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The effectiveness of certain types of activities in the improvement of physical achievement

Ruth Blanche White
Atlanta University

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THE EFFECTIVENESS OF CERTAIN TYPES OF ACTIVITIES
IN THE IMPROVEMENT OF PHYSICAL ACHIEVEMENT

A THESIS
SUBMITTED TO THE FACULTY OF ATLANTA UNIVERSITY
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THE DEGREE OF MASTER OF ARTS

BY
RUTH BLANCHE WHITE

DEPARTMENT OF EDUCATION

ATLANTA, GEORGIA
JUNE 1942
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CHAPTER I

INTRODUCTION

Historical Background

The National Physical Achievement Standards for Girls were established in 1936 as the result of a nation-wide survey of the actual performance of more than 400,000 girls in 53 skills. The study was sponsored by the National Recreation Association under the direction of Dr. Amy R. Howland of the Department of Public Instruction, Mount Vernon, New York, at the request of the Society of State Directors of Health and Physical Education. This request was the direct outgrowth of the publication of the National Physical Achievement Standards for Boys, the result of a survey conducted by the National Physical Achievement Standards Committee in cooperation with the National Recreation Association and the Society of State Directors of Health and Physical Education.

The data from which the achievement standards have been set up were secured from all types of school population and represent a wide geographical distribution including both urban and rural populations.¹

Purpose and Significance of This Study

The National Physical Achievement Standards for Girls were developed for the following purposes: "to promote the joy of achievement, the spirit of sportsmanship, and the satisfactions that come from healthful living."2

This study utilized the National Physical Achievement Standards as a basis for administering and scoring tests. They also served to motivate the subjects to improve their individual scores as well as a measurement of their achievement. By giving tests in certain skills to all individuals before training and to the same individuals after training, it was possible to determine the amount of improvement which resulted from training during the period of the study.

Repetition of the same tests with new subjects from year to year will eventually lead to the establishment of local physical achievement standards which may then be used in the local situation in preference to the national standards.

Therefore, this study was designed to serve the following purposes:

(1) To compare the level of physical achievement of the girls of the first year high school of the Booker T. Washington High School, Norfolk, Virginia, with the national standards for girls of the same age.

(2) To motivate the girls of physical education classes to improve their individual physical achievement scores.

2Ibid., p. 3.
To determine which phases of the Booker T. Washington High School Physical Education Program require greater emphasis for the ultimate improvement of the girls' physical achievement scores.

To initiate the development of local standards of Physical achievement scores for girls.

To determine whether a generalized physical education program contributes more to the improvement of physical achievement than a program limited to stunts and tumbling or games, game skills, and relays.

Description of Tests

The National Physical Achievement Standards are based on fifty-three skills which are divided into four groups:

Group I. Events measured in units of time.
Group II. Events measured in units of distance.
Group III. Events measured by success or failure.
Group IV. Events which are scored according to the number of successful efforts in a given number of trials.\(^3\)

Because of limited time and limited equipment, it was impossible to utilize all test items given for the various age groups. Therefore the test was limited to nine activities which were classified under each group as follows:

Group I. Run and Catch
Group II. Jump and Reach, Rope-Climbing

\(^3\)Ibid., p. 3.
Group III. Backspring, Forward Roll C, Knee Walk C. Wall Pivot

Group IV. Basketball Goal Throw for Accuracy, Horseshoe Pitch.

Run and Catch. Ages 12, 13, 14, 15, 16 and up.
Equipment: Regulation basketball, well inflated.
There are two posts or uprights with a cord stretched between them 10 feet from the ground. The starting line 10 feet long.
Rules: The distance for ages 12 and above, 30 feet. At signal, the performer runs from the starting line, tosses the ball over the cord, catches it and runs back to the starting line. Three such trips are made, finishing at the starting line. In case of failure to catch the ball, it must be secured, tossed over the cord in either direction, and caught before running is continued.
Score is recorded in seconds and tenths of seconds.4

Jump and Reach. Ages 12, 13, 14, 15, 16 and up.
Equipment: Piece of chalk, wall or other perpendicular surface; yard stick or tape measure.
Rules: Performer stands with right side against a wall and holds in the right hand a short piece of chalk. The right arm is stretched up as far as possible with feet remaining flat on the floor. At the top of the reach a mark is made on the wall. Then swinging the arm down and up, if desired, she jumps up and makes a second mark above the first mark. The distance between the two marks is the score. Left arm may be used if desired. Three jumps are allowed.
The best jump is recorded in inches and quarter inches.5

Rope Climbing. Ages 12, 13, 14, 15, 16 and up.
Equipment: A suspended rope at least 12 feet long which shall have no assisting devices such as knots or balls on it. A string or marker should be placed on the rope at 1 foot intervals beginning at 5 feet from the floor or ground.
Rules: Climb must start from standing position. Any style of climbing using hands and feet alternately may be used. In order to get credit for her climb the performer must touch with her hands the highest marker she can reach by climbing.
The actual height climbed is the score.6

4Ibid., p. 16. 5Ibid., p. 13. 6Ibid., p. 16.
Backspring. Ages 14, 15, 16 and up.
Equipment: A gymnasium mat.
Rules: A girl takes her position on the mat on her hands and knees. The performer with a running start of a few steps approaches the side of the kneeling girl. The performer throws her hands to the floor or mat near the kneeling girl and turns a forward roll over her. The performer lands in a standing position. The performer may be assisted by the kneeling girl who may raise her back slightly as the performer goes over. Three trials are permitted if necessary.
Success or failure is the score. 7

Forward Roll C. Ages 14, 15, 16 and up.
Equipment: A gymnasium mat or strip of rug or carpet; 2 parallel lines 3 feet apart.
Rules: The performer must make 3 successive rolls in a straight line between the 2 parallel lines and finish standing in an erect position. Two trials are permitted if necessary.
Success or failure is the score. 8

Knee Walk C. Ages 12, 13, 14, 15, 16 and up.
Equipment: A gymnasium mat or soft surface; 2 lines 3 feet apart.
Rules: The knee walk is executed as in knee walk A. (The performer kneels on both knees. She reaches behind and grasps ankles one in each hand, and presses legs against back of thighs balancing body on both knees) except that the performer must walk 3 feet forward, turn around either left or right and return to starting point without losing balance or using hands. Three trials are permitted.
Success or failure is the score. 9

Wall Pivot. Ages 12, 13, 14, 15, 16 and up.
Equipment: A wall, door, tree, or firm standard.
Rules: The performer faces the wall, standing four or five feet away. With two or three easy running steps she approaches the wall, places one foot against it and jumps over that foot with the other foot. At the same time she turns around with back to the wall using as a pivot the foot which was placed against the wall. This foot must remain in contact with the wall throughout. Five trials are permitted if necessary.
Success or failure is the score. 10

7 Ibid., p. 6. 9 Ibid., pp. 14 - 15.
8 Ibid., pp. 10 - 11. 10 Ibid., p. 18.
Basketball Goal Throw for Accuracy. Ages 12, 13, 14, 15, 16 and up.

Equipment: Regulation basketball, well inflated; regulation basketball goal and back stop; a semi-circle 15 feet in radius drawn from a point directly under the center of the backstop.

Rules: The performer throws from any point outside the 15 foot semi-circle, using any style throw. She must not cross the 15 foot semi-circle at any time during the throw. Any of the 5 throws may be taken from any point outside the 15 foot semi-circle.

The number of successful goals in 5 trials is the score. 11

Horseshoe Pitch. Ages 14, 15, 16 and up.

Equipment: Regulation horseshoes; a stake rising three inches above the ground; a throwing line 30 feet from the stake.

Rules: The performer stands on the throwing line and pitches the horseshoes at the stake attempting to ring it. One foot must be on the throwing line at the time the shoe is released. Every shoe landing within one foot (12 inches) of the stake scores as a successful pitch.

The number of successful pitches in 5 trials is the score. 12

Scoring - The achievement standards for girls have been established on a percentile basis with a corresponding point value for each increased degree of successful performance ... Point values for scores made in the skills in Groups I and II were derived from the percent of each age group that achieved the scores found in the data. ...

Point values for scores made in the activities listed in Groups III and IV were also derived from the per cent of each group that achieved success. From the data secured it was determined what the individual's chances of success were by the per cent of the group that achieved that score. Using a point basis of 10 as represented by 100 per cent, the individual's chances were 4 out of 10 if 40 per cent of her age group succeeded. The point value of her score was therefore 4. When it was found that a large per cent of the group failed at any one score, successful performance at that score was given a greater value than if her chances for success were greater.

In using the scoring tables it should be kept in mind that if the individual makes a higher score than the best one given she should be given a point value of 10 for her performance in Groups I and II. 13

Therefore, all points were awarded on the basis of successful performance of an activity by a large sampling of various age levels. Successful performance by a girl of 14 years of age was awarded a different point value than the same performance by a younger or older girl. All scores used were awarded according to the scales set up in the National Physical Achievement standards for Girls.

Method of Procedure

Choice of Subjects — All subjects used were girls of the regular first year high school classes in physical education in the Booker T. Washington High School from September, 1940 through January, 1941.

Previous training in physical education among these subjects was limited to the last six weeks in the preceding term (1939-40) when physical education was added as a required course.

The experiment was begun in the regular classes, so that all girls in the classes were given tests. As no selection of subjects took place, a random sampling was made as to height, weight, and other physical factors. However, no girl with a recognized physical defect was included.

The study was planned before the classes enrolled. That is, definite periods were set aside for each of the three groups, so that any girl enrolling for physical education at a specified period automatically became a member of that group. This process had as its object the approximation of equality in the number of subjects in each group.
**Organization of Groups** - Three groups were used in the study - a control group and two experimental groups. The control group, A/O, had diversified training consisting of a wide variety of physical education activities while the experimental groups were limited to certain types of physical education activities. Group A/1 (experimental a) was trained only in activities classified as game skills, games and relays. Group A/2 (experimental b) was trained in stunts and tumbling.

**Administering Tests** - Individual score sheets were provided for each girl. (See Appendix) Preliminary information (name, grade, age, height, and weight) concerning each subject was secured and recorded before tests were given. Performance was recorded at the time each item was tested and the appropriate scores awarded afterward; both performance record and score earned were recorded on the individual score sheet.

For economy of time and facility in administration, events requiring the same equipment were given on the same or successive days. The following sequence was observed in all classes on both initial and final tests:

<table>
<thead>
<tr>
<th>Event</th>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Backspring</td>
<td>Gymnasium mat</td>
</tr>
<tr>
<td>2. Forward Roll C</td>
<td>Gymnasium mat</td>
</tr>
<tr>
<td>3. Knee Walk C</td>
<td>Gymnasium mat</td>
</tr>
<tr>
<td>4. Wall Pivot</td>
<td>Wall</td>
</tr>
<tr>
<td>5. Jump and Reach</td>
<td>Wall, chalk, tape measure</td>
</tr>
<tr>
<td>6. Rope Climbing</td>
<td>Rope suspended from ceiling</td>
</tr>
</tbody>
</table>
### Event Equipment Required

<table>
<thead>
<tr>
<th>Event</th>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Horseshoe Pitch</td>
<td>Horseshoes, stake</td>
</tr>
<tr>
<td>8. Basketball Goal Throw</td>
<td>Basketball, Basketball goal</td>
</tr>
<tr>
<td>9. Run and Catch</td>
<td>Basketball, Cord, Jump Standards</td>
</tr>
</tbody>
</table>

In success or failure events (Backspring, Forward Roll, Knee Walk, Wall Pivot), an individual succeeding on first trial passed to be tested on the next event. Those who failed the first time, continued their efforts until they were either successful or exhausted the allotted number of trials.

In an attempt to minimize the effects of fatigue affecting performance no individual was allowed all of the specified number of trials without an intervening rest period to provide for recovery. For example, in Run and Catch every individual took her first trial, then every one took her second, and last everyone took her third. Each girl was scored on her best performance.

Point values were recorded on the individual data sheets as each test item was completed. Points were awarded using the National Physical Achievement Standards for Girls on the basis of the subject's age and performance. Class records showing the scores of the subjects were posted to indicate to each individual her standing in relation to the rest of the class. This served to motivate and maintain interest by providing a knowledge of personal achievement.

**Training Period.**--The training of all three groups was conducted during the regular 50 minutes class periods which were
held twice weekly for 12 weeks. Each group was given 10 hours of special training.

Group A/0, the control, was given the following training period activities:

**Rhythmics**
- Marching
- Folk dancing
- Clog dancing
- Athletic dancing

**Stunts and tumbling**
- Combination forward and backward rolls
- Head stand
- Bridge stand
- Double roll
- Elephant walk
- Hand stand

**Games**
- Three Deep
- Nine Court Basketball
- Progressive Dodgeball
- Poison Snake
- Keep It Up

**Relays** *(Simple relay formation only)*
- Running
- All-up Indian Club Relay
- Running Seal Race
- Eskimo Race

**Fundamental Skills**
- Jumping
- Hopping
- Skipping
- Running
- Walking

Group A/1, experimental a, was trained in activities classified as games, game skills, and relays as follows:

**Mass Games**
- Black and White
- Jump the Scat
- Catch Ball
- Three Deep, etc.
Game Skills
Passing the ball (Basketball, Dodgeball, Volleyball)
Pivoting
Shooting goals
Service (Volleyball)

Team Games
Captain Ball
Progressive Dodgeball
Basketball
New comb

Relays
Formations: Simple, circle, line, shuttle
Skills used: running, hopping, skipping, jumping
Stunt relays  Obstacle relays  Passing relays

Group A/2, experimental b, was trained in activities classified as stunts and tumbling, as follows:

Variations of forward roll
Diving over one or more persons or/and objects
Double roll  Triple roll  Shuttle roll

Variations of backward roll
(See Variations of forward roll)
Combinations of backward and forward rolls
Supporting the body inverted
Head stand  Hand stand
Walking on the hands

Springs
Hand spring  Head spring
Balancing

Stomach balance        Sitting balance
Standing balance on the feet
Standing balance on the hands

Individual Stunts
Roly Poly               Folded Leg Walk
Cricket Walk            Wand Serpentine
The Rocker

Couple Stunts
Elephant Walk           Camel Walk
Twin Walk               Wheelbarrow

Group Stunts
Merry-Go-Round          Opening of the Rose
Walking Chair           Leap Frog
Skin the Snake

Pyramids involving various numbers of girls

Group A/O experiences some of the same activities plus a number of others which resulted in a training in a large number of diversified activities. For the two experimental groups, only certain definite types of activities were entered upon.

Final Test.--At the end of twelve weeks of training each subject was again tested and scored upon the items used in the initial test. The same procedure was utilized as in the beginning.
Treatment of Data

Information including age, height, weight, scores on each event for the final test were collected from individual record sheets on each group. There was a separate record sheet for each of the three groups.

Subjects were eliminated when they had not been tested on all nine items in both initial and final tests or when they had failed to engage in all twelve weeks of training. After elimination there were 43 subjects in Group A/0, control, 36 subjects in Group A/1, experimental a, and 42 subjects in Group A/2, experimental b, making a total of 121 results to be used in treating the data.

The mean (M), standard deviation (σ), and standard error of the mean (σM) were determined for each group on both initial and final tests.

Using these statistics, a comparison between the three groups was made utilizing the standard error of the difference between the means (σD) and the chances of a significant difference of the means (D/σD) to determine the relative standing of the three groups at the time of the initial test and again at the time of the final test to determine which group had achieved the greatest amount of improvement during the training period. (Diagram 1, page 14)
Diagram 1.—Showing the direction of equating the three groups, taken two at a time, based upon the computed measures, the means, standard deviations, and the standard errors.

ACTIVITY PROGRAM - PERIOD - 10 WEEKS
### TABLE 1

Showing the means, standard deviations, standard errors of the mean, difference between the means, standard errors of the difference between the means, critical ratio, and chances in 100 based on the raw scores earned by activity group A/O (control) and activity group A/I (experimental)

<table>
<thead>
<tr>
<th>A. Initial Test</th>
<th></th>
<th>B. Final Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group</strong></td>
<td><strong>A/O (Control)</strong></td>
<td><strong>A/I (Experimental a)</strong></td>
</tr>
<tr>
<td><strong>Number</strong></td>
<td>43</td>
<td>36</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>30.99</td>
<td>25.97</td>
</tr>
<tr>
<td><strong>S. D.</strong></td>
<td>12.39</td>
<td>6.05</td>
</tr>
<tr>
<td><strong>Standard error</strong></td>
<td>1.95</td>
<td>1.01</td>
</tr>
</tbody>
</table>

Reliability of the Difference between the Means

**Difference** .......... 5.02  
**Standard error** .... 2.19  
**Critical ratio** .... 2.29  

**Chances in 100** ............... 99 in favor of A/O

Reliability of the Difference between the Means

**Difference** .......... 0.11  
**Standard error** .... 2.86  
**Critical ratio** .... 0.04  

**Chances in 100** ............... 52 in favor of A/I
TABLE 2
SHOWING THE MEANS, STANDARD DEVIATIONS, STANDARD ERRORS OF THE MEAN, DIFFERENCE BETWEEN THE MEANS, STANDARD ERRORS OF THE DIFFERENCE BETWEEN THE MEANS, CRITICAL RATIO, AND CHANCES IN 100 BASED ON THE RAW SCORES EARNED BY ACTIVITY GROUP A/O (CONTROL) AND ACTIVITY GROUP A/2 (EXPERIMENTAL)

A. Initial Test

<table>
<thead>
<tr>
<th>Group</th>
<th>A/O (Control)</th>
<th>A/2 (Experimental)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>43</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>30.99</td>
<td>31.79</td>
</tr>
<tr>
<td>S. D.</td>
<td>12.89</td>
<td>8.90</td>
</tr>
<tr>
<td>Standard error</td>
<td>1.95</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Reliability of the Difference between the Means

| Difference       | 0.80          |
| Standard error   | 2.36          |
| Critical ratio   | 0.34          |

Chances in 100 ......... 64 in favor of A/2

B. Final Test

<table>
<thead>
<tr>
<th>Group</th>
<th>A/O</th>
<th>A/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>43</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>29.89</td>
<td>36.31</td>
</tr>
<tr>
<td>S. D.</td>
<td>13.05</td>
<td>15.85</td>
</tr>
<tr>
<td>Standard error</td>
<td>1.99</td>
<td>2.45</td>
</tr>
</tbody>
</table>

Reliability of the Difference between the Means

| Difference       | 6.42          |
| Standard error   | 3.13          |
| Critical ratio   | 2.05          |

Chances in 100 ......... 98 in favor of A/2
### TABLE 3

SHOWING THE MEANS, STANDARD DEVIATIONS, STANDARD ERRORS OF THE MEAN, DIFFERENCE BETWEEN THE MEANS, STANDARD ERRORS OF THE DIFFERENCE BETWEEN THE MEANS, CRITICAL RATIO, AND CHANCES IN 100 BASED ON THE RAW SCORES EARNED BY ACTIVITY GROUP A/1 (EXPERIMENTAL) AND ACTIVITY GROUP A/2 (EXPERIMENTAL)

#### A. Initial Test

<table>
<thead>
<tr>
<th>Group</th>
<th>A/1 (Experimental a)</th>
<th>A/2 (Experimental b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>25.97</td>
<td>31.79</td>
</tr>
<tr>
<td>S. D.</td>
<td>6.05</td>
<td>8.90</td>
</tr>
<tr>
<td>Standard error</td>
<td>1.95</td>
<td>1.33</td>
</tr>
</tbody>
</table>

Reliability of the Difference between the Means

| Difference | 5.62 |
| Standard error | 1.67 |
| Critical ratio | 3.36 |

Chances in 100 ......... 100 in favor of A/2

#### B. Final Test

<table>
<thead>
<tr>
<th>Group</th>
<th>A/1</th>
<th>A/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>30.00</td>
<td>36.31</td>
</tr>
<tr>
<td>S. D.</td>
<td>6.55</td>
<td>15.85</td>
</tr>
<tr>
<td>Standard error</td>
<td>1.18</td>
<td>2.45</td>
</tr>
</tbody>
</table>

Reliability of the Difference between the Means

| Difference | 6.31 |
| Standard error | 2.72 |
| Critical ratio | 2.32 |

Chances in 100 ......... 99 in favor of A/2
CHAPTER II

STATISTICAL TREATMENT OF DATA AND INTERPRETATION OF RESULTS

Comparison of Initial Test Scores

The results of the initial physical achievement tests were as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>A/O</th>
<th>A/1</th>
<th>A/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>43</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>30.99</td>
<td>25.97</td>
<td>31.79</td>
</tr>
<tr>
<td>S. D.</td>
<td>12.99</td>
<td>6.05</td>
<td>8.90</td>
</tr>
<tr>
<td>V*</td>
<td>42</td>
<td>23</td>
<td>28</td>
</tr>
</tbody>
</table>

A comparison of the initial scores of Group A/O (control) with those of Group A/1 (experimental a) through calculation of the critical ratio (2.29) shows that there are 99 chances in 100 that the true mean of Group A/O will exceed that of Group A/1. It was practically certain that the true mean of Group A/1 would not exceed the true mean of Group A/O in more than 1 chance in 100. (Table 1A, page 15)

Making a similar comparison between Group A/O and Group A/2; the mean of the second group exceeds that of the first by 0.80 points. The critical ratio (0.34) indicates that the difference is not reliable. The true mean of Group A/2 is probably greater than the true mean of A/O, with 64 chances in 100. (Table 3A, page 17)
The difference between the obtained means of Group A/1 and Group A/2, 5.62, was in favor of Group A/2. The critical ratio, 3.32, indicates absolute certainty that Group A/2 is superior to Group A/1 (100 chances in 100). (Table 2A, page 16).

Comparison of Final Test Scores

The results of the final test, given after 12 weeks of training, were as follows:

<table>
<thead>
<tr>
<th>Group</th>
<th>A/0</th>
<th>A/1</th>
<th>A/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>43</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>29.89</td>
<td>30.00</td>
<td>36.31</td>
</tr>
<tr>
<td>S. D.</td>
<td>13.05</td>
<td>6.55</td>
<td>15.85</td>
</tr>
<tr>
<td>V</td>
<td>44</td>
<td>22</td>
<td>44</td>
</tr>
</tbody>
</table>

Group A/2, as in the initial test, had the highest mean physical achievement score. Group A/1, with second highest mean score, made both experiment groups superior to the control group in the final standing.

The final test scores indicated that Group A/0 had possible superiority over Group A/1 in 48 chances in 100 (critical ratio 0.04 in favor of Group A/1). The difference of 0.11 in the two means was only slightly in favor of Group A/1 (Table 1B, page 15).

Group A/0 was also exceeded by Group A/2 by a difference between the means of 6.42. A critical ratio of 2.05 indicates 98 chances in 100 in favor of Group A/2. This is very close to absolute certainty. (Table 3B, page 17).
Of the experimental groups, Group A/2 remained superior to Group A/1. There was a difference of 6.31 between the means on the final test, a critical ratio of 2.32, and 98 chances in 100 for the superiority of Group A/2. (Table 2B, page 16)

Comparison of Improvement Between Groups

Groups A/O was the only group which failed to show improvement in the final test. The difference of 1.10 between the two tests and in favor of the initial test may have been due to chance. (Diagram 2, page 21)

Group A/1, however, showed an improvement of 4.03 points in the mean score in the final test. Group A/1 was ranked third in the initial test and second in the final test. (Diagram 2, page 21)

In the final test Group A/2 exceeded the initial mean by 4.62 points. Group A/2 not only maintained first rank as with highest mean score in the final test, but, made the greatest amount of improvement during the training period. (Diagram 2, page 21)

Group A/1 surpassed Group A/O in the final test, increasing its chances from 1 in 100 in the initial test to 52 in 100 in the final test. (Table 1, page 15).

The mean of experimental Group A/2 was 0.80 points higher than that of control Group A/O in the initial test or there were 64 chances in 100 in favor of Group A/2. In the final test the mean of Group A/2 continued to exceed the control group with 98 chances in 100 indicating an increased superiority of 34 chances over the first test. At the beginning of the experiment control
Diagram 2.—Showing the relative improvement in physical achievement scores among the three groups during the training period between the initial and final tests.
Group A/0 had 36 chances in 100 as compared to 2 chances in 100 at the conclusion. While Group A/2 increased its mean, through special training, raising its mean score 4.62 points; the control group failed to show any increase in the size of the mean. (Table 2, page 16).

Experimental Group A/2 was also superior to experimental Group A/1 in both tests. The initial test revealed that the difference between the means of the two groups (5.62) was completely reliable (critical ratio 3.36) and in favor of Group A/2 (100 chances in 100). At the time of the final test the actual difference of the means (6.31) was slightly more than in the first test, yet this second difference was slightly less reliable (critical ratio 2.32) though there were 99 chances in 100 in favor of Group A/2. (Table 3, page 17).

Only Group A/2 was superior to Group A/0 at the beginning of the experiment. After all three groups had been subjected to different types of training the control group (Group A/0) proved inferior to both Group A/1 and Group A/2. Group A/2 not only remained superior but increased the difference by improving its mean achievement score and chances of success from 64 in 100 to 98 in 100. Group A/1, before training, was indicated to be inferior to Group A/0 in 99 cases in 100. Training increased the level of achievement of Group A/1 so that it was superior to Group A/0 in 52 chances in 100 (critical ratio 0.04). Group A/1 had gained 52 chances of success (52 in 100 in final test less 1 in initial test) as a result of training. Group A/2 had gained 34 chances (98 in 100 in final test less 64 in initial
### Table 4

**SHOWING THE AVERAGE AGE IN MONTHS, THE STANDARD DEVIATION, ETC., FOR EACH ACTIVITY GROUP**

<table>
<thead>
<tr>
<th>Group</th>
<th>A/0</th>
<th>A/1</th>
<th>A/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>43</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>172.51</td>
<td>176.50</td>
<td>176.23</td>
</tr>
<tr>
<td>S. D.</td>
<td>12.17</td>
<td>10.26</td>
<td>13.86</td>
</tr>
<tr>
<td>Standard error</td>
<td>1.88</td>
<td>1.71</td>
<td>2.11</td>
</tr>
</tbody>
</table>

**Reliability of the Difference between the Means**

**A. Group A/0 and Group A/1**

- Difference ........ 3.89
- Standard error .... 2.54
- Critical ratio .... 1.56
- Chances in 100 .... 94 in favor of A/1

**B. Group A/1 and Group A/2**

- Difference ........ 0.27
- Standard error .... 2.72
- Critical ratio .... 0.10
- Chances in 100 .... 54 in favor of A/1

**C. Group A/0 and Group A/2**

- Difference ........ 3.72
- Standard error .... 2.83
- Critical ratio .... 1.31
- Chances in 100 .... 90 in favor of A/2
test) as a result of training. The percentage of improvement in Group A/1 (51%) over Group A/0 was greater than the percentage of improvement in Group A/2 (34%) by 17% indicating the superiority of training of Group A/1 in improving the achievement scores. These figures indicate that girls engaged in a special type of physical activity (stunts and tumbling for Group A/2; games, relays and game skills for Group A/1) made more improvement in physical achievement than those engaged in a program of diversified physical activity (Group A/0) under similar conditions for the same length of time.

**Age as a Factor in Scoring**

The achievement standards for girls have been established on a percentile basis with a corresponding point value for each increased degree of successful performance. Point values for scores made ... were derived from the percent of each age group that achieved the scores found in the data.¹⁴

In view of the fact that point values were awarded on the basis of expected achievement for each age group, the same performance by subjects in different age groups did not receive the same scores. Thus, the age factor was considered in the scoring, minimizing the effects of age on the improvement of the scores.

It is interesting to note the differences in the mean ages of the three groups. (Table 4, page 23) Control Group A/0 had the lowest mean age (172.51 months). Experimental Group A/1

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¹⁴Ibid., p. 4.
had a mean age (176.50 months) only .27 month greater than Group A/2 (176.23 months). The fact that Group A/0 was younger might be taken to indicate that this group should be slightly inferior to the others on the basis of less experience. The slight difference between A/0 (the youngest group) and A/2 (the oldest group) was slightly less than four months, but the oldest group made the greatest improvement.

There were 94 chances in 100 and 90 chances in 100 that the difference in the true mean ages of Group A/1 and Group A/2 respectively would be exceeded by Group A/0, a high degree of, though incomplete, reliability. (Table 4, page 23)

The difference in the mean ages of Group A/1 and Group A/2 were far less reliable (54 chances in 100 in favor of Group A/1) and may have been due to chance. (Table 4, page 23)

It is safe to conclude, then, that age did not affect the score. The score was based upon age groups, the older groups showing a superiority in performance.

Weight as a Factor in Scoring

The mean weight of Group A/0, 118.03 pounds, was greater than that of either Group A/1, 109.17 pounds, or Group A/2, 106.90 pounds. (Table 5, page 26) The differences were reliable between the control group and the experimental groups.

Comparing mean weights and mean achievement scores, it was found that Group A/2, lightest in weight, made the greatest improvement, while Group A/0, the heaviest group, failed to make improvement. This seems to indicate that weight is a disadvantage in the improvement of the physical achievement scores.
TABLE 5
SHOWING THE AVERAGE WEIGHT IN POUNDS, THE STANDARD DEVIATION, ETC., FOR EACH ACTIVITY GROUP

<table>
<thead>
<tr>
<th>Group</th>
<th>A/O</th>
<th>A/1</th>
<th>A/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>43</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>118.03</td>
<td>109.17</td>
<td>106.90</td>
</tr>
<tr>
<td>S. D.</td>
<td>20.42</td>
<td>16.06</td>
<td>14.0</td>
</tr>
<tr>
<td>Standard error</td>
<td>3.11</td>
<td>2.68</td>
<td>.216</td>
</tr>
</tbody>
</table>

Reliability of the Difference between the Means

A. Group A/O and Group A/1
   Difference ........ 8.86
   Standard error .... 4.58
   Critical ratio .... 1.93
   Chances in 100 .... 97 in favor of A/O

B. Group A/1 and Group A/2
   Difference ........ 2.27
   Standard error .... 2.69
   Critical ratio .... .86
   Chances in 100 .... 80 in favor of A/1

C. Group A/O and Group A/2
   Difference ........ 11.13
   Standard error .... 3.12
   Critical ratio .... 3.57
   Chances in 100 .... 100 in favor of A/O
TABLE 6
SHOWING THE AVERAGE HEIGHT IN INCHES, STANDARD DEVIATIONS, ETC., FOR EACH ACTIVITY GROUP

<table>
<thead>
<tr>
<th>Group</th>
<th>A/O</th>
<th>A/1</th>
<th>A/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>43</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Mean</td>
<td>62.62</td>
<td>62.33</td>
<td>62.13</td>
</tr>
<tr>
<td>S. D.</td>
<td>.21</td>
<td>.22</td>
<td>.25</td>
</tr>
<tr>
<td>Standard error</td>
<td>3.20</td>
<td>.035</td>
<td>.035</td>
</tr>
</tbody>
</table>

Reliability of the Difference between the Means

A. Group A/O and Group A/1
   Difference ........ .29
   Standard error .... 3.21
   Critical ratio .... .090
   Chances in 100 .... 54 in favor of A/O

B. Group A/1 and Group A/2
   Difference ........ .20
   Standard error .... .016
   Critical ratio .... 1.25
   Chances in 100 .... 89 in favor of A/1

C. Group A/O and Group A/2
   Difference ........ .49
   Standard error .... 3.21
   Critical ratio .... .152
   Chances in 100 .... 56 in favor of A/O
Height as a Factor in Scoring

Height, like weight, was not a consideration in awarding point values. The three groups showed little variation in height. The tallest group had a mean height only .49 inches more than the shortest group. Group A/0 was likely to be superior to Group A/1 in only 54 cases in 100 and to Group A/2 in only 56 cases in 100. (Table 6, page 27) In both cases the difference might have been a chance one. The chances of a true difference between Group A/1 and Group A/2 were 89, approaching certainty but not absolutely dependable.

As (1) both experimental groups were shorter than the control group and (2) the control group showed no improvement, the chances are slightly in favor of the shorter girls. However, as the differences were not reliable (that is, might have been due to chance) height was a negligible factor in scoring.
CHAPTER III
SUMMARY AND CONCLUSIONS

Summary

One hundred and twenty-one girls, members of the physical education classes at the Booker T. Washington High School, Norfolk, Virginia, were tested and scored on 9 items selected from the 52 items included in the National Physical Achievement Standards for Girls published by the National Recreation Association.

Age (in months), weight (in pounds) and height (in inches) were recorded with test scores.

The subjects were divided into three groups and each group received a different type of training for twelve weeks. Group A/0, the control group, was trained in a wide variety of activities, such as had been offered during a similar period. Group A/1 was trained only in activities classified as game skills, games, and relays. Group A/2 received training in only those activities known as stunts and tumbling.

At the end of twelve weeks the three groups were given a final test for the purpose of determining the effectiveness of the different types of training on the improvement of their physical achievement scores.

The results were as follows:
1. Control Group A/0 failed to show improvement after training.
2. Experimental Group A/1 (game skills, games, relays) showed an improvement of 4.03 points in the mean score of the
3. Experimental Group A/2 (stunts and tumbling) showed improvement of 4.52 points in the mean score of the final test, or a gain of .49 points more than Group A/1.

Conclusions

1. A wide variety of physical activities alone does not improve physical achievement scores.

2. Training in game skills, games and relays improves physical achievement scores.

3. Training in stunts and tumbling improves physical achievement scores.

4. Game skills, games, and relays result in greater improvement than a diversified program but less improvement than stunts and tumbling.

5. Stunts and tumbling improve physical achievement scores more than a diversified program and more than game skills, games, and relays. Hence, stunts and tumbling should be given greater emphasis in the physical education program for the ultimate improvement of physical achievement scores.

6. The oldest group of girls made the most improvement. The difference in ages was so small that it might have been due to chance, but seems to indicate that age is an advantage.

7. Weight is a disadvantage as the girls who showed most improvement weighed least.

8. The difference in height between the groups was insignificant, therefore height appeared not to affect improvement.
Suggestions for Further Study

1. Correlation between age, height, and physical achievement scores.
2. Correlation between age, weight and physical achievement scores.
3. Correlation between height, weight and achievement scores.
4. Repetition of tests over longer period of time for establishment of local standards of physical achievement.


APPENDIX

A. INDIVIDUAL SHEET USED FOR COLLECTING DATA

Name ____________________________________________ Class _________
Age _____ Birthday _____ Height (ins.) _____ Weight (lbs.) ______

<table>
<thead>
<tr>
<th>Event</th>
<th>Initial Test</th>
<th>Final Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Success</td>
<td>Failure</td>
</tr>
<tr>
<td>Backspring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3 trials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward Roll C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2 trials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee Walk C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3 trials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wall Pivot</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5 trials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basketball Goal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Throw for Accuracy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5 trials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horse shoe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pitch (5 trials)</td>
<td>Distance</td>
<td>Distance</td>
</tr>
<tr>
<td></td>
<td>in.</td>
<td>in.</td>
</tr>
<tr>
<td>Jump and Reach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rope Climbing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run and Catch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>