

CRITERIA FOR TESTING MOTOR FITNESS  
IN THE AVERAGE HIGH SCHOOL  
PHYSICAL EDUCATION  
PROGRAM

BY

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## CHAPTER I

### INTRODUCTION

The physical educator's approach to measurement should be in terms of improved services to boys and girls. The fundamental function of the physical educator is to understand each child's needs in order to give him adequate guidance and to adapt programs to meet his needs. If these functions are to be accomplished efficiently, measurement is indispensable as orderly progress cannot be achieved without the guidance that intelligent use of measurement provides.

Clarke<sup>1</sup> states that successful measurement involves defining and measuring important outcomes of physical education; that is, the needs and capacities of each pupil measurement makes teaching more definite and concrete, and is a very effective teaching device.

The average Montana high school physical education program does not give adequate emphasis to motor fitness and its measurement. It was through work with Montana high school physical education programs that the author became interested in finding an adequate test battery to measure the underlying motor skills. The measurement of these motor skills would not only serve as a basis for construct-

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<sup>1</sup>Clarke, H. Harrison, The Application of Measurement to Health and Physical Education, New York, Prentice-Hall Inc., 1945, p. 1.

ing the high school physical education testing program, but would also help determine the level of the individual's present athletic skill. It was the desire to find such a test battery that led the author to this investigation.

### Statement of the Problem

The purpose of this study was to find a motor fitness test that would measure fitness of boys of high school age, and the results of which would show each boy his specific motor fitness strengths and weaknesses. The program could then be geared to help each boy improve his motor fitness ability with improvement measured by pre-testing and post-testing.

### Procedure

There were several possible ways of securing criterion for this study. The methods suggested were (1) questionnaire, (2) visitation, and (3) surveying available literature. It was decided that surveying the available literature would be the best procedure for achieving the purpose of this study as it provided a good cross section of tests used by leaders in the physical education measurement field.

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<sup>1</sup>M. G. Scott, and E. French, Evaluation in Physical Education, St. Louis, C. V. Mosby Co., 1950, p. 156.

## Importance of the Study

Physical development is often stressed as one of the most important aims of education. Although this is true, very little has been done to set up a standardized motor ability test battery at the high school level. Scott and French<sup>2</sup> have said that every objective held valid by the physical education teacher requires some evaluation results. One of the values of tests is that they tend to clarify for both the student and the teacher the objectives achieved and capacities which are being developed. The fact that there is need for evaluation, and that students are conditioned to expect objective evidence on the capacities accepted as goals, points to teaching opportunities inherent in the wise use of fitness tests.

All America has been urged by the President's Council on Youth Fitness<sup>3</sup> to help spur and encourage development of health, strength, stamina, leadership, courage, and boldness as vital weapons in the armament of the republic. Many of these factors can be furthered in a well-planned, functional motor fitness testing program.

## Definitions of Terms Used

The technical terms used in this study were defined

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<sup>3</sup>President's Council on Youth Fitness, a report to the President of the United States on the Annapolis Conference, June 18-19, 1956. Published by the President's Council on Youth Fitness, U. S. Gov't. Printing Office, Washington, D. C., 1956.

in order to clarify and substantiate the evidence in the materials investigated and the tests used.

Physical fitness. Physical fitness is the capacity of an individual to perform a given task. All activities require muscular effort; therefore, physical fitness includes all life activities. The amount of effort, however, varies from slight demands such as dart throwing to demands which are great, marathon running. The nature of the adjustment refers to the ease or strain with which the adjustment is made. The degree of adjustment refers to the fact that adjustment is continuous. Adjustment of adaptation refers to the relationship between the individual status and the requirements of life activities, whatever they might be.<sup>4</sup>

Motor ability. Motor ability is the present level of skill performance. The three divisions of motor ability include: (1) Basic motor elements--speed, coordination, (2) Fundamental motor skills: running, jumping, (3) Sports skills: basketball, football. Basic motor elements are necessary to performance in fundamental skills, and both of these are necessary to performance in sports skills.<sup>5</sup>

Motor fitness. Motor fitness is a limited phase of motor ability which emphasizes: (1) endurance, (2) motor

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<sup>4</sup>L. A. Larson, and R. R. Yocum, Measurements and Evaluation in Physical Health and Recreation Education, St. Louis, C. V. Mosby Company, 1951, p. 156.

<sup>5</sup>Ibid., p. 24.

explosiveness, (3) strength, (4) agility, (5) flexibility, (6) balance. Specifically, it means the capacity for efficient performance in the basic requirements of running, jumping, dodging, falling, climbing, swimming, lifting weights, carrying loads, and enduring under sustained effort in a variety of situations.<sup>6</sup>

Measurement. Measurement is the determination of the traits, abilities, and characteristics of the individual or group. Measurement concerns the product, or outcome of educational activity.

Evaluation. Evaluation is the determination of how the objectives are achieved. This information includes the nature of leadership, program materials, facilities, equipment, grading, research, program time, participation and administration. Evaluation, therefore, concerns the process of educational activities.

Test Battery. Test battery is a technique of measurement and evaluation used to gain information about the individual or group.

Achievement. Achievement is the accomplishment of the individual beyond a defined starting point, for example, achievement in soccer represents what has been accomplished

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<sup>6</sup>T. K. Cureton, Physical Fitness Appraisal and Guidance, St. Louis, C. V. Mosby Company, 1947, p. 20.

through participation in soccer.

Criteria. Criteria are standards or basic principles which act as guides for the evaluation of educational materials.<sup>7</sup>

Raw Score. Raw scores are the records actually made in the test.

T-Score. A T-Score is a scale score of a test standing that allows comparisons of achievement in various tests.

Weighted Test Items. Weighted test items refer to the degree of difficulty of each individual test item as compared to each of the other test items.

The purpose of this study was to find a motor fitness test that would measure motor fitness of boys in the average high school physical education program. In order to secure the necessary criterion for the construction of an adequate test battery, literature relative to physical education measurement was examined. A review of this literature is presented in Chapter II.

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<sup>7</sup>Cureton, op. cit., pp. 20-21.

## CHAPTER II

### REVIEW OF THE LITERATURE

The evolvement of suitable measuring techniques of motor fitness has been slow. The answer on how to measure fitness was not available at the beginning of World War II when the problem of testing fitness suddenly took on new importance.<sup>1</sup>

Reports in written materials have indicated that much more work has been done toward developing tests for the college level than for the high school level. However, the many persons who have engaged in research related to fitness during the last decade have contributed much to our understanding of the usefulness of the tests, the significance, of each, and the standards to be expected.<sup>2</sup>

Scott and French<sup>3</sup> have listed five component parts of motor fitness. They are: strength, endurance, agility, flexibility, and balance. Larson and Yocum<sup>4</sup> have given a more complete list. Besides the five listed above, resistance to disease, cardio-respiratory endurance, muscular power, speed, coordination and accuracy are included. Cureton<sup>5</sup> has added power to Scott and French's list.

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<sup>1</sup>Scott and French, op. cit., p. 156.

<sup>2</sup>Scott and French, op. cit., p. 157.

<sup>3</sup>Scott and French, op. cit., p. 164.

<sup>4</sup>Larson and Yocum, op. cit., pp. 163-171.

Matthews<sup>6</sup> included six elements underlying motor skills performance. The following listing gives his classification.

1. Body coordination, agility and control
2. Muscular strength
3. Arm and shoulder girdle coordination
4. Motor explosiveness
5. Endurance
6. Agility, flexibility and balance

The main purpose of this problem was to select a test battery which would be of practical use in the average high school physical education class, the battery to include testing devices that measure the six elements underlying the motor skill performances listed. A brief summary will be given of some of the tests used to measure the component parts of motor fitness as found in a survey of the available literature.

Measurement of body coordination, agility and control.

Measurement of body coordination has been defined by Mathews<sup>7</sup> as the capacity of the individual to integrate movements of different kinds (different requirements for each phase of the activity) into one pattern. Scott and French<sup>8</sup> have recommended the obstacle race as one of the

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<sup>6</sup>Mathews, Donald K., Measurement in Physical Education, Philadelphia, W. B. Saunders Company, 1958, p. 19.

<sup>7</sup>Ibid., p. 89.

<sup>8</sup>Scott and French, op. cit., p. 193.

most reliable tests of agility. In this test, the subject starts in a back-lying position on the floor. On a signal he gets up and starts running toward another point. He then encounters a series of obstacles. The score is the number of seconds that is required to run the course.

Larson<sup>9</sup> included the bar snap in his motor ability test battery. He stated that it measured coordination, agility, and control. The subject stands close to the bar, grasping it then swings underneath shooting the feet close to the bar and upward. When sufficient height has been reached for the best distance, the subject releases the bar. Three trials are given and the best one is recorded.

Scott and French<sup>10</sup> also suggested a shuttle race as a means of testing the above three components of motor fitness. It is a little more economical of time than the obstacle race since it can be given to several at the same time, but it is also a little less reliable.

Measurement of muscular strength. Muscular performance tests are tests of activities involving the large muscles of the body, such as running, chins, dips, squat

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<sup>9</sup>Leonard A. Larson, The Research Quarterly, "A Factor Analysis of Motor Ability Variables and Tests, with Tests for College Men," Ann Arbor, Michigan: American Association for Health, Physical Education, and Recreation, Vol. 12, No. 3, p. 499.

<sup>10</sup>Scott and French, op. cit., p. 181.

jumps and broad jump.<sup>11</sup> Cozens<sup>12</sup> muscular strength test consists of the use of five strength items. These items are (1) back strength, (2) leg lift, (3) arm push, (4) chins, and (5) dips. Larson's<sup>13</sup> muscular strength test found that a combination of chinning strength, dipping strength, and vertical jump gave the same validity results as either of the two complete tests of Rogers' and MacCurdy.

MacCurdy's Strength Test was constructed on the basis of the formula "Power equals Force x Velocity." The force is measured by the strength of the legs, back, and arms; the velocity by the vertical jump.<sup>14</sup>

Measurement of motor explosiveness. "The factor described as motor explosiveness is best described as the use of the body weight in a force-time relationship."<sup>15</sup> Larson<sup>16</sup> has included the vertical jump in his test battery to measure motor explosiveness. In this test, the subject is asked to stand close to a wall, face towards the wall, he then reaches as high as he possibly can. Then the subject jumps, throwing both arms upward, touching the highest possible point on the measuring board. The difference

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<sup>11</sup>Mathews, op. cit., pp. 49-50.

<sup>12</sup>Cozens, op. cit., p. 154.

<sup>13</sup>Larson and Yocum, op. cit., p. 163.

<sup>14</sup>H. L. MacCurdy, A Test for Measuring the Physical Capacity of Secondary School Boys, Yonkers, New York, 1933, p. 60.

<sup>15</sup>Larson, op. cit., p. 506.

<sup>16</sup>Ibid., p. 511.

between maximum reach and maximum jump is recorded to the nearest one-half inch. According to Larson, this will give a valid measurement of motor explosiveness.

Measurement of endurance. Perfect endurance may be defined as the ability to maintain the top speed of muscle power indefinitely. This, obviously, is impossible to attain. Maximum effort can be maintained for only brief periods of time.

Exercises for the development of endurance require moderate stimulation of the respiratory and circulatory systems and a minimum of nervous expenditure.<sup>17</sup> Measurement of endurance can be adequately tested in distances from three hundred yards up to one mile.

Measurement of agility, flexibility, and balance. Agility is the capacity of the individual in the rate of changing position in space. Flexibility is the range of movement around a body joint and is directly related to physical fitness. Balance is the reliability of the subject's tactual and kinaesthetic sense and the coordination of his neuro-motor response.<sup>18</sup>

Cozen's<sup>19</sup> dodge run has been used by a number of

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<sup>17</sup>Clarke, op. cit., p. 50.

<sup>18</sup>Bovard, John, and Cozens, Frederick W., Tests and Measurements in Physical Education, Philadelphia, W. B. Saunders Co., 1931, p. 137.

<sup>19</sup>Larson and Yocum, op. cit., p. 163.

physical educators. It was commonly used to measure shiftiness and change in direction, which are subordinate parts of agility. The runner starts at a given point and runs a zig-zag course. Five different hurdles are placed in his way and it is necessary for the runner to run around these obstacles. The time is recorded by a stop watch to the nearest tenth of a second.

From the information received by this review of the literature, Larson's indoor test appeared to be one of the most effective. It was his aim to select a battery which would be simple and yet have a maximum of validity. He used Cozen's list of basic elements of motor ability for setting up his indoor and outdoor tests of motor ability.<sup>20</sup>

Lack of evidence in the available literature on testing of high school boys in physical education was the biggest limitation in the review of the literature. The tests were not pure tests, which reduced the validity and the correlations. The classification device did not indicate what should be one's ability. The constructed tests did predict significantly the total level of ability, but they did not predict each element.

However, after a review of the available literature, specific tests were selected to measure the underlying component elements of motor fitness. The tests selected

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<sup>20</sup> Larson, op. cit., p. 508.

and the elements of motor skills performance which they measure are shown in Table 1.

**TABLE 1. CLASSIFICATION OF TESTS IN TERMS OF THEIR PREDOMINATE CHARACTERISTICS**

| Elements underlying motor skills performance | Tests selected to measure various elements |
|----------------------------------------------|--------------------------------------------|
| 1. Body coordination, agility and control    | 1. Bar snap                                |
| 2. Arm and shoulder girdle coordination      | 2. Bar snap                                |
| 3. Muscular strength and power               | 3. Chinning                                |
| 4. Motor explosiveness                       | 4. Vertical jump                           |
| 5. Agility, flexibility, balance             | 5. Dodging run                             |
| 6. Endurance                                 | *6. 660 yard run                           |

\*Cannot be administered effectively indoors.

The suggested criterion for selecting test items which would best measure the various elements of motor fitness will be discussed in Chapter III.

CHAPTER III  
SUGGESTED CRITERIA FOR THE SELECTION  
OF MOTOR FITNESS TEST ITEMS

The best selection of testing instruments can be accomplished through the application of three general evaluative criteria: (1) scientific authenticity, (2) administrative feasibility, and (3) educational application.

Mathews<sup>1</sup> has stated that "before a test can be considered for use in the program, one should make certain that it has been scientifically constructed and does an accurate job in measuring what it was designed to measure." The criteria used to evaluate a test in terms of its scientific authenticity were validity, reliability, and norms.<sup>2</sup>

Measurement and evaluation methods should be selected on the basis of the program and its objectives. The selection of the tests should be based upon their scientific authenticity, administrative feasibility, and educational application. What is considered as the most important phase of the three general evaluative criteria, scientific authenticity, will be discussed in the next section.

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<sup>1</sup>Mathews, op. cit., p. 19.

<sup>2</sup>Ibid., pp. 19-20.

### Scientific Authenticity

Validity is the most important factor in the selection of test items in terms of its scientific authenticity. Other important factors to consider are reliability and norms.<sup>3</sup> These will be discussed in order of their importance.

Validity. Validity is shown in a test if it measures what it purports to measure. "Since validity is such an important criterion of a test it might be well to illustrate how a test for a team sport, say basketball, might be validated. First a group of players would be administered a given test of basketball playing ability. Next a group of coaches thoroughly familiar with the game and players would subjectively rank the subjects in terms of their playing ability. Then, if the coaches' judgments and the test scores agreed--that is, if those who scored high on the test were also ranked as better players by the coaches--it could be concluded that the test was valid. In other words, the test is measuring what it purports to measure, namely, basketball playing ability. It should be remembered that a test can be no better than its validity, regardless of its reliability and objectivity."<sup>4</sup>

Reliability. Reliability refers to the consistency

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<sup>3</sup>Ibid, p. 20-21.

<sup>4</sup>Ibid, p. 21.

of the measurement of a given test. That is, if a test were administered to a group of pupils today, one should expect the same results from the test if it were administered to the identical group at another time.<sup>5</sup>

Norms. A norm is a standard to which an obtained score may be compared. Few tests in physical education have a good set of norms. It is necessary to emphasize that one must be cautious in applying norms to a group of pupils for which they were not originally intended.<sup>6</sup> Instead, one should construct his own norms or progress charts from the test data on the pupils in the situation for which they are to be applied. The scoring table selected for the test battery was selected to serve as a guide for the physical educator until construction of norms or progress charts could be constructed from the pupils being tested.

After a test's scientific authenticity has been established, it must be examined from the standpoint of its administrative feasibility and educational application. These aspects will be covered individually in the following sections.

#### Administrative Feasibility

In order for a test to be practical, it must be economical in terms of cost and time required for adminis-

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<sup>5</sup>Ibid., pp. 20-21.

<sup>6</sup>Ibid., p. 25.

tration. The time required should be roughly ten per cent of the total time allotted.

### Educational Application

It must be remembered that the test selected must fit the program. Usually the available facilities will dictate the scope of the testing program.<sup>7</sup> The test battery selected by the investigator could be used in the average Montana high school with little or no added equipment.

The purpose of this chapter has been to list criteria to aid in the selection of tests for use in the physical education program of the average high school. A motor fitness test should be an integral part of this program since it measures the underlying component parts of motor fitness. Measurement and evaluation methods should be selected on the basis of the program and its objectives. The selection of the tests should be based upon their scientific authenticity, administrative feasibility, and educational application. Scientifically constructed tests are valid, reliable, and have norms.

In addition to selecting an adequate motor fitness test which meets the above requirements, there are certain techniques which should be followed in order to make the administration of the test effective. These techniques and the actual test battery used will be discussed in Chapter IV.

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<sup>7</sup>Ibid., pp. 25-27.

## CHAPTER IV

### ADMINISTRATION OF THE MOTOR FITNESS TEST

Measurement programs are not easy to administer. They require hard work and close attention to detail. There are a number of important procedures which should be followed in the administration of any testing program if efficiency is to be achieved. The necessary directions and procedures for the efficient administration of the motor fitness test are listed below.

#### Directions and Procedures in Motor Fitness Test Administration

In order to make the test valuable, certain standardized procedures are required. The important directions and procedures for this test are listed in the following section.

1. Make sure each testee has had a physical examination.
2. "Plan to have pupils report for testing in a continuous, unbroken procession. Starts, stops, and waits in the testing process lose time and should be avoided. The physical educator should utilize pupils assigned to his classes."<sup>1</sup>
3. Have all necessary testing equipment set up and organized for the efficient administration of the tests to be given. All floor markings and apparatus should be readied

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<sup>1</sup>Clarke, op. cit., p. 311.

before test time. The complete layout of and details for the testing should be set down on paper. A typical floor plan of the test stations used in the administration of the motor fitness test battery is shown in Figure 1.

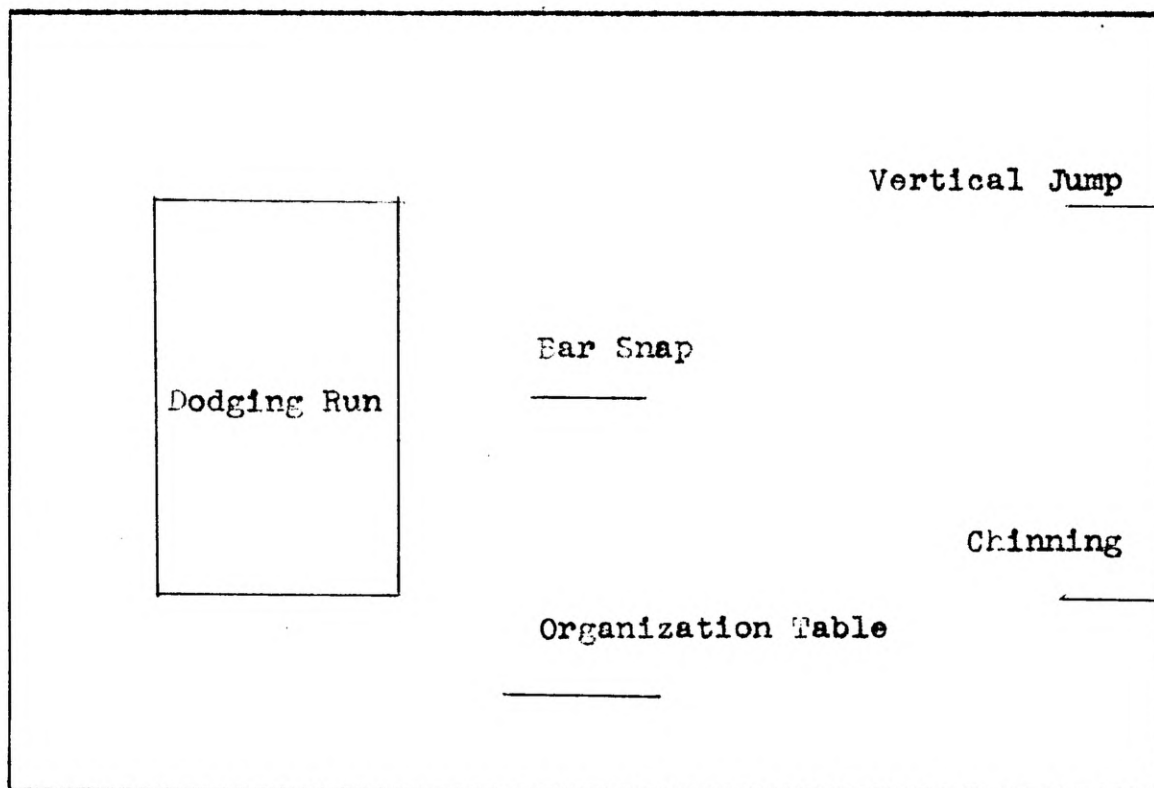


Figure 1. Typical Floor Plan of Test Stations Used in Motor Fitness Test Battery

4. "Provide for the required number of qualified examining and recording assistants. Assistants should be carefully instructed on their duties and on testing techniques they are to perform. Nothing should be left to chance, as it is better not to test at all than to permit

unqualified testers to assist."<sup>2</sup> Bovard, Cozens, and Hagman<sup>3</sup> have concluded that: "Definite mimeographed or printed instructions covering all phases of the testing should be prepared and at least one organizational meeting held. Instructions should be so definite that any member of the staff of examiners may take charge of any station and carry on in an efficient manner." McCall<sup>4</sup> stated that instructions should be brief, employ a demonstration, be uniform, and be in the order of doing.

5. Give students a short explanation of the reason for the test at the outset so that they will understand what it is they are striving to do and what outcomes they may expect.

6. Inform pupils of the results of their own tests. Such information constitutes the best form of motivation possible, and provides an excellent opportunity for improving the pupil's understanding of physical education."<sup>5</sup>

After the necessary directions and procedures have been completed, the actual test battery should be administered. From a review of the available literature on physical education measurement, specific tests were chosen which

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<sup>2</sup> Ibid., p. 312.

<sup>3</sup> Bovard, Cozens, and Hagman, op. cit., p. 375.

<sup>4</sup> W. A. McCall, Measurement, New York, The Macmillan Company, 1939, pp. 80-90.

<sup>5</sup> Clarke, op. cit., p. 312.

the investigator felt best measured the various elements of motor fitness. These elements and the tests which best measured motor fitness appear in Table I. The procedures for administering the specific tests included in the actual test battery will be explained in the following section.

### Test Battery To Be Used

The bar snap is the test selected to measure two elements underlying motor skills performance: (1) Body coordination, agility, and control; (2) Arm and shoulder girdle coordination. The procedure for administering the bar snap is as follows:

The bar snap. In the bar snap, the horizontal bar is placed at four feet six inches. The subject stands close to the bar, grasping it, then swings underneath shooting the feet close to the bar and upward. The back should be arched, and the subject should release the bar when sufficient height has been reached for the best distance. The distance from the plane of the horizontal bar to the maximum distance (back of heels) is the score. Three trials are given and the best one is recorded. The subject is not allowed to jump before the underswing, but must start with the feet on the floor. Distances should be recorded to the nearest inch. One assistant records the best effort of the individual being tested on the test

score card<sup>6</sup> which is illustrated in Figure 3, page 26.

Equipment: Adjustable horizontal bar, score sheet, clipboard, pencil, chalk to mark floor off in inches.

Leadership: One assistant.

Muscular performance tests are tests of activities which involve the large muscles of the body. Chinning was one of the best measures for testing muscular strength and power and was selected as the test to be used in this battery.

Chinning. In chinning, the subject uses the horizontal bar at such height that his feet do not touch the floor when he is in the "lowered arm hang position." To begin the chin, the subject hangs from the bar, and then pulls himself up until his chin is over the bar. He then lowers himself until his arms are straight. The subject is not permitted to kick, swing, or rest. Partial chins do not count. The count is one for each full chin. The assistant records the number of full chins on the score card.<sup>7</sup>

Equipment: Horizontal bar, clipboard, score card.

Leadership: One assistant.

The factor described as motor explosiveness, use of

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<sup>6</sup> Bovard, Cozens, and Hagman, op. cit., p. 373.

<sup>7</sup> Larson, op. cit., p. 509.

the body weight in a force-time relationship, was very adequately measured by the vertical jump. The procedure for administering the vertical jump is given in the next section.

Vertical Jump. In the vertical jump, the subject is asked to stand as close to the wall as is possible with feet flat on the floor. A blackboard is placed on the wall high enough to record the reach and the best jump. A chalk mark is made of the maximum reach at the tip of the fingers for each hand. A line is then drawn between the two points. The subject then stands sideways with right or left arm close to the wall. Chalk dust is placed on the middle finger. The subject jumps, throwing both arms upward, and then records the height with the hand near the wall. The difference between maximum reach and maximum jump is recorded to the nearest one-quarter inch. The best one of three trials is recorded by the assistant on the score card.<sup>8</sup>

Equipment: One blackboard (2' x 4'), chalk dust, score card, clipboard.

Leadership: One assistant.

Cozen's dodge run has been used by a number of physical educators to measure agility, flexibility, and balance. The investigator felt it was an excellent test for measuring these various underlying elements of motor

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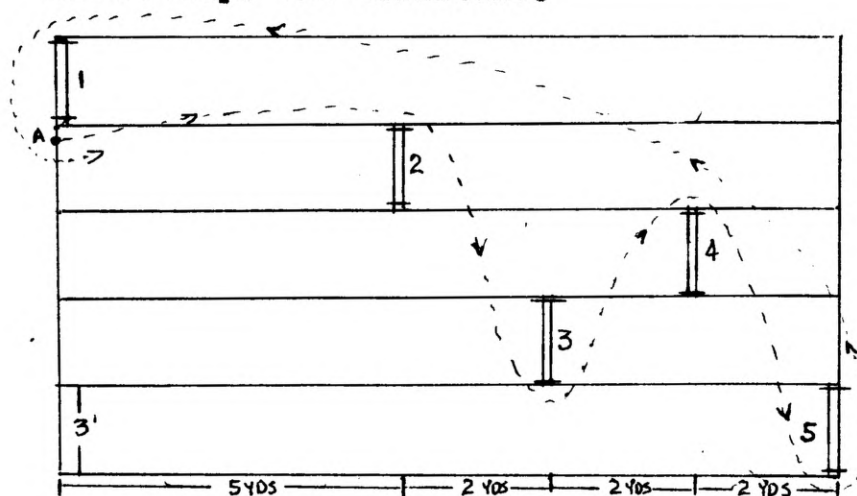
<sup>8</sup> Ibid., p. 503.

fitness. The following section explains the procedure for the dodging run.

**Dodging Run.** In the dodging run, the runner starts at the starting point A and runs as indicated by the dotted line. Point A is also the finish line. The time necessary for two complete cycles is the score. The time is recorded by a stop watch to the nearest tenth of a second. The subject should not touch the hurdles when circling them.<sup>9</sup> A layout of the dodging run course appears in Figure 2.

**Equipment:** Five hurdles, one stop watch, floor diagram, score card, clipboard.

**Leadership:** One assistant.



**Figure 2. Layout of the Dodging Run**

The 660 yard run tests cardio-respiratory endurance. This test should be administered outdoors on a track or on a smooth course for best results. This is the last test item of the suggested battery for measuring motor

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<sup>9</sup>ibid., p. 509.

fitness. Directions for the administration of the 660 yard run are given in the next section.

660 Yard Run. In the 660 yard run, the subject starts to run on the command "Go" and the time is recorded to the nearest tenth of a second.<sup>10</sup>

Equipment: Stop watch, clipboard, score card.

Leadership: One assistant.

The test items included in the suggested battery were found to be an efficient means for evaluating motor fitness. The test items could be performed almost any place; they could also be self-administered, thus enabling the students to practice by themselves. This should be very important to the physical educator in stimulating interest in fitness. The test battery selected for this investigation consisted of the bar snap, chinning, vertical jump, dodging run, and 660 yard run. In order to measure the outcomes of each performer, a suitable scoring table was selected to act as a guide for the user until norms or progress charts could be devised. The following section is devoted to an explanation of the methods of scoring the test items in the suggested test battery.

#### Scoring the Tests

To score the test items, raw scores are changed to

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<sup>10</sup>Reel, S. F., Decathlon Kit, The Author, Garden Grove, California, 1953.

scale scores. The scale scores can then be multiplied by the weights appearing in Appendix A, which results in the relative value given each test item and contributes to the total motor fitness score. The aggregate score is then given a rating to classify the student in relation to the other students tested.

The scoring device is shown in Table 2, Appendix A. The score card is illustrated in Figure 3.

| Name          | Ht.       | Wt.         | Date |           |                       |
|---------------|-----------|-------------|------|-----------|-----------------------|
| Class         | Period    |             |      |           |                       |
| ITEM          | RAW SCORE | SCALE SCORE | WT.  | WT. SCORE | CLASSIFICATION        |
| Barsnap       |           |             | 4.05 |           | Sup. 455-500          |
| Chinning      |           |             | 2.75 |           | Above ave.<br>406-454 |
| Vertical Jump |           |             | 1.00 |           | Average<br>357-405    |
| Dodging Run   |           |             | 1.09 |           | Below ave.<br>306-356 |
| 660 Yard Run  |           |             | 5.0  |           | Inferior<br>Below 306 |
|               |           |             |      |           |                       |

Figure 3. Individual Motor Fitness Classification Record Card

The investigator used parts of the motor fitness test battery selected for this study in physical education programs at the high school level. Individual records were left at the schools and since then have been destroyed.

Although the results were incomplete, sufficient

data were available to justify the following statements:

(1) The tests were adaptable to high school boys with regard to validity, reliability, and practicability.

(2) The testing program stimulated interest in physical fitness.

(3) Test results indicated underlying sports skills ability since the most proficient athletes scored consistently in the ninetieth percentile.

(4) Progress charts stimulated individual interest and provided an excellent opportunity for improving the pupil's understanding of physical education and total fitness.

The proper standardization of test directions and procedures was found to be very necessary for accurate test administration. The test battery selected to measure the elements underlying motor skills performance consisted of the bar snap, chinping, vertical jump, dodging run, and the 660 yard run. This test very accurately measured these elements in an efficient and economical way. The scoring chart was presented to act as a guide until the physical educator could establish his own set of norms or progress charts best suited to the situation.

The final chapter will summarize the preceding chapters. In the process of reviewing and studying material with reference to the original purpose of this investigation, that of obtaining a motor fitness test which could be used in the average high school, certain conclusions and recommendations were drawn. These will be included in Chapter V.

## CHAPTER V

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## Summary

The purpose of this study was to attempt to find a suitable test to measure the motor fitness skills of boys in the average high school physical education program.

The motor fitness test presented in this study was ~~SM~~ basically designed to measure the elements underlying motor skills performance. The elements determined were body coordination, agility, and control; muscular strength; arm and shoulder girdle coordination; motor explosiveness; endurance; balance and flexibility.

The test presented could be used in the average high school boy's physical education program. The tests selected and the results obtained when they were administered clearly indicated that economy of equipment and time were primary factors in selecting the test items. The test battery was an indoor test, with the exception of the 660 yard run. It consisted of the dodging run, bar snap, chinning, vertical jump, and the 660 yard run.

The test indicated in a highly valid way (9687) ~~SM~~ the achievement on a number of tests designed to measure the various elements underlying motor fitness; therefore, it indicated "total achievement" of motor fitness, utilizing the basic elements for the measurement. The test

should be used with this understanding. It did not indicate achievement in sports skills such as basketball and football, but simply indicated one's standing in the elements underlying sport skills.<sup>1</sup>

A scoring table was included in the study to establish a basis for judging each subject's motor fitness through the use of a scale whereby raw scores were changed to scale scores. This would allow the individual's performance to be evaluated.

### Conclusions

This motor fitness test could be used in the average high school boy's physical education class in the hope of establishing interest in the development of motor skills by each boy, and could then be used as a basis for part of each boy's grade. By pre-testing and post-testing, the amount of improvement in motor skills could be measured. The test items would establish areas of weakness where each boy needed improvement in basic motor skills. Development of these motor skills should enable the boy to react with the necessary ability to avoid an accident, do his job more efficiently, and provide adjustment in recreational activities.

The experimental part of the study was not complete, but did offer a general motor fitness testing program which attempted to measure and evaluate motor skills of boys in an average high school physical education class.

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<sup>1</sup>Larson, op. cit., p. 508.

Through the investigator's experience with motor fitness testing in high school physical education programs, certain results were obtained which led to the following recommendations.

#### Recommendations

There is a need for an established motor fitness program in Montana high schools. Physical educators should reevaluate their physical fitness programs to see whether or not they are adequately fulfilling their purpose of improving each individual's fitness.

Teacher training institutions should insist that all graduates in Health and Physical Education are well educated in setting up and carrying out physical education programs stressing physical fitness.

Motor fitness is an important and integral part of total physical fitness. Until educators become aware of this fact, physical education programs in Montana high schools will not make their greatest contributions to the students' physical development or to the educational program in general.

The investigator recommends that the test battery selected for this study serve as a basic guide in measuring motor fitness. This in turn would stimulate individual interest in physical fitness for normal, healthy, everyday living.

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## APPENDIX

## APPENDIX A

Listed below is the scoring table selected to help classify each student tested.

TABLE 2.

## Scale Scores For Motor Fitness Test Battery

| Scale Score | Raw Scores             |                        |                        |                        |                     | Scale Score |
|-------------|------------------------|------------------------|------------------------|------------------------|---------------------|-------------|
|             | *Chins<br>Wt.=<br>2.75 | V.J.**<br>Wt.=<br>1.00 | D.R.**<br>Wt.=<br>1.09 | B.S.**<br>Wt.=<br>4.05 | 660*<br>Wt.=<br>5.0 |             |
| 100         | 17                     | 27.00                  | 19.0                   | 80                     | 1:17.0              | 100         |
| 99          |                        | 26.75                  | 19.1                   | 79.3                   | 1:17.3              | 99          |
| 98          |                        | 26.50                  | 19.2                   | 78.7                   | 1:17.6              | 98          |
| 97          |                        | 26.25                  | 19.3                   | 78.0                   | 1:17.9              | 97          |
| 96          | 16                     | 26.00                  | 19.4                   | 77.3                   | 1:18.2              | 96          |
| 95          |                        | 25.75                  | 19.5                   | 76.7                   | 1:18.8              | 95          |
| 94          |                        | 25.50                  | 19.6                   | 76.0                   | 1:19.1              | 94          |
| 93          |                        |                        | 19.7                   | 75.5                   | 1:19.4              | 93          |
| 92          |                        | 25.25                  | 19.8                   | 75.0                   | 1:19.7              | 92          |
| 91          | 15                     | 25.00                  | 19.9                   | 74.5                   | 1:20.0              | 91          |
| 90          |                        |                        | 20.0                   | 74.0                   | 1:20.3              | 90          |
| 89          |                        | 24.75                  | 20.1                   | 73.5                   | 1:20.6              | 89          |
| 88          |                        | 24.50                  | 20.2                   | 73.0                   | 1:20.9              | 88          |
| 87          |                        | 24.25                  | 20.3                   | 72.5                   | 1:21.2              | 87          |
| 86          | 14                     | 24.00                  | 20.4                   | 71.5                   | 1:21.5              | 86          |
| 85          |                        | 23.75                  | 20.5                   | 71.0                   | 1:21.8              | 85          |
| 84          |                        | 23.50                  | 20.6                   | 70.5                   | 1:22.1              | 84          |
| 83          |                        | 23.25                  | 20.7                   | 70.0                   | 1:22.4              | 83          |
| 82          |                        | 23.00                  | 20.8                   | 69.0                   | 1:22.7              | 82          |
| 81          | 13                     |                        | 20.9                   | 68.5                   | 1:23.0              | 81          |
| 80          |                        | 22.75                  | 21.0                   | 68.0                   | 1:23.3              | 80          |
| 79          |                        | 22.50                  | 21.1                   | 67.5                   | 1:23.6              | 79          |
| 78          |                        |                        | 21.2                   | 67.0                   | 1:23.9              | 78          |
| 77          |                        | 22.25                  | 21.3                   | 66.5                   | 1:24.0              | 77          |
| 76          |                        | 22.00                  | 21.4                   | 66.0                   | 1:24.2              | 76          |
| 75          | 12                     | 21.75                  | 21.5                   | 65.5                   | 1:24.5              | 75          |
| 74          |                        | 21.50                  | 21.6                   | 65.0                   | 1:24.8              | 74          |
| 73          |                        | 21.25                  | 21.7                   | 64.5                   | 1:25.1              | 73          |
| 72          |                        | 21.00                  | 21.8                   | 64.0                   | 1:25.3              | 72          |
| 71          | 11                     |                        | 21.9                   | 63.3                   | 1:25.5              | 71          |
| 70          |                        | 20.75                  | 22.0                   | 62.7                   | 1:25.7              | 70          |
| 69          |                        | 20.50                  | 22.1                   | 62.0                   | 1:26.0              | 69          |
| 68          |                        |                        | 22.2                   | 61.3                   | 1:26.4              | 68          |
| 67          |                        | 20.25                  | 22.3                   | 60.7                   | 1:26.8              | 67          |
| 66          |                        | 20.00                  | 22.4                   | 60.0                   | 1:27.2              | 66          |

TABLE 2. (Continued)

|    |    |       |      |      |        |    |
|----|----|-------|------|------|--------|----|
| 65 | 10 |       | 22.5 | 59.3 | 1:27.6 | 65 |
| 64 |    | 19.75 | 22.6 | 58.7 | 1:27.9 | 64 |
| 63 |    | 19.50 | 22.7 | 57.3 | 1:28.2 | 63 |
| 62 |    | 19.25 | 22.8 | 56.7 | 1:28.4 | 62 |
| 61 |    | 19.00 | 22.9 | 56.0 | 1:28.8 | 61 |
| 60 | 9  | 18.75 | 23.0 | 55.3 | 1:29.2 | 60 |
| 59 |    | 18.50 | 23.1 | 54.7 | 1:29.6 | 59 |
| 58 |    |       | 23.2 | 54.0 | 1:30.0 | 58 |
| 57 |    | 18.25 | 23.3 | 53.3 | 1:30.4 | 57 |
| 56 |    | 18.00 | 23.4 | 52.7 | 1:30.8 | 56 |
| 55 | 8  | 17.75 | 23.5 | 52.0 | 1:31.2 | 55 |
| 54 |    | 17.50 | 23.6 | 51.2 | 1:31.6 | 54 |
| 53 |    | 17.25 | 23.7 | 50.3 | 1:32.0 | 53 |
| 52 |    | 17.00 | 23.8 | 49.5 | 1:32.4 | 52 |
| 51 |    |       | 23.9 | 48.7 | 1:32.8 | 51 |
| 50 | 7  |       | 24.0 | 47.8 | 1:33.2 | 50 |
| 49 |    | 16.75 | 24.1 | 47.0 | 1:33.6 | 49 |
| 48 |    | 16.50 | 24.2 | 46.0 | 1:34.0 | 48 |
| 47 |    | 16.25 | 24.3 | 45.0 | 1:34.4 | 47 |
| 46 |    | 16.00 | 24.4 | 44.0 | 1:34.8 | 46 |
| 45 | 6  | 15.75 | 24.5 | 43.0 | 1:35.2 | 45 |
| 44 |    | 15.50 | 24.6 | 42.0 | 1:35.6 | 44 |
| 43 |    |       | 24.7 | 41.0 | 1:36.0 | 43 |
| 42 |    | 15.25 | 24.8 | 39.7 | 1:36.4 | 42 |
| 41 |    | 15.00 | 24.9 | 38.3 | 1:36.8 | 41 |
| 40 | 5  | 14.75 | 25.0 | 37.0 | 1:37.2 | 40 |
| 39 |    | 14.50 | 25.1 | 35.7 | 1:37.6 | 39 |
| 38 |    | 14.25 | 25.2 | 34.3 | 1:38.0 | 38 |
| 37 |    |       | 25.3 | 33.0 | 1:38.4 | 37 |
| 36 |    | 14.00 | 26.4 | 31.5 | 1:38.8 | 36 |
| 35 | 4  | 13.75 | 26.5 | 30.0 | 1:34.2 | 35 |
| 34 |    | 13.50 | 26.7 | 28.5 | 1:39.6 | 34 |
| 33 |    | 13.25 | 26.8 | 27.0 | 1:40.0 | 33 |
| 32 |    | 13.00 | 26.9 | 25.5 | 1:40.4 | 32 |
| 31 |    |       | 27.0 | 24.0 | 1:40.8 | 31 |
| 30 | 3  |       | 27.1 | 23.7 | 1:41.2 | 30 |
| 29 |    | 12.75 | 27.2 | 23.3 | 1:41.6 | 29 |
| 28 |    | 12.50 | 27.3 | 23.0 | 1:42.0 | 28 |
| 27 |    | 12.25 | 27.4 | 22.7 | 1:42.4 | 27 |
| 26 |    | 12.00 | 27.5 | 22.3 | 1:42.8 | 26 |
| 25 | 2  | 11.75 | 27.6 | 21.7 | 1:43.2 | 25 |
| 24 |    | 11.50 | 27.7 | 21.3 | 1:43.6 | 24 |
| 23 |    |       | 27.8 | 21.0 | 1:44.4 | 23 |
| 22 |    | 11.25 | 27.9 |      | 1:44.8 | 22 |
| 21 |    |       | 28.0 |      | 1:45.2 | 21 |

TABLE 2. (Continued)

|    |   |  |  |  |        |    |
|----|---|--|--|--|--------|----|
| 20 |   |  |  |  | 1:45.6 | 20 |
| 19 |   |  |  |  | 1:46.0 | 19 |
| 18 | 1 |  |  |  | 1:46.5 | 18 |
| 17 |   |  |  |  | 1:47.0 | 17 |
| 16 |   |  |  |  | 1:47.5 | 16 |
| 15 |   |  |  |  | 1:48.0 | 15 |
| 14 |   |  |  |  | 1:48.5 | 14 |
| 13 |   |  |  |  | 1:49.0 | 13 |
| 12 |   |  |  |  | 1:49.5 | 12 |
| 11 |   |  |  |  | 1:50.0 | 11 |

\* Mathews, Measurement in Physical Education, p.94.

\*\* Larson, L. A., "A Factor Analysis of Motor Ability Variables and Tests."

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