Company, 1931), p. 1.

The accuracy of the testing techniques was considered a vital part of this study, in order to insure a good degree of reliability.

The need for better methods of measuring motor ability was stressed by Barrow in his research on the subject of motor ability. He stated:

> Physical educators today need a better evaluation of the college student's ability in motor learning and performance. In the area of general motor ability particularly there is a need for a valid and objective measuring device which is simple to administer. In addition to these criteria the test should provide for practice in some of the fundamental skills, should be of sufficient interest to be highly motivated, should contribute to the experiences which a student already has, should aid materially in the student's development, and should be safe and physically suitable.
>
> A test of this type is necessary for several purposes, but classification is perhaps the first need. Proper placement and scheduling of students for general service classes is mandatory if the individual needs are to be met. The principle of individual needs has not always been applied in practice as it should be. When students are equated in abilities by classification techniques, social development is more likely to occur. Colleges in the past have not challenged the superior student in their service programs any more than they have adequately met the needs of those students in the lower ranges of motor ability.[2]

It was concluded from Barrow's observations that there is a definite need for better motor ability tests.

To understand better the correct way to use motor ability tests, the writer consulted Mathews. Mathews

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[2]Harold M. Barrow, Motor Ability Testing for College Men (Minneapolis: Burgess Publishing Company, 1957), pp. 1-2.

reported the following:

> It becomes obvious that there are many components involved when one attempts to measure the ability of a pupil to participate in skills. Rather than employ all factors in motor ability evaluation the instructor must select a single test or test battery which is most valid in representing the type of general motor ability that he is interested in measuring. Such testing is worthwhile for, knowing the motor ability of the pupils, he may classify groups according to proficiency for participation in physical education classes. It stands to reason that if the physical education program is made up mostly of skill activities it is logical to place pupils of nearly the same general athletic ability together.[3]

Larson and Yocom had the following to say concerning motor ability:

> Fundamental or general motor skills or abilities are used synonymously. The term fundamental or general refers to these skills or abilities which underlie or compose the skills which constitute performance in the various sports. The fundamental sport skills are those of running, jumping, throwing, catching, kicking, climbing, and vaulting. These fundamental skills may further be divided into basic elements, such as muscular strength, endurance, speed, accuracy, balance, rhythm, body coordination, shiftness, steadiness, and agility.[4]

Clarke stated:

> Actually, general motor ability is complex. Many factors enter into efficient motor performance: physical, mental, emotional, and social. It is a Gestalt, with the whole personality dynamically organized, that results in excellent performance. Physically, motor

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[3]Donald K. Mathews, Measurement in Physical Education (Philadelphia: W. B. Saunders Company, 1958), p. 117.

[4]Larson and Yocom, Measurement and Evaluation in Physical, Health, and Recreation Education (St. Louis: C. V. Mosby Company, 1951), p. 184.

> efficiency or skill is composed of strength, endurance, speed, and the co-ordination or control of these elements for accuracy.[5]

After reviewing the literature concerning motor ability, motor performance, and motor ability tests, certain conclusions were formulated. Every author who was consulted indicated that speed, jumping, agility, running, and power are very important factors in motor performance. From these and other factors motor ability tests have been constructed.

II. LITERATURE RELATED TO THE AREA OF THE ANKLE AND ADHESIVE STRAPPING OF THE ANKLE

First, let us look at the anatomical and kinesthetic aspects of the ankle as given by Rasch and Morehouse:

> The ankle is a ginglymus (hinge) joint formed by the articulation of the lower ends of the tibia and fibula with the astragalus. The only movements possible in the ankle are flexion and extension. The anatomic arrangement of the ankle is such that it is poorly supported by muscles and ligaments, particularly on the anterolateral aspect. It is stabilized by a number of ligaments, the most important of which are the tibiofibular and the collateral ligaments. The tendons of the muscles of the gastrocnemius and soleus, the peronei, the tibialis and others form a sort of stirrup which supports the joint. Thus the tone of these muscles affects the stability of the ankle joint. In the erect position, the entire body is transmitted through the ankle to the foot; hence the ankle supports more weight than does any other joint in the body.[6]

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[5] H. Harrison Clarke, The Application of Measurement to Health and Physical Education (New York: Prentice Hall, Inc., 1945), p. 223.

[6] L. E. Morehouse and P. J. Rasch, Scientific Basis of Athletic Training (Philadelphia: W. B. Saunders Company, 1958), pp. 166-167.

Bilik reported the following with regard to the importance of ankle strapping:

> Taping is the colloquial term for strapping with adhesive. It constitutes an important part of the trainer's work. In athletics, we use a great deal of adhesive for preventive, protective, and remedial purposes. Thus we may choose to strap ankles of athletes in order to prevent sprains, we may have to plan a special adhesive support for a joint weakened by previous injuries; to anchor protections and pads; and finally various athletic injuries require skillful strapping to aid healing.[7]

No mention of motor performance appeared in Bilik's writings. Bevan contributed the following about ankle strapping:

> Ankles are particularly susceptible to sprain, and can keep an athlete out of competition for long periods. Preventive measures are consequently necessary. A good trainer applies ankle wraps before every workout and tapes weak ankles daily and for all contests.[8]

Bilik related the following concerning the actual strapping of the ankle:

> The ankle joint is most susceptible to injuries. An effective preventive support is, therefore, an absolute necessity. A great number of schools use some form of cotton ankle roller bandage for the purpose.
>
> Strapping with adhesive is unquestionably the most effective and reliable method of protecting the joint. The narrow strips of adhesive can be made to fit

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[7]S. E. Bilik, The Trainer's Bible (New York: T. J. Reed and Company, 1948), p. 150.

[8]Roland Bevan, The Athletic Trainer's Handbook (New Jersey: Prentice Hall, Inc., 1956), p. 74.

every neck, hollow, and crevice of a joint. By varying the number of strips used we can attain any desired strength of support.[9]

The reader should gain a better understanding of the factors involved in the problem by gleaning the related materials in this chapter. The aim of this chapter was to present some of the important facts concerning motor performance and adhesive strapping.

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[9]Bilik, op. cit., pp. 155-156.

CHAPTER III

PROCEDURE

I. SELECTION OF TESTS

This study was of an experimental nature; therefore, some type of measuring instrument was needed. In planning the procedures to be followed in the study, those tests were selected which would measure motor ability and motor performance. The following criteria for the selection of tests were used:

1. The tests should involve as many basic motor ability skills as possible.
2. The tests should allow for some measure of success by all subjects.
3. The tests should be economical and easy to administer.
4. The tests should be challenging to the participants.

After careful study and investigation two tests were chosen, The Wear Motor Ability Test and the Sargent Chalk Jump Test. The Wear Motor Ability Test was chosen because it measures power, speed, strength, and agility, the primary factors of motor performance. The jumping factor in motor performance is dealt with lightly in the Wear Test; therefore,

the Sargent Chalk Jump Test was chosen to measure the jumping factor in motor performance. The combination of these two tests gave the writer a measuring device of motor performance or ability.

II. TESTING PROCEDURE

The "one group" method of testing was used. The subjects for the study were selected from a freshman non-major physical education activity class at Appalachian State Teachers College during the winter quarter of 1958-1959. Forty students started the test with thirty-nine finishing, as one participant dropped out of school while the tests were being administered.

A pilot period of testing, to familiarize the subjects with the tests, was administered before the actual testing period was started. Both tests were administered three times to the group before their ankles were strapped and three times with their ankles strapped. The tests were administered every Tuesday and Thursday for a period of approximately two months. The tests were administered from 9:00 A. M. each day. The subjects dressed in their physical education activity uniform which consisted of the following:

1. Rubber sole shoes
2. Athletic socks
3. Jockey

4. Shorts
5. Sweat pants
6. T-shirt
7. Sweat shirt

Location and preparation of testing equipment. The Old Gymnasium on the Appalachian State Teachers College campus was selected as the area to be used in administering the tests. The floor was marked off according to the specifications of the Wear Motor Ability Test.

For the Sargent Chalk Jump Test, the writer, with the help of Professor R. E. Thomas, physical education faculty member at Appalachian State Teachers College, constructed a jump board. The board was marked off into lines, one-half inches apart and numbered on each side from seventy-two through one hundred and thirty-six inches. The board was suspended from the balcony by two steel hooks. These hooks kept the board from swinging when being used. (See Diagram 1, page 16.)

Administration of the tests used. Both tests were administered according to materials and space available. Each participant was given both tests three times before he was strapped; then he was given the test three times with strapping.

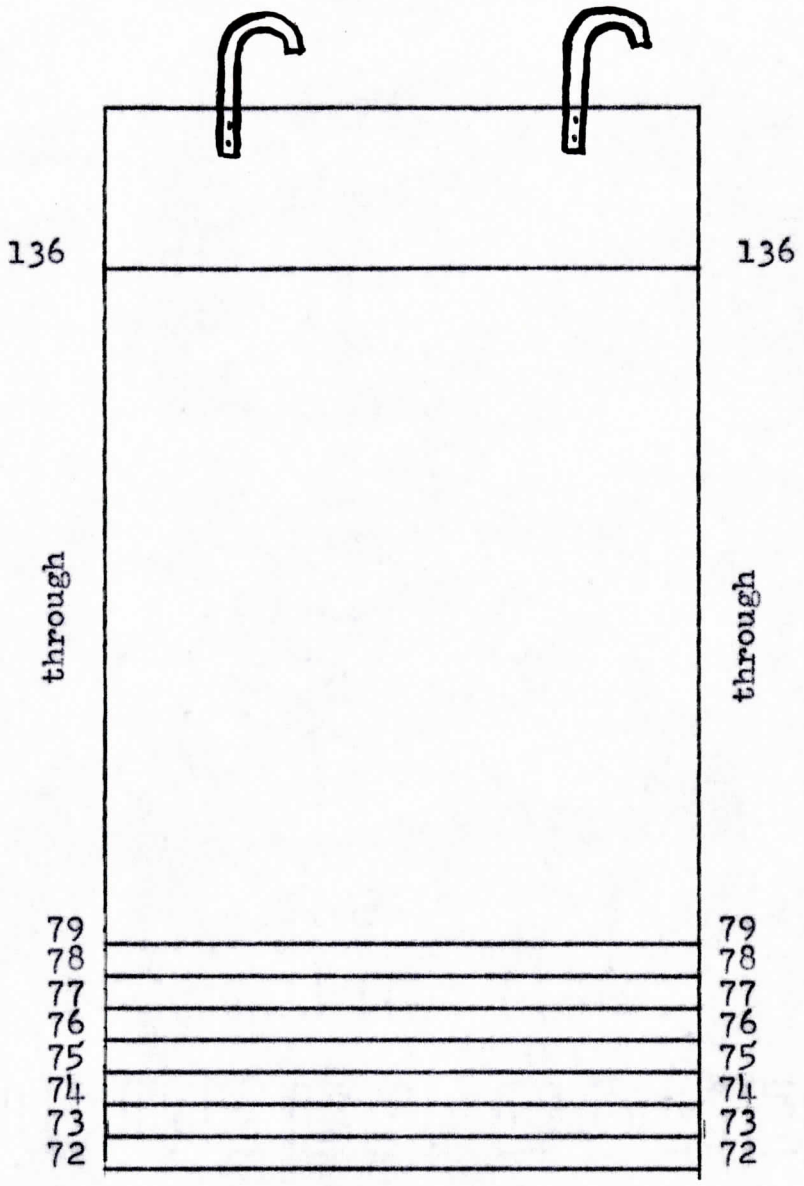

DIAGRAM 1

THE JUMP BOARD USED IN THE EXPERIMENT

The Wear Motor Ability Test was administered in the following manner. This test is designed to measure general motor ability and can be used effectively for classification purposes. The equipment needed consists of four chairs, a pair of high-jump standards (two chairs were used because the standards were not available), a crossbar or rope, a mat, and a stop watch. The performer has a running start of ten feet. The stop watch is started at the end of the ten feet. The performer executes a forward roll on the mat and then continues to the chair indicated in the upper left-hand of the diagram. (See Diagram 2, page 18.) He passes to the left side of the chair, turns to the right, and continues in this direction for thirty feet. He then executes a figure-eight turn around the chairs indicated in the upper right-hand corner of the diagram, which are three feet apart. He then continues on the right side of the course. He continues to the chair indicated in the lower right-hand corner of the course, encircles the chair, and proceeds along the diagonal line to the bar, which is eighteen inches from the floor and at right angles to the diagonal line. He jumps over the bar, continues thirty feet along the diagonal line, performs a pirouette, and continues along the diagonal line to the line where the watch is stopped. This is seventy-five feet from the chair indicated in the lower right-hand corner of the diagram, and he is supposed to run ten feet beyond that line.

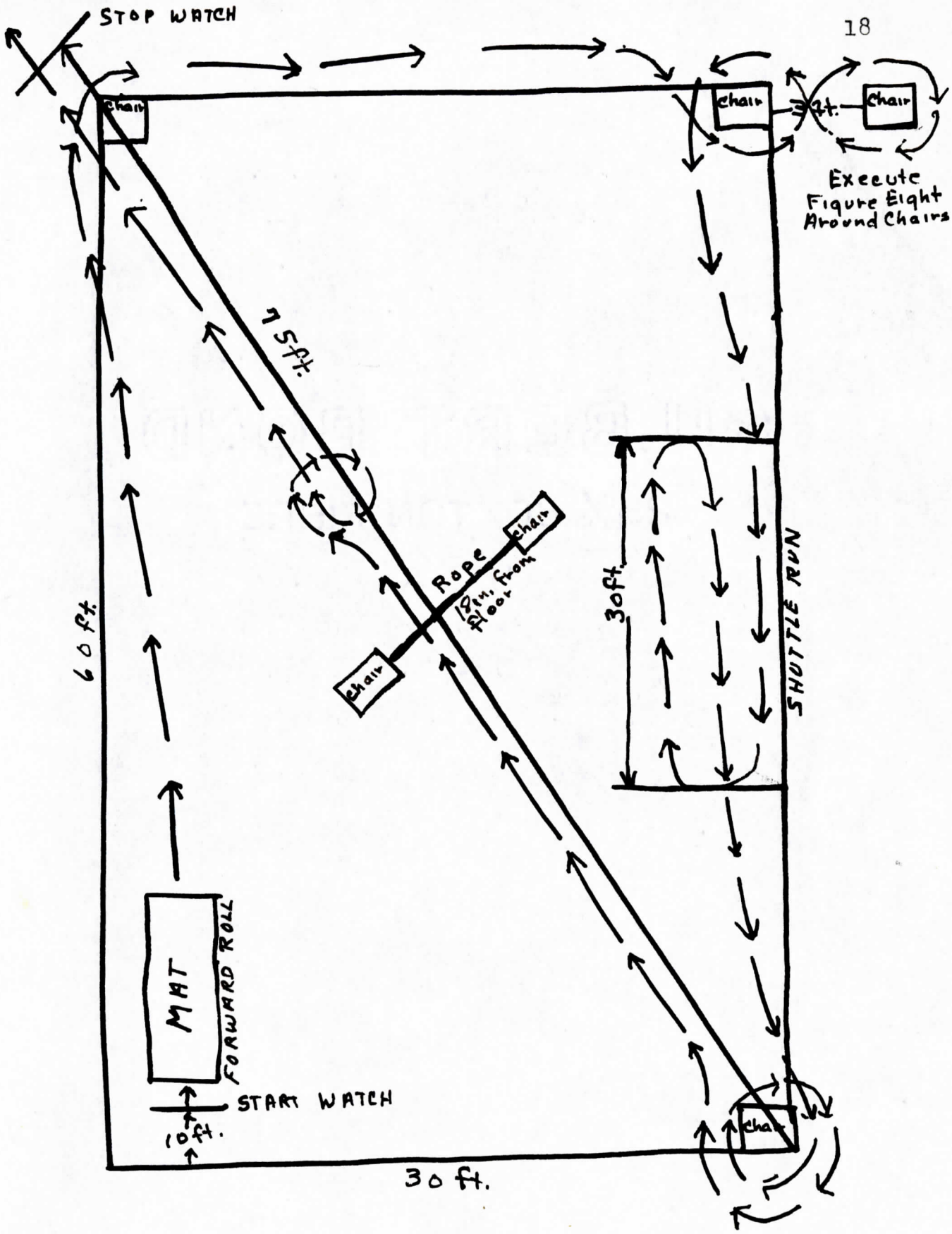

DIAGRAM 2

FLOOR LAYOUT OF WEAR MOTOR ABILITY TEST

The other test administered was the Sargent Chalk Jump. This is not a true Sargent Jump Test, but it has a high correlation with it. The test was administered in the following manner: The person being tested stands with his back to the board and extends his arms up over his head. The point where the index finger reaches is marked. The person being tested turns with either side to the board and holds a piece of chalk in the hand next to the board. He then bends forward at the waist to about a 90 degree angle with the legs slightly flexed at the knees. The arms are downward and backward. A pause is made at this position before the jump to eliminate the possibility of a double jump. The person then thrusts himself upward. The highest point is marked with the chalk. The distance is measured in inches from the original extended mark to the jump mark.

III. ADHESIVE STRAPPING PROCEDURE

Some type of adhesive ankle strapping was needed. Use of the same type of ankle strapping that is generally used on the athletes at Appalachian State Teachers College was decided upon. This particular type of strapping is a combination gibney and half figure eight. One and one-half inch zinc oxide adhesive trainer's tape was used. Each participant shaved his ankles before they were taped and painted

them with tuf-skin. The ankles were then allowed to dry. The same trainer taped all of the ankles as assurance of a more uniform taping procedure.

The first strip of tape used was an anchor strip below the insertion of the gastrocnemius muscle and parallel with the bottom of the foot, which is flexed to a ninety degree angle. The next strip was a vertical strip that starts on the medial side of the ankle and pulls toward the lateral side behind the malleolus on each side. The third strip was a horizontal strip that starts from the inside front and below the malleolus and pulls toward the outside and around the posterior part of the ankle. This procedure of the vertical and horizontal weave was repeated two more times, overlapping the tape about one-half inch each time. After this procedure was completed, the strapping was finished with horizontal strips up to the anchor strip. (See Diagram 3 on page 21.)

Next the half-figure eight strips were applied. The first strip was started at about a thirty degree angle behind the malleolus and under the instep, around to the outside, and secured on the front of the ankle. Two more strips were applied in the same manner, overlapping each strip about one-half its width. (See Diagram 3, page 21.) The tape must be secure and not wrinkled. After the strapping was completed, a powder base was applied to the feet to protect against blisters.

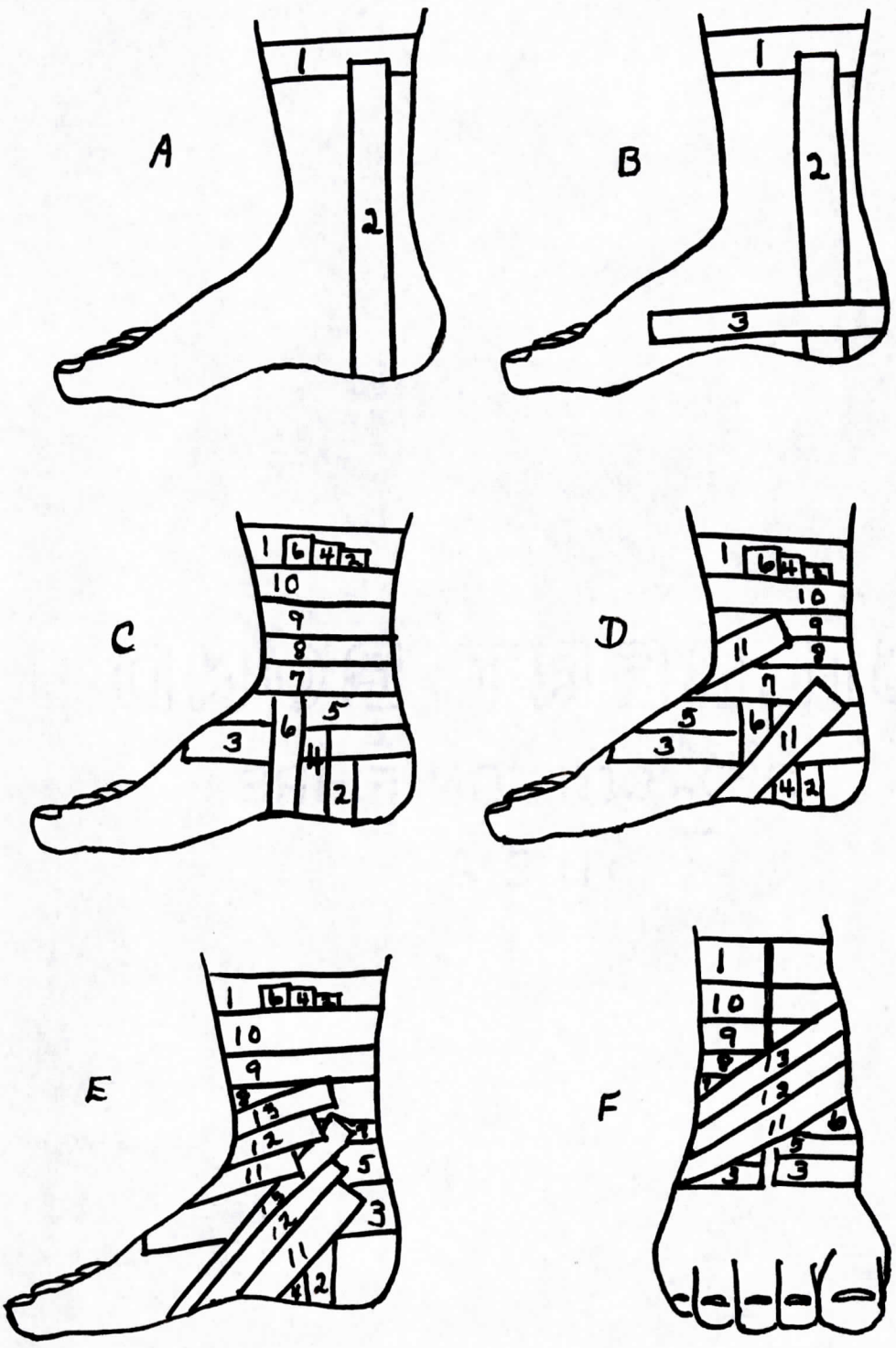

DIAGRAM 3

THE GIBNEY AND HALF-FIGURE EIGHT TAPING PROCEDURE

CHAPTER IV

ANALYSIS OF DATA

I. ORGANIZATION AND COLLECTION OF DATA

Data were recorded by using three by five index cards. (See Diagram 4 on page 23.) The scores of each individual were recorded on a card with his name at the top. The Wear Motor Ability Test scores were recorded on one side of the card and the Sargent Chalk Jump Test scores on the other side of the card.

Each test was administered to each participant three times before his ankles were strapped, as mentioned in Chapter III. The three before strapping scores on each test were then added together and divided by three to get an average score on each test before strapping. To make it clearer to the reader, each participant had an average score before strapping and an average score after strapping for the Sargent Chalk Jump Test. To get the scores for the Sargent Chalk Jump, the person's reaching height was recorded, and then the reaching height was subtracted from the average jumping height to get each person's jumping height in inches.

The before strapping scores for each test and the after strapping scores for each test were set up into different columns so they would be in workable order. (See Tables I and II on pages 24 and 25.)

NAME_____

WEAR MOTOR ABILITY TEST

BEFORE STRAPPING	AFTER STRAPPING	DIFFERENCE
Run 1		
Run 2		
Run 3		
Average		

Scores recorded in seconds.

NAME_____

SARGENT CHALK JUMP TEST

STANDING HEIGHT	JUMPING HEIGHT		DIFFERENCE
	Before Strap.	After Strap.	
	Jump 1		
	Jump 2		
	Jump 3		
	Average		

Scores recorded in inches.

DIAGRAM 4

INDIVIDUAL SCORE CARDS

TABLE I

AVERAGE RAW SCORES*

WMA RAW SCORES		SCJ RAW SCORES	
Before strapping	After strapping	Before strapping	After strapping
28.7	28.3	16.3	17.0
30.7	30.7	17.3	16.7
26.3	25.7	19.7	19.0
25.7	24.7	17.7	15.7
24.0	25.3	22.3	23.0
26.3	25.7	18.3	17.0
26.0	24.7	14.0	15.3
26.0	25.7	22.0	23.3
28.0	27.7	14.7	14.0
28.7	27.0	14.0	15.0
28.7	27.3	18.3	18.7
26.7	26.3	16.7	16.0
25.0	25.0	22.7	22.7
26.7	26.7	19.3	19.7
28.3	29.0	17.7	16.7
28.7	27.7	18.0	16.3
24.7	23.7	20.7	21.0
24.7	23.7	23.7	23.7
25.7	26.0	20.7	21.0
26.3	27.0	16.7	14.7
25.0	24.7	20.3	21.3
29.3	26.7	19.7	18.7
26.3	25.7	17.7	16.7
26.7	26.3	20.0	19.3
27.3	26.7	18.3	19.0
27.0	25.0	18.3	19.3
24.0	23.7	23.0	22.7
26.3	27.3	18.7	18.3
26.0	26.7	18.0	17.7
25.0	26.7	20.3	21.0
28.7	28.7	18.0	20.3
25.0	25.0	19.7	20.7
27.0	27.0	20.7	21.0
27.0	26.7	18.7	18.7
27.7	28.0	16.3	17.3
33.7	33.7	19.0	17.7
25.7	26.7	18.3	16.3
26.7	26.7	22.0	22.0
28.3	28.0	19.7	20.3

*Sargent Chalk Jump scores are recorded in inches, and Wear Motor Ability scores are recorded in seconds.

TABLE II

AVERAGE COMBINATION T-SCORES WITH WEAR ABILITY SCORES
INVERTED TO MATCH SARGENT SCORES
HIGH SCORES WITH HIGH SCORES

Student no.	BEFORE STRAPPING				AFTER STRAPPING			
	WMA	SCJ	Total	Average	WMA	SCJ	Total	Average
1	54	28	82	41.0	60	36	96	48.0
2	54	63	117	58.5	55	67	122	61.0
3	53	47	100	50.0	55	43	98	49.0
4	53	55	108	54.0	55	55	110	55.0
5	55	44	99	49.5	60	38	98	49.0
6	64	64	128	64.0	57	66	123	66.5
7	30	42	72	36.0	28	42	70	35.0
8	40	38	78	39.0	59	43	102	51.0
9	50	63	113	56.5	49	62	111	55.5
10	42	53	95	47.5	43	56	99	49.5
11	55	47	102	51.0	49	49	98	49.0
12	15	50	65	32.5	12	46	58	29.0
13	45	38	83	41.5	43	44	87	43.5
14	44	48	92	46.0	44	31	75	37.5
15	40	28	68	34.0	48	35	83	41.5
16	40	47	87	43.5	46	49	95	47.5
17	50	40	90	45.0	52	34	86	43.0
18	59	66	125	62.5	59	61	120	60.0
19	50	51	101	50.5	49	53	102	51.0
20	42	44	86	43.0	37	42	79	39.5
21	40	46	86	43.0	44	49	93	46.5
22	61	58	119	59.5	65	58	123	61.5
23	61	71	132	66.0	65	69	134	67.0
24	55	58	113	56.5	53	58	111	55.5
25	53	40	93	46.5	48	38	86	43.0
26	59	56	115	57.5	60	59	119	59.5
27	37	53	90	45.0	49	49	98	49.0
28	53	44	97	48.5	55	42	97	48.5
29	50	54	104	52.0	52	51	103	51.5
30	47	47	94	47.0	49	55	104	52.0
31	48	47	95	47.5	59	51	110	55.0
32	64	68	132	66.0	65	61	126	63.0
33	53	49	102	51.0	46	48	94	47.0
34	54	46	100	50.0	49	46	95	47.5
35	59	56	115	57.5	49	58	107	53.5
36	40	46	86	43.0	39	56	95	47.5
37	59	53	112	56.0	59	57	116	58.0
38	48	58	106	53.0	48	58	106	53.0
39	48	49	97	48.5	49	49	98	49.0

II. SELECTING METHODS FOR TREATING DATA

After the data were collected, some method or methods for treating the data had to be decided upon. Several different statistical methods were examined to see if they would apply to this particular experiment. Some of the methods examined were rank order correlation, null hypothesis, difference between variables, the Pearson product-moment of correlation, and several others. The Pearson product-moment of correlation was decided upon because this method is especially designed to correlate two different factors to show their degree of relationship. The other method selected was the null hypothesis. Members of the writer's graduate advisory committee recommended this method because it tests the significant difference between means. It was thought that by correct use of these methods, a good statistical picture of the data could be reached.

The Pearson product-moment of correlation method. Standard correlation charts are available to use in the correlation process. The first step in the correlation was to set the raw data into intervals and substitute one variable for X on the chart and the other variable for Y: for example, letting X equal the before strapping scores and Y equal the after strapping scores. The two sets of scores were then correlated according to the correct pro-

cedure for the Pearson product-moment of correlation.

The scores on the Wear Motor Ability Test were correlated first. The "before strapping" scores were correlated with the "after strapping" scores. The scores were set up in intervals of one (for example, 24.0-24.9 equals one interval). The scores on the before strapping test ran from 24 seconds through 34.9 seconds, with the lower number being the best performance. The scores on the after strapping test ran from 23.7 seconds through 35.9 seconds. After the proper computations were made, the reliability coefficient was a positive .276 per cent with a standard error of ±.149. According to the accepted per cent of reliability of the Pearson product-moment of correlation, only a per cent from .700-.900 is considered reliable to predict with any reasonable accuracy the positive or negative effects of the variables being correlated. One can then see that a correlation of only .276 per cent is not high enough to predict a positive or negative outcome. To have absolutely no correlation the per cent would be zero; therefore, there was a slight indication according to this test that adhesive strapping improved the participants' motor performance. (See Table III, page 28.)

The scores on the Sargent Chalk Jump Test were correlated in the same manner as the Wear Motor Ability Test.

TABLE III

CORRELATIONS

CORRELATION I. Before Strapping vs. After Strapping
Raw Scores on the Wear Motor Ability Test

FACTORS	RANGE OF SCORES	MEAN	STANDARD DEVIATION	COEFFICIENT OF CORRELATION	STANDARD ERROR OF CORRELATION
Before Strapping	24-33.7 seconds	26.815	1.99	.276	± .149
After Strapping	23.7-33.7 sec.	26.648	1.88		

CORRELATION II. Before Strapping vs. After Strapping
Raw Scores on the Sargent Chalk Jump Test

FACTORS	RANGE OF SCORES	MEAN	STANDARD DEVIATION	COEFFICIENT OF CORRELATION	STANDARD ERROR OF CORRELATION
Before Strapping	14-23.7 inches	19.045	2.25	.227	± .153
After Strapping	14-23.7 inches	18.8795	2.58		

CORRELATION III. Before Strapping vs. After Strapping
Combination Average T-Scores on Both Tests

FACTORS	RANGE OF SCORES	MEAN	STANDARD DEVIATION	COEFFICIENT OF CORRELATION	STANDARD ERROR OF CORRELATION
Before Strapping	32.5-66	50	14.46	.307	± .144
After Strapping	29-67	50	13.17		

The reliability score for this test was .227. Again one can see that there was not enough positive or negative correlation to be significant. (See Table III, page 28.)

After the Wear Motor Ability Test scores and the Sargent Chalk Jump Test scores had been correlated separately, they were converted to T-scores. The before and after strapping jump scores were converted to T-scores and then the before and after strapping ability scores were converted to T-scores. The before and after strapping ability scores were then inverted. The reason for inverting these scores was to get each person's best performance scores together. The best performance on the ability test would be the smallest score, while the best performance on the jump test would be the largest score. A participant could have a high score on the jump test and a low score on the ability test and his average score could be lower than a participant who had a poor score on one test and a high score on the other. From the above it is apparent that one set of scores would need to be inverted. The ability test T-scores were inverted so that the person with the highest average score would be the best performer. To invert the T-scores for the ability test, fifty was selected as the mean, since fifty is the mean in any group of T-scores. In the inverting process if a participant had a score of five below 50, which would be 45, his score would change to 55 when inverted. This process was

carried on with all the Wear Motor Ability T-scores, both before and after strapping. The before strapping ability T-scores were then added to the before strapping jump T-scores and the after strapping T-scores added together on both tests. Then the average T-score before strapping for each participant was extracted and the average T-score for each after strapping was extracted. The combination average before strapping T-scores were then correlated with the combination average after strapping T-scores. The Pearson product-moment of correlation was used for this correlation also. The result of this correlation was a reliability of correlation of .307. This combination average T-score correlation did not show a marked positive or negative correlation. According to this correlation there was a slight indication of a positive correlation between the two variables, but not enough to predict one way or the other. (See Table III, page 28, for data of the three different correlations.)

The null hypothesis method. Lindquist summarized quite effectively the null hypothesis method as follows:

> We are very often uniquely interested in testing the hypothesis that two populations sampled are alike in the trait measured, or that the true difference is zero. This hypothesis (that the true difference is zero) is known as the "null" hypothesis.
>
> When the null hypothesis may be rejected at a high level of confidence, we say that the difference is "statistically significant." Frequently, we qualify

> such statements, saying, for example, that a difference is "significant at the 5 per cent level" (meaning that the null hypothesis may be rejected at the 5 per cent level) or that it is "significant at the 1 per cent level" (meaning that we are confident at the 1 per cent level that the null hypothesis is false). When we say that a difference is significant, we mean that it is too large to be reasonably attributed to chance (sampling error) alone, and that we are highly confident ("practically certain") that the two populations differ in the trait measured.[1]

The first step in using the null hypothesis was to find the standard error of the two means involved in the problem. (See Table IV, page 32, for standard error of mean formula.) The next step was to substitute the standard error of the means into the standard error of the difference between means of related variables formula (Table IV). The major step was to use the critical ratio formula to find the level of confidence at which the hypothesis can be accepted or rejected (Table IV).

The following calculations were made with all available data. The means for the before adhesive strapping scores and for the after adhesive strapping scores were taken from the grouped frequency tables method. This method was considered more efficient than the method of adding all the scores together and getting the average mean score. The standard deviation of each group of scores was also derived from the grouped frequency distribution and computed by use

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[1] E. F. Lindquist, A First Course in Statistics (Cambridge: Houghton Mifflin Company, 1942), pp. 130-131.

TABLE IV

TABLE OF FORMULAS

r = Reliability of correlation

n = Number of subjects

Σ = Sum of

f = Frequencies

σ = Standard deviation

M = Mean score

d = Deviation

I = Interval size

STANDARD DEVIATION FORMULA[2]

$$\sigma = I\sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2}$$

STANDARD ERROR OF MEAN FORMULA[3]

$$\sigma_M = \frac{\sigma \text{ OF SAMPLE}}{\sqrt{N-1}}$$

STANDARD ERROR OF THE DIFFERENCE BETWEEN MEANS OF RELATED VARIABLES FORMULA[4]

$$\sigma_{(M_1-M_2)} = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2 - 2r_{12} \times \sigma_{M_1} \cdot \sigma_{M_2}}$$

CRITICAL RATIO FORMULA[5]

$$CR = \frac{\text{SAMPLING ERROR}}{\sigma_{\text{DIFFERENCE}}}$$

[2]Ibid., p. 76.

[3]Ibid., p. 120.

[4]Ibid., p. 135.

[5]Clarke, op. cit. pp. 429-430.

of the standard deviation formula (See Table IV, page 32). The before strapping means were represented by M_1 and the after strapping means by M_2. The standard errors of the means were next computed by use of the standard error formula. The M_1's and M_2's were then substituted in the standard error of the difference between means of related variables formula and correct procedure followed.

The calculations were substituted in the critical ratio formula to get the level of confidence at which the hypothesis could be accepted or rejected. The steps were as follows:

1. Determine sampling error by subtracting one mean from the other on each test. (Find the difference between the two means on the same correlation or on the same test.)
2. Determine the standard difference of mean one (M_1) and mean two (M_2) by use of the standard error of the difference between means of related variables formula.
3. Substitute answers to steps 1 and 2 above in critical ratio formula.
4. The answer obtained in step 3 is standard deviation units.
5. Consult any area relationships under the normal curve table and get the correct per cent listed for the number of standard deviation units in step 4.

6. Subtract the answer in step 5 from 50 per cent and multiply by 2.

The answer revealed the level of confidence by which the hypothesis can be rejected or accepted.

By following the procedures outlined in this chapter, the scores in Table V were obtained.

After the data were analyzed by the methods described in this chapter, the writer then proceeded to summarize the total project, draw conclusions, and make recommendations.

TABLE V

SCORES OF THE THREE DIFFERENT CORRELATIONS

TEST		STANDARD DEVIATION	STANDARD ERROR OF MEAN	STANDARD DIFFERENCE OF $M_1 - M_2$	CRITICAL RATIO	LEVEL OF CONFIDENCE
Wear Motor Ability	Before	1.99	.32	.38	.44 units	66%
	After	1.88	.31			
Sargent Chalk Jump	Before	2.25	.37	.49	.34 units	73.38%
	After	2.58	.42			
Combination Average T-score	Before	14.46	2.3	2.62	.14 units	88.86%
	After	13.17	2.1			

CHAPTER V

SUMMARY AND CONCLUSIONS

I. SUMMARY

This study was undertaken to investigate statistically the effect of adhesive ankle strapping upon the motor performance of a group of male college freshmen at Appalachian State Teachers College.

A review of the literature revealed very little experimental evidence from actual investigation into the area of ankle strapping as related to motor performance. There were several studies in the area of motor ability, but none as related to ankle strapping.

The Wear Motor Ability Test and the Sargent Chalk Jump Test were administered to thirty-nine male freshmen at Appalachian State Teachers College. The results of these tests were treated statistically with the Pearson product-moment of correlation and the null hypothesis method.

The results were as follows: When the results of the Wear Motor Ability Test which had been given before strapping were correlated with similar results after strapping by the Pearson product-moment of correlation method, the coefficient of correlation was found to be .276. This

correlation would seem to indicate a very low positive correlation between the results of the two administrations of the test. In terms of this specific problem it would seem to indicate that strapping of ankles had very little effect upon the motor performance of the individuals tested.

The Sargent Chalk Jump Test was given in conjunction with the above test and at the same times. When correlated by the same method, it produced a correlation of .227. This correlation would also indicate that strapping of ankles had very little effect upon the motor performance of the individuals tested.

In order to combine the results of the two separate tests using different units of measurement, the raw scores obtained on each above test were converted to T-scores through the use of a T-table. The combined T-scores of the tests administered before strapping were averaged and correlated with the combined T-scores of the two tests administered after strapping, again by the method mentioned previously. The coefficient of correlation was found to be .307. This correlation could reasonably be compared to the two preceding correlations. The three correlations indicate that, using the same two tests, the same taping method, and the same procedure, there is probably very little effect from strapping of the ankles as related to motor performance.

In an effort to make an additional check, the writer, working with raw scores, determined the means of the raw scores on the Wear Motor Ability Test before strapping and then after strapping. Also in each case the standard error of the mean was determined. Applying the techniques of the null hypothesis, the formula for standard error of the difference between means of related groups was used. The level of confidence was found to be 66 per cent. On the basis of this figure, which indicated that a sampling error of zero would be found in 66 per cent of similar samples, the hypothesis was accepted. Acceptance of the hypothesis indicated that the true difference between means was zero, and it was unlikely that strapping would have any effect upon motor performance.

The raw scores on the Sargent Chalk Jump Test were treated with the same method as was used for the Wear Motor Ability Test. The level of confidence was 73.86 per cent. Again the hypothesis was accepted. It was again unlikely that adhesive strapping had any noticeable effect upon the motor performance of the individuals tested.

To make still another check, the raw scores on the Wear Motor Ability and Sargent Chalk Jump tests were converted to T-scores. The before strapping T-scores were combined. An average T-score for each individual, both before strapping and after strapping, was obtained. Next,

the same procedure as that applied to the raw scores was used. The level of confidence on the T-score combination scores was found to be 88.86 per cent. This hypothesis was accepted for the same reasons as the other two hypotheses.

It can be noted in each of the above procedures, six in all, that there was a low correlation in the first three and a high level of confidence in the last three. This indicates that, using the same type of strapping, the same tests, and the same procedure, adhesive ankle strapping will have little effect upon motor performance.

II. CONCLUSIONS

Based on the results obtained from the scores of the subjects used in this study and a review of the materials available, the following conclusions were formulated:

1. Much more research is needed in the area of adhesive strapping and its effect upon motor performance.
2. There is no indication, based on the results obtained in this study, that the adhesive ankle strapping used, the gibney and half-figure eight combination, will have any appreciable effect upon motor performance. If there is any positive or negative indication, it is probably due to

sampling error or psychological factors.

3. This study will be of little significance unless further research and experimentation are carried on in this area.

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