THE EFFECT OF A SEMESTER OF PHYSICAL EDUCATION UPON MOTOR ABILITY OF HIGH SCHOOL MALES

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

In his lifetime an individual acquires a vast storehouse of knowledge. Some knowledge is expressed principally in a motor sense, while some is expressed intellectually. In either case the entire organism is involved in a dynamic learning process.

An individual's central nervous system constantly correlates analyzed information that reaches it through the sensory neurons. The effectiveness with which the individual responds depends on the harmonious working of the muscular and nervous systems. Anyone who develops this unity between muscular and nervous systems develops a high motor ability. One possessing a high degree of motor ability possesses those qualities which enhance his chances of leading a richer and more wholesome life.

I. THE PROBLEM

Statement of the Problem. The purpose of this study was to investigate the effects of a semester of physical education upon the motor ability of high school males.

Assumption. The null hypothesis under test was: there will not be any change caused by a physical education program upon the motor ability of high school males. To test the null hypothesis the one percent level of confidence was employed.

Importance of the study. This study was concerned with the area of motor ability and its development. The acquisition of motor ability in pre-school, elementary, and secondary school is very important to the individual as noted by Brownell and Hagman who stated that, "By the end of secondary school, the youth has learned the fundamentals of nearly all the motor skills he will use in his leisure throughout life."[1]

As the amount of leisure time each student has to fill increases, the importance of training him in the skills which will enrich that time also increases. Motor ability which can be transferred to an ever greater number of activities becomes increasingly important.

The ability of youth to meet the problems of life and to function effectively as members of society depends upon their physical skills. Physical skill is a source of recognition and popularity in the group. "It is in his play that the child

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[1]Clifford Lee Brownell, and E. Patricia Hagman, Physical Education, Foundations and Principles (New York, Toronto, London: McGraw-Hill Book Company, Inc., 1951), p. 46.

gains control of his body, acquires accuracy and precision in motion, and in judging distances, sight and sounds."[2]

It is the responsibility of the school to provide for the physical development of youth and for the learning of neuro-muscular skills. Within the school, this responsibility becomes the function of the physical education department.

Limitations of the study. This study was limited to males enrolled in Seaman High School, Topeka, Kansas. Eighty-four of these students who were enrolled in physical education comprized the experimental group because they took part in the daily physical education classes which provided thirty-five minutes of actual performance. Another group consisting of eighty-three students who were not enrolled in physical education were used as a control group.

This study took place during the first and second semesters of the 1967 and 1968 school year. The time between pre-testing and post-testing was fifteen weeks. The participants were sophomores, juniors, and seniors ranging in the fourteen

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[2]M. R. Davie, Problems of City Life (New York: John Wiley and Sons, Inc., 1932), p. 14.

to eighteen age group. Attitude, state of health, the amount of physical handicap, and previous motor experiences, were the uncontrolled factors.

II. DEFINITION OF TERMS USED

Coordination. Coordination in this study refers to harmonious adjustment.[3]

Motor. Motor is derived from its relationship to a nerve or nerve fiber which connects the central nervous system, or a ganglion with a muscle.[4]

Motor ability. Those qualities possessed by an individual in varying amounts and in varying clusters which enables the individual to learn specific acts shall be referred to as motor ability.[5]

Motor educability. In this investigation motor

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[3]Clarence L. Barnhart, Editor in Chief, The World Book Dictionary, (Chicago: Field Enterprises Educational Corporation, 1967), Volume One, A-K, p. 441.

[4]Charles A. Bucher, Foundations of Physical Education (St. Louis: The C. V. Mosby Company, 1952), p. 146.

[5]Elwood C. Davis, and Earl L. Wallis, Toward Better Teaching in Physical Education (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1961) pp. 109-110.

educability will refer to the "ease with which an individual learns new motor skills."[6]

Motor patterns. The generalized movements which enable the individual to relate and integrate one learning expression to another shall be known as motor patterns.[7]

Motor skill. Motor skill implies the development of a high degree of precision in specific activities.[8]

Perception. "Man's awareness of sensory stimuli, his attention to them, and the meaning he attaches to them is perception."[9] It is the complex sequence of events which intervenes between sensation and the response.

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[6]H. Harrison Clarke, Application of Measurement to Health and Physical Education (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1959), p. 299.

[7]Eugene Roach, and Newell C. Kephart, The Purdue Perceptual-Motor Survey (Columbus, Ohio: Charles E. Merrill Books, Inc., 1966), p. 7.

[8]Ibid.

[9]Camille Brown, and Rosalind Cassidy, Theory in Physical Education (Philadelphia: Lea and Febinger, 1963), p. 62.

CHAPTER II

REVIEW OF THE LITERATURE

There is a paucity of material concerning the development of motor ability or opinions of what activities or procedures will result in greater motor ability rather than lesser. A brief summary of the studies relating to motor processes will be given here.

Oberteuffer[1] and Kephart[2] share the opinion that little is known as to how people learn motor skills, but studies indicate that the acquisition of motor patterns are learned early in childhood and are a most important part of education.

Relationship of motor ability and academic success. The significance of movement patterns was indicated by Getman when he stated that kindergarten and primary teachers have utilized them for years confident there was a relationship between movement patterns and academic readiness.[3] Ellis stated, "The

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[1]Delbert Oberteuffer, Physical Education (New York: Harper and Brothers, 1951), p. 188.

[2]N. C. Kephart, The Slow Learner in the Classroom (Columbus, Ohio: Charles E. Merrill Books, Inc., 1960), p. 33.

[3]G. N. Getman, "The Visiomotor Complex in the Acquisition of Learning Skills," Learning Disorders, Vol. I, Special Child Publications of the Seattle Sequin School Corp., Inc., (Seattle: Jerome Helmuth and Bernie Straub Co-Publishers, 1965), p. 64.

acquisition of motor movements is a most important part of educational training."[4] Hebb remarked, "Mental life is motor life . . . . The ultimate in mental ability is the result of the ultimate in motor ability."[5]

All youth must go through life with the body that they were born with, pointed out Forsythe and Duncan, and much of their ability to meet the problems of life and to function effectively as members of society will depend upon physical skills.[6]

Baldwin noted:

> We should not think that motor skill is unimportant . . . . In later childhood the importance of motor skill lies in the fact that it is a source of recognition and popularity in the group . . . . Boys who are awkward are likely to be unpopular and socially maladjusted.[7]

The importance of motor ability was inferred when Davie stated that, "It is in his play that the child gains control

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[4]Robert S. Ellis, Educational Psychology (Toronto, New York, London: D. V. Van Nostrand Company, 1951), p. 247.

[5]D. O. Hebb, The Organization of Behavior (New York: John Wiley and Sons, Inc., 1949), p. 107.

[6]Charles E. Forsythe, and Ray O. Duncan, Administration of Physical Education (New York: Prentice-Hall, Inc., 1951), p. 48.

[7]Alfred L. Baldwin, Behavior and Development in Childhood (New York: The Dryden Press, 1955), p. 293.

of his body, that he acquires accuracy and precision in motion, and in judging distance, sight, and sounds.[8]

In order to have an effective learning experience, Henshaw contended, the motor and sensory pathways must be physiologically sound. If motor pathways and their functions are undeveloped, learning will be incorrect or incomplete. In addition, he pointed out that brain damage, to any degree, causes limitations in the development of muscular coordination, personality, and intellect. He compared the brain to a computer saying that if a system has a damaged part or is fed limited information from its environment its response to its environment will be limited or non-existing. Henshaw further contends that the function of the brain is to relate the organism to its environment. The influence of motor functions in learning is to reinforce the learning process.[9]

According to Dunsing and Kephart, "Too many children with learning disabilities have learned movement patterns as skills and consequently, their responses are stereotyped,

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[8]M. R. Davie, Problems of City Life (New York: John Wiley and Sons, Inc., 1932), p. 14.

[9]Paul S. Henshaw, "Information Per Se," Nature, Vol. 199 (September 14, 1963), pp. 1050-1052.

rigid, and may not be purposeful.[10]

Brace pointed out that a measure of motor educability would make it possible to distinguish slow learners from fast learners and therefore make it possible to classify students into groups on the basis of their ability to learn motor skills.[11]

Perceptual motor development. Roach and Kephart conducted a survey composed of twenty-two scorable items. Each of the twenty-two items were divided into eleven subtests with each subtest measuring some aspect of the individuals perceptual motor development. The main purpose of the study was to provide the teacher with information which could be used to identify children who do not possess the perceptual motor abilities necessary for acquiring academic skills by the visual instructional method. Through motor and perceptual exploration perceptual data are associated to motor data. Only through such a process does perceptual and motor information

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[10]Jack D. Dunsing, and Newell C. Kephart, "Motor Generalizations in Space and Time," Learning Disorders, Vol. I, Special Child Publications of the Seattle Sequin School Corp. Inc., (Seattle: Jerome Helmuth and Bernie Straub Co-Publishers, 1965), p. 85.

[11]D. K. Brace, "Measuring Motor Ability," Research Quarterly, Volume 12 (September, 1941), p. 181.

have the same meaning and suggest the same external reality. It is essential that such matching takes place. If for some reason it does not or if it is restricted the child comes to live in two worlds, a motor world and a perceptual world. Since these two worlds do not give him identical information he is constantly confused by the two pictures presented to him. Perceptual learning thus comes to depend upon prior motor learning as a foundation.[12]

Evidence is mounting, Getman stated, that the majority of children in the lower academic third of the group will characteristically demonstrate inadequacies of ocular mobility. The ocular system is unique in that there are two information receiving circuits, one for each eye, that have to be constantly matched and balanced. Any inadequacy in this relationship causes an immediate problem in comprehension.[13]

> Hammer and Natale conducted a pilot study in 1964, to determine whether practicing the mental components of typing was as effective in the learning of typing as the traditional method of practicing on the typewriter. The data showed that even though the control group (traditional practice)

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[12] Eugene Roach, and Newell C. Kephart, The Purdue Perceptual-Motor Survey (Columbus, Ohio: Charles E. Merrill Books, Inc., 1966), pp. 9-10.

[13] Getman, loc. cit.

> maintained its superiority in speed of typing throughout the testing interval, its mean error increased while that of the experimental group (mental practice) decreased. The investigators concluded that the initial learning of touch typewriting of the letter keyboard could be learned with greater accuracy without motor involvement. This study seemed to be consistent with findings involving mental practice of motor skills.[14]

Effects of nutrition on motor ability. Research into the effects of contributing variables upon motor performance has been pursued most actively in the field of nutrition and fatigue. According to LaVeck and de la Cruz, clinical and laboratory studies have demonstrated the harmful physical and psychological effects of malnutrition in both animals and humans.[15]

Oberteuffer pointed out that undernourished or malnourished children are notoriously poor learners. Speed and efficiency are retarded under such conditions. The onset of fatigue is noted by the slower rate of contractions and a

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[14]Louis A. Govatos, "Motor Skill Learning," Review of Educational Research, Volume 37, No. 5, (December, 1967) p. 595.

[15]Felix de la Cruz, and Gerald D. LaVeck, "The Pediatricians' View of Learning Disorders," Learning Disorders, Volume I, Special Child Publications of the Seattle Sequin School Corp. Inc., (Seattle: Jerome Helmuth and Bernie Straub Co-Publishers, 1965), p. 33.

greater frequency of inaccurate movements.[16]

Recently Brozek conducted a study of psychomotor functions of men undergoing four days of starvation, combined with hard physical work. He found a dramatic decrease in endurance, as measured by having the subjects run on a treadmill to exhaustion. In tests of speed and of eye-hand coordination, deterriorations of statistically high significance were noted. Brozek tested most of his subjects just once, however, he repeated his testing with the same subjects after an interval of six months.[17]

Requirements of motor ability tests. Scott devised a list of requirements she felt a motor ability test should meet if it was going to be reliable:[18]

1. Have the situations somewhat new to the subject.
2. Permit very little practice.
3. Explain carefully but without coaching hints.
4. Set up tests which include as many skills as possible.

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[16]Delbert Oberteuffer, Physical Education (New York: Harper and Brothers, 1951), pp. 159-160.

[17]Josef Brozek, "Crash Diets and Wrestling," Des Moines Sunday Register, (December 17, 1967), p. 6-7.

[18]M. Gladys Scott, "Assessment of Motor Abilities of College Women through Objective Tests," Research Quarterly Volume 10 (October, 1939), pp. 63-83.

5. Tests with multiple elements in common of significance should be used.
6. Tests should give the opportunity for showing developed skills.
7. Test emphasis should not include factors such as endurance, strength, and so forth.
8. Include a variety of skills for wider representation.

Ways to measure motor ability. Motor ability tests are useful to group individuals in a physical education program and to test the effectiveness of the program. The tests are constructed to test all around ability and do not depend upon any special skill or upon previous practice. They involve the use of the large muscle groups and they test the capacity for performance.[19] McCloy points out these variables that influence motor learnings; muscular strength, dynamic energy, ability to change direction, flexibility, agility, peripheral vision, good vision, concentration, an understanding of the mechanics of the techniques of the activities, and the absence of disturbing or inhibitory complications.[20] Motor ability is not readily measured by any one test as studies indicate

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[19]Sarah R. Riedman, Physiology of Work and Play (New York: Holt, Rinehart and Winston, 1950), pp. 534-539.

[20]Charles H. McCloy, "A Preliminary Study of Factors in Motor Educability," Research Quarterly (May, 1964), pp. 28-29.

that there are different types of motor learning. Several of the more commonly used motor ability tests are as follows:

1. The Cozens Test
2. The Burpee Test
3. The Iowa Brace Test
4. Arthur Adams Motor Educability Test

Ways of measuring motor performance were reviewed by Adams in 1954. After studying numerous proposed tests of motor ability he concluded there were two types of motor educability tests, the stunt-type and the sport-type. He felt that the two were not significantly related. He studied forty-nine sport-type tests and selected four which he believed would measure the motor movement necessary for having success in sport-type activities. These tests consisted of wall volley tests, tennis ball throw, ball bounce test, and basketball shooting. The combined tests had a multiple correlation of .79.[21]

Effects of sex, age, and speed on motor ability. An investigation into the effects of age, sex, and speed on a rotary pursuit involving sixty-four children from kindergarten

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[21]Arthur Adams, "A Test of Construction Study of Sport-Type Motor Educability for College Men," (unpublished Doctoral Dissertation, Louisiana State University, Baton Rouge, Louisiana, 1954), pp. 63-78.

through the third grade was pursued by Daval, Hastings, and Klein. The study indicated that all children were able to perform the rotary pursuit task. The greatest increase in the ability to perform occurred between the kindergarten and the first grade.

In a longitudinal study extending over a five year period Govatos reported on the mean motor performance of twenty-three boys and twenty-five girls initially listed in the second grade on numerous motor activities. It was noted that as the subjects advanced in grade, their performances increased significantly.

Significant sex differences were noted on the ball bounce, ball throw for distance, and the standing broad jump. The advantage enjoyed by the boys through the testing period was attributed to their greater interest and more frequent opportunities to engage in related activities. In the other motor activities the girls were able to compete satisfactorily.[22]

Semantics. If people are to communicate and pass ideas without misleading or changing the connotations of the experiences involved, then the problem of semantics must be overcome.

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[22]Govatos, op. cit., p. 592.

Oberteuffer said, "The big motor skills of walking, jumping, climbing, and skipping, as well as skating and swimming are learned fairly easily."[23] Brown and Cassidy, however, in referring to these same movements said, "When various combinations of fundamental movements are made they may be called fundamental movement patterns. These include; walk, run, jump, slide, kick, crawl, climb, ... among others."[24]

Roach and Kephart attempted to clarify the problem of semantics when they pointed out that there is a difference between a motor "pattern" and a motor "skill." An individual with the ability to perform certain activities or a limited group of activities with a high degree of effectiveness possesses motor "skill." It allows the individual to do one thing extremely well. The motor "pattern" stresses the purpose of the act and thus, the outcome of the movement. The motor pattern allows the individual to do many things satisfactorily. Motor patterns are the foundation upon which complex learnings are based while motor skills make only a limited contribution to the learning process.[25]

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[23]Oberteuffer, op. cit., p. 194.

[24]Camille Brown, and Rosalind Cassidy, Theory in Physical Education, (Philadelphia: Lea and Febinger, 1963), p. 75.

[25]Roach, and Kephart, op. cit., p. 7.

The writers review of research studies indicates that the ultimate success of an individual depends on, or in part on, the development of motor ability. Its importance was pointed out by Baldwin, Duncan, Dunsing, Henshaw, Kephart, and Brace when they inferred that all learning is based on motor experiences and that the academic success of an individual depends on his ability to perform motor activities.[26]

Roach, Kephart, Getman, Hammer, and Natale stated that motor activities that involve perceptual information may be hindered by ocular inadequacies which constantly confuse the individual by giving contradictory information which causes an immediate problem in comprehension.[27]

LaVeck, de la Cruz, Oberteuffer, and Brozek have demonstrated the harmful physical and psychological effects of malnutrition in performing motor activities both in animals and humans.[28]

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[26]Baldwin, loc. cit.; Duncan, loc. cit.; Dunsing, loc. cit.; Henshaw, loc. cit.; Kephart, loc. cit.; and Brace, loc. cit.

[27]Roach, loc. cit.; Kephart, loc. cit.; Getman, loc. cit.; Hammer, and Natale, (see Govatos, loc. cit.).

[28]LaVeck, loc. cit.; de la Cruz, loc. cit.; Oberteuffer, loc. cit.; Brozek, loc. cit.

Numerous tests have been devised to measure different aspects of the various types of motor ability. Scott devised a list of requirements she felt a motor ability test should meet to be reliable.[29]

Daval, Hastings, and Govatos noted that sex did not make a significant difference in the performance of certain motor activities. They found, however, that as age increases so does the individuals ability to perform motor activities.[30]

Roach and Kephart attempted to bridge the communication gap in their explanation of semantics.[31]

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[29]Scott, loc. cit.

[30]Daval, loc. cit.; Hastings, loc. cit.; Govatos, loc. cit.

[31]Roach, loc. cit.; Kephart, loc. cit.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to investigate the effects of a semester of physical education upon the motor ability of high school males.

A pre- and post-motor educability test was administered to an experimental and a control group. The resultant scores of both groups were equated using the analysis of variance and covariance technique. The scores were compared to note the growth in motor ability indicated by the test.

Experimental sample. Of the total male population, eighty-seven in number, who enrolled in physical education, eighty-four subjects completed the fall program and were included in the study. Fifty-six of these males were tenth graders and twenty-eight were eleventh and twelfth graders. Sixty students were fourteen and fifteen years old; twenty-four were sixteen to eighteen years old. They were in class daily for one, fifty-minute period. The subjects took part in thirty-five minutes of activities which are found in the fall semester of a typical physical education program. These activities were calisthenics, rope-jumping, touch football,

soccer, wrestling, and gymnastics. No changes were instigated to provide special treatment for the sake of this research because the writer wished to keep the treatment of subjects such as any other school could and would provide.

Control sample. Included in this group were high school males who were not enrolled in physical education or athletics. These subjects were eleventh and twelfth grade students. They ranged in age from sixteen to eighteen. These boys were individuals who had achieved so little pleasure from, and sucess in, physical education activities that they had not chosen to pursue physical education classes beyond the required number of years. The eleventh and twelfth graders in Seaman are not required to take physical education, but are encouraged to enroll in either daily physical education classes or athletics.

It was judged of greater convenience to the school to test this control sample at a time other than during the testing of the experimental sample, so the control groups involvement in the research occurred during the spring semester of 1968. The control groups activities consisted of the walking around through the school program; the sitting, rising, stretching, and bending acts that are necessary to daily living.

Experimental design. In this study:

1. A pre-treatment of Arthur Adams Motor Educability Test[1] was administered to an experimental and control group of high school males.
2. There was a passage of fifteen weeks of time during which the experimental group engaged in the daily physical education activities, while the control group did not.
3. A post-treatment administration of the same test was provided.
4. Statistical analysis of the resultant scores of both groups using the analysis of variance and covariance technique to statistically equate them. By this method the writer could hold the initial differences constant and thus be able to compare the growth in motor ability as shown by scores obtained on the test.

Testing device. The Adams Motor Educability Test was selected to measure the motor ability of the students involved in this study.[2] Adams' test was selected because of its high reliability, the ease with which it could be administered, the low cost of its administration, and the availability of the needed equipment.

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[1]Arthur Adams, "A Test of Construction Study of Sport Type Motor Educability for College Men" (unpublished Doctoral Dissertation), Louisiana State University, Baton Rouge, Louisiana, 1954), pp. 63-78.

[2]Ibid.

The tests were administered in the gymnasium of Seaman High School between the hours of eight in the morning and two in the afternoon. The subjects were dressed in physical education uniforms. No prior training or practice was allotted the students. The battery of tests were as follows:

Wall Volley Test: The subject stands behind a line drawn three feet from a wall and volleys above a line drawn on the wall ten and one-half feet above the floor. The volley is started with a two-handed toss against the wall. The number of volleys up to ten is recorded on each of seven trials. The score on each trial stops when:

1. ten points have been scored.
2. the subject steps on or over the restraining line.
3. a volley does not go above the line drawn on the wall.
4. a "caught" ball is ruled by the scorer.

The two hand toss starting the volley counts. The total score for the test is the sum of the scores made on the seven trials.

Tennis Ball Throw: The subject lies flat on his back holding a tennis ball. He throws the ball six feet or higher in the air and catches it in either hand while remaining in the "lying on back" position. It is a failure if:

1. the ball is not thrown at least six feet in the air.
2. the ball is not caught in one hand.

3. the "lying on back" position is not maintained during the entire procedure.

The total score is the number of successful attempts in ten trials.

Ball Bounce Test: The subject stands in the middle of a circle six feet in diameter holding a medium weight softball bat one hands' length from the heavy end. The subject attempts to bounce a volleyball on the top of the bat, not the side, but on the very top of the bat. The number of bounces up to ten is recorded on each of ten trials. The score stops on each trial when:

1. ten points have been scored.
2. the subject steps on or over the line bounding the six foot circle.
3. the ball hits the subjects body.
4. the ball does not go six inches above the end of the bat.

The total score for this test is the sum of the scores made on the ten trials.

Basketball Shooting: The subject takes twenty shots from the free throw line using any method or combination of methods. The score is the number of successful attempts in twenty trials.

CHAPTER IV

ANALYSIS OF DATA

In this study of the development of motor ability a comparison was made of the scores obtained by a group of eighty-four males who were enrolled in the 1967 fall semester of physical education, and those obtained by eighty-three males who were in the high school but not participating in either athletics or physical education during their period of testing. The writer attempted to ascertain whether the development of motor ability shown by boys in fifteen weeks of physical education would be significantly greater than boys not in a physical education program.

These students could not be treated as matched groups since they varied in age, number, and initial motor ability. That is, the control group was older and demonstrated higher motor ability (had a higher pre-test mean score) in the beginning than did the younger experimental group. This gave the control group a definite advantage at the start.

To enable the writer to compare the effect of fifteen weeks of treatment on two such diverse groups it was necessary to use the statistical method of analysis of variance and

covariance to hold these initial differences constant.[1] Only by using the technique of analysis of variance and covariance was it possible to make a valid comparison of the two groups change in scores after treatment.

Table 1, p. 26, presents the essential data for this comparison. The data were drawn from the individual scores of the students in each group at the pre-test and post-test administrations.

The F value of 9.2 was computed by the analysis of variance and covariance. Reference to the F table indicates that an F value for 165 and 1 degrees of freedom at the one percent level of confidence was 6.81. Since this value was smaller than 9.2 we reject the null hypothesis of no difference in the mean and conclude the two groups differ significantly in their gain of motor ability when the original inequality of motor ability was held constant. Therefore, we adopt the hypothesis that the experimental group will gain more in their development of motor ability than the control group.

It was also important in this study to note that not only is there a significant difference, but to determine which group

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[1]George W. Snedecor, Statistical Methods (Ames, Iowa: The Iowa State College Press, 1950), p. 225.

Table I. Sums of Squares Table

Group	N	y^2	yz	z^2
Experimental Group	84	20,108,828.81	13,726,648.36	22,713,310.15
Control Group	83	15,275,705.04	9,257,155.40	13,276,239.14
Σ		35,384,533.85	22,983,803.76	
Total	167	35,404,856.63	22,845,661.07	36,928,565.48

showed a mean gain.

After discovering both groups gained in their means, it was meaningful to discover which group showed the greatest mean gain. Only by this final step could the writer complete his study of whether participation in a physical education program adds to the development of motor ability.

To obtain the adjusted mean the deviation of each group mean from the grand mean was determined. Refer to Table 2, p. 28. In this instance the group mean of the experimental group was 846.09 when substracted from the grand mean of 857.05 a positive score of 10.96 was obtained because the grand mean was larger than the group mean. The same procedure was followed for the control group. Each difference is then multiplied by the regression coefficient of .6495, which is obtained from the Sums of Squares Table by dividing the sum of the product of pre-test times the post-test, 22,983,803.76 by the sum of pre-test squared, 35,384,533.85. This value, 7.118520, is added to the post-test to obtain the adjusted means, 1050.96. Thus when we compare the adjusted means of the experimental group, 1050.96, to the adjusted means of the control group, 886.66, the experimental group achieved significantly more at the one percent level of confidence in motor ability than did the control group when initial factors were held constant.

Table II. Adjusted Means

Group	Group Means Pre	Post	Difference	byz	Correction
Experimental Group	846.09	1043.84	10.96	.6495	7.118520
Control Group	868.15	893.87	-11.10		-7.209450
Total	857.05 (Grand Mean)				

Adjusted mean scores of post test:

Physical education 1043.84 + 7.12 = 1050.96

Non-Physical education 893.87 - 7.21 = 886.66

A difference of 164.30

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to evaluate the effects of a semester of physical education upon the development of motor ability in high school males. To obtain this goal a study was designed to test the mean motor ability of an experimental group and a control group. The experimental group was treated by being exposed to a typical physical education program for one semester. The control group was not treated. A pre- and post-administration of Adams Motor Educability Test[1] was used to determine both groups level of motor ability.

The groups were unmatched in age and in their ability to perform motor activities. Therefore in order to determine which group gained in motor ability the technique of analysis of variance and covariance was used.

I. SUMMARY

The development of motor ability is an unknown quality which can be observed in action and is so varied in its

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[1]Adams, loc. cit.

individual application that it is impossible to relate any specific activity or sequence of activities to its best development. However, through past efforts at developing high motor ability in physical activities, much has been learned which gives many clues. Research, such as this study, in which an attempt was made to measure an initial state of motor ability with a specific tool, provides a framework for other research efforts which may or may not support these results.

Only by designing a pattern of research using tools available to others and developing new techniques, can a pool of knowledge about the best methods of developing motor ability be accumulated.

This was not a study of how motor ability develops, but rather of whether it develops. It will take further analysis of another design to determine just what and how motor ability was developed.

II. FINDINGS

Both the control group and the experimental group gained in their ability to perform motor activities. The experimental group engaged in activities found in a typical physical education program showed a marked gain over those not engaged in

such a program.

III. CONCLUSIONS

The writer feels that no problem in physical education or in education as a whole is more important than the question of how motor ability develops. Rigorous research is needed to determine just what are the best activities or the best method to develop motor ability. Current studies indicate mental observation, knowledge and response, sex, age, strength, and physical involvement are a few of the variable factors that effect an individuals ability to learn motor activities.

IV. RECOMMENDATIONS

If motor ability is important in academic as well as physical well-being and if being in physical education activities daily will promote better skill, then it should become a common practice to require physical education throughout the elementary and high school years. It may be hoped that the foundation of good habits and daily physical activity will be so self-evident in their benefits to each individual by the time of graduation that he will maintain them throughout life.

Future studies should be conducted to determine what activities contribute most to the development of motor ability.

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APPENDIX

GROUP A. Physical Education Class

Student	Y(Pre)	Y^2	Z(Post)	Z^2	YZ
1.	2,064.53	4,262,284.12	2,000.85	4,003,400.72	4,130,814.85
2.	1,997.28	3,989,127.40	1,599.88	2,559,616.01	3,195,408.33
3.	1,973.67	3,895,373.27	1,898.71	3,605,099.66	3,747,426.97
4.	1,892.14	3,580,193.78	2,035.69	4,144,033.78	3,851,810.48
5.	1,720.89	2,961,462.39	1,383.70	1,914,625.69	2,381,195.49
6.	1,711.14	2,928,000.10	1,986.47	3,946,063.06	3,399,128.28
7.	1,600.24	2,756,396.86	1,519.45	2,308,728.30	2,431,484.67
8.	1,635.97	2,676,397.84	1,225.45	1,501,825.74	2,004,864.88
9.	1,544.69	2,386,067.20	1,150.09	1,322,707.01	1,776,532.52
10.	1,486.75	2,210,425.56	1,483.32	2,200,238.22	2,205,326.01
11.	1,438.26	2,068,591.83	1,506.73	2,270,235.29	2,167,069.49
12.	1,405.70	1,975,992.49	1,538.85	2,368,059.32	2,163,161.45
13.	1,382.53	1,911,389.20	1,993.19	3,972,806.38	2,755,644.97
14.	1,377.17	1,896,597.20	1,485.05	2,205,373.50	2,045,166.31
15.	1,361.24	1,852,974.34	1,374.68	1,880,758.85	1,871,269.40
16.	1,320.42	1,743,508.98	1,504.73	2,264,212.37	1,986,875.59
17.	1,285.78	1,653,230.21	2,009.54	4,038,251.01	2,583,826.34
18.	1,259.16	1,585,438.91	1,461.64	2,136,391.49	1,840,438.62
19.	1,135.38	1,289,087.74	1,170.04	1,368,993.60	132,884.88
20.	1,132.80	1,283,235.84	2,019.26	4,077,410.95	2,287,417.73
21.	1,123.24	1,261,668.10	1,349.45	1,821,015.30	1,514,632.98
22.	1,116.24	1,245,991.74	969.93	940,764.20	1,082,674.66
23.	1,090.11	1,188,339.81	1,449.82	2,101,978.03	1,580,463.28
24.	1,034.39	1,069,962.67	1,102.60	1,215,726.76	1,140,518.41
25.	992.08	984,222.73	1,374.26	1,888,590.55	1,264,429.14
26.	987.44	975,037.75	1,104.09	1,219,014.73	1,090,222.63
27.	917.10	841,072.41	784.60	615,597.16	719,556.66
28.	910.78	829,520.21	1,186.87	1,408,660.40	10,809,772.41

GROUP A. Physical Education Class (Cont.)

Student	Y(Pre)	Y^2	Z(Post)	Z^2	YZ
29.	868.36	754,049.09	679.80	462,128.04	590,311.13
30.	856.78	734,071.97	1,797.58	3,231,293.86	1,540,130.59
31.	838.09	702,394.85	1,276.56	1,629,605.43	1,069,872.17
32.	835.95	698,812.40	1,212.40	1,469,913.76	1,013,505.78
33.	831.85	691,974.42	807.79	652,524.68	671,960.11
34.	809.23	654,853.19	581.43	338,060.84	470,510.60
35.	802.09	643,348.37	2,050.95	4,206,395.90	1,645,046.49
36.	781.05	610,039.10	293.87	86,359.58	229,527.16
37.	751.80	565,203.24	803.60	645,772.96	604,146.48
38.	743.38	552,613.82	1,223.13	1,496,046.99	909,250.38
39.	1,377.05	1,896,266.70	1,830.84	3,351,975.11	2,521,158.22
40.	1,106.30	1,223,899.69	1,123.42	1,262,072.50	1,242,839.55
41.	977.58	955,662.66	1,060.95	1,125,614.90	1,037,163.50
42.	742.01	550,578.84	1,039.24	1,080,019.79	771,126.47
43.	733.65	538,242.32	467.38	218,444.06	342,893.34
44.	699.69	489,566.10	961.35	924,193.82	672,646.98
45.	693.70	481,219.69	1,034.11	1,069,383.49	717,362.11
46.	693.67	481,178.07	507.20	257,251.84	535,540.99
47.	616.85	380,503.92	2,390.27	5,713,390.67	1,474,438.05
48.	610.58	372,807.94	601.08	361,297.17	367,007.43
49.	593.31	352,016.76	1,257.17	1,580,476.41	745,891.53
50.	583.37	340,320.56	1,074.16	1,153,819.71	626,632.72
51.	570.09	325,002.61	397.04	157,640.76	226,348.53
52.	533.34	284,451.56	591.03	349,316.46	315,219.94
53.	532.74	283,811.91	831.50	691,392.25	442,973.31
54.	531.89	282.906.97	585.34	342,622.92	311,336.49
55.	531.48	282,470.99	446.71	199,549.82	237,417.43

GROUP A. Physical Education Class (Cont.)

Student	Y(Pre)	Y^2	Z(Post)	Z^2	YZ
56.	523.30	273,842.89	1,672.89	2,798,560.95	875,423.34
57.	505.20	255,227.04	637.58	406,508.26	322,105.42
58.	495.47	245,490.52	512.92	263,086.93	254,136.47
59.	491.41	241,483.79	794.24	630,817.18	390,297.48
60.	471.42	222,236.82	785.30	616,696.09	370,206.13
61.	471.18	220,010.59	837.25	700,987.56	394,495.46
62.	464.35	215,620.92	590.26	348,406.87	274,087.23
63.	460.63	212,179.99	807.97	652,815.52	372,175.22
64.	457.60	209,397.76	908.41	825,208.73	415,688.42
65.	444.52	197,598.03	512.92	263,086.93	228,003.20
66.	440.39	193,943.35	1,051.80	1,106,283.24	463,202.20
67.	421.66	177,797.16	960.95	923,424.90	405,194.18
68.	421.58	177,729.70	507.63	257,688.22	214,006.66
69.	408.62	166,970.30	930.79	866,370.02	380,339.41
70.	401.35	161,081.82	625.80	391,625.64	251,164.83
71.	379.08	157,672.53	602.35	362,825.52	228,338.84
72.	367.19	134,828.50	466.14	217,286.50	171,161.95
73.	350.35	122,745.12	480.62	230,995.58	168,385.22
74.	347.02	120,422.88	331,26	109,733.19	114,953.85
75.	333.69	111,349.02	534.35	285,529.92	178,307.25
76.	326.62	106,680.62	874.17	764,173.19	285,521.41
77.	289.14	83,601.94	426.89	182,235.07	123,430.97
78.	266.21	70,867.76	256.26	65,669.19	68,211.97
79.	246.81	60,915.18	373.75	139,689.06	92,245.24
80.	218.18	47,602.51	447.07	199,871.58	97,541.73
81.	106.45	11,331.60	386.75	149,575.56	41,169.54
N = 84	71,071.25	80,241,240.44	87,682.97	11,240,729.54	87,914,008.86

GROUP B. Non-Physical Education

Student	Y(Pre)	Y^2	Z(Post)	Z^2	YZ
1.	2,177.56	4,741,767.55	2,003.28	4,013,130.76	4,362,262.40
2.	2,014.58	4,058,532.58	2,068.19	4,277,409.88	4,166,534.21
3.	1,624.96	2,640,495.00	1,104.04	1,218,904.32	1,794,020.84
4.	1,600.98	2,563,136.96	1,182.74	1,398,873.91	1,893,543.09
5.	1,568.69	2,460,788.32	1,421.24	2,019,923.14	2,229,484.98
6.	1,559.38	2,431,665.98	1,336.74	1,786,873.83	2,084,485.62
7.	1,544.69	2,386,067.20	567.52	322,078.95	876,642.47
8.	1,538.48	2,366,920.71	1,614.37	2,606,190.50	2,483,675.96
9.	1,521.33	2,314,444.97	1,303.14	1,698,172.86	1,982,505.98
10.	1,473.19	2,170,288.78	1,326.43	1,759,416,54	1,954,083.41
11.	1,435.64	2,061,062.21	895.53	801,973.98	1,285,658.69
12.	1,382.25	1,910,615.06	1,200.38	1,440,912.14	1,659,225.26
13.	1,358.17	1,844,625.75	243.61	59,345.83	330,863.79
14.	1,338.14	1,790,618.66	988.82	977,764.99	1,323,179.59
15.	1,266.21	1,603,287.76	936.01	876,114.72	1,185,185.22
16.	1,260.80	1,589,616.64	1,188.45	1,412,413,40	1,498,397.76
17.	1,254.33	1,573,343.75	1,036.25	1,073,814.06	1,299,799.46
18.	1,219.55	1,487,302.20	1,315.68	1,731,013.86	1,604,537.54
19.	1,191.48	1,419,624.60	1,102.77	1,216,101.67	1,313,928.40
20.	1,185.64	1,405,742.21	1,479.22	2,188,091.81	1,753,822.40
21.	1,159.57	1,344,602.58	1,046.76	1,095,706.50	1,213,791.49
22.	1,136.54	1,291,723.17	805.53	648,878.58	915,517.07
23.	1,097.10	1,203,628.14	1,008.49	1,017,052.08	1,106,414.38
24.	1,071.86	1,148,883.86	724.63	525,088.64	776,701.91
25.	1,040.94	1,083,556.08	1,394.19	1,943,765.76	1,451,268.14
26.	1,028.00	1,056,784.00	1,139.44	1,298,323.51	1,171,344.32
27.	1,026.02	1,052,717.04	1,011.19	1,022,505.22	1,037,501.16
28.	1,016.14	1,032,540.50	1,218.63	1,485,059.08	1,238,298.69

GROUP B. Non-Physical Education (Cont.)

Student	Y(Pre)	Y^2	Z(Post)	Z^2	YZ
29.	996.71	993,430.82	462.32	213,739.78	460,798.97
30.	987.02	974,208.48	1,571.62	2,469,989.42	1,551,220.37
31.	983.91	968,078.89	1,493.77	2,231,348.81	1,469,735.24
32.	980.12	960,635.20	609.75	371,795.06	597,628.17
33.	964.24	929,758.78	933.06	870,600.96	899,693.77
34.	959.70	921,024.09	493.71	243,749.56	473,813.49
35.	942.34	888,004.68	940.20	883,976.04	885,906.07
36.	921.61	849,364.99	936.01	876,114.72	862,718.18
37.	889.62	791,423.74	978.10	956,679.61	870,137.32
38.	881.10	777,337.21	496.65	246,661.22	437,598.32
39.	869.79	756,534.64	1,240.06	1,537,748.80	1,078,591.79
40.	837.86	702,009.38	987.96	976,064.96	827,772.17
41.	826.78	683,565.17	1,063.35	1,130,713.22	879,156.51
42.	782.94	612,995.04	1,039.79	1,081,163.24	814,093.18
43.	710.56	504,895.51	581.20	337,793.44	412,977.47
44.	705.08	497,137.81	1,284.62	1,650,248.54	905,759.87
45.	700.89	491,246.79	1,065.85	1,136,036.22	747,043.61
46.	699.69	489,566.10	1,391.14	1,935,270.50	973,366.75
47.	698.09	487,329.65	1,193.27	1,423,893.29	833,009.85
48.	685.66	470,129.64	960.20	921,984.04	658,370.73
49.	680.76	463,434.18	1,244.12	1,547,834.57	846,947.13
50.	674.55	455,017.70	737.73	544,245.55	497,635.77
51.	658.17	433,187.75	721.66	520,793.16	474,974.96
52.	646.37	417,794.18	994.73	989,487.77	642,963.63
53.	637.84	406,839.87	659.44	434,861.11	420,617.21
54.	636.99	405,756.26	861.27	741,786.01	548,620.38
55.	633.47	401,284.24	734.55	539,563.70	465,315.39
56.	595.69	354.846.58	373.17	139,255.85	222,293.64

GROUP B. Non-Physical Education (Cont.)

Student	Y(Pre)	Y^2	Z(Post)	Z^2	YZ
57.	590.70	348,926.49	366.00	133,956.00	216,196.20
58.	585.20	342,459.04	939.30	882,284.49	549,678.36
59.	574.58	330,142.18	357.16	127,563.27	205,216.99
60.	568.69	323,408.32	557.20	311,587.24	317,442.75
61.	567.83	322,420.91	422.01	178,092.44	239,629.94
62.	553.87	306,771.98	706.78	499,537.97	391,464.24
63.	534.78	285.989.65	306.88	94,175.33	163,959.85
64.	467.46	218,518.85	534.43	285,615.42	249,824.65
65.	457.69	209,480.14	476.16	226,728.35	217,933.67
66.	446.75	199,585.56	555.53	308,613.58	248,183.03
67.	439.64	193,283.33	659.44	434,861.11	289,916.20
68.	435.00	189,225.00	412.75	170,362.56	179,546.25
69.	428.84	183,903.75	444.61	197,678.05	190,666.55
70.	421.52	177,679.11	923.53	852,907.66	389,286.37
71.	398.22	158,579.17	1,427.18	2,094,031.01	568,331.62
72.	392.31	153,907.14	737.73	544,245.55	289,418.86
73.	363.87	132,401.78	499.50	249,500.25	181,753.07
74.	360.01	129,607.20	391.72	153,444.56	141,023.12
75.	360.00	130,025.15	400.83	160,664.69	144,298.80
76.	347.03	120,429.82	427.90	183,098.41	148,494.14
77.	312.55	97,687.50	724.98	525,596.00	226,592.50
78.	263.95	69,669.60	501.71	251,712.92	132,426.35
79.	218.89	47,912.83	329.56	108,609.79	72,137.39
80.	217.78	47,428.13	218.22	47,619.97	47,523.95
81.	104.52	10,924.43	436.08	190,165.77	45,579.08
82.	837.86	702,009.38	987.96	976,064.96	827,772.17
83.	527.11	277,844.95	732.56	536,644.15	240,558.05
N = 83	72,056.42	77,831,460.02	74,191.28	79,593,661.17	73,666,288.32