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A COMPARISON OF TWO METHODS OF DEVELOPING PHYSICAL
FITNESS IN FOURTH AND FIFTH GRADE GIRLS

DISSERTATION
Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

by
Bette Jean Logsdon, B. S., A. M.

*****

The Ohio State University
1962

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CHAPTER I
INTRODUCTION

It does not require diligent scrutinizing by a discerning reader of the literature to detect the peaks of interest in fitness which have occurred periodically in physical education. This cyclic devotion is revealed through the numerous studies and writings dedicated to this field of inquiry. One of the most recent additions to the publications on this theme and the impact it made were the factors influencing this study. ¹ A fitness program designed for the youth of today as proposed in this pamphlet advocates fifteen minutes a day of vigorous exercise. The program outlined in this booklet and prescribed to fulfill this recommendation of daily exercise is composed of calisthenic type exercises to be performed in a specific, predetermined order. ²

² Ibid., p. 56.
Statement of the Problem

Purpose

The purpose of this study was (1) to determine whether the practice of basic skills could augment the physical fitness level of young girls at a rate comparable to the increase induced through a calisthenic program, and to ascertain to what extent the two programs affected performance in basic skills, and (2) to determine the relationship, if any, between constitutional body build, when classified by Sheldon's system of somatotyping, and physical maturity, as determined through skeletal X-ray, with performance as measured by the selected tests.

Importance of the Study

The purpose of this study was to determine whether the acquisition or practice of motor skills through performing fundamental skills frequently found in the play life of the child influenced the physical fitness level of the child, and, conversely, to see what influence the practice of exercises prescribed for a physical fitness program had on the acquisition of basic motor skills. It would appear logical that the elementary physical education curriculum should be founded largely on the

developmental needs of the children and should be substantiated and improved through research.

The influencing principle inferred here was not original but rather was promulgated by leading educators. Anna Espenschade referred to the importance of skill development as an important developmental task. She said,

Since the acquisition of skills and participation in active games is recognized as an important developmental task of later childhood, tests of gross motor abilities are measures of this aspect of fitness.\(^4\)

The developmental task to which Dr. Espenschade referred is one postulated by Robert Havighurst in his book, Developmental Tasks and Education. He expounded this specifically when he defined one of the developmental tasks of childhood in this manner:

To learn the physical skills that are necessary for the games and physical activities that are highly valued in childhood—such skills as throwing and catching, kicking, tumbling, swimming, and handling simple tools.\(^5\)

The intent of this study was not to chide physical fitness and daily vigorous exercise. It was the usurping by calisthenics of as much as fifty per cent of the total

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time allotted to the entire physical education curriculum in the elementary schools which caused the real concern.

Stratemeyer and her colleagues set the focus for this experiment when they said, "The method by which work is accomplished must be as important as the work itself." This, along with the statement by Lester and Alice Crow who said, "Motor skills are more important to growing youth than we sometimes permit ourselves to believe . . .," confirmed the thesis that to be physically fit is important but a more meaningful method of arriving at this state is needed particularly for those working with children.

Harold Shane, in the Thirteenth Yearbook of the John Dewey Society, in reference to all elementary education illustrated a tragedy which is true also in physical education. He said,

The discrepancy between what elementary schools are actually doing and what they are capable of doing is perhaps the great challenge of the present day to school people concerned with early and middle childhood.

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The Hypothesis

It was this belief that a better method could be found to enhance the physical fitness status of young girls which produced the following hypothesis: (1) The physical fitness level of young girls, as measured by the Fitness Screening Test,9 will be augmented by the practice of the Latchaw Battery of Motor Skills10 at a rate comparable to that which is induced through the calisthenic program described in the manual by the President's Council11 and (2) at the same time, the practice of the Latchaw Battery of Motor Skills will increase the skills of the participants, as measured by that battery, at a significant rate compared to the increase in basic skills produced by the calisthenic program.

Other suppositions behind the purpose of the study was to determine, if any, the influence which somatotype and level of maturity had on performance on the two batteries of tests.


11President's Council on Youth Fitness, op. cit., pp. 56-77.
Definition of Terms

Physical Fitness

The term physical fitness can and has acquired many meanings to many people. Peter Karpovich conveyed the specific definition which was used to define the term for the purpose of this study when he said that "physical fitness measures merely the ability to pass physical fitness tests . . . ."\(^\text{12}\) Therefore, for this exposition, physical fitness means the level at which the subject is able to perform the three items of the screening test as outlined in the manual by the President's Council on Youth Fitness.\(^\text{13}\)

Fundamental Motor Skills

The intent of this study was to show how skills inherent in the play life of the child could be used as a means of developing physical fitness. The skills basic to many physical education activities in the fourth, fifth, and sixth grades include running, jumping, throwing and catching, striking, and kicking.\(^\text{14}\) Consequently these were the skills which were accepted as being fundamental motor skills of the age group studied.


\(^\text{13}\)President's Council on Youth Fitness, *op. cit.*, p. 19.

Calisthenic Program

The term, calisthenic, is used for the purpose of this study to define the day's order or exercise routine as outlined in the manual by the President's Council on Youth Fitness. It consists of the following exercises to be done in the succeeding order: Jumping Jack, Tortoise and Hare, Windmill, Squat Thrust, Twist and Bend, Back Stretcher, Body Bender, Wing Stretcher, and Pushups plus running and selected additional developmental exercises also illustrated and described in the manual.\textsuperscript{15}

Delimitations

The Locale

The setting for the experiment was the public elementary schools of Grandview Heights, Ohio, a largely residential suburb adjacent to the western side of Columbus. The city is approximately two and one-half square miles in area with no opportunity for expansion. The residents in a casual, empirical survey largely appeared to be from the middle and upper middle classes.

Both the Thomas A. Edison and the Robert Louis Stevenson Elementary Schools were used. These two schools

\textsuperscript{15}President's Council on Youth Fitness, \textit{op. cit.}, pp. 56-77.
represented the complete elementary school system of Grandview Heights and contained all the grades through the sixth.

The Subjects

The study was restricted to fourth and fifth grade girls. It should be noted that all the children in the study appeared to be Caucasian.

The Regular Physical Education Program

The required physical education program can be an influencing factor in many studies of this design. It was essential then to point out that neither of the schools employed a physical education specialist and the individual classroom teachers were at liberty to plan the physical education curriculum for their classes. During this experiment the activities herein provided supplanted whatever program of physical education the classroom teachers normally initiated.

The Tests

The tests selected to measure physical fitness\(^{16}\) and those chosen to measure the ability to perform fundamental motor skills\(^{17}\) must be recognized as limitations.

\(^{16}\)President's Council of Youth Fitness, op. cit., pp. 19-26.

\(^{17}\)Latchaw, op. cit., pp. 440-443.
The Experiment

The very nature of the experiment itself posed numerous limitations. The length of the activity portion of the study was established to include thirty periods, each fifteen minutes in length, which were held daily during the school week. Both boys and girls attended the activity programs simultaneously; however, only the girls were regarded for this project. The presence of both sexes may have influenced the performance of the one sex under investigation.

The number of children present at each activity period devoted to the practice of fundamental motor skills ranged from forty-five to fifty-four of which twenty to twenty-five were girls. In the sessions of formal calisthenic exercises the classes varied in size from thirty-six to forty-nine with nineteen to twenty-four of these being girls. These large numbers must be viewed as a possible delimiting factor even though two teachers were present at all times. Also, the activities were all restricted to the gymnasium of the school where the children were enrolled. Thus space should be regarded as a limiting factor.
CHAPTER II

DISCUSSION OF RELATED LITERATURE

AND SELECTED INSTRUMENTS

Review of Related Research

Physical Fitness

This is one topic which has not been disregarded by writers and research enthusiasts. The profusion of studies and the numerous articles written by many people, including the President of the United States,\(^\text{18}\) attest to its popularity. Perhaps the recent seed of interest was germinated by the report by Kraus-Hirschland\(^\text{19}\) of the Kraus-Weber test. The American Association for Health, Physical Education and Recreation through its fitness project\(^\text{20}\) gave national impetus to this area of concern.

Members of the aroused profession have conducted a multitude of studies ascertaining and comparing the fitness


level of children of this and other countries. Among the myriad contributors to this phase of fitness research are Kelliher,21 Kirchner and Glines,22 Phillips et al.,23 and Faine and Mathews.24 The two general conclusions which may be drawn from studies of this design are that girls were universally more flexible than boys of the same age and American children displayed a higher incidence of failure on the physical fitness tests than did their alien counterparts.

The comparison of the fitness level of one group with another is merely one phase of the research which has been directed toward physical fitness. Many investigators have focused their physical fitness oriented research toward endeavoring to determine the value of different programs as a means of contributing to the physical fitness level of the participants.


Wireman\textsuperscript{25} compared the effects of these four approaches with respect to increasing physical fitness in college males: (1) a program of calisthenics, games and sports with students receiving periodic information and knowledge of the results; (2) the second group received instruction in calisthenics, games and sports but no information of the results were given to the participants; (3) a third group were taught games and sports and received knowledge of the results; and (4) the last group was taught games and sports with no results given to the subjects. His two major conclusions were that knowledge of results did facilitate an increase in physical fitness and course content was not a factor in physical fitness improvement. In other words, knowledge of results more than activity used (as variables tested) appeared to be superior for the singular task of increasing the physical fitness status of male college freshmen.\textsuperscript{26}

Oureton revealed a greater gain in motor fitness by those students undertaking physical fitness clinical work


\textsuperscript{26}Ibid., p. 664.
in comparison with those in the regular physical education program.27

Kusinitz and Keeney,28 working with junior high boys, demonstrated the relative value of resistive exercises over a regular physical education program for increasing physical fitness. The experimental group doing resistive exercises exceeded the control group on all the post-tests; however, both groups did increase their ability to perform most of the tests.

Other studies similarly devoted to determining the value of different programs with respect to increasing performance on physical fitness tests were done by Wilbur,29 Landiss,30 and Sills.31


Anna Espenschade chose to use both the California Physical Performance Test and the Kraus-Weber Test in her work ascertaining the level of fitness of fourth grade children. The data indicated a positive relationship between the Kraus-Weber scores and the quality of performance by boys in running, jumping, throwing, and situps; however, there was little relationship shown in the data for girls. This, along with other works by Espenschade, more nearly parallels this study. A thought introduced by her penetrated the thinking of the writer and influenced the formulation of the topic for investigation. This idea was that the deciding factor in performance is coordination including the effective use of strength.

Clarke saw the need for physical abilities and made this note in summary of a rather complete study involving boys ages nine through fourteen:

Thus, it would appear that boys with superior physical traits enjoy greater peer status and are more favorably judged as having desirable

32Anna Espenschade, op. cit., pp. 274-278.
33Ibid., p. 277.
over-all personality traits by administrators and teachers than are boys with inferior physical traits.  

**Motor Performance**

Glassow and Kruse made this report as a result of their research with girls ages six to fourteen involving jumping, running, and throwing skills.

The indication that girls tend to maintain the same relative position within the group suggests at least two possible explanations. It may be that early development of motor coordination is essential for later success or that an inherent native motor ability may determine the limit of achievement during the growing years.

The first hypothesis might be considered as reiterating the thought just cited by Espenschade. Could it be that motor coordination should be the focal point of physical education programs?

**Constitutional Body Build**

Thomas Cureton substantiated the essential presence of somatotyping in studies of physical fitness when he said,

It may be postulated that the somatotyping (body typing) of young men is a fundamental

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procedure for body mechanics and physical fitness teachers. This approach is necessary because almost every type of physical fitness test ultimately must be normed or interpreted in terms of constitutional type.\textsuperscript{38}

Among the critics of Sheldon's method of somatotyping\textsuperscript{39} is Lasker who, because of his studies, felt perhaps somatotyping served better as a measurement of nutritional status than as a measure of inherent tendencies to specific constitutional types.\textsuperscript{40}

Even though there was a welter of divergent thought surrounding somatotyping there seemed to be agreement among most investigators that perhaps this was the best method to ascertain constitutional body build since it obviously appeared to be the method most widely used by researchers.

Willgoose and Rogers conducted a study on the relationship of somatotype to physical fitness in college men. These were some of the conclusions they were able to cull


\textsuperscript{39}Sheldon, et al., \textit{op. cit.}, pp. 80-100.

from their data:41 (1) Individuals who are high in the endomorphic component score low in physical fitness; (2) when the mesomorphic component increased the individual's strength increased; (3) apparently endomorphy is a limiting factor in fitness; (4) physical fitness as measured by the PFI was clearly indicated to be high in the extreme mesomorphs; (5) because of the low, insignificant correlation obtained between PFI and ectomorphy it was concluded that this third component did not influence fitness to any great extent; and (6) the fitness of the ectomorphic student seemed to depend on the amount of the mesomorphic component he displayed.

Child revealed through his study of over five hundred male students at Yale that the relationships between somatotype and various aspects of personality were of such magnitude that they warranted considering somatotype as an important determinant of personality.42


Somatotyping was used by Sills and Mitchem\(^{43}\) for the prediction of performance on physical fitness tests and by Perbix\(^{44}\) to study its relationship with motor fitness. Perbix concluded that there was a significant relationship between mesomorphy and knee pushups and her study further revealed a negatively significant relationship between endomorphy and knee pushups when the mesomorphic component was low.\(^{45}\) Sills and Mitchem in their study found a substantial relationship between body build and situps, pullups and three hundred yard shuttle run.\(^{46}\)

Janoff and her colleagues delved into the relationship between somatotype and simple, objective measures of behavior. They concluded, with respect to resistance to pain stimulation, their data yielded suggestive evidence of a negative relationship with ectomorphy and a positive relationship with endomorphy.\(^{47}\)


\(^{45}\) Ibid., p. 90.

\(^{46}\) Sills and Mitchem, *op. cit.*, p. 70.

In a longitudinal study Millan tested the motor skills of 208 primary grade boys and girls through the use of the standing broad jump, the softball throw for distance, box-vaulting, the twenty-yard crab race, throwing form, rope-jumping, simple ball skills, rhythms, and balance beam walking. Through these tests Millan was able to observe that (1) body build exerted an influence on all large-muscle skills, (2) somatotype was a factor in determining the age at which the large-muscle skills were learned, (3) physique was not the sole factor in the acquisition and performance of all motor skills, and (4) body build was a dominant factor in sex differences in motor skills.\textsuperscript{48}

A common thread of agreement was interwoven throughout the studies concerning somatotype and its relationship to physical fitness and motor performance. The literature revealed considerable consistency in showing mesomorphy correlating with the higher levels of physical fitness and motor performance and conversely indicated a low correlation coefficient when they were correlated with endomorphy.

**Determining Maturation Level**

Several methods of determining the level of maturation of subjects have been used by investigators. Creighton

Hale,\textsuperscript{49} employing Crampton public hair ratings, found that the boys who participated in the 1955 Little League World Series were adolescent and not, as their chronological ages would indicate, preadolescent. Seventeen per cent were pubescent, forty-five and one-half were postpubescent, and only thirty-seven and one-half per cent were prepubescent. His data further revealed that height and weight of postpubescent boys were equal to the height and weight of the average fourteen year old boy. It was also of interest to learn that seven out of eight of the starting pitchers were postpubescent and all boys batting in the fourth position, clean-up hitters, were postpubescent.

Wilton Krogman,\textsuperscript{50} who also studied Little League World Series participants, selected radiographs of the left hand and wrist and assessed them using the Todd Atlas\textsuperscript{51} to determine maturation level found, in general, the successful Little League ball player is biologically old for his age. Nearly fifty per cent of the sample from the 1957 Little League World Series were advanced in skeletal ossification.


even when the readings were corrected to exclude those in the accepted range of plus and minus one year.

Nancy Bayley,\textsuperscript{52} again using the Todd method of determining maturity, was able to see some correlations with respect to both boys and girls. The findings indicated especially before fifteen years the taller boys were more mature than the average. However, after fifteen years the correlations dropped rapidly though they remained positive. These correlations were not true for the girls, which perhaps was due to the fact the ages of the girls studied constituted ages nearer to maturity. Interesting observations made of the girls were: (1) there was no relationship between size and relative maturity from age thirteen and one-half to fourteen and one-half; however, at the later ages the late-maturing girls were relatively tall and the early maturing girls were relatively short, and (2) there appeared to be a tendency for late-maturing girls to have relatively broad shoulders.

It was disclosed in another article by Bayley that mature size can be predicted with fair accuracy if the present size and skeletal age of the child are known.\textsuperscript{53}

\textsuperscript{52}Nancy Bayley, "Size and Body Build of Adolescents in Relation to Rate of Skeletal Maturing," \textit{Child Development}, XIV (March, 1943), p. 45.

Pryor, substantiating the use of X-rays of the hand to determine the maturation level of the subject through observing bone ossification, said,

The hand is a good index of the extent of ossification in the entire skeleton, an early union of the epiphyses of the hand indicates a corresponding early union of all of the epiphyses.\textsuperscript{54}

In a study involving primary grade school children, Seils\textsuperscript{55} revealed positive correlations of .42 for boys and .38 for girls between throwing performance and skeletal maturity whereas age, height and weight showed an insignificant relationship with throwing performance. Catching ability showed slightly higher correlations with the boys' coefficient being .45 and the girls' .49.

The literature quite consistently revealed that skeletal age was a more accurate indicator of bodily maturity than chronological age, height or weight. The rationale of the writers showed the early entry into puberty by females corresponding closely with an accelerated development in skeletal maturity over the male during this


same period. Another apparent area of agreement was perceived readily in the close relationship between motor ability and skeletal age.

Description of the Instruments

Tests to Measure Fundamental Skills

The Latchaw Battery of Motor Skills\(^{56}\) was selected for measuring the skills basic to the play life of the child because (1) it contained only tests of motor skills; (2) it was normed for the fourth, fifth, and sixth grades; and (3) because all items could be administered and practiced in a gymnasium.

Dr. Latchaw had this to say about the Battery:

Satisfactory reliabilities were obtained for each test by sex and by grade, and the tests were then given to the remainder of the selected population. Face validity was used for every test; that is, the test purported to measure only the particular performance that constituted the test. No effort was made to set up a criterion for a particular technique or sport. It was possible that the results of the tests might be related to performance in specific sports, but the purpose of this study was to measure performance as described in each test.\(^{57}\)

The product-moment correlations for reliability of each test for girls as shown in Table I ranged from .77 to .97.

\(^{56}\)Latchaw, op. cit., pp. 440-443.

TABLE I

PRODUCT-MOMENT CORRELATIONS FOR RELIABILITY
OF EACH TEST FOR GIRLS

<table>
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<th>Test</th>
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<th>Grade V</th>
<th>Grade VI</th>
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<tr>
<td></td>
<td>N</td>
<td>r</td>
<td>N</td>
</tr>
<tr>
<td>Basketball Wall Pass</td>
<td>50</td>
<td>.94</td>
<td>47</td>
</tr>
<tr>
<td>Volleyball Wall Volley</td>
<td>48</td>
<td>.88</td>
<td>55</td>
</tr>
<tr>
<td>Vertical Jump</td>
<td>56</td>
<td>.92</td>
<td>55</td>
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<td>Standing Broad Jump</td>
<td>53</td>
<td>.93</td>
<td>54</td>
</tr>
<tr>
<td>Shuttle Run</td>
<td>56</td>
<td>.84</td>
<td>55</td>
</tr>
<tr>
<td>Soccer Wall Volley</td>
<td>58</td>
<td>.77</td>
<td>46</td>
</tr>
<tr>
<td>Softball Repeated Throws</td>
<td>61</td>
<td>.80</td>
<td>47</td>
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The Battery consisted of seven tests which were adapted from established tests reported by Scott and French. It included two tests of jumping ability, the Standing Broad Jump for distance and the Vertical Jump for height; two throwing tests, the Basketball Wall Pass and the Softball RepeatedThrows; one test to measure kicking ability, the Soccer Wall Volley; one test to measure striking ability, Volleyball Wall Volley; and, the Shuttle Run,


to measure agility and speed in running. The descriptions of these tests follow:

LATCHAW BATTERY OF MOTOR SKILLS

Basketball Wall Pass

This test measures the ability of the subject to throw a basketball successively into a given target area from a specified distance.

Equipment.
1. Regulation basketball, stop watch.
2. Markings: On a flat wall space, mark a target area 8 ft. wide and 4 ft. high, at a distance of 3 ft. from the floor. A restraining line 8 ft. long is drawn on the floor 4 ft. from the wall and parallel to the wall target.

See Figure 1 in the Appendix.

Test. The subject stands at any place he chooses in back of the restraining line. On the signal "Go" he throws the ball against the wall into the target area in any manner that he chooses, if the ball gets out of control at any time, he must recover it himself without assistance. A successful throw is one that goes into the target area and is made from behind the restraining line. Line balls are not fair hits. The ball may be caught on a bounce if the subject so chooses. However, the ball need not be caught to constitute a successful throw.

Scoring. One point is given for each successful throw. The subject is given a ten second practice trial. The test administrator scores verbally during this trial, encourages the subject to retrieve balls rapidly, and to throw the ball as fast as he can successfully manipulate it. This score is not recorded.

Two 15-sec. trials are given, after the practice trial. The total number of points is recorded for

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each trial. The better of the two trials is the final score for the test.

Volleyball Wall Volley

This test measures the ability of the subject to strike a volleyball with the hands a repeated number of times against the wall within a given target area and from a specified distance on the floor.

Equipment.
1. Regulation volleyball, stop watch.
2. Markings: On a flat wall space, mark a target area 8 ft. wide and at least 3 ft. high, at a distance of 3 ft. from the floor. A restraining line 3 ft. long is drawn on the floor 4 ft. from the wall and parallel to the wall target.

See Figure 2 in the Appendix.

Test. The subject stands at any position he chooses in back of the restraining line. On the signal "Go" he tosses or throws the ball against the wall. The ball may be tossed against the wall when it is necessary to start it again. If the ball gets out of control, the subject retrieves it himself, brings it back to the restraining line, and starts it again. A successful hit is one that, upon rebounding from the wall, is clearly batted into the target area from behind the restraining line on the floor. If the ball is thrown or pushed against the wall, it does not constitute a successful hit. Line balls are not fair hits.

Scoring. One point is given for each successful hit. The subject is given a ten second practice trial. The test administrator scores verbally during this trial, calling the attention of the subject to balls that are not legal hits if he pushes the ball at any time. This score is not recorded.

Four 15-sec. trials are given, after the practice trial. The total number of points is recorded
for each trial. The best of the four trials is the final score for the test.

Vertical Jump

This test measures the ability of the subject to jump vertically and reach as high as possible from a stationary position on the floor.

Equipment. One inch cloth strips suspended from a horizontal bar, and spaced at 1-in. intervals from each other. The longest strip is 5 ft. from the floor and the shortest strip is 8 ft. 11 in. from the floor. Each strip is weighted with a penny at the end nearest the floor to insure even hanging.

See Figure 3 in the Appendix.

Test. The subject stands with both heels on the floor under the suspended strips, and reaching with one hand, touches the highest strip that he can. This is recorded under "reaching height." The subject jumps from a stationary position under the bar, and reaches the highest strip that he can. He may start from a crouch if he wishes, but he may not take any steps or preliminary bounce. Any number of trials is allowed, but it is advisable to estimate the approximate place along the scale where the subject's best jump will be, in order to avoid fatigue from too many trials.

Scoring. The score is the difference in inches between the height of the reach and the height of the best jump.

Standing Broad Jump

This test measures the ability of the subject to jump horizontally from a standing position.

Equipment.
1. Tumbling mat, at least 9 ft. long.
2. Measuring tape, unless mat is calibrated permanently.

See Figure 4 in the Appendix.
Test. The subject stands with both toes touching the restraining line that marks the take-off area, and from this standing position jumps as far forward as he can. Any preliminary movement that is made must be executed with some part of both feet in contact with the take-off area. The subject is given three consecutive trials and measurement is taken to the last inch. For example, if the subject jumps 5 ft. 2 in., the jump is recorded as five feet-two inches. This distance is measured from the restraining line of the take-off area to the nearest contact made on landing. (This is usually to the first heel mark made on landing, but if the subject loses balance, falls backward and catches himself with his hand or body, the mark nearest the restraining line is used in measuring the distance of the jump.)

Scoring. The best of three trials, in feet and inches, is the score for the test.

Shuttle Run

This test measures the ability of the subject to run rapidly between two given marks, necessitating quick stops and changes of direction.

Equipment.
1. Stop watch, calibrated in 1/10 sec.
2. Markings: Two 12-in. lines are marked on the floor, parallel to each other and at a distance of 20 ft. apart. The line that is indicated to be the starting line should have an area in back of it free from obstruction that is at least 20 ft. long, to give the runner an opportunity to check his speed after passing this line upon completing his run.

See Figure 5 in the Appendix.

Test. The subject stands with the toe of his forward foot on the starting line. On the signal "Go" he runs to the opposite line, touches it (or beyond it) with one or both feet. This constitutes one complete trip. The subject does not stop, but continues running to the opposite line until he has completed three trips, or a total of
120 ft. If the subject fails to touch, or step over, a line at any time during the run, he is stopped at once and no score is recorded for the trial. After a brief resting period he is given one opportunity to repeat this performance, and if he fails again to execute the test correctly, the test score is rejected.

The time in 1/10 sec. is taken from the signal "Go" to the crossing of the starting line upon completing the three trips (120 ft).

Two trials are given in this test. Subjects are tested in pairs, with one of the pair resting while the other is performing, thus alternating with each other on the trials.

Scoring. The score for this test is the better of the two trials, recorded in seconds to the nearest tenth.

Soccer Wall Volley

This test measures the ability of the subject to kick a soccer ball a repeated number of times against the wall within a given target area and from a specified distance on the floor.

Equipment.
1. Regulation soccer ball, stop watch.
2. Markings: On a flat wall space, mark a target area 4 ft. wide and 2\(\frac{1}{2}\) feet high which extends to the floor. A similar area is marked on the floor, 4 ft. wide and 2\(\frac{1}{2}\) long which extends from and is parallel to the wall target. The 4 ft. line on the floor, farthest from the wall target, is extended 1 ft. on either side, and constitutes the restraining line.

See Figure 6 in the Appendix.

Test. The ball is placed back of the restraining lines at any position desired by the subject (usually toward the center of the line). On the signal "Go" the subject kicks the ball against the wall into the target area, and as it rebounds he continues to kick it repeatedly against the wall. If the ball gets out of control, the subject retrieves it himself, brings it back to the
restraining line, and starts it again. The subject may not touch the ball with his hands while it is in the rectangular floor area between the restraining line and the target. If the ball stops within this area, he must remove it by using his foot. At any time that the ball is outside of this rectangular floor area, the subject may use his hands in retrieving or moving the ball.

A successful hit is one that is kicked with the foot into the target area on the wall from behind the restraining line on the floor. Line balls are not fair hits. To constitute a fair hit, the ball must be kicked from in back of the restraining line (not on it), and must land between the lines that bound the wall target.

Scoring. One point is given for each successful hit. Each time that the ball is touched with the hands when it is inside the rectangular floor area, one point is subtracted from the score. The subject is given a 15-sec. practice trial. The test administrator scores verbally during this trial, calling attention to balls that are not legal hits. This score is not recorded.

Four 15-sec. trials are given, after the practice trial. The total number of points is recorded for each trial. The best of the four trials is the final score for the test.

Softball Repeated Throws

This test measures the ability of the subject to throw a softball, using an overhand throw, into a given target area from a specified distance.

Equipment.

1. Regulation 12-in. inseam softball, stop watch.
2. Markings: On a flat wall space, mark a target area 5½ ft. wide and at least 10 ft. high, at a distance of 6 in. from the floor. A throwing area, 5½ ft. square, is marked on the floor at a distance of 9 ft. from the target and parallel to it. A back-stop, 12 ft. long and 2½ ft.
high (at least) is placed 15 ft. in back of the throwing area.

See Figure 7 in the Appendix.

Test. The subject stands at any place he chooses inside of the throwing area. On the signal "Go" he throws the ball against the wall into the target area, using an overhand throw, and continues successive throws until the signal "Stop" is given. The balls may be received from the target either on the bounce or on the fly. If the ball gets out of control at any time, the subject must recover it himself without assistance. Most of these balls will be stopped by the back-stop, but if this is not the case, the subject must chase the balls himself. A successful throw is one that is an overhand throw that goes into the target area and is made from inside the throwing area. Line balls are not fair hits.

Scoring. One point is given for each successful throw. The subject is given a ten-second practice trial. The test administrator scores verbally during this trial. This score is not recorded.

Two 15-sec. trials are given, after the practice trial. The total number of points is recorded for each trial. The better of the two trials is the final score for the test.

Tests to Measure Physical Fitness

It has been mentioned previously that the current fitness program as outlined in the manual by the President's Council on Youth Fitness\(^1\) was the incentive for embarking on the study; therefore, the Screening Test\(^2\) as described

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\(^{61}\)President's Council on Youth Fitness, op. cit., p. 19.

\(^{62}\)Ibid., pp. 19-24.
in the manual by the Council was selected as the instrument to ascertain the physical fitness level of the children.

This Battery purports to measure arm and shoulder strength, flexibility and abdominal strength, and agility through the employment of Pullups (modified for girls), Situps, and Squat Thrusts.\textsuperscript{63}

A description of these tests follow:\textsuperscript{64}

**YOUTH PHYSICAL FITNESS BATTERY**

**Modified Pullups (Girls)**

**Equipment.**
1. Any bar adjustable in height and comfortable to grip. A piece of pipe, placed between two stepladders and held securely, may be used.

**Starting Position.** Adjust height of bar to chest level. Grasp bar with palms facing out. Extend the legs under the bar, keeping the body and knees straight. The heels are on the floor. Fully extend the arms so they form an angle of 90 degrees with the body line. The partner braces the pupil's heels to prevent slipping.

**Action.**
1. Pull body up with the arms until the chest touches the bar.
2. Lower body until elbows are fully extended.
3. Repeat the exercise attempting to achieve the "Excellent" score for her age, but not exceeding that number.

(For this study, 50 was considered the maximum number.)

\textsuperscript{63}Ibid., p. 19.

\textsuperscript{64}Ibid., p. 19-24.
Rules.
1. The body must be kept straight.
2. The chest must touch the bar and the arms must then be fully extended.
3. No resting is permitted.
4. One pullup is counted each time the chest touches the bar.

Situps

Starting Position. Pupil lies on his back with legs extended, feet about 1 foot apart. The hands, with fingers interlaced, are grasped behind the neck. The other pupil holds his partner's ankles and keeps his heels in contact with the floor while counting each successful situp.

Action.
1. Sit up and turn the trunk to the left. Touch the right elbow to the left knee.
2. Return to starting position.
3. Sit up and turn the trunk to the right, touching the left elbow to the right knee.
4. Return to the starting position.
5. Pupil should do as many situps as he can, but not exceed the number shown below in the "Excellent" category for his age and sex. (For this study the pupil was instructed to do as many as he could in 30 seconds.)
6. One complete situp is counted each time the pupil returns to starting position.

Squat Thrust

Equipment. A stopwatch, or a watch with a sweep-second hand (Stopwatch was used in this study.)

Starting Position. Pupil stands at attention.

Action.
1. Bend knees and place hands on the floor in front of the feet. Arms may be between, outside or in front of the bent knees.
2. Thrust the legs back far enough so that the body is perfectly straight from shoulders to feet (the pushup position).
3. Return to squat position.
4. Return to erect position.

**Scoring.** The teacher carefully instructs the pupils how to do correct squat thrusts. The teacher tells the pupil to do as many correct squat thrusts as possible within a 10-second time limit. (For this study, a 30-second time limit was used.) The teacher gives the starting signal, "Ready!—Go!" On "Go" the pupil begins. The partner counts each squat thrust. At the end of 10 second, the teacher says, "Stop."

**Methods of Determining Level of Maturation**

Two well-known methods of determining maturation level by assessing hand-wrist radiographs are those established by Todd\(^6\) and revised by Greulich-Pyle.\(^6\) Through a review of both sets of standards it was decided to use those prescribed originally by Todd since his method of classification showed changes in skeletal age every six months while the later index employed yearly increments. Both works illustrated changes in three month intervals during infancy.

The radiographs to be assessed were compared with those reprinted in the *Atlas of Skeletal Maturation*.\(^6\) The skeletal age of the subject was resolved when the determinants of maturity on the individual's radiograph were

\(^6\)Todd, op. cit.


\(^67\)Todd, op. cit.
identifiable and were matched consistently with the standards revealed on a plate in the atlas. The skeletal age was assigned to the radiograph to correspond with the age designated on the plate with which it was matched.

**Determinant of Constitutional Body Build**

Sheldon's method of appraising the constitutional body build was chosen because of its current popularity. His somatotyping procedure estimates the degree to which the three morphic categories, endomorphy, mesomorphy, and ectomorphy, are manifested in the subject. Each component is rated on a scale of one through seven with the higher numbers indicating the greater manifestation of the characteristic within the individual. Therefore, somatotypes are recorded in a three digit number, such as 632, with each of the separate integers representing one of the categories. The first number is reserved for endomorphy, the second for mesomorphy, and the third records ectomorphy. A subscript to any one figure should be read as one-half. A somatotype of 5232 would indicate endomorphy to be more than five and less than six, and thus would be read five and one-half.

These numbers are derived through the process originated by Sheldon and perfected by him and his associates.

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68William H. Sheldon et al., op. cit., pp. 80-100.
The anthropometric measurements taken from the pictures along with the height, weight, and chronological age of the subject are used to determine the somatotype. The *Atlas of Men*[^69] is one of the more recent publications which describes the technique as it has been perfected and illustrates pictorially the diverse classifications of somatotype.

CHAPTER III
THE PROCEDURE

The Site

The Edison and Stevenson Elementary Schools of Grandview Heights, Ohio, provided the setting for the experiment. These schools comprise the complete elementary school system for this predominantly residential community. The Superintendent of Schools was approached concerning the feasibility of using Grandview Heights as the site for the study. A meeting was arranged with him, the principals of the two schools, and the other doctoral candidate who served as an assistant to the investigator and who used the data collected on the male students for a parallel study. It was decided in this meeting to include all fourth and fifth grade children when the enrollment figures revealed an insufficient number in any one grade.

After the program was discussed with the three administrators and their unofficial endorsement became apparent, the Superintendent presented the prospectus to the members of the School Board of Grandview Heights for their approval.

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70 Robert E. White (Ph.D. dissertation in process, The Ohio State University, Columbus, Ohio).
This granted, it was arbitrarily decided to have the Calisthenics Program in the Stevenson School and the Basic Skill Program in the Edison School. A meeting of the fourth and fifth grade teachers and the principal was held in each of the elementary schools to explain the program, its purpose, and to answer questions regarding the plan. Following these meetings every fourth and fifth grade classroom was visited and the program was explained to the children. Their cooperation and enthusiasm were solicited.

**The Subjects**

All fourth and fifth grade boys and girls participated in the program; however, only thirty-seven girls from each school served as subjects in the experiment. The chronological ages of these girls ranged from nine through twelve years. These girls all appeared to be Caucasian.

**The Pre-test**

The Latchaw Battery of Motor Skills\(^1\) and the Fitness Screening Test\(^2\) were then administered to all fourth and fifth grade children in the two schools. These two batteries contained a total of ten tests, seven of which

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were skill tests and three of which were fitness tests. The investigator administered the Soccer Wall Volley, the Repeated Softball Throws, the Vertical Jump, and the Standing Broad Jump to all children in both schools while the assistant tested the children on the Repeated Basketball Throws, the Volleyball Wall Volley, the Shuttle Run, and the Modified Pullups (regular position for the boys). The Squat Thrust and the Situps were administered and supervised by the researcher and the assistant with the children working with partners.

The Groups Equated

Through the work of unbiased assistants in the Statistical Laboratory at The Ohio State University, forty-two matched pairs were obtained from the two schools. These pairs represented one girl from each of the two programs. The composite scores on the Latchaw Battery were used as a means of equating the groups. The composite scores were computed for each girl by adding the decile scores calculated from the raw scores on the seven tests of basic skill. In addition to approximating the composite scores of the two girls, profiles of the seven skill test scores were plotted on separate graphs and the statisticians referred to these to assist them in matching the pairs more precisely.
Three girls of the original forty-two matched pairs moved from the school district during the experiment so they and their matched partners were dropped. Another subject became ill which necessitated removal of her and her counterpart in the other program. Only one girl failed to take part in the program because of apparent disinterest. Since this was a program offered by non-school personnel, she was not coerced to take part and she vacillated in and out of the program which made it imperative that both she and her matched pair in the other school be removed from the study. These removals left a total of thirty-seven of the original forty-two matched pairs who completed the experiment.

The identity of the selected pairs never was revealed to the subjects and no participating child ever knew that her scores were excluded from the experiment.

The Experiment

The experiment was designed to include thirty, fifteen minute lessons of vigorous activity to be held daily during the school week. These lessons excluded the testing periods which came before and after the program. The Skill School, so called because the vigorous activity was provided through the practice of the seven tests of basic skill mentioned in the testing material, had two fourth grades and two fifth grades. The Calisthenic School,
deriving its name from the program devoted to calisthenic exercises, had the same number of grades as above plus an additional room composed of students from both the fourth and fifth grades.

Since the school day was rearranged by the administrators and teachers to permit this experiment, and because both the investigator and the assistant were responsible for and present at each lesson, it was decided to schedule daily two classes in the Skill School and three in the Calisthenic School to accommodate the larger enrollment.

All fourth grade children in the Skill School participated in the first class which was held from 9:40 A.M. to 9:55 A.M. The fifth grade children from that same school attended the second class which started at 10:00 A.M. and ended at 10:15 A.M.

The classes for the Calisthenic program were scheduled as follows: The two fourth grades attended class from 10:35 A.M. to 10:50 A.M., one of the fifth grades plus the fourth graders from the combined classroom were in the gymnasium from 10:55 A.M. to 11:10 A.M., and the final class from 11:15 A.M. to 11:30 A.M. was reserved for the remaining fifth grade class as well as for the fifth graders from the room containing students from both grades.

Each program was conducted in the school where the children were enrolled. The two schools were within a very
few blocks of each other. By scheduling the program stressing skills at the earlier hours the equipment required in the skill program could be arranged before the lessons started. Thus it was possible for the two instructors to make the shift very quickly between the two schools.

This schedule was altered only once during the entire experiment. On one day the program in the Skill School began earlier to allow the gymnasium to be readied for a pre-arranged assembly.

The Skill Program

The children were divided by various means to practice the shuttle run as soon as they arrived in the gymnasium. Sometimes they ran according to classes, other times according to sex, and more frequently in arbitrary groups but they always started the sessions by practicing the shuttle run two or three times.

Then, immediately after the shuttle run, they divided into six groups of not more than nine each to practice the remaining six tests of basic skill. These groups were held constant after the first two days when it was decided to arrange all the girls in three of the groups and all of the boys in the other three. It was noticed that the superior ability of the boys sometimes intimidated the
This was especially true in the Repeated Softball Throws when the balls rebounded rapidly. One group went to each of the following stations to practice: Basketball Wall Pass, Volleyball Wall Volley, Vertical Jump, Repeated Softball Throws, Soccer Wall Volley, and the Standing Broad Jump. After approximately two minutes of practice the groups were rotated in the order given above with the children at the Standing Broad Jump moving to the Basketball Wall Pass practice area. This routine was followed daily in the Skill School. Thus, each child practiced every skill for thirty consecutive school days. The director of the study and the assistant moved from one group to another instructing and encouraging good form.

Enough equipment was provided to enable every student to be active and constantly engaged in practicing the basic skill tests at every station. At the Vertical Jump area, however, the children were instructed and encouraged to practice their jumps while waiting a turn to measure the actual jump at the device made for this purpose.

The Exercise Program

The children entered the gymnasium and arranged themselves in lines so as to allow for freedom of movement. The researcher or assistant took turns leading the exercises by standing on the stage in front of the class.
demonstrating the movements and counting the cadence. The day's order in the Council's manual\textsuperscript{73} was used with the exercises following in the existing sequence: Jumping Jack, Tortoise and Hare (running in place), Windmill, Squat Thrust, Twist and Bend, Back Stretcher, Body Bender, Wing Stretcher, and Pushups. The girls, in practicing the Pushups, started in the modified position but many were able to use the long position as the program progressed. The number of times each exercise was executed increased as the routine was learned. An effort was made to have all children practice the exercises in good form.

In addition to the above day's order, an exercise taken in order from the list of supplemental exercises appearing in this same manual\textsuperscript{74} was used as a surprise feature in each lesson. This list consisted of sixteen exercises. They were: Up Oars, Squat Jump, Jump and Touch, Bobber, Snap and Twist, Body Bender, Back Twist, Bend and Squat, Reclining Pullups, Bear Hug, Side Flex, One-Foot Balance, Riding the Bicycle, Leg Raiser, Bouncing Ball, and Deep Breather. All of these except the Leg Raiser were used. The surprise exercise was used for two consecutive days; then it was dropped and the next exercise on the supplemental list was added.

\textsuperscript{73}\textit{Ibid.}, pp. 56-65.
\textsuperscript{74}\textit{Ibid.}, pp. 66-77.
Following the exercise from the supplemental list the children moved into a circular formation for running. They, on command, interspersed sprinting with knees lifted high with running in place with the knees raised to the same height. This was found to be a good method to arrive at vigorous running with a large group in a small area.

**Motivational Devices**

Since the intent was to provide vigorous activity, the investigator felt it essential to motivate the subjects because both programs were extremely rigid in their structure. Some devices which were used to motivate both groups were: (1) The children were timed for brief periods to see how many times they could execute the skill or exercise. (2) They were challenged to see how many times they could perform the skill or exercise or how far they could jump, reach, bend, or twist. (3) A copy of the individual's original test scores for all ten tests was distributed to each child to show where he was at the beginning of the experiment. (4) Stress was placed on individual improvement and total group achievement. The two groups were aware of the program being practiced in the other school and some reference was made occasionally by the investigator and the assistant, as well as the children, to encourage them to try to surpass the achievement of the
other school. (5) Instruction, demonstration, and words of encouragement were given by the researcher and the assistant in an attempt to bring about correct form and maximum effort on the part of every participant each moment.

In addition, the children in the Calisthenic Program enjoyed the occasional privilege of leading the exercises, a technique which cannot be discounted as a means of motivation.

**Photographing and X-raying Subjects**

It was the plan to photograph and X-ray each child for the purpose of somatotyping and determining maturation level. Because of the nature of these procedures it was necessary to solicit the approval of the parents in order to obtain these data. A letter requesting permission to take the pictures and the X-ray was submitted to the Superintendent for his approval prior to sending it to the parents. The letters were sent; then separate meetings of the boys and girls from each room followed. These meetings held during the third week of the experiment were designed to acquaint the children with the manner in which the data would be collected, to answer questions, to give them the purpose for asking for this information, and to allow the investigator time to establish rapport with the subjects.
Many girls and some parents were reluctant to grant permission; however, fifty out of the 104 who actually took part in the program did permit the X-rays and the pictures to be taken. It so happened that these fifty girls represented exactly twenty-five from each school but they included many who were outside of the group formed by the matched pairs. Upon receiving permission to take the pictures and the X-rays, a note was sent to the parents scheduling the appointment for the latter.

On a Saturday four and one-half weeks after the experiment had started, all of the children from both schools were transported by bus to the Anatomy Department on the campus of The Ohio State University for the purpose of taking the hand-wrist X-rays. These were taken by Professor Grant Graves, M.D., Acting Chairman of the Department of Anatomy, who was assisted by Assistant Professor Edna Wooten, Ph.D., who held an appointment in both the Physical Education and Anatomy Departments. The Department of Radiology on campus hand-developed all of the radiographs to insure clarity.

The radiographs were assessed by Dr. Wooten who used the standards established by Todd.\textsuperscript{75} The reliability of her readings was determined by selecting fifteen of the radiographs through the use of the Chart of Random Numbers

\textsuperscript{75}Todd, \textit{op. cit.}
and reassigning a skeletal age to each. This reassessment correlated at .986 with the original reading using the Pearson-product moment method of correlation. This high reliability coefficient confirmed the statement by Todd, who said, "Assessors of greatly unequal experience readily assess the maturity of skeletal roentgenograms within a six-month divergence."76

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76Ibid., p. 19.
INTERPRETATION OF THE DATA AND CONCLUSIONS

Groups Equated

The girls in both schools were tested on the seven basic skills at the onset of the study and were equated on the basis of their initial performance on the tests of basic skill. The raw scores of the seven items for each girl were converted to decile scores to compute a composite score on the battery. After the composite score of the individual subjects from one school were matched as nearly as possible with composite scores of subjects from the other school, separate profiles of the seven tests were plotted for each participant to endeavor to equate the girls on the scores on each test by comparing the performance on all seven tests. This process yielded forty-two comparable pairs.

To determine the similarity of the two groups the mean and standard deviation for each of the seven items were computed. The proximity of the means and standard deviations shown in Table II attest to the likeness of the groups. The greatest discrepancy between the groups was found in the Soccer Wall Volley which was the test which
Latchaw listed as having the lowest reliability coefficient. This was noted in Table I, Page 24.

**TABLE II**

**MEANS AND STANDARD DEVIATIONS OF MATCHED PAIRS ON TESTS OF BASIC SKILL (N=42)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Calisthenics</th>
<th>Basic Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S. D.</td>
</tr>
<tr>
<td>Standing Broad Jump</td>
<td>49.1</td>
<td>5.2</td>
</tr>
<tr>
<td>Shuttle Run</td>
<td>14.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Vertical Jump</td>
<td>9.3</td>
<td>1.8</td>
</tr>
<tr>
<td>Basketball Wall Pass</td>
<td>12.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Volleyball Wall Volley</td>
<td>5.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Soccer Wall Volley</td>
<td>9.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Softball Repeated Throws</td>
<td>6.7</td>
<td>1.2</td>
</tr>
</tbody>
</table>

The three tests of physical fitness were administered during the initial testing period but no attempt was made to use this evidence to assist with equating the groups. However, it was interesting to note the approximation which the groups revealed on their performance on the physical fitness items. Table III shows that the groups had identical means on the Squat Thrust with .3 difference in the standard deviations and while they varied 1.3 on the means of the Situp the standard deviations of that test showed only a .1 difference. The greatest divergence was found in the means of the Pullup.
TABLE III
MEANS AND STANDARD DEVIATIONS OF MATCHED PAIRS ON TESTS OF PHYSICAL FITNESS (N=42)

<table>
<thead>
<tr>
<th>Test</th>
<th>Calisthenics</th>
<th>Basic Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S. D.</td>
</tr>
<tr>
<td>Squat Thrust</td>
<td>12.9</td>
<td>2.2</td>
</tr>
<tr>
<td>Pullup</td>
<td>24.3</td>
<td>11.0</td>
</tr>
<tr>
<td>Situp</td>
<td>11.5</td>
<td>3.2</td>
</tr>
</tbody>
</table>

With the exception of the Standing Broad Jump where the standard deviations differed 2.1, it can be said that the homogeneity of the two groups was very similar.

No appreciable difference was noted when the five pairs were withdrawn from the original matched groups. The reduction in the number of matched pairs was necessitated by families moving from the community, illness, or in the case of one subject, apparent lack of interest. The minor adjustments which were necessitated by the change in the number of subjects are recorded in Table IV. It was found that the elimination of the five matched pairs affected a slightly higher mean on four of the basic skill tests for both the Calisthenic and Basic Skill groups. Conversely, each group showed a decrease on two of the physical fitness items.
Samples Taken from Normal Population

In examining the data several factors assisted in defining the population from which the samples for this study were drawn as being normal and representative.

**TABLE IV**

**MEANS OF MATCHED PAIRS ON ALL ITEMS OF THE PRE-TEST (N=37)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Calisthenics Mean</th>
<th>Basic Skills Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standing Broad Jump</td>
<td>49.6</td>
<td>49.3</td>
</tr>
<tr>
<td>Shuttle Run</td>
<td>14.2</td>
<td>14.2</td>
</tr>
<tr>
<td>Vertical Jump</td>
<td>9.5</td>
<td>10.1</td>
</tr>
<tr>
<td>Basketball Wall Pass</td>
<td>12.8</td>
<td>13.7</td>
</tr>
<tr>
<td>Volleyball Wall Volley</td>
<td>5.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Soccer Wall Volley</td>
<td>9.3</td>
<td>8.1</td>
</tr>
<tr>
<td>Softball Repeated Throws</td>
<td>6.7</td>
<td>6.6</td>
</tr>
<tr>
<td>Squat Thrust</td>
<td>13.1</td>
<td>12.9</td>
</tr>
<tr>
<td>Pullup</td>
<td>24.8</td>
<td>30.4</td>
</tr>
<tr>
<td>Situp</td>
<td>11.5</td>
<td>10.3</td>
</tr>
</tbody>
</table>

There seemed to be indications which would lend supporting evidence to the normalcy of the population which was examined. Through comparing the norms on the basic skills for fourth and fifth grade girls which were established by Latchaw77 with the means of the 104 girls who comprised the total number tested in both schools and the means of the equated groups, persuading similarity was found.

77Latchaw, *op. cit.*, pp. 65-75.
The propinquity of the means are illustrated in Table V for the equated groups, for the population from which the samples were selected, and for the norms for the fourth and fifth grade girls. The Soccer Wall Volley was the item with the widest discrepancy. Even this, however,

**TABLE V**

**ORIGINAL MEANS ON TESTS OF BASIC SKILLS COMPARED WITH ESTABLISHED NORMS**

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean Norms 78</th>
<th>Mean Calisthenic</th>
<th>Mean Basic Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girls 4 Gr.</td>
<td>Mean N=104</td>
<td>Mean N=37</td>
</tr>
<tr>
<td>Standing Broad Jump</td>
<td>48</td>
<td>49</td>
<td>49.0</td>
</tr>
<tr>
<td>Shuttle Run</td>
<td>14</td>
<td>13+</td>
<td>14.3</td>
</tr>
<tr>
<td>Vertical Jump</td>
<td>10</td>
<td>10+</td>
<td>9.8</td>
</tr>
<tr>
<td>Basketball Wall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pass</td>
<td>12</td>
<td>13</td>
<td>13.3</td>
</tr>
<tr>
<td>Volleyball Wall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volley</td>
<td>4</td>
<td>5+</td>
<td>5.8</td>
</tr>
<tr>
<td>Soccer Wall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volley</td>
<td>7+</td>
<td>7+</td>
<td>8.8</td>
</tr>
<tr>
<td>Softball</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeated Throws</td>
<td>6+</td>
<td>7+</td>
<td>6.7</td>
</tr>
</tbody>
</table>

was not a striking variation. It should be recalled that this was the test with the lowest reliability as shown in Table I, page 24. Therefore, it could be said that the population and the samples selected seemed to respond normally on the tests of basic skills.

78Ibid.
When the radiographs were assessed and the skeletal ages assigned these data appeared to support the thesis that the samples were representative of a normal population. Greulich and Pyle\textsuperscript{79} calculated the standard deviations for each year which are recorded in Table VI along with the corresponding skeletal and chronological ages for each of the subjects X-rayed. When one standard deviation was added to or subtracted from the chronological age of each subject it was found that the skeletal age fell within this range thirty out of fifty times. This yielded a ratio of five to three or sixty per cent which again is about what can be expected in a normal population.

In further analysis of this data, it was revealed that only one subject was in excess of two standard deviations in her skeletal age. This, too, contributed evidence to the normal developmental status of the group since this ratio of forty-nine to one approximates the normal expectation. However, Greulich and Pyle caution that the limits of "normality" should be considered nothing more than a useful rule-of-thumb for evaluating skeletal assessments of individual children.\textsuperscript{80} It is necessary also to be cognizant that the data on the skeletal age may have some bias

\textsuperscript{79}Greulich and Pyle, \textit{op. cit.}, p. 53.

\textsuperscript{80}Ibid., p. 49.
TABLE VI
DIFFERENCE BETWEEN SKELETAL AND CHRONOLOGICAL AGE

<table>
<thead>
<tr>
<th>C. A.</th>
<th>S. A.</th>
<th>S. D.*</th>
<th>Months Outside +1 S.D.</th>
<th>C. A.</th>
<th>S. A.</th>
<th>S. D.*</th>
<th>Months Outside +1 S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9-3</td>
<td>9-3</td>
<td>10.74</td>
<td>0</td>
<td>10-5</td>
<td>9-9</td>
<td>11.73</td>
<td>0</td>
</tr>
<tr>
<td>9-11</td>
<td>9-3</td>
<td>11.73</td>
<td>0</td>
<td>10-9</td>
<td>11-9</td>
<td>11.94</td>
<td>0</td>
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<td>9-6</td>
<td>10-3</td>
<td>11.73</td>
<td>0</td>
<td>10-7</td>
<td>11-9</td>
<td>11.94</td>
<td>+2</td>
</tr>
<tr>
<td>10-5</td>
<td>10-3</td>
<td>11.73</td>
<td>0</td>
<td>10-4</td>
<td>11-9</td>
<td>11.73</td>
<td>+5</td>
</tr>
<tr>
<td>11-9</td>
<td>12-9</td>
<td>10.24</td>
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<td>11-0</td>
<td>10-9</td>
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<td>0</td>
</tr>
<tr>
<td>12-7</td>
<td>11-9</td>
<td>10.67</td>
<td>0</td>
<td>10-9</td>
<td>11-3</td>
<td>11.94</td>
<td>0</td>
</tr>
<tr>
<td>9-11</td>
<td>11-9</td>
<td>11.73</td>
<td>+10</td>
<td>9-6</td>
<td>9-9</td>
<td>11.73</td>
<td>0</td>
</tr>
<tr>
<td>10-1</td>
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<td>11.73</td>
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<td>9-9</td>
<td>9-3</td>
<td>11.73</td>
<td>0</td>
</tr>
<tr>
<td>10-1</td>
<td>9-3</td>
<td>11.73</td>
<td>0</td>
<td>9-5</td>
<td>12-3</td>
<td>11.73</td>
<td>+8</td>
</tr>
<tr>
<td>12-0</td>
<td>11-3</td>
<td>10.24</td>
<td>0</td>
<td>10-10</td>
<td>11-9</td>
<td>11.94</td>
<td>0</td>
</tr>
<tr>
<td>9-7</td>
<td>11-3</td>
<td>11.73</td>
<td>+9</td>
<td>10-3</td>
<td>8-9</td>
<td>11.73</td>
<td>-6</td>
</tr>
<tr>
<td>10-6</td>
<td>11-3</td>
<td>11.94</td>
<td>0</td>
<td>9-10</td>
<td>8-9</td>
<td>11.73</td>
<td>-1</td>
</tr>
<tr>
<td>9-11</td>
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<td>11.73</td>
<td>+4</td>
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<td>11.73</td>
<td>-2</td>
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<td>11-9</td>
<td>11.73</td>
<td>+3</td>
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<td>11-9</td>
<td>11.73</td>
<td>+12</td>
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<td>+18</td>
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<td>-6</td>
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<tr>
<td>10-11</td>
<td>11-3</td>
<td>11.94</td>
<td>0</td>
<td>11-0</td>
<td>12-3</td>
<td>11.94</td>
<td>+3</td>
</tr>
<tr>
<td>11-1</td>
<td>11-9</td>
<td>11.94</td>
<td>0</td>
<td>10-4</td>
<td>8-9</td>
<td>11.73</td>
<td>-7</td>
</tr>
<tr>
<td>9-11</td>
<td>11-9</td>
<td>11.94</td>
<td>0</td>
<td>9-4</td>
<td>8-9</td>
<td>10.74</td>
<td>0</td>
</tr>
<tr>
<td>10-9</td>
<td>11-9</td>
<td>11.94</td>
<td>0</td>
<td>11-6</td>
<td>11-9</td>
<td>10.24</td>
<td>0</td>
</tr>
<tr>
<td>11-0</td>
<td>10-9</td>
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<td>10-2</td>
<td>11-3</td>
<td>11.73</td>
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<tr>
<td>10-7</td>
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<td>0</td>
<td>10-8</td>
<td>11-3</td>
<td>11.94</td>
<td>0</td>
</tr>
<tr>
<td>9-7</td>
<td>9-9</td>
<td>11.73</td>
<td>0</td>
<td>11-1</td>
<td>10-9</td>
<td>11.94</td>
<td>0</td>
</tr>
<tr>
<td>9-11</td>
<td>9-9</td>
<td>11.73</td>
<td>0</td>
<td>9-8</td>
<td>10-9</td>
<td>11.73</td>
<td>+1</td>
</tr>
<tr>
<td>9-11</td>
<td>10-3</td>
<td>11.73</td>
<td>0</td>
<td>10-1</td>
<td>11-3</td>
<td>11.73</td>
<td>+2</td>
</tr>
</tbody>
</table>

*For the purpose of determining the approximate standard deviation, a subject was considered to be 11 years old if her chronological age was between 10 years six months and 11 years five months.

because the X-rays were taken of only the fifty girls who volunteered for this portion of the study. With this in mind it can be said that the population seemed to be
distributed normally both in its developmental pattern and in its ability to perform the selected tests of basic skills.

**Somatotype**

After the eighteen anthropometrical criteria were taken and the somatotype calculated, the subjects were first classified according to the primary morphological component. This was done by categorizing them as an endomorph, mesomorph, or ectomorph according to the characteristic which had the highest rating in the somatotype. For an example, a girl with a somatotype of 523 would be tabulated with endomorph as the primary component since the 5 for endomorph is the largest of the three numbers. When the components were equal or balanced, such as the case in a somatotype of $3^23^2$ or 443, they were not recorded in any one of the three categories since no dominant component was in evidence. Table VII illustrates the dominance of the three components within the group somatotyped.

Endomorphy is illustrated as the dominant component of the total group with 60.6 per cent of those somatotyped demonstrating dominance in this characteristic. Ectomorphy was second with 10 per cent. The high incidence of endomorphy in this group of young girls supports the statement concerning women found in *The Varieties of Human*...
TABLE VII
CLASSIFICATION OF SUBJECTS BY PRIMARY MORPHOLOGICAL COMPONENT

<table>
<thead>
<tr>
<th>Primary Component</th>
<th>Number of Cases</th>
<th>Mean Basic Skill Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endomorph</td>
<td>33</td>
<td>37.6</td>
</tr>
<tr>
<td>Mesomorph</td>
<td>1</td>
<td>57.0</td>
</tr>
<tr>
<td>Ectomorph</td>
<td>5</td>
<td>46.6</td>
</tr>
</tbody>
</table>

Physique. There it was stated that endomorphy was much commoner in women than in men with mesomorphy having the reverse relationship. This statement supported by the above data caused the writer to hypothesize in the following manner. Perhaps a compulsory, stringent activity program based on the premise of muscular development accompanied by a controlled diet might effect a significant change in constitutional body build especially in the young girl.

Sheldon in supporting the stability of the somatotype said,

In order for the somatotype to change, the skeleton must change, as well as the shape of the head, the bony structure of the face, the neck, wrists, ankles, calves, and forearms, and the relations of stature to measurement made at places where fat does not accumulate. The deposit or removal of fat does not change the

Sheldon, et al., The Varieties of Human Physique, pp. 66-67.
somatotype for it does not change significantly any of the measurements except those where the fat is deposited. 82

The alteration of the somatotype through weight reduction was supported by Lasker 83 who worked with volunteer conscientious objectors subjected to a European type famine diet for twenty-four weeks. This resulted in a twenty-four per cent reduction in weight and measurements taken at the time demonstrated a tendency to decrease in every respect measured, even stature.

This evidence, plus the fact that Sheldon seems to rely heavily on fat and the places where it is normally deposited for substantiating an unchangeable somatotype, causes the researcher to query what effect would the hypertrophy of muscle along with a diet prepared for the purpose of maintaining proper proportional weight have on the somatotype of young girls who have the characteristics of an endomorph with the predominance of soft roundness throughout the body?

Sheldon did suggest the answer somewhat by saying, "Perhaps food or early environmental factors may play a part in the final determination of the somatotype." 84

82 Ibid., p. 221.
83 Lasker, op. cit., p. 323.
84 Sheldon, et al., op. cit., p. 227.
It was found that the girls of the fourth and fifth grades responded in much the same manner on the battery of basic skills as the college men did on the Physical Fitness Index as reported by Willgoose and Rogers.85

Table VII, Page 57, indicates that endomorphs on the average made lower scores on the basic skill battery than ectomorphs and mesomorphs. The one mesomorph in the group somatotyped made the highest composite score on the battery of basic skills. These data, however, should be considered as inconclusive because of the limited numbers involved.

These findings, though based on insufficient numbers and on estimated somatotypes, should assist in establishing the need for a range in performance levels or standards for the various ages or grades rather than a dogmatic, specified level of performance for everyone within a certain age group irrespective of individual differences.

TABLE VIII
DISTRIBUTION OF THE THREE MORPHOLOGICAL CLASSES IN THE TWO PROGRAMS

<table>
<thead>
<tr>
<th>Primary Components</th>
<th>Calisthenic (N)</th>
<th>Basic Skill (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endomorph</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Mesomorph</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ectomorph</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

A brief examination of the distribution of the three primary components in each of the two programs revealed a striking similarity between the two groups with the calisthenic groups having slight advantage over the skill group because of having one more mesomorph and one less endomorph. However, the differences were so slight that the data seemed to reveal once again that the groups though equated originally on only their initial performance on the basic skills proved to be extremely similar in other areas.

Results of the Two Vigorous Activity Programs

The mean gains within the group were calculated for both the Calisthenic Program and the Basic Skill Program and the data were analyzed. In Table IX the Basic Skill Program participants showed an increase on all ten items. They displayed a mean gain of 8.8 inches in the Standing Broad Jump and 1.5 inches in the Vertical Jump. These subjects decreased their time in the Shuttle Run by 1.16 seconds thus improving their score. The Basketball Wall Pass was executed 6.5 times more during the best fifteen second trial on the post-test than it was on the pre-test with the Volleyball Wall Volley increasing by 7.1 volleys and the Soccer Wall Volley by 2.9 volleys. The performance on the Softball Repeated Throws was enhanced by a mean gain
### TABLE IX

**MEANS FOR INITIAL TEST SCORES AND CHANGE IN TEST SCORES WITH STATISTICS FOR TESTING THE SIGNIFICANCE* OF THE MEAN CHANGE**

<table>
<thead>
<tr>
<th></th>
<th>Calisthenic</th>
<th></th>
<th>Basic Skill</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial Mean</td>
<td>Change</td>
<td>df=36 t</td>
<td>Initial Mean</td>
</tr>
<tr>
<td>Standing Broad Jump</td>
<td>49.622</td>
<td>3.243</td>
<td>4.958</td>
<td>.001</td>
</tr>
<tr>
<td>Shuttle Run</td>
<td>14.216</td>
<td>-0.308</td>
<td>-2.936</td>
<td>.01</td>
</tr>
<tr>
<td>Basketball Wall Pass</td>
<td>12.783</td>
<td>0.838</td>
<td>1.919</td>
<td>NS</td>
</tr>
<tr>
<td>Volleyball Wall Volley</td>
<td>5.378</td>
<td>-0.027</td>
<td>-0.066</td>
<td>NS</td>
</tr>
<tr>
<td>Soccer Wall Volley</td>
<td>9.270</td>
<td>1.351</td>
<td>5.981</td>
<td>.001</td>
</tr>
<tr>
<td>Softball Repeated</td>
<td>6.730</td>
<td>0.162</td>
<td>0.877</td>
<td>NS</td>
</tr>
<tr>
<td>Squat Thrust</td>
<td>13.081</td>
<td>1.622</td>
<td>4.973</td>
<td>.001</td>
</tr>
<tr>
<td>Situp</td>
<td>11.541</td>
<td>1.568</td>
<td>3.717</td>
<td>.001</td>
</tr>
</tbody>
</table>

N = 37

* t₀⁵ (df = 35) = 2.030.

* t₀¹ (df = 35) = 2.724.

* t₀₀¹ (df = 35) = 3.598.
of 2.1. The "t" was used to determine the level of significance. That the gain is highly significant is revealed through noting that all of the mean gains for the Basic Skill Program were significant at the .001 level of confidence.

This would indicate rather conclusively that for the girls in the Program of Basic Skills the practice of the tests of basic skills did augment their performances on those tests and, at the same time, contributed significantly to improving their level of physical fitness. This would tend to indicate that basic skills require a degree of strength, flexibility, and endurance as measured by these tests of physical fitness.

The increase in the basic skill performance could be attributed in part to the subjects becoming familiar with the test. This is a factor which must not be overlooked or minimized. However, the same fact does not hold true for the gains made on the physical fitness test by the Basic Skill Group since they did not practice these tests during the experiment.

The data on the Calisthenic Program showed a similar but a reversed pattern since the participants increased their performance on several of the tests of basic skill after devoting their experimental time to the practice of calisthenics. The mean gain indicated an increase of 3.2
inches on the Standing Broad Jump and 1.1 on the Vertical Jump. These subjects decreased their time on the Shuttle Run by .3 of a second thus slightly improving their score on that item. The Basketball Wall Pass was executed .8 times more during the best fifteen second time trial on the post-test with the Volleyball Wall Volley decreasing by .02 volleys and the Soccer Wall Volley showing an additional 1.4 volleys. The performance on the Softball Repeated Throws was enhanced by a mean gain of .2. It was indicated that the Standing Broad Jump, Vertical Jump, and Soccer Wall Volley were all significant at the .001 level of confidence while the Shuttle Run was significant at the .01 level.

This data seemed to substantiate the premise that there are similar components in basic skills as there are in calisthenic type exercises since this group did show an increase on some of the tests of basic skill.

It was interesting to note that with the exception of the Soccer Wall Volley which had the lowest reliability coefficient, the Calisthenic Group failed to show a significant increase on any of the tests which involved eye hand coordination through the manipulation of a ball.

Further analysis of Table IX reveals a significant increase at the .001 level for the Calisthenic Group on all of the tests of physical fitness.
The null hypothesis was tested by computing the differences of the mean gains between the two groups.

Table X shows the program of basic skills was significantly superior to the calisthenic program for the development of basic skills. The difference between the mean gains of five of the seven basic skills were significant at the .001 level and one, the Vertical Jump, was significant at
the .01 level. Again, the Soccer Wall Volley was the only test which did not yield a significant difference but it did exemplify a slight positive preference for the skill program.

Therefore, the null hypothesis must be rejected because the practice of the Latchaw Battery of Motor Skills did result in a significant increase in skill development as measured by that battery when the mean gains made by the two experimental groups were compared.

These findings perhaps did not reveal anything which one would not expect but the same treatment of the data on the tests of physical fitness presented information which might not come within the realm of expectation.

The program of calisthenics failed to show a significant difference over the basic skill program for the purpose of developing fitness. While neither program yielded a significant difference even at .10 level on any items within the battery, it is interesting to note that the Calisthenic Program was exceeded by the Basic Skill Program on two of the three tests of physical fitness. Then, too, on the Pullups, the one item on which the Basic Skill Group was exceeded by the Calisthenic Group, two things should be remembered. First, this was the item with the widest discrepancy between the original means of the matched groups with a difference of 5.6 between the two groups. Second,
fifty was the maximum score allowed on this test. Since the Basic Skill Group had a mean 5.6 higher than the Calisthenic subjects at the beginning and the maximum limit was established, the possible range for improvement was not as great for the Basic Skill participants as it was for those in the Calisthenic program. However, it must be pointed out that the increase by the Calisthenic group did represent a 77 per cent increase compared to 61 per cent for the Basic Skill subjects.

It is, therefore, necessary to reject the null hypothesis since the practice of the Battery of Motor Skills did induce an increase in the level of performance on the Fitness Screening Tests comprised of the Squat Thrust, Situp, and Pullup comparable to the increase produced by the Calisthenic Program.

Summary

Two groups of thirty-seven girls in the fourth and fifth grades were equated on the basis of their original composite scores of the Latchaw Battery of Motor Skills to determine the extent to which the practice of one program effected a change in performance on tests of basic skill and physical fitness.

One group, the Basic Skill Group, practiced the tests of basic skill for fifteen minutes daily during the school
week for thirty lessons while the second group, the Calisthenic Group, practiced the calisthenic exercise program, as designed in the Youth Fitness Manual, for a comparable period.

Basic Skill tests and physical fitness tests were given before and after the experimental period to determine the extent to which each activity program contributed to improving performance on the tests.

In addition, somatotypes and skeletal age were computed for those subjects who volunteered for this extended evaluation program. The X-rays and pictures were taken in an effort to ascertain the influence these data might have had on the findings of the study.

Conclusions

The conclusions which may be made as a result of this study are:

1. The data collected on the girls volunteering to be X-rayed to determine skeletal age appeared to indicate that the girls of the fourth and fifth grades of the two schools selected for the site of the experiment were distributed in their maturation level as one might expect in a normal population. Sixty per cent of the cases revealed the maturation level to fall within plus and minus one standard deviation away from the chronological age and only one subject,
two per cent of the total group surveyed, was markedly advanced in her level of maturation.

2. The individuals somatotyped displayed a high incidence of endomorphy as the primary component of their somatotype. The data substantiated findings reported in other studies by showing that endomorphy negatively affected performance on basic skills. Furthermore, the only subject with mesomorphy as the primary component had the highest composite score in the group somatotyped.

The results, though inconclusive because of the number of cases, attest to the fact that females seem to rate high in the endomorphological component.

3. Vigorous activity provided through the practice of basic skills increased the level of physical fitness at a rate comparable to the increase effected by vigorous calisthenic exercises while at the same time increasing significantly the ability to perform the tests of basic skill.

4. The difference was found to be highly significant in favor of the Skills Program when the difference of the means gains between groups were analyzed for the purpose of determining achievement in basic skill development.

5. The data seemed to indicate rather conclusively that the advocacy of a vigorous calisthenic program for fourth and fifth grade girls could be superseded by the practice of basic skills for the purpose of developing
physical fitness since the Skill Program proved to be just as effective as the Calisthenic Program in augmenting physical fitness. In addition, skills were increased significantly through this program of basic skills.

**Suggestions for Further Study**

The analysis of the data, the actual working with the children, and the writing of the thesis suggested topics for further research which might lend purpose and direction to the field of elementary school physical education. The following suggestions might serve as incentives for further study:

1. A study to show the effect of a well-rounded program of physical education.

   The problem would be to determine to what extent a program designed to insure maximum activity to develop skill and physical fitness might contribute to the total development of the child. It would necessitate not only measuring physical fitness and basic skill achievement but also would involve measures to indicate the extent to which the various programs contribute to the social and emotional status of the child and to the problem solving ability or the ability to think and react correctly to a situation.

2. The variety of body build, skeletal age, skill and physical fitness achievement observed in one grade lends
evidence to the need for determining a range of norms within age groups which would acknowledge these individual differences.

3. The high incidence of endomorphy in the group studied suggests a study to determine the degree to which the somatotype of girls might be altered during the formative years through appropriate diet and vigorous exercise.
Figure 1. Target for Basketball Wall Pass

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Figure 2. Target for Volleyball Wall Volley

87Ibid., p. 17.
Figure 3. Illustration of Vertical Jump Equipment

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88Ibid., p. 20.
Figure 4. Calibrated Mat for Standing Broad Jump\textsuperscript{89}

\textsuperscript{89}Ibid., p. 23.
Figure 5. Floor Markings and Pathway of Running for Shuttle Run**

**Ibid., p. 26.**
Figure 6. Target and Floor Markings for Soccer Wall Volley

\[91\] Ibid., p. 29.
Figure 7. Target and Floor Markings for Softball Repeated Throws

Ibid., p. 32.
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