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Development of a Group of Indian Pupils in Strength and Motor Educability as a Result of A Year's School Activities

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DEVELOPMENT OF A GROUP OF INDIAN PUPILS IN STRENGTH AND MOTOR EDUCABILITY AS A RESULT OF A YEAR'S SCHOOL ACTIVITIES

BY

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CHAPTER I

INTRODUCTION

A major objective of the programs of physical education, health education, and recreation is the acquisition, on the part of the student, of a wide variety of motor skills. Measurement will aid in the accomplishment of this objective by (1) determining the status, educability, and capacity, of the individual's motor skill, and (2) determining the effectiveness of the programs.[1]

Exercises of strength, as in weight lifting and in wrestling, demand strong muscular effort during each contraction. Large muscle groups are used vigorously, giving at the same time fixation of the chest with attendant stoppage of respiration and increase in arterial pressure. Necessarily, then, bodily strength must always be of primary concern to the physical educator, as upon it depends the individuals ability to learn physical skills, to maintain body vigor, and to resist fatigue. Moreover, endurance and speed depend to some degree upon strength.[2] Karpovich and Pestrecov in their study of inmates and college students also indicated that endurance was based upon strength.[3] Those who were stronger also increased in endurance more rapidly.

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[1]L. A. Larson and R. D. Yocom, Measurements and Evaluation in Physical Education and Recreation Education, pp. 200-201, Mosby: St. Louis, 1951.

[2]H. Harrison Clarke, The Application of the Measurement to Health and Physical Education, Prentice-Hall: New York, 1945.

[3]Peter V. Karpovich, "Fatigue and Endurance", Supplement to the Research Quarterly, Vol. XLI, No. 2, p. 416, May 1941.

The problem of physical fitness, which would include all the tests employed in this study, has been a concern of people throughout the ages. Formal exercise for their therapeutic and fitness benefits are part of recorded history extending from the time of primitive man to the present. This application of exercise to develop the body was apparent long before physical education as a profession was recognized.[4]

In the present study it was important to find out the strength, coordination, agility, and general condition of the freshmen and sophomore students at the Flandreau Indian Vocational High School. In the early days primitive man developed and conditioned his body for efficient performance through vigorous activity. In modern times our children need to be encouraged along the lines of physical education, health and recreation.

It may be assumed that the modern day physical educators are aware of the importance of physical fitness as an objective of physical education. Some feel this should be accomplished through physical fitness activities in physical education and others feel it should be brought about through activities of a recreational nature. Since the program at the Flandreau Indian Vocational High School was in the early stages it was considered important to determine the effect of various physical education, as well as the other activities, on the physical fitness and coordination of the pupils.

Clarke stated that there was a definite relationship between

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[4]H. Harrison Clarke, Physical Fitness News Letter, University of Oregon, Series III, No. 8, April 1957.

physical exercise and physical fitness. He also pointed out that during vigorous exercise, the blood circulation quickens, thus supplying the cells with oxygen and nutrition and removing waste products. The heart's activity is accelerated exercising and strengthening its own fibers, as well as pumping the blood and stimulating its circulation. Appetite is aroused and digestion of food is improved in an active body. Abdominal and chest muscles are strengthened, thus increasing the power of voluntary muscles which control the whole length of the digestive tract. Exercise causes deep and rapid breathing, which replaces the constant, shallow breathing, associated with sedentary life. Exercise also stimulates growth and strengthens the bones, muscles, ligaments, and tendons.[5]

In McCloy's test of motor capacity he used the following elements (1) the Classification Index (as a measure of size and maturity), (2) The Sargent Jump (as a measure of power), (3) Iowa Brace (as a measure of motor educability), and (4) Burpee Test (as a measure of agility and coordination).[6] In the present study the Classification Index, the Iowa Brace, the Kraus-Weber Test, and Larsen's Muscular Strength Test were employed.

Statement of the Problem

The purpose of this study was to determine the changes in motor

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[5]Clarke, op. cit., pp. 55-56.

[6]C. H. McCloy, "The Measurement of General Motor Capacity and General Motor Ability", Research Quarterly, Supplement 5, pp. 46-61, March 1934.

educability and strength resulting from a years physical education and athletic activity at Flandreau Indian Vocational High School.

Sub-Problems

1. To administer strength and motor educability tests at the beginning of school year and to record the results.

2. To retest the students at completion of school year and to record the results.

3. To determine the progress of the students through comparison of the initial test results with the final test results.

Delimitations

1. Inasmuch as some of the students participated in athletics as well as in physical education it was difficult to determine whether changes were the result of the physical activities, the athletic activities, or both.

2. While all the students lived in school dormitories and ate at the same boarding club it was not feasible to control the exact amount and kind of food each individual consumed.

CHAPTER II

RELATED LITERATURE

The term "motor educability" was introduced into the literature of physical education by McCloy in 1934 and was defined as "the ability to develop high skill quickly."[7] A test of motor educability which would analyze accurately the ability to learn, or the aptitude of the individual for learning, would contribute to a better understanding of physical performance and would provide an effective tool for the administration of the physical education program. Although there is a close relationship between motor educability and learning, only one study has utilized a learning criterion in an effort to validate an "educability" test. The relative value of the various tests as measures of "motor educability" has not been experimentally determined. Studies have been confined in general, to the isolation and definition of the factor of motor educability through empirical or statistical means, to comparisons between two types of motor educability, and to the relation of these tests to achievement, not to the ability to learn.[8]

Coordination is the ability of the individual to integrate movements of different kinds into one simple pattern. There are different requirements for each activity; for example coordination is involved in

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[7]Robert M. Hoskins, "The Measurement of General Motor Capacity and General Motor Ability", Research Quarterly, Supplement 5:1, pp. 46-61, March 1934.

[8]Eugenia Cirr, "The Relationship Between Measures of Motor Educability and the Learning of Specific Motor Skills", Research Quarterly, Vol. 13, pp. 43-53, 1942.

the basketball skills of dribbling, passing, and shooting. Most coordination skills involve some agility, balance, and speed. These abilities are also important in motor educability. Large amounts of muscular strength and endurance are usually not required unless the coordination activity is continued for a long period of time. Coordination skills are found in everyday life and in many athletic activities.

Agility is the ability of the individual to change position in space. Agility also involves the ability to change direction as well as some strength, and endurance.

Balance is the ability of the individual to control organic equipment neuromuscularly.

The Brace Test was one of the first standardized tests of motor ability. It consists of 20 stunts, graduated from simple to the more complex. The test was scored on success or failure basis. The total successes constitute the score. A perfect score therefore was 20. The test was a measure of basic elements of motor skills. The elements that seemed to be measured were: balance, coordination agility, accuracy, and steadiness. After this test had been utilized for some time McCloy revised it and called it the Iowa Revision of the Brace Test. McCloy's work at Iowa on the stunt type test as an index of motor educability involved the Brace Test as well as additional stunt items. The stunt tests in the Iowa Brace were selected as measures of motor educability according to the following criteria: Improvement with age; low correlation with factors of size, strength maturity and power; and high correlation with track and field events where size and other factors were eliminated. It was assumed that improvement was due to motor

learning. McCloy reduced the number of items in the Brace Test from 20 to 10. The 10 were divided into two batteries of five each. The selected tests varied for each group of girls and boys of the elementary, junior, and senior high school grades.

The motor educability tests represented a pioneer development in this field. There has been research in this field but it has dealt mostly with small muscle skills. Morehouse, however, combined a knowledge of psychology and motor learning, and listed six objectives which would guide the individual in the mastery of motor skills and in the process of learning.

These objectives were:

1. Improvement of timing.
2. Reduction of extra useless movements.
3. Adjustment of movements so that forces are applied directly.
4. Muscle teamwork or relaxation of nonworking muscles during performance.
5. Proper pacing or distribution of effort.
6. Resolving of as many movements as possible to a reflex level.[9]

The test was found to have a moderate degree of validity. Those individuals scoring high in these tests had the motor ability equipment for learning new skills more rapidly than those with low scores.

In classifying tests in terms of the predominant factors which they measured, Cozens classified the vertical jump as a measure of jumping and leg strength. Larson identified it as a measure of a factor he termed motor explosiveness; in that the test item required the use

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[9]L. E. Morehouse, "Recent Studies of Learning Factors of Motor Skills", Journal of Health, Physical Education, and Recreation, Vol. 14, pp. 57-60, 62, January, February, 1948.

of the boys weight in the force-time relationship.

The Sargent Jump, named after its originator, Dr. Dudley A. Sargent, consists of a vertical leap into the air, and is primarily a test of the ability of the body to develop power in relation to the weight of the individual himself.[10]

After adequate practice in the execution of the Sargent Jump, McCloy obtained a correlation of .85 between the best jump from two series of three jumps each, performed on two different days.[11] When the four jumps were put together, a reliability of .98 was found. In a small group of college men the jump was recorded after practice and Coleman found a reliability of .96. Most experimenters agree that the best results are obtained if the subjects are allowed to practice and master the fundamentals of the vertical jump.

In some other studies, the Sargent Jump was found to correlate with track and field events for men and boys from .65 to .81. Studies also have agreed that the best single measure for predicting "jump power," was the vertical jump.

Chinning as a test item in physical fitness, is used as a measure of muscular endurance; or "The capacity of the individual to continue successive exertions under conditions where a load is placed on the muscle groups being tested." As a measure of motor ability, Larson used chinning as a test of dynamic strength. This he defined

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[10] Dudley A. Sargent, "Physical Test of a Man", American Physical Education Review, Vol. XXVI, No. 4, p. 188, April 1951.

[11] C. H. McCloy, "Recent Studies in the Sargent Jump", Research Quarterly, Vol. III, No. 2, p. 235, May 1932.

as "strength determined by the ability to lift the body weight and propel it upward."[12]

Larson described the administration of the push-up test for boys. He stated that the push-ups could be performed on either regular gymnasium parallel bars or on wall parallels (or "dipping bars"). He made the following additional comments:

1. The bars should be adjusted at approximately shoulder height.
2. The subject should stand at the end of the parallel bars, grasping one bar in each hand. He jumps to the front support with arms straight (this counts one). He lowers his body until the angle of the upper arm and forearm is less than a right angle, then pushes up to the straight-arm position (this counts two). This movement is repeated as many times as possible. The subjects should not be permitted to jerk or kick when executing push-up.
3. If the subject does not go down to the proper bent-arm angle or all the way up to a straight-arm position, half credit only is given, up to four half counts.

Hatlestad commented on a number of tests which supported the ability of individuals to perform motor skills. The most commonly used tests in this field are the Brace Motor Ability test, the Iowa Revision of the Brace Motor Ability Test, and the Johnson Physical Skill test. A test was conducted by Hatlestad on 130 women in physical education classes at Kansas State Teachers College of Pittsburg. The subjects were chosen from six classes in tap, beginning folk dancing, modern dancing, gymnastics and two sections of required physical education.

The Iowa Revision of the Brace Test had an Inter-correlation

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[12] L. A. Larson and R. D. Yocom, Measurements and Evaluation in Physical Education and Recreation Education, Mosby: St. Louis, 1951.

of .81 with the Brace Motor Ability test, and .42 with the Johnson Physical Skill test. The raw scores of all these tests were converted into t-scores used by McCall's method of percentile ranking.

It was further pointed out that Scott had presented data in November, 1939, of over 1,000 subjects who had taken the Iowa Revision of Brace Test and that she had found the scores fairly stable.[13]

The need for muscular fitness was impressed upon Dr. Kraus in the observation of common backache. Dr. Kraus found in his studies that a good percentage of patients unable to perform the tests improved as their strength and flexibility increased with muscle training. While in training and maintaining good physical fitness their performance would improve but as soon as the program was discontinued the person would return to their original condition. Using the Kraus-Weber Test of Minimum Muscular Fitness, Kraus and Hirschland reported that 57.9 per cent of 4,458 American children tested, between the ages of six through nineteen years, failed to meet even a minimum standard required for health, which is indicated by their inability to pass all items on the test. The results of this test also indicated that physical educators in America were failing to meet the objective of physical fitness through their programs. Most physical educators had a great concern about results found in the failure of the American students to pass the test.

The Kraus-Weber Test was composed of six items. One of the items

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[13] S. Lucille Hatlested, "Motor Educability Test for Women College Students", Research Quarterly, Vol. 13, pp. 10-14, 1942.

was designed to test flexibility. The other five items were designed to measure the strength of the upper and lower back, the abdominal muscles, and the flexor muscles of the hip joint. Failure on any one of these items, according to Kraus, indicated that the child was below minimum muscular fitness for good health.[14]

Landis conducted a study in which he compared eight selected physical education activities as to their development of physical fitness and motor ability in 1,031 male freshmen participating in selected activities. The activities included swimming, boxing, weight training, tennis, wrestling, volleyball, tumbling-gymnastics, and basic conditioning. The criteria for determining physical fitness and motor ability was the Larson Test of Motor Ability, which included the baseball throw, pull-ups, vertical jump, and bar snap, and two selected tests from the Air Force Physical Fitness test, the 300-yard shuttle run and sit-ups. The students were matched by the Physical Fitness test and age into eight parallel sections, and after one semester of instruction, were retested using the same test measures. From the findings Landis concluded (1) that improvement in physical fitness was equally attained by conditioning and tumbling-gymnastics, (2) that swimming, tennis, and boxing were least apt to increase scores on physical fitness, and (3) that wrestling and tumbling-gymnastics best developed all phases of physical fitness.[15]

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[14]Hans Kraus and Ruth P. Hirschland, "Minimum Muscular Fitness Tests in School Children", Research Quarterly, Vol. XXV, pp. 178-188, May 1954.

[15]Carl W. Landis, "Influence of Physical Education Activities on Motor Ability and Physical Fitness of Male Freshmen", Research Quarterly, Vol. 26:3, pp. 295-307, October 1955.

Cureton in a two-year study of 2,600 freshmen at the University of Illinois found significant improvement in the Larson Strength Index Test. The number of Chin-ups improved 27.95%, Vertical Jump improved 2.5%, and Dipping improved 49.30%.[16]

Kulcinski investigated the effect of informal and formal and combination methods of instruction on freshmen. Twenty-two stunt type tests were administered to the students before they were divided into four groups. The four groups included a formal group in which all exercises and instruction were of a formal nature, and informal group in which individual help and suggestions were given, a combination group in which the types of instruction were alternated from formal to informal, and a control group in which no instruction was given at all. He found the group which used the informal method had the greatest increase in the stunt improvement, followed by the one employing the combined method and after that the one which used the formal method. The control group ranked last in improvement.[17]

The preceding articles serve as a basis for understanding and properly administering the tests used in this study. It has been shown that these tests have either been previously validated or have been used before with considerable success.

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[16] Thomas K. Cureton, "Improvement in Motor Fitness Associated with Physical Education and Physical Fitness Clinic Work", Research Quarterly, Vol. 14: 2, pp. 154-157, May 1943.

[17] Louis Kulcinski, "Comparative Effectiveness of Formal, Informal and Combination Methods of Instructing University Freshmen in Fundamental Muscular Skills", Research Quarterly, Vol. 2: 2, pp. 18-26, May 1931.

The Kraus-Weber test was chosen largely because of the great national interest displayed in its results during the past few years.

CHAPTER III

COLLECTION OF DATA

Description of Subjects

Subjects consisted of 88 pupils at the Flandreau Indian Vocational High School. They ranged from 13 years to 19 years in age, from 86 pounds to 198 pounds in weight and from 61 inches to 75 inches in height. In order to be admitted to the Flandreau Indian Vocational High School they must be at least "one-fourth Indian." The students ate at the same dining hall on the campus so the diet and the amount of food would be fairly uniform. Two large dormitories on the campus housed all the students so the number of hours each student slept would be approximately the same. Lights were turned out at ten o'clock and the boys were awakened each morning at six o'clock.

Activity Program

The program at the Flandreau Indian Vocational High School was established in 1954. It was compulsary for both the freshmen and sophomores during the school year 1957-1958. However, it should be noted that this was the first year of required physical education for the sophomores at the school.

The periods were one hour in length and the boys met twice a week on either Monday and Wednesday, or Tuesday and Thursday. Included in the school program were the following activities: touch football--ten periods; basketball--ten periods; softball--ten periods; vollayball--

ten periods; track--eight periods. The hour periods were broken down approximately as follows: eight minutes to dress; ten minutes of calisthenics; fifteen minutes for fundamentals in various activities; seventeen minutes of actual games; and ten minutes to shower for next class. In addition to the physical education program the students could participate in other activities which might have had a bearing on their physical fitness. Along with the regular varsity athletics they could play horseshoe, ping pong, pool, outdoor basketball, volleyball, and other activities that were available on the campus. The subjects had free time in the evenings as well as on Saturday and Sunday to play in the gymnasium and to participate in various activities. The intramural program was fairly comprehensive and many of the subjects participated in that program. These students did not live at home because the Flandreau Indian Vocational High School is a Boarding School supported by the Federal Government.

Test Administration

The three tests were administered at the beginning of the school year before any instruction was given in the activity. The subjects were retested at the end of the school year and the results of both tests were recorded.

The following tests were administered:

(1) Larson's Muscular Strength Test[18]
   (a) Chinning
   (b) Dipping

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[18] L. A. Larson and R. D. Yocom, Measurements and Evaluation in Physical Education and Recreation Education, Mosby: St. Louis, 1951.

(c) Vertical Jump

(2) Iowa Revision of the Brace Test--ten stunts beginning with easier ones and advancing to the tougher ones. The stunts were selected to fit the High School student.

(a) Grapevine
(b) Forward Hand Kick
(c) Leg Cross Squat
(d) Russian Dance
(e) Top
(f) Side Leaning Rest
(g) Full Right Turn
(h) Kneel--Jump to Feet
(i) One Knee Tough Floor
(j) Single Squat

(3) Kraus-Weber Test--a test devised to test physical fitness.

(a) Abdominal Plus
(b) Abdominal Minus
(c) Psoas
(d) Lower Back
(e) Upper Back
(f) Length of back and hamstrings--touching toes

The first three classes of the program were used for Larson's Muscular Strength Test. The explanation of the test only lasted part of the first period and actual testing proceeded for the remainder of that period. In order to avoid the effect of fatigue no two phases of exhaustive endurance and agility test were given on the same day.

The testing program for each period was as follows:

1. First, second, and third class period--Larson's Muscular Strength Test--the orientation and Sargent Jump were given the first period, chinning the second, and dipping the third.

2. Fourth class period--The Iowa Revision of the Brace Test was given during this period with partner scoring system employed.

3. Fifth and sixth period--The Kraus-Weber Test was given to each student individually.

The Iowa Revision of the Brace Test was composed of ten stunts described earlier in this paper. If the stunt was successful the first attempt the student received two points; if there was a failure on the first trial, and success on the second trial, the stunt was scored with one point. With ten stunts making up the test the highest possible score was 20. The range in the initial test was from five to twenty, and on the final test it was from seven to twenty.

In the Larson's Muscular Strength Test raw scores for each item, chinning, dipping, and vertical jump were obtained in the testing. The final score was tabulated by the method of Larsen and Yocom.[19] The range in the initial test was 118 to 369, and in the final test was from 118 to 395.

The pass and fail method of scoring was used in administaring the Kraus-Weber Test. If a fail was recorded in any phase of the test the subject received a fail for his final score.

Students who were absent during any phase of tests had to make up that portion the next period. Six students had been dismissed from school between tests therefore the number tested varied in each test. Scores for these students were eliminated before final computations were made.

Final test were conducted in the same order as the initial tests. The final test began early enough for completion prior to the time school ended.

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[19]Larson and Yocom, op. cit., Table XXCI, p. 475.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF RESULTS

From raw scores obtained in this study comparisons were made of results obtained from the initial and the final tests. Means, differences between means, standard errors of the differences and t-value were computed from the results of Larsen's Muscular Strength Test and the Iowa Revision of the Brace Test. In the third test, the Krauss-Weber test, the pass and fail method of scoring was used and the results recorded on a percentage basis.

The experimental design was the "single group" method and the means were therefore those for correlated groups. Inasmuch as these groups were correlated the following formula for obtaining the standard error of the difference was employed:

$$\sigma(m_1 - m_2) = \sqrt{\sigma^2 m_1 + \sigma^2 m_2 - 2r_{12}\,\sigma m_1\,\sigma m_2}$$ [20]

In Table I will be found the figures illustrating the results obtained from a comparison of the initial and the final tests.

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[20] E. F. Lindquist, The First Course in Statistics, p. 135, Houghton Mifflin Company: Boston, New York, 1942.

TABLE I. MEANS, DIFFERENCE BETWEEN MEANS, STANDARD ERROR OF DIFFERENCE, AND THE CRITICAL RATIO(t-value) FOR THE TWO TESTS

Test	M_1 Initial Score Results	M_2 Final Score Results	Diff. (M_1-M_2)	S.E.Diff.	t-value
Larson's Strength Muscular Test	231.72	270.80	39.08	6.30	6.20
Iowa Revision of Brace Test	13.70	15.30	1.60	1.41	1.14

The null hypothesis was applied in both instances. The degrees of freedom (N-1) for the Iowa Revision of the Brace Test was 87 and for Larson's Muscular Strength Test was 81. In both cases a t-value of 1.66 was therefore needed for significance at five per cent level and 2.38 for significance at the one per cent level.[21]

In the case of Iowa Revision of the Brace Test the t-value of 1.14 obtained was too small to be significant at either the one per cent or five per cent level and the null hypothesis was therefore accepted.

For Larson's Muscular Strength Test on the other hand the t-value of 6.20 was far above that required for significance at either the five or one per cent level. The null hypothesis must therefore be rejected and a definite improvement in strength assumed.

The Kraus-Weber test (Figure 1) was administered to 82 students

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[21] Lindquist, op. cit., p. 240.

at the beginning of the school year with 67 pupils (77.6 per cent) passing and 15 (22.4 per cent) failing. The same test at the end of the school year showed 71 pupils (80.6 per cent) passing and 11 (19.4 per cent) failing.

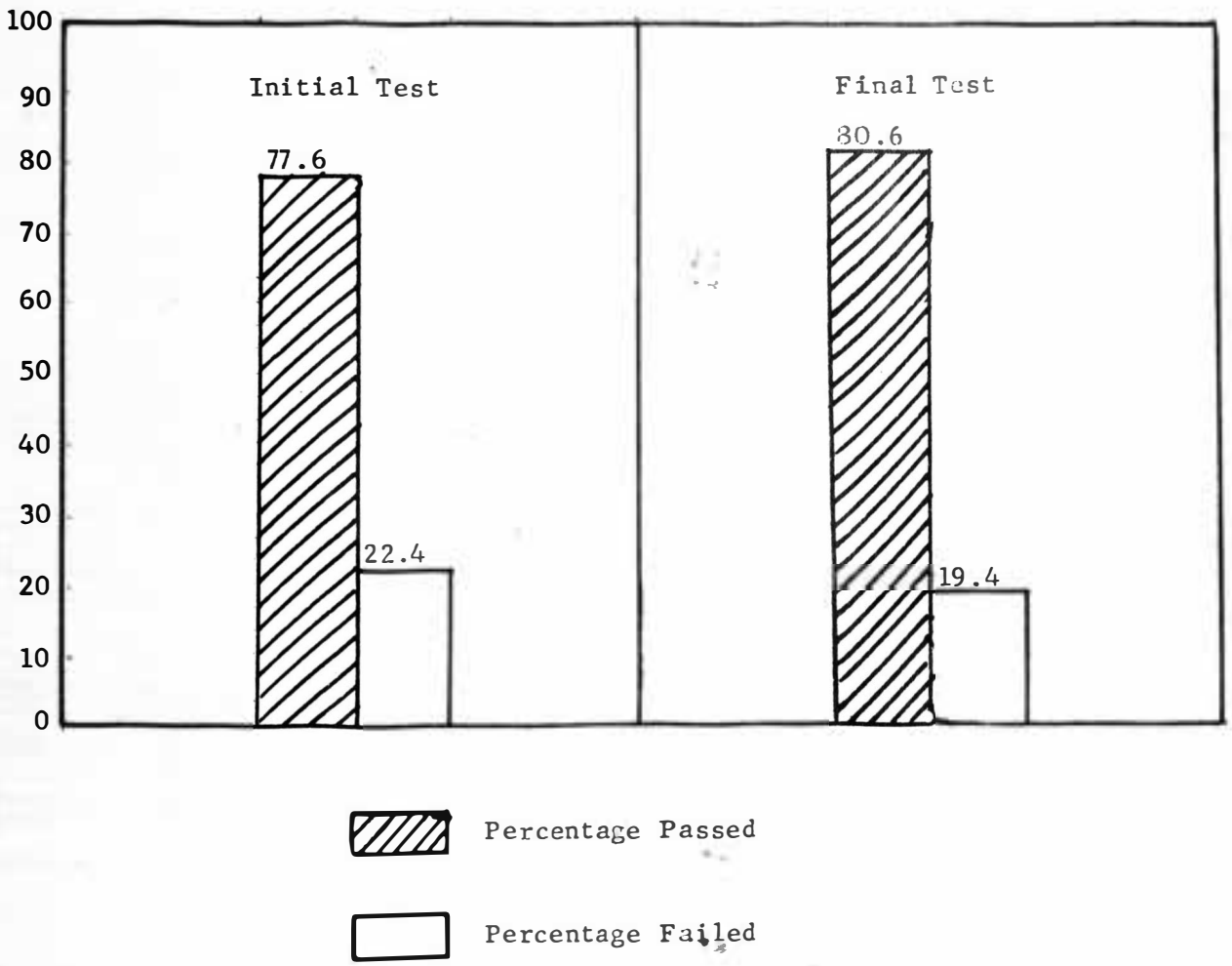

Figure 1. Percentage of Pupils Passing and Failing Kraus-Weber Test

CHAPTER V

SUMMARY AND CONCLUSIONS

Larson's Muscular Strength Test was administered to 88 students ranging in age from 13 years to 19 years. The Iowa Revision of the Brace Test and Kraus-Weber Test was administered to 82 students. Of this total, 61 were freshmen boys and 21 were sophomores. The boys tested were from five different states and were from various different tribes. Tests were administered at the beginning and end of the school year.

The data obtained in this study would seem to justify the following conclusions:

1. Pupils attending Flandreau Indian Vocational High School improved a great deal in strength during the course of the school year.

2. The motor educability of the pupils did not increase during the year. This was perhaps to be expected as the ability to learn new skills might not change a great deal.

3. Pupils increased in the ability to pass the Kraus-Weber Test. This would indicate that fewer students were below standard in minimum muscular fitness at the end of the school year than at the beginning.

4. From the observation of the author, who taught the students in physical education and who administered the tests, the boys who had a good attitude toward activity and play improved their scores the most.

LITERATURE CITED

Clarke, Harrison H., Physical Fitness News Letter, University of Oregon, Series III, No. 8, April, 1957.

Clarke, Harrison H., The Application of the Measurement to Health and Physical Education, Prentice-Hall: New York, 1945.

Cureton, Thomas K., "Improvement in Motor Fitness Associated with Physical Education and Physical Fitness Clinic Work", Research Quarterly, Vol. 14:2, pp. 154-157, May, 1943.

Girr, Eugenia, "The Relationship Between Measures of Motor Educability and the Learning of Specific Motor Skills", Research Quarterly, Vol. 13, pp. 43-53, 1942.

Hatlestad, S. Lucille, "Motor Educability Test for Women College Students", Research Quarterly, Vol. 13, pp. 10-14, 1942.

Karpovich, Peter V., "Fatigue and Endurance", Supplement to the Research Quarterly, Vol. XII, No. 2, p. 416, May, 1941.

Kraus, Hans, and Hirschland, Ruth P., "Minimum Muscular Fitness Tests in School Children", Research Quarterly, Vol. XXV, pp. 178-188, May, 1954.

Kuleinski, Louis, "Comparative Effectiveness of Formal, Informal and Combination Methods of Instructing University Freshmen in Fundamental Muscular Skills", Research Quarterly, Vol. 2:2, pp. 18-26, May, 1931.

Landis, Carl W., "Influence of Physical Education Activities on Motor Ability and Physical Fitness of Male Freshmen", Research Quarterly, Vol. 26:3, pp. 295-307, October, 1955.

Larson, L. A., and Yocum, R. D., Measurements and Evaluation in Physical Education and Recreation Education, Mosby: St. Louis, 1951.

Lindquist, E. E., The First Course in Statistics, p. 135, Houghton Mifflin Company: Boston, New York, 1942.

McCloy, C. H., "Recent Studies in the Sargent Jump", Research Quarterly, Vol. III, No. 2, p. 235, May, 1932.

McCloy, C. H., "The Measurement of General Motor Capacity and General Motor Ability", Research Quarterly, Supplement 5, pp. 46-61, March, 1934.

Morehouse, L. E., "Recent Studies of Learning Factors of Motor Skills", Journal of Health, Physical Education, and Recreation, Vol. 14, pp. 57-62, January, February, 1948.

Sargent, Dudley A., "Physical Test of a Man", American Physical Education Review, Vol. XXVI, No. 4, p. 188, April, 1951

APPENDIX

RECORD FORM AND CLASSIFICATION INDEX FOR LARSONS STRENGTH TEST

Test Items	Raw Score	Weighted Std. Score	Classification	
1. Chinning			Excellent:	368-Up
2. Dipping			Good:	309-367
3. Vertical Jump			Average:	249-308
			Poor:	190-248
			Very Poor:	189

Classification _____ Total Score _____

Name _____

KRAUSE-WEBER TEST

NAME _____

BOY _____ GIRL _____

AGE _____ BIRTHDAY _____ _____
MONTH YEAR

SCHOOL _____

	TEST RESULTS PASS	FAIL
Total test		
1. Abd.+		
2. Abd.-		
3. Psoas		
4. Upper back		
5. Lower Back		
6. Flexibility		

IOWA REVISION OF THE BRACE TEST
MOTOR EDUCABILITY

Stunt Number	First Trial	Second Trial	Score
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Total Score _____

T-Score _____

NAME _____

Name	Larsen's Muscular Strength Test Initial	Larsen's Muscular Strength Test Final	Difference	Iowa Revision of Bruce Test Initial	Iowa Revision of Bruce Test Final	Difference	Krama-Weber Test Initial	Krama-Weber Test Final
1	251	298	+47	16	17	+1	P	P
2	226	269	+43	18	20	+2	P	P
3	96	180	+84	16	15	-1	F	F
4	270	314	+44	18	17	-1	P	P
5	195	203	+ 7	10	13	+3	P	P
6	188	258	+70	7	12	+5	F	P
7	347	371	+24	12	14	+2	P	P
8	257	270	+23	13	20	+7	P	P
9	198	269	+71	14	17	+3	P	P
10	280	317	+37	14	16	+2	P	P
11	249	297	+48	11	9	-2	P	P
12	382	373	- 9	19	18	-1	P	P
13	196	241	+45	13	13	0	P	P
14	196	253	+57	14	13	-1	P	F
15	233	300	+67	16	16	0	P	P
16	291	330	+38	17	16	-1	P	P
17	230	301	+71	7	12	+5	P	P
18	196	225	+29	13	13	0	F	P
19	254	246	- 8	11	13	+2	P	P
20	335	350	+15	11	18	+7	P	P
21	155	206	+51	12	15	+3	F	F
22	166	176	+10	11	10	-1	P	P
23	255	270	+15	15	18	+3	P	P
24	283	305	+22	18	10	-8	P	P
25	395	396	+ 1				P	P
26	247	300	+53	14	16	+2	P	P
27	277	316	+29	14	16	+2	P	P
28	255	245	-10	10	16	+6	P	P
29	255	315	+60	11	14	+3	P	P
30	118	140	+22	12	12	0	F	F

Name	Larsen's Muscular Strength Test Initial	Larsen's Muscular Strength Test Final	Difference	Iowa Revision of Brace Test Initial	Iowa Revision of Brace Test Final	Difference	Kraus-Weber Test Initial	Kraus-Weber Test Final
31	238	260	+22	13	14	+1	P	P
32	190	215	+25	9	13	+4	P	P
33	162	193	+31	9	18	+9	P	P
34	167	185	+18	10	10	0	P	P
35	206	251	+45	13	14	+1	P	P
36	218	263	+45	16	15	-1	P	P
37	174	196	+22	5	9	+4	P	P
38	201	183	-18	11	12	+1	P	P
39	249	263	+14	15	16	+1	P	P
40	287	316	+29	15	18	+3	P	P
41	169	203	+34	9	14	+5	P	P
42	236	285	+49	13	17	+4	P	P
43	180	213	+33	10	13	+3	P	P
44	209	206	- 3	10	11	+1	P	P
45	180	191	+11	10	9	-1	P	P
46	189	206	+17	16	16	0	P	P
47	221	255	+34	10	14	+4	P	P
48	231	223	- 8	9	9	0	P	P
49	219	230	+11	10	14	+4	P	P
50	124	163	+39	11	15	+4	P	P
51	186	226	+40	14	16	+2	P	P
52	298	317	+19	17	17	0	P	P
53	176	193	+17	13	16	+3	P	P
54	311	361	+50	16	19	+3	P	P
55	302	340	+38	13	16	+3	P	P
56	280	241	-39	14	15	+1	P	P
57	307	366	+59	17	18	+1	P	P
58	377	370	- 7	15	17	+2	P	P
59	330	376	+46	17	18	+1	P	P
60	281	300	+19	14	16	+2	P	P

Name	Larsen's Muscular Strength Test Initial	Larsen's Muscular Strength Test Final	Difference	Iowa Revision of Brace Test Initial	Iowa Revision of Brace Test Final	Difference	Kraus-Weber Test Initial	Kraus-Weber Test Final
61	327	364	+37	16	17	+1	P	P
62	183	215	+32	9	15	+6	P	P
63	223	230	- 3				P	P
64	293	311	+18	18	18	0	P	P
65	333	370	+38	17	16	-1	P	P
66	246	301	+55	11	13	+2	P	P
67	294	189	-105	16	18	+2	P	P
68				16	15	-1	P	P
69				10	13	+3	P	P
70	304	393	+89	14	15	+1	P	P
71	306	383	+77	15	18	+3	P	P
72	339	339	0	18	19	+1	P	P
73	299	348	+49	17	16	-1	P	P
74	348	396	+48	20	18	-2	P	P
75	325	378	+53	17	18	+1	P	P
76	271	342	+71	15	17	+2	P	P
77	241	345	+104	15	18	+3	P	P
78	324	330	+ 6	19	17	-2	P	P
79	272	321	+39	14	15	+1	P	P
80	303	373	+70	13	17	+4	P	P
81	320	261	-69	18	17	-1	P	P
82	323	384	+59	17	18	+1	P	P
83	230	289	+59	14	15	+1	P	P
84				19	19	0	P	P
85				16	16	0	P	P
86				14	18	+4	P	P
87				15	17	+2	P	P
88				14	18	+4	P	P