7-1-1965

# A Study of Democratic Pupil-Teacher Planning in Physical Education

Edward A. Christopherson

# A STUDY OF DEMOCRATIC PUPIL-TEACHER PLANNING IN PHYSICAL EDUCATION

by

Edward A. Christopherson

B. S. in Physical Education, Concordia College, 1961

A Thesis

Submitted to the Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the Degree of

Master of Science

Grand Forks, North Dakota

July

1965

# A STUDY OF DEMOCRATIC PUPIL-TEACHER PLANNING IN PHYSICAL EDUCATION

Edward A. Christopherson, Master of Science

The thesis here abstracted was written under the direction of Walter C. Koenig and approved by John L. Gunday and Eldon M. Cade as members of the examining committe, of which Mr. Koenig was chairman.

The purpose of this study was to determine the effectiveness of using democratic teaching methods in achieving physical education aims and objectives on the high school level.

For the basis of evaluation in this study, experimental and control groups were selected. The experimental group was taught under a democratic environment while the control group was taught in the traditional physical education manner. The democratic teaching methods employed in this investigation allowed for pupil-teacher planning in the selection of aims and objectives, class activities, and the methods of choosing squads and squad leaders. The duration of the study was for one school year.

Pre- and post-tests of knowledge, motor skills, and fitness were used for both groups. An evaluation checklist of outcomes was administered at the time of the second testing.

At the beginning of the study, initial testing showed both groups to be comparable in ability as indicated by the knowledge and motor skills tests. The control group scored significantly higher on the fitness test.

At the conclusion of the study the experimental group had improved significantly in all tests at the .02 level of confidence. The control group improved significantly on the motor skills test, but not on the knowledge and fitness tests. Results of the comparisons between groups indicated that the experimental groups had scored significantly higher than the control group in all areas of measurement, including the evaluation checklist of outcomes.

This abstract of a thesis submitted by Edward A. Christopherson in partial fulfillment of the requirements for the Degree of Master of Science in the University of North Dakota is hereby approved by the committee under whom the work of the thesis has been done.

W. C. Koenig
Chairman

John L. Quaday

Elton Tin Gale

Christopher J. Hamre
Dean of the Graduate School

This thesis, submitted by Edward A. Christopherson in partial fulfillment of the requirements for the Degree of Master of Science in the University of North Dakota, is hereby approved by the committee under whom the work has been done.

W. C. Koenig
Chairman

John F. Sunday

Eldon M. Gale

Christopher J. Hamre
Dean of the Graduate School

## ACKNOWLEDGEMENTS

The writer wishes to acknowledge his indebtedness to Dr. John L. Gunday and Mr. Walter C. Koenig, for their advice and guidance in making this study possible.

He further wishes to extend his gratitude to all persons cooperating in providing the statistics and information for this study.

Finally, the author expresses deepest appreciation and thanks to his wife, Sylvia, for her assistance and encouragement during the preparation of this thesis.

TABLE OF CONTENTS

LIST OF TABLES

# CHAPTER I

## INTRODUCTION

One of the characteristics of a good educational system is the continued progress that is made toward offering learning experiences that are of the most value to the educational development of the child. A prime requisite toward this end is not only teachers with a good preparatory background, but teachers with a creative and courageous imagination in the methods that they employ in providing the most suitable environment possible for learning to take place.

The successful teacher is one who utilizes methods found to be effective by others and may even create techniques of his own that may be used for a particular group. He is also willing to: (1) try out, (2) apply, and (3) experiment with the suggestions given him.[1]

Some studies have indicated that students with freedom of expression in the classroom derive a more meaningful and successful learning experience. Rather than an authoritarian atmosphere, the teacher may use methods which allow for a democratic environment to provide for this expression. This study was concerned with the merits of democratic pupil-teacher planning and its application to the teaching of physical education.

### The Problem

The purpose of this study was to determine the effectiveness of

---

[1] Elwood C. Davis and Earl L. Wallis, Toward Better Teaching in Physical Education, (Englewood Cliffs: Prentice-Hall, Inc., 1962), p. 30.

ocratic pupil-teacher planning in achieving the objectives of physical education.

The specific purposes of the study were:

1. To determine th ability of junior and senior high school students to plan their own objectives for their classes and to achieve those objectives.

2. To determine the ability of students to select their own activities with objectives in mind.

3. To compare the effectiveness of attaining objectives by the use of democratic pupil-teacher planning as contrasted to teacher directed planning.

## Need for the Study

Every successful educator realizes the importance of providing the most challenging experiences possible for every child. One of the teaching methods used to some degree by many teachers is democratic planning by the students, under the direction of the teacher, to provide for interest and motivation. However, this technique has been used on a limited basis and therefore, requires further research to determine the value of such a method as used in the teaching of physical education.

The autocratic oriented classroom will probably continue for sometime in some learning experiences, but there is evidence that the goals set forth for some experiences seem to be achieved more successfully in a democratic environment. The society in which we live gives opportunity for freedom of expression and this has, to some extent, carried over into the classroom. The aims and objectives as developed by students themselves and the effort that they put forth in assisting with the selection of classroom act-

ivities need increased utilization. The research of democratic classroom planning will help us to fully realize the value this may have in the learning experience. The opportunities for democratic planning seem limitless in the area of physical education and there is a definite need for extensive study with this method of teaching.

It is hoped that, through this study, substantial evidence has been obtained showing the need for the increased use of democratic pupil-teacher planning in the teaching of physical education.

## Delimitations

This problem was limited to two classes of high school boys physical education in the Public Schools of Lisbon, North Dakota, during the 1964-65 school year. Both groups consisted of boys of varied age, from the ninth to the twelfth grade level. One class of 23 members served as the experimental group. Another class of 22 members was the control group and served as a basis for comparison. Class scheduling did not allow any changes in class membership for either group during the study.

Identical tests (knowledge, physical fitness and skill) were administered to both classes the first week in October and again the second week in May of that school year. In addition, during the time of second testing, an evaluation checklist of outcomes was administered.

For the purpose of this study, democratic pupil-teacher planning was limited to the experimental group.

## Definitions

Experimental Group: Membership in this group was composed of boys who took part in democratic pupil-teacher planning and assisted in the class leadership throughout the entire school year. This group numbered 23 boys.

Control Group: Membership in this group consisted of 22 boys. The control group was taught through traditional physical education instruction methods.

Democratic Pupil-Teacher Planning: The teaching method used for the experimental group. The pupils were given opportunity to select aims and objectives, assist in selection of class activities, assist in instruction and help in evaluation of individual and class progress.

## CHAPTER II

## REVIEW OF RELATED LITERATURE

Although the studies relative to democratic classroom planning are somewhat limited in number, a careful investigation of current periodicals reveal several that have been completed in physical education and other education areas.

Collins[1] has made an investigation of democratic classroom methods and has completed a study to determine whether there were more satisfactory group relations in a physical education class in which captains were elected by the students, and the captains chose the players in secret, or in a class where the captains and players were assigned to teams on the basis of a classification test score. The primary purpose of this study was to investigate the social aspects of a physical education class in regard to satisfactory group relations.

Collins' first conclusion in his study was that there appeared to be more dissatisfaction with teammates on teams in which the students themselves had no part in the selection of players and captains than in the member-selected class. However, group cohesion in a class where team members were chosen by the General Motor Capacity Test scores improved over a period of time.

---

[1]Arden B. Collins, "The Democratic Method Versus Test Score Method of Assigning Players and Captains and the Effects Upon Satisfactory Group Relations" (unpublished research study, Dept. of Physical Education, University of North Dakota, 1960).

The opposite was true in the member-selected class. At the beginning of the study satisfaction with teammates was evident, but as tournaments were played and the first place team increased its lead daily, there was more dissatisfaction with teammates. Then, players who hindered the progress of the team were noticed by opponents as well as by members of their own team. For this reason member-selected teams do not necessarily give rise to the most satisfactory group relations.

Roth[2] has completed a study of techniques for developing socially acceptable group relationships in physical education classes. His study employed the use of sociometric devices in working toward desirable social goals.

Two methods of organizing teams for competition were used for the purpose of studying the sociometric outcomes. In one class the captains were selected by a student vote and then the captains secretly chose their team members. In another class, captains and teams were organized on the basis of motor test scores. Throughout the study sociometric tests were administered to both groups to determine group cohesion and peer acceptance.

Results of this study indicated that the students in the captain selected class were better judges of team captains and players than any tested measures available to determine leadership qualities and playing ability. It was also noted that better group relations existed in the captain selected class.

---

[2]Clair M. Roth, "A Comparison of Selected Methods for Equalizing Competition in a Team Sport Activity Within Boys Physical Education Classes" (unpublished Master's thesis, Dept. of Physical Education, University of North Dakota, 1961).

Bockstruck and Jaeger[3] have conducted an interesting study on democratic classroom methods in Minnesota high schools. Their survey of student leadership practices in Minnesota showed that physical educators need to give more attention to the democratic definition of leadership.

Leadership is usually viewed as any contribution to the establishment and attainment of group purposes. It may take many forms and can be achieved in many ways. According to the authors of this study, the true meaning of democratic leadership is a problem solving experience in which the student must be an active force in determining goals, making decisions, and in evaluating the results of the experience. The physical educator who appoints sound leaders for the sole purpose of delegating his responsibilities in order to get the task accomplished is not making a contribution to leadership.

Bockstruck and Jaeger stated that a sound program of democratic student leadership must be guided by procedures such as the following:

1. Stimulate potential leaders to define goals and problems in relation to the group.

2. Plan with the group so that group thinking is translated into group action.

3. Define responsibilities of leadership within a given group, which are appropriate to the capacity of the members.

4. Encourage creative action on the part of each individual.

5. Evaluate individual and group accomplishment by the group.

Anne Bachman[4] illustrated in her study how democratic pupil-

---

[3]Bockstruck and Jaeger, "Effective Student Leadership," Journal of Health, Physical Education, and Recreation. (December, 1959).

[4]Anne M. Backman, "Let your Students Set Their Own Goals," Journal of Health, Physical Education, and Recreation. (May, 1959).

teacher planning can be executed in a realistic way in her physical education classes.

At the beginning of the year the first class period was used by the students to decide upon their own aims and objectives under the guidance of their teacher. This was done in open class discussions with competent reporters taking the minutes of each group meeting. Committees from each group then met and combined the aims and objectives, from which the most ideal were selected. The investigator noted that these aims and objectives were not necessarily ideal by physical education standards, but they were their own and the students derived much from them in attempting to achieve the aims and objectives that they had set.

The students also selected an evaluating procedure in which they helped administer weekly skill tests and record improvement of each class member. Squad leaders met weekly to discuss the progress of the class and noted ways in which the class could be improved.

In addition, the students were allowed to work on various projects during the course of the year to improve the class. Committees were set up to eliminate the time wasted in getting equipment to and from a play area, eliminate tardiness to classes and to improve performance, sportsmanship, et cetera.

In evaluating the results of this study the teacher noted the democratic methods used during the school year contributed to improvement in many areas. These improvements included better group cooperation, greater student interest, improved performances in the various skills, and better sportsmanship. The opportunities for leadership also provided for the growth of the students in this area of development.

In an article by Soar[5] attention was brought to focus upon the transition which often takes place between the environment of the primary classroom and that of the upper grades. Interest, willingness, spontaneity, and enthusiam are some of the ingredients of the lower elementary level, whereas an atmosphere of passive resistance, hostility, lack of freedom, and pent-up tensions often describe the classroom in the upper grades and high school.

The author went on to investigate some of the causes of poor teacher-pupil relations and he has brought to light some interesting facets of this problem. In a review of a study by Hughes and Associates[6] the findings show that the excessive use of dominative functions were demonstrated by the fact that 80 per cent of all records showed that the teachers were dominative in over 50 per cent of their total teaching acts. Those teachers studied were selected as being outstandingly good within a progressive school system.

Similar work by Flanders[7], as reviewed by Soar, indicated that differences in teacher classroom methods were reflected in differences in students' attitudes and motivation. His study suggests that a greater liking for the teacher and improved motivation occurred in classrooms where

---

[5]Robert S. Soar, "The Effect of Teacher's Classroom Methods and Personality on Pupil Learning," High School Journal, (May, 1961).

[6]Marie Hughes, et al., "Development of the Means for the Assessment of the Quality of Teaching in Elementary Schools," Final Report, U.S. Office of Education, (Project 353, University of Utah, 1959). (Robert S. Soar, ibid., pp. 289-293).

[7]N. A. Flanders, "Teacher-Pupil Contacts and Mental Hygiene," Journal of Social Issues, 15: 30-34 (1959). (Robert S. Soar, ibid.).

the students had increased opportunity for the expression of their own ideas and feelings. In those classrooms in which attitudes are less desirable, the teacher spends more time lecturing and often gives more directions and criticism.

Soar also makes reference to his study of teacher personality and attitudes. He concluded that the teacher with scores indicating high social skills (as measured by the Minnesota Multiphasic Inventory) differed in the way they taught from teachers who appeared less socially skilled. "Socially skilled" in this context means the ability of a person to be comfortable and at ease with other people and with himself: who is confident, self-assured, and skillful in establishing harmonious working and social relationships with other people. Self-direction and pupil participation in decision-making were more typical of classrooms of the more skilled teachers. In addition, the social skills which pupils learned in the classroom (skills, cooperative planning, and work) were greater in the classrooms of the skilled teachers than they were in the classrooms of less skilled teachers.

A commonly accepted objective of physical education is to teach physical skills for leisure time use, but how many physical education instructors actually analyze the leisure time interest of the student? It is unfortunate that few physical educators allow their students to have a part in the planning of activities.

Dr. Vendien[8] based her doctoral dissertation on the study of leisure time participation in physical recreational activities. In this

---

[8]Lynn Vendien, "Are You Teaching Leisure Time Skills?" Journal of Health, Physical Education, and Recreation, (November 1960).

study, girls in Michigan high schools were asked to list the activities presented in their physical education classes; to indicate the school-sponsored out-of-class activities in which they participated; to list their own leisure time (not school-sponsored) activity interests; and to answer questions about leisure time pursuits that they did not, but in which they would like to take part. A stratified random sampling was used in this study.

The results of this study revealed that ten leisure time activities did not appear in any part of the school program. Outing activities predominated in the list of skills not included in school programs - boating, tobogganing, fishing, horseback riding, hiking, camping, cycling, horseshoe pitching, rope skipping, and archery. The girls indicated an interest in learning more about water skiing, diving, golf, fencing, cheerleading, archery, horseback riding, bowling, and tennis.

The new activities in which girls indicated an interest for participation were horseback riding, water skiing, swimming, skiing, golf, and tennis. In most cases these activities were not taught because of the lack of facilities, no one to teach the skill, lack of skill to participate, lack of time, and no one with whom to participate in the activity.

It can be said without disagreement that all students like to do things in which they were most interested and that the learning process is at the same time greatly increased. Studies show that participation in recreational sports in adult years seems to depend primarily upon childhood and youth experiences, for satisfying skills learned in early life are not easily forgotten.

To make the democratic atmosphere of the physical education class

more meaningful there should be more opportunity for student selection of activities which are leisure time oriented.

Many changes have taken place in education since the days of the school master with a hickory stick to the present day when counseling has come to have so great a place in the school program. The teacher's role has not been discounted but rather, his knowledge, experience, and authority are coming to be used with greater and deeper understanding in relationship to the group or the pupil.

Frequently teachers have been known to wonder why their pupils did not more readily perceive the purposes set by the teacher, and put forth in all-out effort toward the achievement of those goals. In all probability the teacher's conception of meaningful purposes and outcomes attained from a particular subject or activity differ considerably from the views held by the students. Likewise, there are differences of viewpoint and differences of purpose among pupils.

In essence, the task of the teacher is to find out what his students are most interested in learning and shape his education toward that end. The more difficult course, but attainable to some degree, would be to find some means of stimulating the pupil's interest in an activity selected by the teacher and then to proceed to educate him accordingly.

Because almost every teacher has attained adulthood, the intervening years of experience since childhood tend to dim the experiences of childhood, thus making it difficult for the adult mind and the child's mind to see alike or think in like terms. As a result, also a mistake is sometimes made of trying to take too great a leap at once as compared with step-by-step progress.

When a teacher makes a determined effort to understand the

purposes of the students, the teacher will then be a real inspiration to the pupil, and the pupil can even inspire the teacher to better teaching. Better education will result because the aims of pupil and teacher have been brought closer together.[9]

It is the opinion of Todd[10] that educating youth for democracy involves more than verbal instruction and that the understanding of democracy would be more applicable to daily living by experience in the classroom. In her study, effort was made to translate democratic principles into action situations in the physical education class so as to: increase interaction through participation; increase group cohesion; decrease the number of rejected, isolated, and near-isolated students; improve physical and communicative skills; and induce pupil cognizance of the process, values, and limitations of democracy.

Methods used by Todd in her democratic methods of teaching were joint pupil-teacher planning, selection of squads for each activity on the basis of sociometric tests, opportunities for self-direction, and self and peer evaluation.

According to Todd, this method of instruction produced a more positive interaction between individuals, greater group cohesion and expressed approval and satisfaction by a large majority of the students.

Some work has been done by social psychologists relative to the democratic environment. Lewin, Lippitt, and White[11], completed a study

---

[9]Dean M. Schweickhard (ed.), "Pupil-Teacher Aims," Minnesota Journal of Education, (October, 1959).

[10]Francis Todd, "Democratic Methodology in Physical Education," Research Quarterly, (March, 1952), pp. 106-110.

[11]Kurt Lewin, Ronald Lippitt, and Ralph White, "Patterns of Aggressive Behavior in Experimentally Created 'Social Climates'," Journal of Social Psychology, (May, 1939), pp. 271-299.

in patterns of aggressive behavior in experimentally created atmospheres for 10-year-old boys. The purpose of their study was to investigate the effect of certain kinds of leadership on the social climate of children's groups and the ways in which children respond in these climates.

In the first experiment of this study, Lippitt compared two comparable groups. One group was controlled autocratically while the other was under democratic leadership. In a second experiment, Lippitt and White added a "laissez-faire" type of environment in which four comparable clubs of 10-year-old boys passed successively through club periods of five democratic periods, five autocratic periods, and two "laissez-faire" periods. Each club was equated to ensure the same pattern in each group. The club activities included mask making, mural painting, soap carving, model airplane construction, etc.

Stenographic records of each club meeting included all social interaction andan analysis of group structure. Parents and teachers were interviewed; each boy was given the Rorschach test and a Moreno-type questionnaire, and was interviewed three times.

The results of this study indicated significat differences in the effects of the three social climates. In the first experiment, hostility was found to be thirty times as frequent in the autocratic as in the democratic group. Aggression was eight times as frequent. Evidence indicated that aggression and hostility were due to the repressive influence of the autocrat, since there were outbursts of aggression on the days of transition to a freer atmosphere. Aggression also appeared to rise sharply whenever the autocrat left the room. However, the study revealed that

19 out of 20 boys liked their democratic leader better than their autocratic leader, and 7 out of 10 also liked their "laissez faire" leader better. Under a democratic environment the group was held together by common goals and they continued to work even while the leader was gone.

The Yearbook of the Association for Supervision and Curriculum[11] discussed to some extent the importance of personal involvement by the student in democratic planning. However, this publication warned that "by allowing children to plan only about things which do not matter to them, we run the risk of teaching them that democratic processes do not work. Pupil-teacher planning that is staged, that requires children to mouth meaningless ritual or to guess what plans the teacher has already decided, can negate the importance of planning and restrict creative thinking."

## Summary

In conclusion, various aspects of related literature were noted relative to the democratic environment. In the studies completed by Collins and Roth, both investigated the social aspects in regard to group relations in physical education classes. Bookstruck and Jaeger studied democratic student leadership, while Anne Bachman illustrated execution of pupil-teacher planning. Dr. Vendien emphasized student selection of class activities. A study done by Soar reviewed the differences in teacher classroom methods and teacher personality and attitudes. Todd's study applied the

---

[11]Arthur W. Combs (ed.), Perceiving, Behaving, Becoming, Yearbook of the Association for Supervision and Curriculum Development, National Education Association, (Washington, D. C.: National Education Association, 1962), p. 155.

processes, principles and values of democracy to physical education. The area of democratic environment has also been explored by social psychologists, Lewin, Lippitt and White.

After reviewing the foregoing studies it can be concluded that the use of democratic methods in the classroom had significant affect on the attitudes and achievement of the students involved.

# CHAPTER III

## PROCEDURE

The selection of the experimental and control groups for this study was done randomly. From the six high school boys physical education classes, these two groups were selected because of comparable size. The experimental group of 23 members met during the second period of the morning on Monday and Thursday and the control group of 22 were scheduled for the second period in the afternoon of the same day. Both classes consisted of students from grade levels nine through twelve. The mean grade levels were 10.695 for the experimental group and 10.454 for the control group.

Since no equating procedures were possible for this study, a comparison was made between the experimental and control groups after the initial testing. The "t" values for the Hamphill Knowledge Test and the Adams Sport-Type Motor Educability Test showed no significant difference in mean scores between groups. There was a significant difference in the Harvard Step Test, with the control group demonstrating a statistically better mean score. Table 1 on page 18 shows the results of comparison for the initial testing.

The experimental group met during special sessions for two one-hour periods outside of the regularly scheduled class the first week in October. The purposes of these meetings were to select the aims and objectives for the year, to consider activities that would best enable them to achieve their objectives, and to decide upon the methods of selecting squads and squad leaders. The physical education instructor served only

Table 1

MEANS OF EXPERIMENTAL AND CONTROL GROUPS IN THE INITIAL TESTING, STANDARD ERROR OF DIFFERENCE BETWEEN MEANS, "t" VALUES AND LEVEL OF CONFIDENCE

| Test | Exp. Group Mean | Con. Group Mean | S.E. of Dif. Between Means | "t" Values | Sig. at .02 level |
|---|---|---|---|---|---|
| Hemphill Knowledge | 23.65 | 25.45 | 1.095 | 1.643 | No |
| Adams Sport-Type Motor Educability | 64.347 | 64.909 | 1.757 | .032 | No |
| Harvard Step | 96.304 | 99.318 | 1.0463 | 2.881 | Yes |

in an advisory capacity at these meeting.

After open class discussion, each student was asked to write on paper two aims and objectives that he felt would be appropriate for the class. Upon collection of the aims and objectives from the students, the instructor typed them on a ditto, combining those with the same thought. At the next class meeting each student received a copy of the ditto for his own reference and study. The class then voted on the aims and objectives they felt would be best for their class. These aims and objectives are presented in Chapter IV.

In the initial class meeting of the school year both classes had been asked to complete a Leisure Time Survey and Pupil Inventory of Activities.[1] From this survey only the experimental group was allowed freedom

[1] See Appendix A, p. 39.

of choice in activities for the year. Opportunities for choice also included activities not mentioned on the survey.

Further choice was given relative to the selection of squads and squad leaders. Again, the class was opened for discussion and suggestions as to the procedure they would favor using. The class voted to select four squad leaders who would in turn select their own squads for an activity unit. At the end of a unit the squad leader would appoint a new leader from his squad and this new leader, along with the three other new squad leaders, met privately for the formation of new squads. This procedure continued throughout the year, allowing all class members to serve as squad leaders for at least one unit.

During the time a student was a squad leader he was given freedom to direct the squad as he saw fit. At various times he was also given opportunity to lead the class in calisthenics, assist in taking roll, assist in administering skill tests, evaluating progress, et cetera.

Throughout the year periodic class meetings were held to evaluate class progress and plan class activities. On several occasions the class voted to extend the duration of a unit or limit the activity to a shorter period of time, depending on their progress. A committee was also appointed by the class to deal with tardiness, discipline and any other problem during the course of the year.

In this study the control group was taught with the usual teacher-directed classroom procedures. The aims and objectives for the year were teacher-selected and there was no freedom of choice in class activities.

For the purpose of this investigation, identical tests were

administered to both the experimental group and the control group to determine any difference between the student centered classroom and the teacher dominated classroom method of instruction. These tests included tests of knowledge, physical fitness, and motor skills. The tests were administered twice during the year to both groups, the first week in October and again the second week of May of that school year. A checklist of outcomes was also administered at the time of the second testing to determine outcomes of each group for the year.

All students in the experimental and control classes were tested under the same conditions. All tests were given in the same sequence so as not to cause a variability in the results. The scores of the tests were recorded on the score cards as shown in Appendix E, page 49, and filed for use in the second testing at the end of the school year. Care was given to assure similar conditions in the retest.

## Knowledge Test

The Hemphill Knowledge Tests for Boys[2] was used for this phase of the testing. This test has been designed for secondary-school boys to determine knowledge of the various physical activities. For this study the students were tested in their knowledge of the following activities: football, basketball, soccer, volleyball, handball, tennis, and wrestling. These areas of the test are included in Appendix D. To insure more valid results this particular test was administered in a regular classroom.

---

[2]Ray Hemphill, "Information Tests in Health and Physical Education for High School Boys," Research Quarterly, Vol. III, No. 4 (December, 1932), p. 83.

## Physical Fitness Test

The Harvard Step Test[2] was employed for this phase of testing because of the economy of administration offered in this type of test.

### Equipment

Benches 20 inches high

Stop watches

Score cards and pencils

### Procedure

The class was oriented in the purpose and procedures of the Harvard Step Test.

At the time of testing the investigator directed the class to count off by two's and half of the class was instructed to stand at attention in front of the benches preparatory to the command "Go!". The subject then placed one foot on the bench, with legs straightened and body erect, and immediately stepped down again one foot at a time. The cadence was counted by the investigator: up-2-3-4, up-2-3-4, the command coming every two seconds. The exercise was kept up for five minutes continuously unless the subject stopped from exhaustion before the end of that time. Each observer made sure that the subject stepped fully up on the bench with-out assuming any crouching position, and that he kept the proper pace.

As soon as the subject stopped at his own accord, or was stopped by the examiner at the end of 5 minutes, he sat down. The observers then noted the duration of the exercise and recorded the results on the score card. The

---

[2]C. H. McCloy and Norma D. Young, Tests and Measurements in Health and Physical Education, 3rd ed. (New York: Appleton-Century-Crofts, Inc., 1954), pp. 303-304.

observers took the pulse count from 1 minute to 1½ minutes immediately after the exercise and recorded the score on the score card. The remaining half of the class was then tested repeating the same procedure.

Scoring

After the time and pulse beat had been obtained, the final score was obtained from a short form scoring table[4] which was developed for this test.

The short form of scoring the Harvard Step Test was proposed by Johnson and Robinson at the Harvard Fatigue Laboratory.[5] The exercise phase is the same as for the regular test; however, the pulse is counted once from one minute to one minute thirty seconds. The following formula is used to obtain the Physical Efficiency Index (PEI) score:

$$PEI = \frac{\text{Duration of Exercise in Seconds X 100}}{5.5 \text{ X Pulse Count}}$$

Skill Testing

For economy of administration in this phase of testing the Adams Sport-Type Motor Educability Test[6] was employed. This test measures two types of motor educability, stunt-type and sport-type. This test includes a wall volley test, a lying tennis ball catch, a ball bounce test, and a basketball shooting test.

---

[4]See Appendix D, p. 47.

[5]Reported by Edward C. Schneider and Peter V. Karpovich, Physiology of Muscular Activity, 4th ed. (Philadelphia: W. B. Saunders Company, 1953), p. 270. As cited by H. Harrison Clarke, Application of Measurement to Health and Physical Education, (Englewood Cliffs: Prentice-Hall, Inc., 1961), pp. 106-107.

[6]Arthur R. Adams, "A Test Construction Study of Sport-Type Motor Educability Test for College Men," Microcarded Doctoral Dissertation, Louisiana State University, 1954, cited by H. Harrison Clarke, loc. cit., p. 354.

Procedure

Four squad leaders were thoroughly briefed and used as assistants in this test. The class was divided into four squads and then rotated to each station.

Wall Volley Test: The subject stood three feet from a wall and volleyed a volleyball above a line drawn on the wall 10½ feet above the floor. The score on each trial was the number of consecutive volleys up to 10. The total score was the sum of scores on 7 trials.

Lying Tennis Ball Catch: The subject lay flat on his back, holding a tennis ball. He then threw the ball 6 feet or higher in the air and caught it in either hand, while remaining in the lying position. The score was the number of successful attempts in 10 trials.

Ball Bounce Test: The subject stood in the middle of a 6 foot circle and attempted to volley a volleyball on the top end of a bat. The score on each trial was the number of consecutive volleys up to 10. The total score was the sum of scores on 10 trials.

Basketball Shooting Test: The subject attempted 20 free throws from the foul line. The score was the number of baskets made.

Scoring

The raw score was placed on a score card[7] and these four scores were then totaled upon completion of the test to obtain the final score.

Checklist of Outcomes

To determine the outcomes of both the experimental and the control groups for the year, an evaluation checklist by Cowell[8] was filled out by

---

[7]See Appendix E, p. 49.

[8]Charles C. Cowell, "Validating an Index of Social Adjustment for High School Use," Research Quarterly, Vol. XXIX, No. 1 (March, 1958), p. 7, cited by H. Harrison Clarke, loc. cit., p. 258.

each student at the time of retesting in May. It was requested that the student omit his name from the checklist and that he use his best judgement in its completion. The only identification placed on the paper was the section of the class so that comparisons could later be made between the control and experimental groups.[9]

[9]See Appendix C, p.45.

# CHAPTER IV

## RESULTS OF THE STUDY

One of the purposes of this study was to determine the ability of high school students to plan their own aims and objectives in physical education. The results of this study indicated that students on this level possessed the ability to develop aims and objectives of reasonable value. The aims and objectives as selected by the experimental class are as follows:

1. To learn the rules and skills for a variety of physical education activities.
2. To work toward better physical development.
3. To develop the body for better strength, coordination and agility for more enjoyment in physical education activities.
4. To learn better sportsmanship in our class.
5. To develop into good leaders.
6. To work for better team work.
7. To enjoy ourselves in physical education.

This study also indicated that the high school physical education students used in this study possessed the ability to select activities with aims and objectives in mind. The activities and the duration of each activity, as selected by the experimental group are listed below.

Activities Selected by the Experimental Group and the Duration of the Activity

| | |
|---|---|
| Speedball | 4 Weeks |
| Flickerball | 4 Weeks |
| Volleyball | 4 Weeks |

| | |
|---|---|
| Basketball | 4 Weeks |
| Stunts, Tumbling, Apparatus, Weight Lifting | 4 Weeks |
| Badminton, Handball | 5 Weeks |
| Mass Activities and Self Testing | 3 Weeks |
| Softball | 2 Weeks |
| Tennis | 3 Weeks |

The purpose of the testing in this study was to determine if any signigicant changes had occurred in the achievement of goals in a physical education class that was given ample opportunity for democratic pupil-teacher planning. The basis for comparison with a control group was the Hemphill Knowledge Test for Boys, the Adams Sport-Type Motor Educability Test, the Harvard Step Test, and an evaluation checklist of outcomes. Following the collection of the data, it became necessary to select a statistical instrument that would determine the significance of the difference between the initial test and the retest for both groups, and also between groups.

## Statistical Procedure

This study assumed the null hypothesis in analysis of the differences between the pre- and post tests for both groups and between the groups. This hypothesis, as stated by Garrett,[1] "asserts that there is no true difference between two population means, and the difference found be-

---

[1]Henry E. Garrett, Statistics in Psychology and Education, (New York: Longmans, Green and Company, 1959), p. 212.

tween two samples is, therefore, accidental and unimportant."

To test the significance of difference between means of each group on each test (test and retest) and between the means of the experimental and control groups the "t" technique was used. Upon determination of "t" values for the comparisons of the means, each "t" value was checked for significance of difference with the Table of "t", as found in Garrett's book on statistics.

Complete details of the mathematical procedure employed in the treatment of the data for this study is presented in Appendix F, pages 51-78.

## Results of Comparison Between Test and Retest

### Hemphill Knowledge Test

Experimental Group

The mean scores were 23.65 for the initial test and 26.48 for the retest. The sum of the mean difference showing an increase of 2.83. The standard error of the mean difference between the initial test and retest was .69. With 22 degrees of freedom and a "t" value of 4.10, the null hypothesis was rejected at the .02 level of confidence.

Control Group

The mean scores were 25.45 for the initial test and 25.73 for the retest. The sum of the mean difference showed an increase of .28. The standard error of the mean difference between the initial test and retest was .59. With 21 degrees of freedom and a "t" value of .474, the null hypothesis was accepted with no significant difference indicated between means.

Adams Sport-Type Motor Educability Test

Experimental Group

The mean scores were 64.35 for the initial test and 82.70 for the retest. The sum of the mean difference showed an increase of 18.35. The standard error of the mean difference between the initial test and retest was 1.18. With 22 degrees of freedom and a "t" value of 15.55, the null hypothesis was rejected at the .02 level of confidence.

Control Group

The mean scores were 64.91 for the initial test and 76.05 for the retest. The sum of the mean differences showed an increase of 11.14. The standard error of the mean difference between the initial test and retest was 1.23. With 21 degrees of freedom and a "t" value of 9.056, the null hypothesis was rejected at the .02 level of confidence.

Harvard Step Test

Experimental Group

The mean scores were 96.30 for the initial test and 106.95 for the retest. The sum of the mean difference showed an increase of 10.65. The standard error of the mean difference between the initial test and retest was .79. With 22 degrees of freedom and a "t" value of 13.48, the null hypothesis was rejected at the .02 level of confidence.

Control Group

The mean scores were 99.32 for the initial test and 100.68 for the retest. The sum of the mean difference showed an increase of 1.36. The standard error of the mean difference between the initial test and retest was .67. With 21 degrees of freedom and a "t" value of 2.03, the

null hypothesis was accepted with no significant difference indicated between means.

### Checklist of Outcomes

Experimental Group

The mean score of the checklist was 76.56. This instrument was administered only at the time of retesting at the conclusion of the school year.

Control Group

The mean score of the checklist was 69.63. This instrument was administered only at the time of retesting at the conclusion of the school year.

## Results of Comparisons Between Experimental and Control Groups

### Hemphill Knowledge Test

The mean differences of the scores on the test and retest for the experimental group was 2.83 and for the control group .28. The standard error of the difference between $mean_1$ difference and $mean_2$ difference was .91. With 44 degrees of freedom and a "t" value of 2.81, the null hypothesis was rejected at the .02 level of confidence. The difference is significant.

### Adams Sport-Type Motor Educability Test

The mean difference of the scores on the test and retest for the experimental group was 18.35 and for the control group 11.14. The standard error of the difference between $mean_1$ difference and $mean_2$ difference was 1.70. With 44 degrees of freedom and a "t" value of 4.24, the

null hypothesis was rejected at the .02 level of confidence. The difference is significant.

### Harvard Step Test

The mean difference of the scores on the test and retest for the experimental group was 10.65 and for the control group 1.36. The standard error of the difference between $mean_1$ difference and $mean_2$ difference was 1.04. With 44 degrees of freedom and a "t" value of 8.93, the null hypothesis was rejected at the .02 level of confidence. The difference is highly significant.

### Checklist of Outcomes

The mean of the scores for the experimental group was 76.56 and for the control group 69.63. The standard error of the difference between $mean_1$ and $mean_2$ was 1.70. With 44 degrees of freedom and a "t" value of 3.90, the null hypothesis was rejected at the .02 level of confidence. The difference is significant.

## Summary of Data Analysis

A comparison of the means of the test scores in initial testing revealed that there was no significant difference in the ability of the experimental and the control groups. The results of the retesting for the experimental group showed significant improvement over the initial testing in all test mean scores. However, the control group showed a significant improvement in only the Adams Sport-Type Motor Educability Test at the time of the second test.

The results of the retesting showed the experimental group to have achieved at a more significant level in all tests than the control group.

All mean scores, mean score differences, and "t" values for both the experimental and control groups are presented in Tables 2 and 3 on pages 32 and 33.

TABLE 2

MEAN SCORES, "t" VALUES AND LEVEL OF CONFIDENCE
FOR BOTH GROUPS ON ALL PRE- POST TEST RESULTS

| Test | Experimental Group | | | | | Control Group | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Test I | Test II | Mean Diff. | "t" Value | Sig. at .02 level | Test I | Test II | Mean Diff. | "t" Value | Sig. at .02 level |
| Hemphill Knowledge | 23.65 | 26.48 | 2.82 | 4.10 | yes | 25.45 | 25.73 | .28 | .474 | no |
| Adams Sport-Type Motor Educability | 64.35 | 82.70 | 18.35 | 15.55 | yes | 64.91 | 76.05 | 11.14 | 9.056 | yes |
| Harvard Step | 96.30 | 106.95 | 10.65 | 13.48 | yes | 99.32 | 100.68 | 1.36 | 2.03 | no |

TABLE 3

MEAN DIFFERENCES OF THE SCORES ON TEST AND RETEST FOR BOTH GROUPS, STANDARD ERROR OF DIFFERENCE BETWEEN MEAN DIFFERENCE, "t" VALUES AND LEVEL OF CONFIDENCE

| Test | Exp. Group Mean Difference | Cont. Group Mean Difference | S E of Diff. Between Mean Difference | "t" Value | Significance at .02 level |
|---|---|---|---|---|---|
| Hemphill Knowledge | 2.83 | .28 | .91 | 2.81 | yes |
| Adams Sport-Type Motor Educability | 18.35 | 11.14 | 1.70 | 4.24 | yes |
| Harvard Step | 10.65 | 1.36 | 1.04 | 8.93 | yes |
| Checklist of Outcomes | 76.56 | 69.63 | 1.70 | 3.90 | yes |

# CHAPTER V

## SUMMARY

At the commencement of this study two classes of comparable size were selected as a basis of comparison. These classes were selected randomly without equating procedures. During the school year only the experimental group was given extensive opportunities for democratic pupil-teacher planning. The control group class periods were planned in almost all instances by the instructor and all classroom activities were teacher-directed. Each group was tested at the beginning and again at the conclusion of the school year on a test and retest basis. These tests included a knowledge test, motor educability tests, and a physical fitness test. A checklist of outcomes was administered at the conclusion of the experimental period.

Comparisons were made between the mean differences on theinitial tests and retests within each group. Mean differences were then compared between groups to determine any significant changes. The null hypothesis was assumed in all instances of comparison. The "t" technique was employed to test this hypothesis at the .02 level of confidence, as found in the Table of "t".

## Conclusions

1. The results of this study indicate that democratic instructional methods contributed to greater achievement than autocratic methods in physical education for participating groups.

2. The control group showed a significant improvement in the

Adams Sport-Type Motor Educability Test, but not in the Harvard Step test or the Hemphill Knowledge Test.

3. The results of comparisons between the experimental and control groups indicated a significant difference on all tests and the checklist of outcomes. Each comparison indicated a higher level of achievement by the experimental group, with a highly significant difference on the Harvard Step Test.

4. Although it could not be measured objectively, this writer noted a higher level of cooperation, interest, and positive attitude demonstrated by the experimental group.

## Recommendations

Although this study indicated a significant difference in results obtained through the use of different methods of teaching considered herein, it is recommended that further studies be made on the democratically oriented classroom in the area of physical education. Further recommendations are as follows:

1. Studies should be made with classes meeting more than twice weekly.

2. Further studies of this nature should be made with homogeneous grade level groupings.

3. Further studies of this nature should be made with homogeneous ability groupings.

4. More extensive use of student leadership in physical education classes should be studied.

5. A study of this nature should be conducted using a wider variety of measuring instruments.

BIBLIOGRAPHY

Books

Brown, Cassidy, and Wiles. Supervision in Physical Education. Englewood Cliffs: Prentice-Hall, Inc., 1956.

Clarke, Harrison H. Application of Measurement. Englewood Cliffs: Prentice-Hall, Inc., 1961.

Combs, Arthur W., (ed.). Perceiving, Behaving, Becoming. Yearbook of the Association for Supervision and Curriculum Development, National Education Association. Washington: National Education Association, 1962.

Davis, Elwood C., and Wallis, Earl L. Toward Better Teaching in Physical Education. Englewood Cliffs: Prentice-Hall, Inc., 1962.

Garrett, Henry E. Statistics in Psychology and Education. New York: Longmans, Green and Co., 1959.

Karpovich, Peter V., and Schneider, Edward C. Physiology of Muscular Activity. 4th ed. Philadelphia: W. B. Saunders Co., 1953.

McCloy, C. H., and Young, Norma D. Tests and Measurements in Health and Physical Education. 3rd ed. New York: Appleton-Century-Crofts, Inc., 1954.

Articles and Periodicals

Backamn, Anne M. "Let Your Students Set their Own Goals," Journal of Health, Physical Education, and Recreation. (May, 1959).

Bookstruck and Jaeger. "Effective Student Leadership," Journal of Health, Physical Education, and Recreation. (December, 1959).

Cowell, Charles C. "Validating an Index of Social Adjustment for High School Use," Research Quarterly, Vol. XXIX, No. 1, (March, 1958), p. 7.

Flanders, N. A. "Teacher-Pupil Contacts and Mental Hygiene," Journal of Social Issues, 15 (1959), pp. 30-34.

Hemphill, Faye. "Information Tests in Health and Physical Education for High School Boys," Research Quarterly, Vol. III, No. 4, (December, 1932), p. 83.

Lewin, K., Lippitt, R., and White, R. "Patterns of Aggressive Behavior in Experimentally Created 'Social Climates'," Journal of Social Psychology. (May, 1939), pp. 271-299.

Schweickhard, Dean M., (ed.). "Pupil-Teacher Aims," Minnesota Journal of Education, (October, 1959).

Soar, Robert S. "The Effect of Teacher's Classroom Methods and Personality," High School Journal, (May, 1961).

Todd, Francis. "Democratic Methodology in Physical Education," Research Quarterly, Vol. XXIII, No. 1, (March, 1952), pp. 106-110.

Vendien, Lynn. "Are You Teaching Leisure Time Skills?" Journal of Health, Physical Education, and Recreation, (November, 1960).

Reports

Hughes, Marie, et al. "Development of the Means for the Assessment of the Quality of Teaching in Elementary Schools," Final Report, U. S. Office of Education. Project 353, University of Utah, 1959.

Unpublished Material

Collins, Arden B. "The Democratic Method Versus Test Score Method of Assigning Players and Captains and the Effects Upon Satisfactory Group Relations." Unpublished research study, Department of Physical Education, University of North Dakota, 1960.

Other

Adams, Arthur R. "A Test Construction Study of Sport-Type Motor Educability Test for College Men." Microcarded Doctoral Dissertation, Louisiana State University, 1954.

Roth, Clair M. "A Comparison of Selected Methods for Equalizing Competition in a Team Sport Activity Within Boys, Physical Education Classes." Unpublished Master's Thesis, Dept. of Physical Education, University of North Dakota, 1961.

# APPENDIX A

Leisure Time Survey and Pupil Inventory of Activities

What do I need to know to be able to participate with others

| In my neighborhood | In this school | At home with family | After I graduate | | I can do it as well as I need to | I can not do it as well as I need to | I can not do it and I don't want to | I can not do it but I want to learn |
|---|---|---|---|---|---|---|---|---|
| | | | | Touch football | | | | |
| | | | | Flag football | | | | |
| | | | | Soccer | | | | |
| | | | | Speedball | | | | |
| | | | | Flickerball | | | | |
| | | | | Volleyball | | | | |
| | | | | Badminton | | | | |
| | | | | Handball | | | | |
| | | | | Basketball | | | | |
| | | | | Self testing | | | | |
| | | | | Wrestling | | | | |
| | | | | Stunts & tumbling | | | | |
| | | | | Rhythms | | | | |
| | | | | Ice Skating | | | | |
| | | | | Track & field | | | | |
| | | | | Golf | | | | |
| | | | | Softball | | | | |
| | | | | Tennis | | | | |
| | | | | | | | | |

Brown, Cassidy and Wiles, Supervision in Physical Education, (Englewood Cliffs: Prentice-Hall Inc., 1956).

APPENDIX B

## The Memphill Knowledge Test for Boys

### Basketball Technics and Methods

+ 1. During a pivot one foot should be in contact with the floor until the ball is passed.

o 2. The palm of the hand should meet the ball first in catching it.

+ 3. The faster a man is coming in, the easier the pass to him should be made.

+ 4. The best players come to meet the passes.

+ 5. The bounce pass should hit the floor even with the guard's foot.

+ 6. The palm of the goal-shooter's hand should be horizontal when coming in fast from the front.

o 7. Tall men should stay away from the backboard on the free throw lane when a free throw is being taken.

o 8. The last pass of a tip-off play should be received in the corner of the court.

o 9. The best teams have at least 20 plays to use from tip-off.

o 10. The best teams use the dribble to advance the ball rapidly.

### Football Technics and Methods

o 1. Right-handed passers should advance their right foot when throwing passes.

+ 2. Ball carriers should keep the ball on the side opposite any would-be tackler.

o 3. The defensive ends should play as low as the defensive guards on the same team.

o 4. The place-kicker should keep his eye on the goal while kicking.

+ 5. Rushing the passer is an aid in pass defense.

+ 6. A good tackler has a wide base with the body weight low at the instant of contact.

o 7. The defensive fullback should wait for the advancing ball-carrier.

+ 8. The nearer the backfield man is to the line of scrimmage, the easier should be the pass from center.

+ 9. The hands should touch the ball first in catching punts.

o 10. All offensive men are eligible to receive forward passes.

Soccer

o 1. The hands should be used on the ball in making most passes in soccer.

+ 2. The goal-tender should stay between the goal and the ball.

o 3. When the attackers are coming in close to the goal, the goal-tender should advance to meet the ball.

Handball

+ 1. The serve should be made with the open palm.

o 2. The best players strike all returns at arms length.

+ 3. A return should generally be so placed that the ball will bounce away from the opponent.

Tennis

+ 1. The follow-through should be a part of every serve.

o 2. Position on the court should be maintained with one man near the net at the center and the other near the center of the baseline (doubles).

o 3. The best servers crouch when making the serve.

Volleyball

o 1. The server should use a side-arm swing.

+ 2. Returns should be made to the opponent's backcourt.

o 3. All the team should shift to the side that the serve comes on.

Wrestling

1. The best wrestlers keep the hands and arms

.....extended
....¾...in close to the body

(continued next page)

.....out to the sides
.....above the shoulders
.....on the mat

2. The object in applying any hold should be to

.....cause pain
.....break bones
.....choke your man
.....touch the shoulders of opponent to the mat
.....knock the opponent out

# APPENDIX C

OUTCOMES OF ACTIVITIES: AN EVALUATION CHECK-LIST

| | To What Extent Did I Learn: | (5) A Very Great Deal | (4) A Great Deal | (3) Somewhat | (2) Very Little | (1) Not at All |
|---|---|---|---|---|---|---|
| 1. | To sacrifice my own personal "whims" or desires for the group or team? | | | | | |
| 2. | To test myself - to see if I could "take it," endure hardship and "keep trying" to do my best under adversity? | | | | | |
| 3. | To overcome awkwardness and self-consciousness? | | | | | |
| 4. | To recognize that the group can achieve where the individual alone cannot? | | | | | |
| 5. | That each team member has a unique or special contribution to make in the position he plays? | | | | | |
| 6. | To share difficult undertakings with my "buddies" because of struggling together for a goal? | | | | | |
| 7. | To respect the skill and ability of my opponents and be tolerant of their success? | | | | | |
| 8. | To make friendships with boys from other schools and to maintain good relationships in inter-school games? | | | | | |
| 9. | To feel the school team helped reduce "cliques" and factions by developing loyality and community of interests? | | | | | |
| 10. | To consider and practice correct health and training routine, eg. eating, sleeping, avoidance of tobacco, etc? | | | | | |
| 11. | To "take turns" and to "share"? | | | | | |
| 12. | To develop physical strength, endurance and a better looking body? | | | | | |
| 13. | To be loyal and not "let my buddy, the coach, team, or school down"? | | | | | |
| 14. | To give more than I get - not for myself but for an ideal or for one's school, town, or country? | | | | | |
| 15. | To develop a sense of humor and even to be able to laugh at myself occasionally? | | | | | |
| 16. | To think and act "on the spot" in the heat of a game? | | | | | |
| 17. | To understand the strategy - the "why" of the best methods of attack and defense in games? | | | | | |
| 18. | To understand and appreciate the possibilities of the body with respect to skill, speed, endurance, and quickness of reactions? | | | | | |
| 19. | That in sports there is no discrimination against talent? It is performance and conduct and not the color of one's skin or social standing that matters. | | | | | |
| 20. | That nothing worth while is accomplished without hard work, application, and the "will to succeed"? | | | | | |

(From "Our Function Is Still Education!" The Physcical Educator, March 1957, pp. 6-7.)

# APPENDIX D

## SCORING TABLE FOR HARVARD STEP TEST

| Duration of Effort | Heart Beats from 1 Minute to 1½ minutes in recovery | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65-69 | 70-74 | 75-79 | 80-84 | 85-89 | 90-over |
| 0-29" | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 0'30"-0'59" | 20 | 15 | 15 | 15 | 15 | 10 | 10 | 10 | 10 | 10 | 10 |
| 1'0"-1'29" | 30 | 30 | 25 | 25 | 20 | 20 | 20 | 20 | 15 | 15 | 15 |
| 1'30"-1'59" | 45 | 40 | 40 | 35 | 30 | 30 | 25 | 25 | 25 | 20 | 20 |
| 2'0"-2'29" | 60 | 50 | 45 | 45 | 40 | 35 | 35 | 30 | 30 | 30 | 25 |
| 2'30"-2'59" | 70 | 65 | 60 | 55 | 50 | 45 | 40 | 40 | 35 | 35 | 35 |
| 3'0"-3'29" | 85 | 75 | 70 | 60 | 55 | 55 | 50 | 45 | 45 | 40 | 40 |
| 3'30"-3'59" | 100 | 85 | 80 | 70 | 65 | 60 | 55 | 55 | 50 | 45 | 45 |
| 4'0"-4'29" | 110 | 100 | 90 | 80 | 75 | 70 | 65 | 60 | 55 | 55 | 50 |
| 4'30"-4'59" | 125 | 110 | 100 | 90 | 85 | 75 | 70 | 65 | 60 | 60 | 55 |
| 5' | 130 | 115 | 105 | 95 | 90 | 80 | 75 | 70 | 65 | 65 | 60 |

NORM (SHORT FORM)

Below 50 - Poor
50 - 80 - Average
Above 80 - Good

INSTRUCTIONS FOR THE USE OF TABLE:

1) Find the appropriate time for duration of effort.
2) Then find the appropriate column for the pulse count.
3) Read off the score where the line and column intersect.
4) Interpret according to the scale or norm given.

# APPENDIX E

# INDIVIDUAL TEST RECORDING CARD

| NAME_____ | GROUP_____ | | |
|---|---|---|---|
| **Harvard Step Test** | **INITIAL TEST** | **RETEST** | **DIFFERENCE** |
| Pulse rate (1 to 1½ min.) | | | |
| **Skill Testing** | **INITIAL TEST** | **RETEST** | |
| 1. Wall volley (sum of 7 trials) | | | |
| 2. Lying tennis ball catch (sum of 10 trials) | | | |
| 3. Ball bounce (sum of 10 trials) | | | |
| 4. Basketball shoot (sum of 20 trials) | | | |
| TOTAL (sum of all skill tests) | | | DIFFERENCE |

APPENDIX F

## COMPUTATION OF THE STANDARD DEVIATION AND STANDARD ERROR OF THE MEAN IN THE INITIAL TEST FOR THE EXPERIMENTAL GROUP

### Memphill Knowledge Test

| Score | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 30 | 1 | 5 | 5 | 25 |
| 28 | 1 | 4 | 4 | 16 |
| 27 | 1 | 3 | 3 | 9 |
| 26 | 3 | 2 | 6 | 36 |
| 25 | 3 | 1 | 3 | 9 |
| 24 | 4 | 0 | 0 | 0 |
| 23 | 3 | -1 | -3 | 9 |
| 22 | 1 | -2 | -2 | 4 |
| 21 | 1 | -3 | -3 | 9 |
| 20 | 3 | -4 | -12 | 144 |
| 19 | 2 | -5 | -10 | 100 |
| | N=23 | | | $\Sigma fd^2=361$ |

$M = \frac{X}{N}$ $\qquad M = 23.65$

Standard deviation

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{361}{23}} = \sqrt{15.694} = 3.961$$

Standard Error of the mean

$$\sigma M \text{ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{3.96}{\sqrt{23}} = \frac{3.96}{4.80} = .825$$

## COMPUTATION OF THE STANDARD DEVIATION AND STANDARD ERROR OF THE MEAN IN THE INITIAL TEST FOR THE CONTROL GROUP

### Hemphill Knowledge Test

| Score | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 30 | 1 | 5 | 5 | 25 |
| 29 | 2 | 4 | 8 | 64 |
| 28 | 2 | 3 | 6 | 36 |
| 27 | 3 | 2 | 6 | 36 |
| 26 | 3 | 1 | 3 | 9 |
| 25 | 1 | 0 | 0 | 0 |
| 24 | 6 | -1 | -6 | 36 |
| 23 | 3 | -2 | -6 | 36 |
| 19 | 1 | -3 | -3 | 9 |
| | N=22 | | | $\Sigma fd^2=251$ |

$M = \frac{\Sigma}{N}$ $\qquad M = 25.45$

Standard deviation

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{251}{22}} = \sqrt{11.409} = 3.377$$

Standard Error of the mean

$$\sigma_{M\ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{3.377}{\sqrt{22}} = \frac{3.377}{4.69} = .720$$

COMPUTATION OF STANDARD ERROR OF DIFFERENCE BETWEEN MEANS FOR THE EXPERIMENTAL AND CONTROL GROUPS IN THE INITIAL TEST AND THE VALUE OF "t"

Hemphill Knowledge Test

| Experimental Group | | Control Group | |
|---|---|---|---|
| $M_1$ | = 23.65 | $M_2$ | = 25.45 |
| $\sigma_1$ | = 3.961 | $\sigma_2$ | = 3.377 |
| $N_1$ | = 23 | $N_2$ | = 22 |
| $\sigma M_1$ | = .825 | $\sigma M_2$ | = .720 |

S E of difference between $M_1$ and $M_2$

$$\sigma D = \sqrt{(\sigma M_1)^2 + (\sigma M_2)^2}$$

$$\sigma D = \sqrt{(.825)^2 + (.720)^2}$$

$$\sigma D = \sqrt{.680625 + .518400}$$

$$\sigma D = \sqrt{1.199025}$$

$$\sigma D = 1.095$$

t value

$$t = \frac{M_1 - M_2}{\sigma D}$$

$$t = \frac{23.65 - 25.45}{1.095}$$

$$t = \frac{1.80}{1.095}$$

$$t = 1.643$$

Not significant at the .02 level

## COMPUTATION OF THE STANDARD DEVIATION AND STANDARD ERROR OF THE MEAN IN THE INITIAL TEST FOR THE EXPERIMENTAL GROUP

### Adams Sport-Type Motor Educability Test

| Score | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 111 | 1 | 10 | 10 | 100 |
| 97 | 1 | 9 | 9 | 81 |
| 95 | 1 | 8 | 8 | 64 |
| 87 | 1 | 7 | 7 | 49 |
| 83 | 1 | 6 | 6 | 36 |
| 76 | 1 | 5 | 5 | 25 |
| 73 | 1 | 4 | 4 | 16 |
| 72 | 2 | 3 | 6 | 36 |
| 70 | 1 | 2 | 2 | 4 |
| 68 | 2 | 1 | 2 | 4 |
| 62 | 1 | 0 | 0 | 0 |
| 61 | 1 | -1 | -1 | 1 |
| 56 | 1 | -2 | -2 | 4 |
| 54 | 1 | -3 | -3 | 9 |
| 48 | 1 | -4 | -4 | 16 |
| 47 | 1 | -5 | -5 | 25 |
| 44 | 2 | -6 | -12 | 144 |
| 34 | 1 | -7 | -7 | 49 |
| 29 | 2 | -8 | -16 | 156 |
| | N=23 | | | $\Sigma fd^2$= 819 |

$$M = \frac{\Sigma}{N} \qquad M = 64.347$$

Standard deviation

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{819}{23}} = \sqrt{35.608} = 5.967$$

Standard error of the mean

$$\sigma M = \frac{\sigma}{\sqrt{N}} = \frac{5.967}{\sqrt{23}} = \frac{5.967}{4.80} = 1.243$$

## COMPUTATION OF THE STANDARD DEVIATION AND STANDARD ERROR OF THE MEAN IN THE INITIAL TEST FOR THE CONTROL GROUP

### Adams Sport-Type Motor Educability Test

| Score | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 105 | 1 | 11 | 11 | 121 |
| 96 | 1 | 10 | 10 | 100 |
| 94 | 1 | 9 | 9 | 81 |
| 90 | 1 | 8 | 8 | 64 |
| 88 | 1 | 7 | 7 | 49 |
| 78 | 1 | 6 | 6 | 36 |
| 77 | 1 | 5 | 5 | 25 |
| 74 | 1 | 4 | 4 | 16 |
| 73 | 1 | 3 | 3 | 9 |
| 70 | 1 | 2 | 2 | 4 |
| 69 | 1 | 1 | 1 | 1 |
| 66 | 1 | 0 | 0 | 0 |
| 61 | 1 | -1 | -1 | 1 |
| 50 | 2 | -2 | -4 | 8 |
| 49 | 2 | -3 | -6 | 18 |
| 47 | 1 | -4 | -4 | 16 |
| 45 | 1 | -5 | -5 | 25 |
| 38 | 1 | -6 | -6 | 36 |
| 34 | 1 | -7 | -7 | 49 |
| 25 | 1 | -8 | -8 | 64 |
| | N=22 | | | $\Sigma fd^2 = 723$ |

$$M = \frac{\Sigma}{N} \qquad M = 64.909$$

**Standard deviation**

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{723}{22}} = \sqrt{32.863} = 5.732$$

**Standard error of the mean**

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{5.732}{\sqrt{22}} = \frac{5.732}{4.69} = 1.222$$

COMPUTATION OF STANDARD ERROR OF DIFFERENCE BETWEEN MEANS FOR THE EXPERIMENTAL AND CONTROL GROUPS IN THE INITIAL TEST AND THE VALUE OF "t"

Adams Sport-Type Motor Educability Test

| Experimental Group | Control Group |
|---|---|
| $M_1 = 64.347$ | $M_2 = 64.909$ |
| $\sigma_1 = 5.967$ | $\sigma_2 = 5.732$ |
| $N_1 = 23$ | $N_2 = 22$ |
| $\sigma M_1 = 1.243$ | $\sigma M_2 = 1.222$ |

S E of difference between $M_1$ and $M_2$

$$\sigma D = \sqrt{(\sigma M_1)^2 + (\sigma M_2)^2}$$

$$\sigma D = \sqrt{(1.243)^2 + (1.222)^2}$$

$$\sigma D = \sqrt{1.545249 + 1.493284}$$

$$\sigma D = \sqrt{3.038533}$$

$$\sigma D = 1.757$$

t value

$$t = \frac{M_1 - M_2}{\sigma D}$$

$$t = \frac{64.347 - 64.909}{1.757}$$

$$t = \frac{.562}{1.757}$$

$$t = .032$$

Not significant at the .02 level

COMPUTATION OF THE STANDARD DEVIATION AND STANDARD ERROR OF THE MEAN IN THE INITIAL TEST FOR THE EXPERIMENTAL GROUP

**Harvard Step Test**

| Score | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 130 | 3 | 4 | 12 | 144 |
| 115 | 1 | 3 | 3 | 9 |
| 105 | 2 | 2 | 4 | 16 |
| 100 | 1 | 1 | 1 | 1 |
| 95 | 4 | 0 | 0 | 0 |
| 90 | 7 | -1 | -7 | 49 |
| 80 | 3 | -2 | -6 | 36 |
| 75 | 2 | -3 | -6 | 36 |
| | N=23 | | | $\Sigma fd^2$= 291 |

$$M = \frac{\Sigma}{N} \qquad M = 96.304$$

**Standard deviation**

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{291}{23}} = \sqrt{12.652} = 3.556$$

**Standard error of the mean**

$$\sigma M = \frac{\sigma}{\sqrt{N}} = \frac{3.556}{\sqrt{23}} = \frac{3.556}{4.80} = .740$$

## COMPUTATION OF THE STANDARD DEVIATION AND STANDARD ERROR OF THE MEAN IN THE INITIAL TEST FOR THE CONTROL GROUP

### Harvard Step Test

| Score | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 130 | 4 | 3 | 12 | 144 |
| 115 | 1 | 2 | 2 | 4 |
| 105 | 4 | 1 | 4 | 16 |
| 95 | 2 | 0 | 0 | 0 |
| 90 | 7 | -1 | -7 | 49 |
| 80 | 2 | -2 | -4 | 16 |
| 75 | 2 | -3 | -6 | 36 |
| | N=22 | | | $\Sigma fd^2 = 265$ |

$$M = \frac{\Sigma}{N} \qquad M = 99.318$$

Standard deviation

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{265}{22}} = \sqrt{12.045} = 3.470$$

Standard error of the mean

$$\sigma M = \frac{\sigma}{\sqrt{N}} = \frac{3.470}{\sqrt{22}} = \frac{3.470}{4.69} = .7398$$

COMPUTATION OF STANDARD ERROR OF DIFFERENCE BETWEEN MEANS FOR THE EXPERIMENTAL AND CONTROL GROUPS IN THE INITIAL TEST AND THE VALUE OF "t"

Harvard Step Test

| Experimental Group | Control Group |
|---|---|
| $M_1 = 96.304$ | $M_2 = 99.318$ |
| $\sigma_1 = 3.556$ | $\sigma_2 = 3.470$ |
| $N_1 = 23$ | $N_2 = 22$ |
| $\sigma M_1 = .740$ | $\sigma M_2 = .7398$ |

S E of difference between $M_1$ and $M_2$

$$\sigma D = \sqrt{(\sigma M_1)^2 + (\sigma M_2)^2}$$

$$\sigma D = \sqrt{(.740)^2 + (.7398)^2}$$

$$\sigma D = \sqrt{.547600 + .54730404}$$

$$\sigma D = \sqrt{1.09490404}$$

$$\sigma D = 1.0463$$

t value

$$t = \frac{M_1 - M_2}{\sigma D}$$

$$t = \frac{96.304 - 99.318}{1.046}$$

$$t = \frac{3.014}{1.046}$$

$$t = 2.881$$

Significant at the .02 level

INITIAL TEST AND RETEST OF EXPERIMENTAL GROUP

HEMPHILL KNOWLEDGE TEST

| | Initial Test | Retest | Difference |
|---|---|---|---|
| 1. | 19 | 27 | 8 |
| 2. | 26 | 23 | -3 |
| 3. | 24 | 28 | 4 |
| 4. | 24 | 26 | 2 |
| 5. | 20 | 26 | 6 |
| 6. | 24 | 27 | 3 |
| 7. | 30 | 29 | -1 |
| 8. | 23 | 27 | 4 |
| 9. | 28 | 28 | 0 |
| 10. | 25 | 29 | 4 |
| 11. | 26 | 32 | 6 |
| 12. | 22 | 23 | 1 |
| 13. | 25 | 32 | 7 |
| 14. | 21 | 25 | 4 |
| 15. | 27 | 29 | 2 |
| 16. | 24 | 27 | 3 |
| 17. | 23 | 25 | 2 |
| 18. | 20 | 21 | 1 |
| 19. | 19 | 28 | 9 |
| 20. | 20 | 21 | 1 |
| 21. | 25 | 29 | 4 |
| 22. | 23 | 23 | 0 |
| 23. | 26 | 24 | -2 |
| | 544 | 609 | 65 |

| | |
|---|---|
| Mean Score of Initial Test | 23.65 |
| Mean Score of Retest | 26.48 |
| Sum of Difference of Scores Between Initial test and Retest | 65 |
| Mean Score of Difference Between Tests | 2.826 |

## COMPUTATION OF THE STANDARD DEVIATION OF DIFFERENCES, STANDARD ERROR OF THE MEAN DIFFERENCE, AND THE VALUE OF "t" FOR THE EXPERIMENTAL GROUP

### Hemphill Knowledge Test

| Test and Retest Difference | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 9 | 1 | 5 | 5 | 25 |
| 8 | 1 | 4 | 4 | 16 |
| 7 | 1 | 3 | 3 | 9 |
| 6 | 2 | 2 | 4 | 16 |
| 4 | 5 | 1 | 5 | 25 |
| 3 | 2 | 0 | 0 | 0 |
| 2 | 3 | -1 | -3 | 9 |
| 1 | 3 | -2 | -6 | 36 |
| 0 | 2 | -3 | -6 | 36 |
| -1 | 1 | -4 | -4 | 16 |
| -2 | 1 | -5 | -5 | 25 |
| -3 | 1 | -6 | -6 | 36 |
| | N=23 | | | $\Sigma fd^2=249$ |

$$M = \frac{\Sigma}{N} \qquad M = 2.83$$

S D of Differences

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{249}{23}} = \sqrt{10.826} = 3.290$$

S E of Mean Difference

$$\sigma M \text{ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{3.29}{\sqrt{23}} = \frac{3.29}{4.80} = .6854 \text{ or } .69$$

$$t = \frac{\text{Actual Mean Difference}}{\text{S E of Mean Difference}} = \frac{2.83}{.69} = 4.10$$

Value of "t" is significant at the .02 level.

INITIAL TEST AND RETEST OF CONTROL GROUP

HEMPHILL KNOWLEDGE TEST

| | Initial Test | Retest | Difference |
|---|---|---|---|
| 1. | 27 | 27 | 0 |
| 2. | 19 | 22 | 3 |
| 3. | 30 | 24 | -6 |
| 4. | 28 | 29 | 1 |
| 5. | 26 | 28 | 2 |
| 6. | 29 | 29 | 0 |
| 7. | 24 | 24 | 0 |
| 8. | 23 | 24 | 1 |
| 9. | 29 | 30 | 1 |
| 10. | 24 | 29 | 5 |
| 11. | 27 | 27 | 0 |
| 12. | 25 | 26 | 1 |
| 13. | 27 | 28 | 1 |
| 14. | 24 | 25 | 1 |
| 15. | 23 | 25 | 2 |
| 16. | 24 | 21 | -3 |
| 17. | 28 | 28 | 0 |
| 18. | 23 | 20 | -3 |
| 19. | 26 | 21 | -5 |
| 20. | 24 | 22 | -2 |
| 21. | 26 | 30 | 4 |
| 22. | 24 | 27 | 3 |
| | 560 | 566 | 6 |

| | |
|---|---|
| Mean Score of Initial Test | 25.45 |
| Mean Score of Retest | 25.73 |
| Sum of Difference of Scores Between Initial test and Retest | 6 |
| Mean Score of Difference Between Tests | .28 |

## COMPUTATION OF THE STANDARD DEVIATION OF DIFFERENCES, STANDARD ERROR OF THE MEAN DIFFERENCE, AND THE VALUE OF "t" FOR THE CONTROL GROUP

Hemphill Knowledge Test

| Test and Retest Difference | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 5 | 1 | 5 | 5 | 25 |
| 4 | 1 | 4 | 4 | 16 |
| 3 | 2 | 3 | 6 | 36 |
| 2 | 2 | 2 | 4 | 16 |
| 1 | 6 | 1 | 6 | 36 |
| 0 | 5 | 0 | 0 | 0 |
| -2 | 1 | -1 | -1 | 1 |
| -3 | 2 | -2 | -4 | 16 |
| -5 | 1 | -3 | -3 | 9 |
| -6 | 1 | -4 | -4 | 16 |
| | N=22 | | | $\Sigma fd^2$=171 |

$$M = \frac{\Sigma}{N} \qquad M = .28$$

S D of Differences

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{171}{22}} = \sqrt{7.77} = 2.79$$

S E of Mean Difference

$$\sigma M \text{ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{2.79}{\sqrt{22}} = \frac{2.79}{4.69} = .594$$

$$t = \text{Actual Mean Difference} = \frac{.28}{.59} \qquad t = .474$$

Value of "t" is not significant at the .02 level.

## COMPUTATION OF STANDARD ERROR OF DIFFERENCE BETWEEN MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS AND THE VALUE OF "t"

Hemphill Knowledge Test

| Experimental Group | Control Group |
|---|---|
| $M_1$ Dif. = 2.83 | $M_2$ Dif. = .28 |
| $\sigma_1$ Dif. = 3.29 | $\sigma_2$ Dif. = 2.79 |
| $N_1$ =23 | $N_2$ = 22 |
| $\sigma M_1$ Dif. = .69 | $\sigma M_2$ Dif. = .59 |

S E of difference between $M_1$ Dif. and $M_2$ Dif.

$$\sigma D = \sqrt{(\sigma M_1 \text{ Dif.})^2 + (\sigma M_2 \text{ Dif.})^2}$$

$$\sigma D = \sqrt{(.69)^2 + (.59)^2}$$

$$\sigma D = \sqrt{.4761 + .3481}$$

$$\sigma D = \sqrt{.8242}$$

$$\sigma D = .91$$

t value

$$t = \frac{M_1 \text{ Dif.} - M_2 \text{ Dif.}}{\sigma D}$$

$$t = \frac{2.83 - .28}{.91}$$

$$t = \frac{2.55}{.91}$$

$$t = 2.81$$

Significant difference at the .02 level

## INITIAL TEST AND RETEST OF EXPERIMENTAL GROUP

### Adams Sport-Type Motor Educability Test

| | Initial Test | Retest | Difference |
|---|---|---|---|
| 1. | 62 | 103 | 41 |
| 2. | 34 | 69 | 35 |
| 3. | 29 | 47 | 18 |
| 4. | 29 | 37 | 8 |
| 5. | 87 | 69 | -18 |
| 6. | 76 | 120 | 44 |
| 7. | 97 | 110 | 13 |
| 8. | 44 | 79 | 35 |
| 9. | 111 | 136 | 25 |
| 10. | 48 | 83 | 35 |
| 11. | 83 | 84 | 1 |
| 12. | 47 | 47 | 0 |
| 13. | 72 | 93 | 21 |
| 14. | 70 | 88 | 18 |
| 15. | 95 | 110 | 15 |
| 16. | 72 | 92 | 20 |
| 17. | 68 | 58 | -10 |
| 18. | 56 | 64 | 8 |
| 19. | 54 | 84 | 30 |
| 20. | 44 | 59 | 15 |
| 21. | 73 | 87 | 14 |
| 22. | 68 | 114 | 46 |
| 23. | 61 | 69 | 8 |
| | 1480 | 1902 | 422 |

| | |
|---|---|
| Mean Score of Initial Test | 64.347 |
| Mean Score of Retest | 82.695 |
| Sum of Difference of Scores Between Initial Test and Retest | 442 |
| Mean Score of Difference Between Tests | 18.35 |

## COMPUTATION OF THE STANDARD DEVIATION OF DIFFERENCES, STANDARD ERROR OF THE MEAN DIFFERENCE, AND THE VALUE OF "t" FOR THE EXPERIMENTAL GROUP

### Adams Sport-Type Motor Educability Test

| Test and Retest Difference | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 46 | 1 | 8 | 8 | 64 |
| 44 | 1 | 7 | 7 | 49 |
| 41 | 1 | 6 | 6 | 36 |
| 35 | 3 | 5 | 15 | 225 |
| 30 | 1 | 4 | 4 | 16 |
| 25 | 1 | 3 | 3 | 9 |
| 21 | 1 | 2 | 2 | 4 |
| 20 | 1 | 1 | 1 | 1 |
| 18 | 2 | 0 | 0 | 0 |
| 15 | 2 | -1 | -2 | 4 |
| 14 | 1 | -2 | -2 | 4 |
| 13 | 1 | -3 | -3 | 9 |
| 8 | 3 | -4 | -12 | 144 |
| 1 | 1 | -5 | -5 | 25 |
| 00 | 1 | -6 | -6 | 36 |
| -10 | 1 | -7 | -7 | 49 |
| -18 | 1 | -8 | -8 | 64 |
| | N=23 | | | $\leqslant fd^2 = 739$ |

$$M = \frac{\leqslant fd}{N} \qquad M = 18.35$$

S D of Differences

$$\sigma = \sqrt{\frac{\leqslant fd^2}{N}} = \sqrt{\frac{739}{23}} = \sqrt{32.13} = 5.67$$

S E of Mean Difference

$$\sigma_{M\ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{5.67}{\sqrt{23}} = \frac{5.67}{4.80} = 1.181$$

$$t = \frac{\text{Actual Mean Difference}}{\text{S E of Mean Difference}} = \frac{18.35}{1.18} = 15.550$$

Value of "t" is significant at the .02 level.

INITIAL TEST AND RETEST OF CONTROL GROUP

Adams Sport-Type Motor Educability Test

| | Initial Test | Retest | Difference |
|---|---|---|---|
| 1. | 49 | 79 | 30 |
| 2. | 34 | 43 | 9 |
| 3. | 90 | 97 | 7 |
| 4. | 69 | 80 | 11 |
| 5. | 74 | 93 | 19 |
| 6. | 47 | 64 | 17 |
| 7. | 38 | 43 | 5 |
| 8. | 77 | 83 | 6 |
| 9. | 105 | 117 | 12 |
| 10. | 50 | 68 | 18 |
| 11. | 96 | 95 | -1 |
| 12. | 66 | 72 | 6 |
| 13. | 70 | 92 | 22 |
| 14. | 50 | 60 | 10 |
| 15. | 49 | 70 | 21 |
| 16. | 25 | 46 | 21 |
| 17. | 73 | 83 | 10 |
| 18. | 61 | 66 | 5 |
| 19. | 94 | 68 | -26 |
| 20. | 45 | 70 | 25 |
| 21. | 78 | 99 | 21 |
| 22. | 88 | 85 | -3 |
| | 1428 | 1673 | 245 |

Mean Score of Initial Test 64.909

Mean Score of Retest 76.045

Sum of Difference of Scores Between Initial Test and Retest 245

Mean Score of Difference Between Tests 11.136

## COMPUTATION OF THE STANDARD DEVIATION OF DIFFERENCES, STANDARD ERROR OF THE MEAN DIFFERENCE, AND THE VALUE OF "t" FOR THE CONTROL GROUP

### Adams Sport-Type Motor Educability Test

| Test and Retest Difference | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 30 | 1 | 8 | 8 | 64 |
| 25 | 1 | 7 | 7 | 49 |
| 22 | 1 | 6 | 6 | 36 |
| 21 | 3 | 5 | 15 | 225 |
| 19 | 1 | 4 | 4 | 16 |
| 18 | 1 | 3 | 3 | 9 |
| 17 | 1 | 2 | 2 | 4 |
| 12 | 1 | 1 | 1 | 1 |
| 11 | 1 | 0 | 0 | 0 |
| 10 | 2 | -1 | -2 | 4 |
| 9 | 1 | -2 | -2 | 4 |
| 7 | 1 | -3 | -3 | 9 |
| 6 | 2 | -4 | -8 | 64 |
| 5 | 2 | -5 | -10 | 100 |
| -1 | 1 | -6 | -6 | 36 |
| -3 | 1 | -7 | -7 | 49 |
| -26 | 1 | -8 | -8 | 64 |
| | N=22 | | | $\Sigma fd^2 = 734$ |

$$M = \frac{\Sigma}{N} \qquad M = 11.14$$

S D of Differences

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{734}{22}} = \sqrt{33.36} = 5.78$$

S E of Mean Difference

$$\sigma_{M\ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{5.78}{\sqrt{22}} = \frac{5.78}{4.69} = 1.232$$

$$t = \frac{\text{Actual Mean Difference}}{\text{S E of Mean Difference}} = \frac{11.14}{1.23} = 9.056$$

Value of "t" is significant at the .02 level.

COMPUTATION OF STANDARD ERROR OF DIFFERENCE BETWEEN MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS AND THE VALUE OF "t"

Adams Sport-Type Motor Educability Test

Experimental Group

$M_1$ Dif. = 18.35

$\sigma_1$ Dif. = 5.67

$N_1$ Dif. = 23

$\sigma M_1$ Dif. = 1.18

Control Group

$M_2$ Dif. = 11.14

$\sigma_2$ Dif. = 5.78

$N_2$ Dif. = 22

$\sigma M_2$ Dif. = 1.23

S E of difference between $M_1$ and $M_2$

$$\sigma D = \sqrt{(\sigma M_1 \text{Dif.})^2 + (\sigma M_2 \text{Dif.})^2}$$

$$\sigma D = \sqrt{(1.18)^2 + (1.23)^2}$$

$$\sigma D = \sqrt{1.3924 + 1.5129}$$

$$\sigma D = \sqrt{2.9053}$$

$$\sigma D = 1.7044 \text{ or } 1.70$$

t value

$$t = \frac{M_1\text{Dif.} - M_2\text{Dif.}}{\sigma D}$$

$$t = \frac{18.35 - 11.14}{1.70}$$

$$t = \frac{7.21}{1.70}$$

$$t = 4.2411 \text{ or } 4.24$$

Significant difference at the .02 level

INITIAL TEST AND RETEST OF EXPERIMENTAL GROUP

Harvard Step Test

| | Initial Test | Retest | Difference |
|---|---|---|---|
| 1. | 130 | 140 | 10 |
| 2. | 90 | 95 | 5 |
| 3. | 90 | 105 | 15 |
| 4. | 80 | 95 | 15 |
| 5. | 105 | 130 | 25 |
| 6. | 95 | 115 | 20 |
| 7. | 90 | 90 | 0 |
| 8. | 100 | 80 | -20 |
| 9. | 115 | 135 | 20 |
| 10. | 95 | 105 | 10 |
| 11. | 75 | 105 | 30 |
| 12. | 90 | 95 | 5 |
| 13. | 95 | 96 | 0 |
| 14. | 90 | 90 | 0 |
| 15. | 105 | 135 | 30 |
| 16. | 75 | 80 | 5 |
| 17. | 80 | 130 | 50 |
| 18. | 80 | 115 | 35 |
| 19. | 90 | 90 | 0 |
| 20. | 130 | 95 | -35 |
| 21. | 130 | 135 | 5 |
| 22. | 95 | 115 | 20 |
| 23. | 90 | 90 | 0 |
| | 2215 | 2460 | 245 |

| | |
|---|---|
| Mean Score of Initial Test | 96.304 |
| Mean Score of Retest | 106.956 |
| Sum of Difference of Scores Between Initial Test and Retest | 442 |
| Mean Score of Difference Between Tests | 18.35 |

COMPUTATION OF THE STANDARD DEVIATION OF DIFFERENCES, STANDARD ERROR OF THE MEAN DIFFERENCE, AND THE VALUE OF "t" FOR THE EXPERIMENTAL GROUP

Harvard Step Test

| Test and Retest Difference | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 50 | 1 | 6 | 6 | 36 |
| 35 | 1 | 5 | 5 | 25 |
| 30 | 2 | 4 | 8 | 64 |
| 25 | 1 | 3 | 3 | 9 |
| 20 | 3 | 2 | 6 | 36 |
| 15 | 2 | 1 | 2 | 4 |
| 10 | 2 | 0 | 0 | 0 |
| 5 | 3 | -1 | -3 | 9 |
| 0 | 5 | -2 | -10 | 100 |
| -5 | 1 | -3 | -3 | 9 |
| -20 | 1 | -4 | -4 | 16 |
| -35 | 1 | -5 | -5 | 25 |
| | N=23 | | | $\Sigma fd^2 = 333$ |

$M = \frac{\Sigma}{N}$ $\qquad M = 10.65$

S D of Differences

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{333}{23}} = \sqrt{14.478} = 3.804$$

S E of Mean Difference

$$\sigma_{M\ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{3.80}{\sqrt{23}} = \frac{3.80}{4.80} = .791$$

$$t = \frac{\text{Actual Mean Difference}}{\text{S E of Mean Difference}} = \frac{10.65}{.79} = 13.481$$

Value of "t" is highly significant at the .02 level.

INITIAL TEST AND RETEST OF CONTROL GROUP

Harvard Step Test

| | Initial Test | Retest | Difference |
|---|---|---|---|
| 1. | 105 | 115 | 10 |
| 2. | 80 | 80 | 0 |
| 3. | 95 | 130 | 35 |
| 4. | 105 | 90 | -15 |
| 5. | 95 | 90 | -5 |
| 6. | 90 | 90 | 0 |
| 7. | 90 | 90 | 0 |
| 8. | 75 | 80 | 5 |
| 9. | 115 | 90 | -25 |
| 10. | 90 | 105 | 15 |
| 11. | 90 | 105 | 15 |
| 12. | 130 | 115 | -15 |
| 13. | 75 | 95 | 20 |
| 14. | 130 | 105 | -25 |
| 15. | 80 | 90 | 10 |
| 16. | 90 | 105 | 15 |
| 17. | 90 | 95 | 5 |
| 18. | 105 | 105 | 0 |
| 19. | 105 | 105 | 0 |
| 20. | 90 | 90 | 0 |
| 21. | 130 | 115 | -15 |
| 22. | 130 | 130 | 0 |
| | 2185 | 2215 | 30 |

| | |
|---|---|
| Mean Score of Initial Test | 99.318 |
| Mean Score of Retest | 100.681 |
| Sum of Difference of Scores Between Initial Test and Retest | 30 |
| Mean Score of Difference Between Tests | 1.36 |

COMPUTATION OF THE STANDARD DEVIATION OF DIFFERENCES, STANDARD ERROR OF THE MEAN DIFFERENCE, AND THE VALUE OF "t" FOR THE CONTROL GROUP

Harvard Step Test

| Test and Retest Difference | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 35 | 1 | 5 | 5 | 25 |
| 20 | 1 | 4 | 4 | 16 |
| 15 | 3 | 3 | 9 | 81 |
| 10 | 2 | 2 | 4 | 16 |
| 5 | 2 | 1 | 2 | 4 |
| 0 | 7 | 0 | 0 | 0 |
| -5 | 1 | -1 | -1 | 1 |
| -15 | 3 | -2 | -6 | 36 |
| -25 | 2 | -3 | -6 | 36 |
| | N=22 | | | $\Sigma fd^2 = 215$ |

$$M = \frac{\Sigma}{N} \qquad M = 1.36$$

S D of Differences

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{215}{22}} = \sqrt{9.77} = 3.125$$

S E of Mean Difference

$$\sigma_{M\ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{3.13}{\sqrt{22}} = \frac{3.13}{4.69} = .67$$

$$t = \frac{\text{Actual Mean Difference}}{\text{S E of Mean Difference}} = \frac{1.36}{.67} = 2.03$$

Value of "t" is <u>not</u> significant <u>at the .02 level</u>.

COMPUTATION OF STANDARD ERROR OF DIFFERENCE BETWEEN MEAN DIFFERENCES FOR THE EXPERIMENTAL AND CONTROL GROUPS AND THE VALUE OF "t"

Harvard Step Test

| Experimental Group | Control Group |
|---|---|
| $M_1$ Dif. = 10.65 | $M_2$ Dif. = 1.36 |
| $\sigma_1$ Dif. = 3.80 | $\sigma_2$ Dif. = 3.13 |
| $N_1$ = 23 | $N_2$ = 22 |
| $\sigma M_1$ Dif. = .79 | $\sigma M_2$ Dif. = .67 |

S E of difference Between $M_1$ and $M_2$

$$\sigma D = \sqrt{(\sigma M_1 \text{Dif.})^2 + (\sigma M_2 \text{Dif.})^2}$$

$$\sigma D = \sqrt{(.79)^2 + (.67)^2}$$

$$\sigma D = \sqrt{.6241 + .4489}$$

$$\sigma D = \sqrt{1.0730}$$

$$\sigma D = 1.0358 \text{ or } 1.04$$

t value

$$t = \frac{M_1\text{Dif.} - M_2\text{Dif}}{\sigma D}$$

$$t = \frac{10.65 - 1.36}{1.04}$$

$$t = \frac{9.29}{1.04}$$

$$t = 8.9326 \text{ or } 8.93$$

Significant difference at the .02 level.

SCORES ON THE CHECKLIST OF OUTCOMES FOR THE EXPERIMENTAL AND CONTROL GROUPS

| Experimental Group | Control Group |
|---|---|
| 75 | 74 |
| 61 | 70 |
| 70 | 75 |
| 86 | 60 |
| 63 | 66 |
| 81 | 36 |
| 86 | 70 |
| 63 | 81 |
| 93 | 82 |
| 75 | 87 |
| 65 | 79 |
| 80 | 65 |
| 84 | 57 |
| 70 | 47 |
| 69 | 80 |
| 92 | 73 |
| 70 | 72 |
| 60 | 80 |
| 88 | 58 |
| 77 | 65 |
| 79 | 69 |
| 83 | 86 |
| 91 | |
| 1761 | 1532 |
| N = 23 | N = 22 |
| Mean = 76.56 | Mean = 69.63 |

## COMPUTATION OF THE STANDARD DEVIATION OF DIFFERENCES, STANDARD ERROR OF THE MEAN DIFFERENCE, AND THE VALUE OF "t" FOR THE EXPERIMENTAL GROUP

### Evaluation Checklist of Outcomes

| Scores | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 93 | 1 | 10 | 10 | 100 |
| 92 | 1 | 9 | 9 | 81 |
| 91 | 1 | 8 | 8 | 64 |
| 88 | 1 | 7 | 7 | 49 |
| 86 | 2 | 6 | 12 | 144 |
| 84 | 1 | 5 | 5 | 25 |
| 83 | 1 | 4 | 4 | 16 |
| 81 | 1 | 3 | 3 | 9 |
| 80 | 1 | 2 | 2 | 4 |
| 79 | 1 | 1 | 1 | 1 |
| 77 | 1 | 0 | 0 | 0 |
| 75 | 2 | -1 | -2 | 4 |
| 70 | 3 | -2 | -6 | 36 |
| 69 | 1 | -3 | -3 | 9 |
| 65 | 1 | -4 | -4 | 16 |
| 63 | 2 | -5 | -10 | 100 |
| 61 | 1 | -6 | -6 | 36 |
| 60 | 1 | -7 | -7 | 49 |
| | N=23 | | | $\leq fd^2 = 743$ |

$$M = \frac{\Sigma X}{N} \qquad M = 76.56$$

S D of Differences

$$\sigma = \sqrt{\frac{\leq fd^2}{N}} = \sqrt{\frac{743}{23}} = \sqrt{32.304} = 5.683$$

S E of Mean Difference

$$\sigma_{M\ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{5.68}{\sqrt{23}} = \frac{5.68}{4.80} = 1.183$$

## COMPUTATION OF THE STANDARD DEVIATION OF DIFFERENCES, STANDARD ERROR OF THE MEAN DIFFERENCE, AND THE VALUE OF "t" FOR THE CONTROL GROUP

Evaluation Checklist of Outcomes

| Scores | f | d | fd | $fd^2$ |
|---|---|---|---|---|
| 87 | 1 | 10 | 10 | 100 |
| 86 | 1 | 9 | 9 | 91 |
| 82 | 1 | 8 | 8 | 64 |
| 81 | 1 | 7 | 7 | 49 |
| 80 | 2 | 6 | 12 | 144 |
| 79 | 1 | 5 | 5 | 25 |
| 75 | 1 | 4 | 4 | 16 |
| 74 | 1 | 3 | 3 | 9 |
| 73 | 1 | 2 | 2 | 4 |
| 72 | 1 | 1 | 1 | 1 |
| 70 | 2 | 0 | 0 | 0 |
| 69 | 1 | -1 | -1 | 1 |
| 66 | 1 | -2 | -2 | 4 |
| 65 | 2 | -3 | -6 | 36 |
| 60 | 1 | -4 | -4 | 16 |
| 58 | 1 | -5 | -5 | 25 |
| 57 | 1 | -6 | -6 | 36 |
| 47 | 1 | -7 | -7 | 49 |
| 36 | 1 | -8 | -8 | 64 |
| | N=22 | | | $\Sigma fd^2 = 734$ |

$$M = \frac{\Sigma X}{N} \qquad M = 69.63$$

S D of Differences

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N}} = \sqrt{\frac{734}{22}} = \sqrt{33.363} = 5.776$$

S E of Mean Difference

$$\sigma_{M\ dif.} = \frac{\sigma}{\sqrt{N}} = \frac{5.78}{\sqrt{22}} = \frac{5.78}{4.69} = 1.232$$

## COMPUTATION OF STANDARD ERROR OF DIFFERENCE BETWEEN MEANS FOR THE EXPERIMENTAL AND CONTROL GROUPS AND THE VALUE OF "t"

### Evaluation Checklist of Outcomes

| Experimental Group | Control Group |
|---|---|
| $M_1 = 76.56$ | $M_2 = 69.63$ |
| $\sigma_1 = 5.68$ | $\sigma_2 = 5.78$ |
| $N_1 = 23$ | $N_2 = 22$ |
| $\sigma M_1 = 1.18$ | $\sigma M_2 = 1.23$ |

S E of difference between $M_1$ and $M_2$

$$\sigma D = \sqrt{(\sigma M_1)^2 + (\sigma M_2)^2}$$

$$\sigma D = \sqrt{(1.18)^2 + (1.23)^2}$$

$$\sigma D = \sqrt{1.3924 + 1.5129}$$

$$\sigma D = \sqrt{2.9053}$$

$$\sigma D = 1.70$$

t value

$$t = \frac{M_1 - M_2}{\sigma D}$$

$$t = \frac{76.56 - 69.93}{1.70}$$

$$t = \frac{6.63}{1.70}$$

$$t = 3.90$$

significant difference at the .02 level.