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The Effectiveness of Using Increased Increment Track and Field Scoring Tables with Female University Physical Education Students

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THE EFFECTIVENESS OF USING INCREASED INCREMENT TRACK AND FIELD SCORING TABLES WITH FEMALE UNIVERSITY PHYSICAL EDUCATION STUDENTS

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CHAPTER I

THE PROBLEM AND ITS BACKGROUND

Introduction

Many attempts have been made to devise means by which performances in track and field athletics could be evaluated and compared. In the days of Ancient Greece, the Pentathlon was considered to be the greatest test of athletic prowess. The athletes contested five events and an overall winner was declared based on best all-round performance. This contest has its present day counterparts in the modern pentathlon and the decathlon for men, and the pentathlon for women, all of which form part of the modern Olympic program. In these modern contests, scoring tables are used to award points for the performances of the athletes in the various events, and the athlete with the highest total number of points is declared the winner.

The International Amateur Athletic Federation, hereafter referred to as the IAAF, issues the official

scoring tables for use with the decathlon for men, and with the pentathlon for women. The present tables in use for the men were issued in 1962, and those in use for the women were issued in 1954.

The scoring tables issued by the IAAF have often been the subject of criticism, and alternative unofficial tables appear from time to time, the best known being "Systeme Rationnel Pour Classer Les Performances Athletiques" which were adopted by the Portugese Athletic Federation in 1949 and revised in 1962. These tables are generally referred to as the "Portugese Tables", and are often quoted by track and field statisticians writing in periodicals.[1]

The official IAAF tables and the Portugese tables are not suitable for use in all situations and circumstances. They both use the metric system, which means that conversions from English measurements must be made, and they are designed for use with adults, using full sized equipment and implements. This makes them unsuitable for use with junior athletes, or with

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[1]Obtainable from: Federacao Portuguesa de Atletismo, P. da Alegria, 65 - Lisboa - Portugal.

school children, or with adults using lighter equipment. They are also based on the existing world record in each event, and the relationship between the world records for various events is often different from the relationship between events of the performances of a particular group of people.

For these reasons, other forms of scoring tables have been developed and are in use. In England the Milocarian Scoring Tables[2] are used by schools competing for the Milocarian Trophy. In Australia there is a scoring table in use for women who wish to compete for the Herbert Lowe Trophy,[3] and in the United States of America, Core has produced tables[4] for use in five events with men. Scoring tables for twelve events, some of which are not standard, such as the 660 yard run and the 70 yard high hurdles, were produced in 1953 by Reel.[5]

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[2]Obtainable from: The Amateur Athletic Association, 26 Park Crescent, London, W. 1. England.

[3]Wendy Ey, "Methods for Obtaining Point Scores of Comparable Value," Modern Athlete and Coach, III, 4 (July, 1965), 34-35.

[4]Obtainable from: John T. Core, 1224C, West Broad Street, Richmond, Virginia 23220.

[5]Obtainable from: S. F. Vincent Reel, Box 659, Garden Grove, California.

In the Physical Education Department at Rhodes University, South Africa, all the physical education students, both male and female, are required to undergo an annual practical examination in track and field athletics. This examination is held at the end of the third term in September each year. Each student is tested for achievement in the events they have been taught during the year, and points are awarded from scoring tables for the performances recorded. The total number of points gained by each student is then used to grade the student. The Milocarian Tables have been found suitable for use with the men, but the IAAF tables, in use for the women, have not proved satisfactory.

Since no suitable alternative table for the women students could be found, the author decided to investigate the possibility of constructing a scoring table which could be easily and effectively used at the University. The author's interest in women's track and field arises from the fact that he teaches the men and the women students in the physical education department, and is coach to the University Track and Field Club, which has a flourishing women's section.

The Problem

There were two purposes involved in this study. The first objective was to construct increased increment scoring tables for selected track and field events based on the achievement of female physical education students at Rhodes University, South Africa, using the initial performances recorded by the students in each event during the years 1957, 1958, 1959, 1960, 1961, 1964, 1965, and 1966. Secondly, the tables were used to test the effectiveness of the increased increment principle in predicting the improvement of the students in subsequent trials during the same period.

An increased increment table is based upon the theory that it is more difficult for a superior performer to improve performance than it is for a poor performer to improve. A person who puts the shot sixty feet and who improves to sixty-one feet is considered to have made more improvement than the person who puts the shot forty feet and improves to forty-one feet. The increased increment table is therefore constructed so that for the one foot improvement in performance,

more points are awarded to the superior performer than to the poor performer. Conversely, a poor performer would have to improve more than a superior performer to gain the same number of points increase. McCloy[6] and Cozens[7] were the initial developers of the increased increment principle, and both make it clear that such tables are for use with heterogeneous groups, and that the equation to be used in the calculation of such scoring tables is parabolic in nature. Further discussion of the development of the increased increment tables will be continued in Chapter II.

The principle of the increased increment scale appears to be based on the assumption that progress in track and field events will be rapid to begin with, and become slower as proficiency improves, and eventually taper off into a plateau. This would be indicated by the "typically shaped" learning curve, negative

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[6]Charles H. McCloy, The Measurement of Athletic Power (New York: A. S. Barnes and Company, 1932), 9-37.

[7]Frederick W. Cozens, "A Curve for Devising Scoring Tables in Physical Education," Research Quarterly, II, 4, (December, 1931), 67-75.

in nature, often quoted in textbooks.[8] If it is true that improvement in track and field events usually follows such a pattern, then it should also be true that the average improvement of a group of poor performers in one event, will score a number of points approximately equivalent to the number of points scored by the average improvement of a group of superior performers or a group of average performers.

Definitions

1. Increased increment scoring tables. - Tables used for allocating points for performances recorded in track and field or other athletic events that are based on the principle that an improvement by a superior performer is worth a larger number of points than an identical improvement by a poor performer.

2. Universal Scoring Tables. - A name often given to an increased increment type of scoring table designed to cover a wide range of ability in heterogeneous groups.

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[8] Bryant J. Cratty, Movement Behaviour and Motor Learning, (Philadelphia: Lea and Febiger, 1964), 226-231.

3. IAAF. - The International Amateur Athletic Federation. This is the governing body for track and field throughout the world, with its headquarters at Windsor House, 46 Victoria Street, London, SW1, England.

4. IAAF Handbook. - The handbook of rules and regulations governing track and field events and competition issued every two years by the International Amateur Athletic Federation. Obtainable through Track and Field News, P. O. Box 296, Los Altos, California 94022. Price $2.00.

5. Portuguese Tables. - A set of scoring tables for men and women published by the Portuguese Athletic Federation.

6. The western roll. - A style of high jumping in which the athlete passes over the bar with his spine parallel to it. The athlete runs towards the bar, takes off from one foot, passes over the bar as described, that is, on his side, and turns to land on the take-off foot.

7. The straddle style. - Another style of high jumping, sometimes referred to as "the belly roll" in which the athlete passes over the bar with his body

parallel to and facing the bar. The run-up and take-off are similar to the western roll style, but the athlete turns more to face the bar as he crosses it, and then he usually lands on the opposite hip and hand to the take-off leg.

8. The crouch start. - A method athletes use at the start of a race in which the athlete kneels on one knee with his hands on the ground behind the starting line.

9. The glide. - A movement in putting the shot used to gain momentum by hopping across the throwing circle with the shot before the actual delivery is made

10. First class pass; second class pass; third class pass; fail. - The four grades which a student at Rhodes University can achieve at the end of the academic year. See Table 2.

11. Rhodes University. - A non-denominational co-educational University of approximately 1600 students located at Grahamstown, Cape Province, South Africa. It is one of four English-speaking Universities in the Republic of South Africa. There are also four Afrikaans-speaking Universities, one bi-lingual University, and

one bi-lingual correspondence University. These Universitites serve the white section of the population. There are separate institutions for the Bantu, Indian, and Colored sections of the population.

Background to the Study

In order to understand the situation from which the data for constructing the scoring tables were obtained, and in which it is proposed to use the tables, a description of the program at Rhodes University is necessary.

The System at Rhodes University. To attend the University, a student must have passed an academic examination conducted on a nation-wide basis at the end of the secondary school stage of education. This examination is held in the last term of a high school student's school career. Certain combinations of subjects must be passed to qualify for courses leading to Bachelor of Arts or Bachelor of Science degrees. Students who passed the examination but lacked certain required subjects might attend the University, but

would only be admitted to courses leading to the award of a Teacher's Diploma. A Teacher's Diploma enables a student to teach in a Primary School (United States Elementary School), or up to Standard Eight in a Secondary School (United States Junior High School).

Students studying for the Bachelor of Arts, or for Teaching Diplomas may elect to study physical education, but the latter are limited to the first two years of the three year course, except in special circumstances.

It is important to note that there is no required physical education program at the University. All students in the Physical Education Department have elected to study the subject.

Physical education is offered as a subject in the Bachelor of Arts degree. To obtain this degree, students are required to have passed ten courses, each course requiring attendance throughout a four-term academic year. Four courses are normally studied during the first year, four during the second year, and two in the final (third) year. The two final year courses are in the student's two major subjects. These two

major subjects must also be taken during the first and second year. A typical program would be as shown in Table 1.

TABLE 1

AN EXAMPLE OF THE B.A. DEGREE PROGRAM

First Year	Second Year	Third Year
Geography I	Geography II	Geography III
Physical Ed. I	Physical Ed. II	Physical Ed. III
Psychology I	History I	
English I	Geology I	

Students majoring in physical education would therefore complete three one year courses in the Physical Education Department. Students not majoring in physical education would complete one or two years in the Department.

Each one year course in the University begins approximately on February 26th, and ends on November 30th. The academic year is divided into four terms varying between six and eight weeks in length, with a

one week vacation between the first and second, and the third and fourth terms, and with a four week vacation between the second and third terms. Minor examinations in academic work only are held during the last week of the second term, and comprehensive examinations in theory and practical work are held throughout the four weeks of November in the fourth term. The grade which the student receives at the end of the one year course is determined by his achievement in the final November examinations. The grading system at present in use is shown in Table 2.

TABLE 2

GRADING SYSTEM AT RHODES UNIVERSITY

Percentage	Grade Awarded
Below 40%	Fail
40% to 54%	3rd. Class Pass.
55% to 69%	2nd. Class Pass.
70% and over	1st. Class Pass.

In the Physical Education Department, each one year course consists of theory work and practical work. Equal marks are awarded for each section, and combined to give the student a percentage.

The Practical Work in the Physical Education Department. Track and field athletics forms a part of the practical work program in physical education for both male and female students. During each one year course the female students are taught the following practical activities: Gymnastics; Rhythmical Movement; Aquatics; Team Sports; and Track and Field. Two hundred marks are awarded for theory, and two hundred marks for the practical work. The marks for practical work are divided up among the various activities mentioned above.

A student gains a certain number of marks in each practical subject, and these marks are added to give a total. The practical marks and the theory marks are converted to percentages and added together. The total percentage is divided by two to give the final percentage.

It would be unrealistic to expect students to be examined in all aspects of practical work during the week set aside by the University for practical examinations

late in October each year. The Aquatic course is held in the first term, and the examination is held at the end of the course. Team Sports are graded during the course of the year, and the Track and Field examination is held at the end of the third term in September of each year.

Only Gymnastics and Rhythmical Movement are graded during the week in October.

The Track and Field Program for Women Students. This has undergone considerable development during the years that the author has been associated with the program. It is from this period that the data used in this study have been compiled.

At one time the students' marks in track and field were derived by (a) the performances of the students in each event, and (b) by the subjective assessment of the style of the students when demonstrating. In more recent years, marks have been awarded solely on the basis of the achievement of the students. It was felt that improved performances would be a natural result of improvements in technique.

The present track and field program is arranged so that the events taught and tested each year are as shown in Table 3.

TABLE 3

EVENTS INCLUDED IN EACH ACADEMIC YEAR

First Year	Second Year	Third Year
100 yards	100 yards	100 yards
880 yards	880 yards	880 yards
80m. hurdles	80m. hurdles	Long Jump
High Jump	High Jump	Putting the Shot
Long Jump	Discus Throwing	Discus Throwing
Putting the Shot	Javelin Throwing	Javelin Throwing

This program has been arranged so that in each year there is a short distance running event, a long distance running event, a jumping event, and a throwing event. Each event is included for at least two years, and the running events have been included in each year because of their value in maintaining the fitness of the students. The shot put is included in the first year as it is

the simplest of the throwing events, and because it should be taught before the discus throw to avoid negative transfer effects. The hip action of the discus is different to that of the shot, yet can easily transfer into the shot put action with adverse results unless the correct shot put technique is first established.

The students receive instruction in track and field events during two 45 minute periods per week for the first three terms of the year. This usually yields a total of approximately 20 weeks instruction, or 40 teaching periods. Some of these are lost owing to rain, high wind, or other difficulties. Whenever possible, indoor instruction, either practical or in the form of loop films, is substituted in such circumstances.

The Need for the Study

It was the intention of the author to replace the IAAF tables with an increased increment scale for each event based on the performances of students recorded in the track and field examinations during the years 1957, 1958, 1959, 1960, 1961, 1964, 1965, and 1966.

The reasons for wanting to replace the IAAF tables were as follows:

1. The IAAF tables are apparently based on the performances of experienced athletes, and the upper limit in each event has been established by the current world record. When inexperienced athletes are scored on these tables they usually achieve a low score in the throwing events. This is because it requires some years of application and training in the throwing events to reach a standard equivalent to that in an event depending more upon natural ability, such as the long jump. The throwing events require much practice of the technique involved. A similar situation occurs in events requiring aerobic endurance, such as the half mile. Much training is required to develop the cardio-respiratory system. The track and field program in the Physical Education Department at Rhodes University is not designed to develop specialist athletes, and time does not allow extensive practice, so the scores in the highly technical or physiological events fall short of those obtained in the natural ability events.

This fact can be illustrated by comparing the points gained by the empirical standards which have been established. The events compared are from the same year of instruction.

TABLE 4

A COMPARISON OF POINTS SCORED ON THE IAAF TABLES BY EVENTS CONTESTED IN THE FIRST YEAR OF INSTRUCTION

Natural Ability Event		Points	Technical Event	Points
100 yards	14.0 secs.	415	High Jump 3' 8"	345
Long Jump	12' 6"	436	Half Mile 3m 30 secs.	293
80m. hurdles	16.0 secs.	466	Shot Put 22' 0"	444

The construction of a scoring table based on the actual performances of the students should enable performance in one event to be compared more effectively with performance in another event, and would have more meaning for the students.

2. The IAAF tables are printed for use with the metric system. The tables for running refer to the 100 meters and the 800 meters, and all distances and

heights in the field events are printed in meters and centimeters. The tables therefore have little meaning for the students who are familiar with the English system of measurement. To be of use in grading, conversion tables must be used to convert feet and inches into meters and centimeters, and to estimate the 100 meters and 800 meters times from those recorded in the 100 yards and 880 yards.

Tables constructed using English measurements would eliminate these problems.

3. The students would be more effectively motivated by tables based on actual performances of their predecessors and calculated with English measurements. They would be able to see at once their weak events, and would be able to compare their performances easily with those of their peers and their predecessors.

The increased interval principle of construction might encourage students to try to improve as much as possible, since successive improvements would be rewarded with an increasing number of points.

4. An increased increment table should allow a system of grading to be used based on the actual

improvement of each student. The average performance improvement of a group of students during first, second, and third trials could be calculated. The number of points gained by the improvement could be read from the tables using the mean of the scores at each trial. The number of points difference between the means could be transferred to any other part of the scale and the actual improvement required to gain this number of points could be obtained.

Another method would be to calculate the average of the performances of a particular class at the end of their first test in the event. This average would score a certain number of points. At the end of the second test the average of the performances could again be calculated and converted to points. The difference between the two totals of points would represent the average improvement of the group. This difference between the points could then be used at any point on the scale to predict how much improvement any single individual should have made.

This use of the scale would only be possible if improvement in track and field events followed the

pattern outlined earlier in the chapter; that is, according to a parabolic curve.

5. Track and field for women is increasing in extent throughout the world, especially in Eastern European, African, and Asiatic countries. In England, America, and South Africa however, there is still some resistance to women participating, and few colleges in these countries include it in their programs. In a survey conducted by Shepherd[9] in the United States, only 50 institutions of the 100 surveyed indicated that they had some form of track and field for women in their physical education programs, and this was of a limited nature consisting mainly of the 100 yards sprint, the high jump, and the long jump.

This situation is rapidly changing however, and there appears to be a quickening interest in the value of track and field for women and girls. The introduction of track and field for high school girls will

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[9]Sharon Shepherd, "An Investigation of the Women's Track and Field Program of Selected Teacher Education Institutions with a Proposed Program of Track and Field for Women," (unpublished Master's dissertation, Ohio University, 1962).

create a demand for suitably trained teachers, and college and university physical education departments may soon find the need to include the activity in their programs.

In the absence of more suitable tables, those developed in this study might prove valuable at both the high school and college level.

6. McCloy described how he developed the idea of the increased increment scale in his book, The Measurement of Athletic Power.[10] They are calculated in relation to the power developed by expert male athletes at each velocity, distance, or height achieved. This enabled him to decide upon the exponent of the parabolic curve for the various events.

It appears that no study has yet been made to verify if the improvement of inexperienced female athletes follows a similar pattern to that proposed by McCloy for the athletes in his study.

If it is true that improvement does follow this pattern, then the average improvement of a group of

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[10] McCloy, op. cit., 9-37.

superior performers in one event should score the same number of points as the average improvement of a group of poor performers in the same event.

Delimitations

The performances upon which the scoring tables were constructed and tested were obtained from results recorded in the annual practical track and field examinations held by the Physical Education Department at Rhodes University, South Africa, during the year 1957, 1958, 1959, 1960, 1961, 1964, 1965, and 1966.

The total number of students involved was 143. Table 5 shows the number of students who recorded performances in the tests held at the end of each year of instruction. The first recorded performance of a student in any one event was regarded as a "first trial," the second recorded performance was regarded as a "second trial," and so on.

The performances of third year students in the year 1964 were considered as first trials, since their performances in 1962 and 1963 were not available.

All first trials in the discus and javelin were recorded by second year students, since those events were only introduced during the second year of the program.

TABLE 5

THE NUMBER OF STUDENTS RECORDING FIRST, SECOND, OR THIRD TRIALS IN THE EIGHT EVENTS TESTED

Event	First Trial	Second Trial	Third Trial
100 Yards	141	63	28
880 Yards	103	39	6
80M. Hurdles	100	28	-
High Jump	134	51	16
Long Jump	140	58	22
Putting the Shot	142	56	19
Discus Throw	90	43	-
Javelin Throw	90	43	-

The scoring tables were constructed using "first trials" only.

The low number of students who recorded a third trial in the 880 yards is due to the fact that this

event was introduced recently into the program in place of the one mile flat.

Limitations were imposed on certain events. It was the purpose of the program to teach the students the western roll and straddle styles of high jumping, and the students were required to use one of these styles in the tests.

In the 80 meter hurdles, the students were permitted to have the hurdles spaced either 8 meters or 8 yards apart. The IAAF has recognized that the regulation spacing of 8 meters is actually retarding some of the world's leading female hurdlers because of their height and speed. The 100 meter hurdles for women has been successfully introduced with the hurdles spaced 8.5 meters apart. The majority of the students at Rhodes space the hurdles 8 yards apart, but the better athletes, some of whom compete in meetings, choose to space the hurdles at 8 meters (26 feet 2 inches). This arrangement permits the majority of students to develop a three-stride rhythm and helps to prevent accidents.

Limitations

Three factors may be considered to impose limitations on the study.

1. The results of performances recorded during the years 1962 and 1963 were not available.

2. The number of students who recorded third trials is low for some events. This was caused by changes in the program, and the relatively small number of students who actually reached the third year. Several events have been taught and tested for two years only, so third trials were not recorded, as in the discus throw, the javelin throw, and the 80 meter hurdles. Other events only have third trials recorded because of changes made in the program. Only the 100 yards and 880 yards are true three trial events, and the reason for the low number of third trials in the 880 yards has already been explained.

3. Students were highly motivated to perform well during the actual examinations, but not sufficiently motivated to train diligently throughout the year. This situation can be expected with regular physical

education students who do not participate actively in competitions. Many girls therefore showed a decline in performance in the 100 yards as increased weight and changing body shape took its toll. In events where skill was involved, progress was evident.

Whether performances improve or decline however, if the principle on which the increased increment table is based is valid, then either improvement or decline will be similar for superior, average and poor performers.

Summary

Female physical education students at Rhodes University, South Africa, pursued a program of practical work that includes track and field athletics. Selected events were included in a 20 week teaching program extending over the first three terms of each academic year. At the end of the program, an annual examination was held and the best performance of each student in each event was recorded. It has been the custom to award points for the performances from the IAAF tables and to use those points to grade the students.

The IAAF tables have not proved satisfactory, and although there were a variety of scoring tables available for use with the male students, no others were apparently available for use with the female students.

It was decided to construct scoring tables using the performances of 143 students recorded in examinations during the years 1957, 1958, 1959, 1960, 1961, 1964, 1965, and 1966.

The increased increment type of scale, suggested by McCloy as suitable for use in athletics with heterogeneous groups, was chosen as the basis for the calculation of the tables.

McCloy's scales were developed for use with men, and there is no evidence that the same principles hold true for women. If it is true that improvement in track and field follows a parabolic curve with a known exponent, then the tables should be able to predict improvement for a person at any point on the scale. This principle was tested in the study.

Should the principle on which increased increment scales are based be valid, students could be graded by comparing their actual improvement with their predicted improvement. The value of such tables in motivating students to improve their performances should also be considered.

A review of the studies relating to the use of the increased increment type of scoring tables will be made in the next chapter.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The measurement, classification, and testing of physical ability developed near the end of the nineteenth century. In 1894 the Normal School of Gymnastics at Milwaukee introduced a battery of nine tests that measured students' ability in such activities as jumping, climbing, and shot putting.[1] At about the same time, the Lake Erie District of the Turnerbund proposed a class pentathlon, and this was administered for the first time on Labor Day, 1894, by the Gymnastic Societies of Cleveland, Ohio.[2]

Credit for the development of a comprehensive test utilizing the elements of running, jumping, vaulting, climbing, and similar activities is given

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[1] John F. Bovard, Frederick W. Cozens, and E. Patricia Hagman, Tests and Measurements in Physical Education, (Philadelphia: W. B. Saunders Company, 1949), 25.

[2] Ibid., 25.

to Meylan of Columbia, who began working in 1904, and whose ideas spread widely across the United States.[3]

Bovard, Cozens, and Hagman[4] give an extensive historical review of the development of testing in physical education. In the early days, scoring devices were often constructed arbitrarily with little or no use of statistical procedures. Scales were often devised on the basis of experience and observation.

The application of scientific methods and statistical procedures led to the development of many types of scoring tables and tests of ability,[5] especially in the area of physical education. At the same time, the sport of competitive track and field athletics also felt the need for methods of scoring that would enable performance in one event to be compared with performance in another event. The decathlon event made the

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[3] Ibid., 25

[4] Ibid., 27

[5] Ibid., 89-112; 309-324.

development of a points scoring system essential, and the first official IAAF Decathlon Scoring Tables were approved at the Third Congress of the IAAF, Geneva, 1921.[6] There have also been several unofficial scoring tables developed for use in track and field (see Chapter I, Page 3).

It can be seen that the development of track and field scoring tables followed two distinct pathways:

1. Within the physical education profession.
2. Within the sphere of competitive track and field.

Developments Within the Physical Education Profession

McCloy[7] indicates that W. A. McCall was responsible for developing the T-Scale, which became popular as a method of constructing scoring tables. McCall based his scales on a method using the frequency

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[6]F. A. M. Webster, The Science of Athletics, Revised Edition, (London: Nicholas Haye, 1948), 141.

[7]C. H. McCloy, Tests and Measurements in Health and Physical Education, Second Edition, (New York: F. S. Crofts and Company, 1946), 97.

distribution, described by Bovard, Cozens, and Hagman.[8]

From this T-Scale developed the T-Score,[9] based on the mean and the standard deviation of a homogeneous group, and now in wide use.

The T-Score is an even-step scale. This means that an equal number of points are given for equal improvement at any point on the scale.

McCloy[10] considered the use of T-Scores as suggested by McCall and Brace in the construction of track and field scoring tables, and decided that while they were suitable for homogeneous groups, they were not suitable for universal use with heterogeneous groups. He felt that a different scale should be devised, one based on the increased increment principle.

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[8]Bovard, Cozens, and Hagman, op. cit., 315-316.

[9]E. F. Lindquist, A First Course in Statistics, (Cambridge, Massachusetts: Houghton Mifflin Company, 1942), 149.

[10]C. H. McCloy, The Measurement of Athletic Power, (New York: A. S. Barnes and Company, 1932), 10-11.

In the early thirties there was much emphasis on producing scoring tables. Neilson and Cozens[11] devised achievement scales for elementary and junior high school boys and girls in physical education activities. They decided that they could not use an increased increment scale because they did not know the limits of achievement in the activities chosen. They chose an even step interval plan extending three standard deviations on either side of the mean.

A scoring table for college women in the fifty yards dash, the running broad jump, and the basketball throw for distance was constructed by Mitchell.[12] It was designed for use with beginners and experts, and she felt that barring unusual differences in training, college women were a homogeneous group. She therefore decided to use the T-Score.

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[11] N. P. Neilson and F. W. Cozens, "Achievement Scales in Physical Education Activities for Boys and Girls in Elementary and Junior High Schools," Research Quarterly, V, 3, (October 1934), 3.

[12] A. V. Mitchell, "A Scoring Table for College Women in the Fifty Yards Dash, Running Broad Jump, and the Basketball Throw for Distance," Research Quarterly Supplement, V, 1, (March 1934), 86.

McCloy[13] pursued his idea of a universal scoring table based upon the increased increment principle, and established seven criteria which he felt such tables should meet:

1. They should award the same number of points for equivalent performances in different events.

2. They should award a progressively increasing number of points as performance improved.

3. The increase in difficulty should be considered only from a physical point of view, and subjective factors, such as courage, should be ignored.

4. The maximum score should be far enough above the world's record to avoid frequent revision of the tables.

5. The zero point should be sufficiently low to enable the tables to be used with anyone old enough to engage in competitive athletics.

6. The rate of increment of points should be computed by mathematical and statistical methods, and not be subjectively estimated.

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[13]McCloy, op. cit., 12-37.

7. The method should be simple enough to allow others to use it for constructing further tables.

Enlisting the aid of Dr. O. H. Smith, DePauw University, McCloy[14] investigated the power developed by athletes in the standing shot put, and concluded that power in this event varied with the 1.5 power of the range. The figure 1.5 was accepted as the exponent of a parabolic curve indicating the increasing difficulty of gaining distance in the shot put. This exponent was then used to construct a scoring table for the shot, and to derive exponents for the other events.

Although McCloy[15] was not sure that the curve for all events was parabolic in nature, he accepted it as being true, and computed the exponents for the other events by the formula:

$$\frac{(\text{Shot Put W})^{1.5}}{(\text{Shot Put M})^{1.5}} = \frac{(\text{Other Field Event W})^{n}}{(\text{Other Field Event M})^{n}} = \frac{(\text{Track Event M})^{n}}{(\text{Track Event W})^{n}}$$

Solve for n.

W = World Record.

M = Mean of collected data.

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[14] McCloy, op. cit., 19.

[15] McCloy, op. cit., 21.

The equation for the track events was inverted because time was used as a measure of velocity, and time is a reciprocal function of velocity, decreasing as velocity increases.

In actually computing the points for the scoring tables, McCloy[16] decided to use a 1000 point scale with the world's record placed at 900 points. Zero was placed at the twenty five points mark. He decided against using standard deviations for determining the range of scores, and eventually adopted the following formula to calculate the points scored by a performance:

$$\text{Points} = \frac{925\ (\text{Actual Performance})^n}{(\text{World's Record})^n} - 25 \text{ (Field Events)}$$

$$\text{Points} = \frac{925\ (\text{World's Record})^n}{(\text{Actual Performance})^n} - 25 \text{ (Track Events)}$$

Where n = the exponent for the event.

The equation for track events is inverted for the reasons stated above.

The principle of McCloy's increased increment tables aroused considerable interest and led to

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[16]McCloy, op. cit., 32.

further research. Cozens[17] analyzed McCloy's study and decided that although the parabolic curve for the different events might not be the same, and each event had a slightly different exponent, a "best-fit" curve with an exponent of two would be accurate enough and more practicable to use. He suggested the following procedure be adopted in constructing an increased increment scale:[18]

1. Find the means and standard deviations of the performances of the group for which scoring tables are desired.

2. Use the basic formula $Y = 2X^2$ to compute the number of points for various performances, where Y = the number of points, and X is the standard deviation distance from zero which is set at five standard deviations below the mean. One thousand points is five standard deviations above the mean.

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[17] F. W. Cozens, "Three Research Studies in Physical Education," Research Quarterly, II, 4, (December 1931), 67-75.

[18] Ibid., 74.

Cozens[19] later developed a decathlon table for use with track squads based on the formula $Y = KX^2$, where K is any constant depending on the range of the scale. His scales ranged from four standard deviations above the mean of the group he tested, to 1.75 standard deviations below the mean.

It would appear that the studies by Cozens formed the basis of the full explanation on the use and construction of increased increment scoring tables that appears in the book by Bovard, Cozens, and Hagman.[20] Using one of the methods recommended in this book, the author constructed the tables developed in this study. A full description of the method used is given in Chapter IV.

Schwall[21] studied the Detroit Decathlon Scoring Tables, and compared them with the various other

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[19]F. W. Cozens, "A Fall Decathlon for Track Squads," Research Quarterly, IX, 2 (May 1938), 3.

[20]Bovard, Cozens, and Hagman, op. cit., 318-324.

[21]Joseph J. Schwall, "A Statistical Analysis of the Detroit Decathlon and a Comparison of its Scoring Tables with Other Selected Tables," (Unpublished Master's Dissertation, Wayne University, Detroit, 1942).

methods of constructing scoring tables that have been mentioned in this study, and concluded that because contestants are classified for the Detroit Decathlon, the scoring tables should be based on the normal curve method.

Phelan[22] developed a track and field pentathlon scoring table using the formula suggested by Bovard, Cozens, and Hagman.[23] Two other studies[24,25] were conducted on the use of increased increment scales, but the author was unable to procure them.

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[22]Clarence W. Phelan, Jr., "The Development of a Track and Field Pentathlon Scoring Table," (Unpublished Master's Dissertation; University of Washington, Seattle, 1963).

[23]Bovard, Cozens, and Hagman, op. cit., 322.

[24]R. K. Cutler, "The Increased Scale in the Evaluation of Performances in Physical Ability Tests," (Unpublished Master's Dissertation; University of Oregon, Eugene, 1934).

[25]J. E. Suzick, "The Development of an Increased Increment Scale for Use in the Evaluation of Performances in Selected Physical Ability Tests for Boys in the Ninth Grade," (Unpublished Master's Thesis; University of Washington, Seattle, 1953).

According to statements made in one of his books,[26] McCloy also produced increased increment scoring tables for girls, but these could only be obtained in mimeographed form direct from McCloy, and because of his death the author was unable to obtain a copy of them. In a personal letter to the author, A. J. Wendler of the University of Iowa, who worked quite closely with McCloy in the thirties, states that he does not remember seeing the scoring tables for girls, but suggests that the exponents used by McCloy would be valid for constructing such tables.

Another study on the use of an increased increment scoring system with girls was reported in 1945 in "Education for Victory".[27] The improvement of girls in the standing broad jump, the basketball throw, the potato race, pull-ups, push ups, sit-ups,

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[26]C. H. McCloy, Tests and Measurements in Health and Physical Education, Second Edition, (New York: F. S. Crofts and Company, 1947), 93.

[27]E. Metheney et alia, "Physical Performance Levels for High School Girls. Evaluation of Improvements in Performance", Education for Victory III, 21 (May 1945), 8-10.

and squat thrusts was studied, and those girls whose initial scores were low showed greater improvement than those whose initial scores fell in the upper levels. It was indicated that the scoring tables make no provision for differences in individual ceiling capacity for performance, and since there was no statistical approach, teachers were advised to use the tables with discretion.

Developments Within the Sport of Track and Field Athletics

The IAAF and Portuguese Tables. The Decathlon Scoring Tables approved by the IAAF in Geneva, 1921, were based upon performances recorded in Olympic Games track and field events up to and including the 1912 Olympic Games. Points were awarded on the following basis:

> "For a performance similar to the best result obtained at the 1912 or previous Olympic Games, 1000 points will be awarded. Other performances are valued in accordance with this table."[28]

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[28]Webster, op. cit., 141.

In the running events, points were scored for every one fifth of a second, and in the field events for every two fifths of an inch.

These tables were superseded in 1934 by the "Finnish Tables", submitted by the Finnish Athletic Association. The "Swedish Tables" displaced the Finnish Tables in 1950, and in 1954 the IAAF approved Scoring Tables for Women. The tables at present in use for men were approved by the IAAF in 1962.[29]

The Portuguese Athletic Association produced its own tables in 1949.[30] The latest edition of the Portuguese Tables appeared in 1962, and although used extensively by magazines and track and field statisticians, they have never been accepted by the IAAF.

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[29]All IAAF Tables may be obtained from: International Amateur Athletic Federation, 46 Victoria Street, London, S. W. 1., England.

[30]Systeme Rationnel Pour Classer Les Performances Athletiques. Obtainable from: Federacao Portuguesa De Atletismo, P.da Alegria, 65, Lisboa, Portugal.

Kihlberg and Karvonen[31] studied the methods by which track and field scoring tables were constructed, and concluded that tables based on means and standard deviations were unsuitable for National or World groups. They also felt that the IAAF tables in use at that time were based on statistical observations of average speeds in running for the track events, while in the field events the points were probably subjectively awarded.

Meade[32] felt that the IAAF and Portuguese Tables were based largely on arbitrary calculations.

In an effort to ascertain the basis upon which the IAAF tables were constructed, the author wrote to the IAAF Technical Committee member[33] who supervized the construction of the present official tables.

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[31] J. Kihlberg and M. J. Karvonen, "Comparison on a Statistical Basis of Achievement in Track and Field Events," Research Quarterly, XXVIII, 3, (October 1957), 244.

[32] George P. Meade, Athletic Records; The Whys and Wherefores (New York: Vantage Press Inc., 1966), 186.

[33] A. Jorbeck, Erik Sandbergsgaten 17, Solna, Sweden.

In a letter to the author, the Assistant Secretary of the IAAF[34] indicated that it was doubtful if a reply would be received, and this was the case. It can be seen from Table 6 however, which shows the number of points gained by excellent and poor performers, men and women, in the 100 meters, that some sort of increased increment principle was used in both the IAAF and the Portuguese Tables.

TABLE 6

Comparison of Points Gained by Superior and Poor Men and Women Athletes in the 100 Meters Using IAAF and Portuguese Tables

	Performance Improvement (Seconds)	Number of Points Gained	
		IAAF Tables	Portuguese Tables
MEN	10.2 to 10.1	24	24
	15.6 to 15.5	12	-
	13.8 to 13.7	-	13
WOMEN	11.1 to 11.0	26	-
	10.8 to 10.7	-	23
	18.6 to 18.5	9	-
	16.5 to 16.6	-	10

[34] F. W. Holder, Hon. Assistant Secretary, International Amateur Athletic Federation, 46 Victoria Street, London, S. W. 1., England.

Other Tables. Mitchell[35] mentions the Randolph-Macon Points System published in the Official Handbook of the National Committee on Women's Athletics.[36] These were based on an even-step increment, but no information was given on the method of construction.

The 1954 Milocarian Scoring Table[37] used in England for high school boys' competitions, was based on the increased increment principle, and the tables produced by Reel[38] also used that principle. McCollum[39] constructed tables based on frequency distributions and percentiles, in which points were awarded on an increased increment principle.

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[35]Mitchell, op. cit., 5.

[36]Published by: American Sports Publishing Company, New York, 1925-26, 1930-31, Pages 103-107.

[37]1954 Milocarian Scoring Tables; obtainable from: Amateur Athletic Association, 26 Park Crescent, London, W. 1., England.

[38]S. F. Vincent Reel, Decathlon Kit; Individual Score Chart, P. O. Box 659, Garden Grove, California.

[39]Robert H. McCollum, "A Junior High School Sextathlon," Athletic Journal, XXXVIII, 5 (January 1958), 44.

Ecker[40] and Sylvia[41] published tables for use with high school and college athletes, but no description of the methods used in the construction was given.

Summary

Scoring tables in track and field athletics have been developed during the past fifty years. The main purposes of such tables have been to compare the performances of two individuals in a number of events, such as in the decathlon, or to compare a performance in one event with a performance in another event. This development has occurred both in the field of physical education and in the area of competitive track and field athletics.

Physical educationists who have conducted research into scoring tables have used mathematical and statistical procedures. Brace constructed tables using

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[40]Tom Ecker, "A Decathlon for High School Boys," Athletic Journal, XLI, 8 (April 1961), 58.

[41]Alfred J. Sylvia, "A Decathlon for High School and College," Athletic Journal, XLIV, 8 (April 1964), 38.

the T-Score. McCloy accepted T-Scores for constructing scoring tables for use with homogeneous groups, but thought that an increased increment scale was necessary for use with heterogeneous groups.

Cozens confirmed McCloy's study on the increased increment principle of constructing scoring tables, but suggested a "best-fit" curve for all events would be suitable, rather than a separate curve for each event. Bovard, Cozens, and Hagman discussed in detail the construction of scoring tables based upon this principle.

Three other studies were conducted on the use of the increased increment principle in physical ability tests for boys. Mitchell constructed scoring tables based upon T-Scores in three events for college women, and Metheney et alia discussed the use of the increased increment scoring system in certain activities for high school girls.

In the area of competitive track and field athletics, various scoring tables presented by the Finnish and Swedish Athletic Federations have been

accepted by the IAAF. Kihlberg and Karvonen felt that although statistical calculations based upon speed of running had been used in these tables, subjective estimations had also played a role.

The Portuguese Tables are in wide use throughout the world but have not been accepted by the IAAF. Meade felt that they were based upon arbitrary calculations based upon running speeds.

Various other tables have appeared but the principles of construction have usually been omitted.

The majority of the scoring tables used in track and field athletics, including the IAAF and Portuguese Tables, are based upon some form of increased increment principle.

CHAPTER III

TESTING PROCEDURES

The increased increment scales developed and tested in this study were constructed from performances recorded by 143 female physical education students at Rhodes University, South Africa, in the annual practical track and field examinations held at that institution during the years 1957, 1958, 1959, 1960, 1961, 1964, 1965, and 1966.

The tests for these examinations were held in September each year, at the end of the third term. A time table was prepared and posted on the notice board several weeks before the tests took place so that the students would know their test days well in advance and could prepare accordingly. Normally a student would complete all her events in two testing sessions. An example of the timetable typical of that used with first year students was:

First Day: 100 yards; High Jump; 880 yards.

Second Day: 80 meter hurdles; Long Jump; Shot; 880 yards.

The 880 yards was held on both days to enable students to take a second attempt if they so desired.

The two test days were usually held within the same week, and never more than three days apart.

At the time allocated for testing, the staff of the physical education department supervised the various events, acting as judges and timekeepers. The students moved from one event to another. It was usual to begin with the 100 yards, or the 80 meter hurdles, and have all the students take two attempts at these events. The students would then circulate among two or three field events which were organized concurrently. All the students and staff came together again at the close of the session for the running of the 880 yards.

All events were conducted according to IAAF rules and regulations,[1] except where special considerations and conditions were imposed as stated in the detailed description of the events that appears below.

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[1] IAAF Rules for Competition: obtainable from Windsor House, 46 Victoria Street, London S. W. 1., England.

The students were allowed the choice of footwear, both during the course of instruction, and during the testing. The majority of students competed in bare feet.

If weather conditions such as a strong wind or heavy rain made it difficult to obtain accurate results, testing was postponed to another day previously allocated for the purpose on the examination timetable. Postponement was seldom necessary.

The regular track and field facilities of the University were used. The running events were held on a standard sized 440 yard grass running track. The location of the field events varied from time to time, but they were always held on a level surface using regulation equipment except as indicated in the detailed description of each event.

The Testing Procedure for Each Event

100 yards. Starting blocks were permitted, but rarely used. The students ran two at a time, and were timed independently on stop watches, the time being

recorded to a tenth of a second. In the case of a split-timing where the hand of the stop watch stopped between two of the tenth marks, the time was recorded to the higher tenth, (that is, the slower time).

All timing and starting was carried out by the staff of the physical education department.

The starter used the following commands, "On your marks, set, go!" and on the word "go!" lowered his upraised arm as rapidly as possible. The starter held a white handkerchief to assist the timekeepers. The timekeepers started their watches the moment they saw the starter move his upraised arm.

If the students left their marks before the command, "go!" they were recalled by a whistle. The students were not disqualified for false-starting, and were permitted to use a standing or a crouch start. Almost without exception, the crouch start was used.

Each student was allowed two attempts in this event, the second attempt following the completion of the first attempts. Running the students in pairs ensured sufficient rest between the first and second attempts. Research has shown that in short distance

sprints, reliable results are obtained from the best of two trials, and that further trials rarely improve performance.[2]

880 yards. The students ran two laps of the 440 yard track. The start was not in lanes, and to avoid congestion and to facilitate timing, the students ran in groups of six to eight persons at a time.

The usual commands were used to start the event.

Three stop watches were started on the command "go:" and while the event was on, the watch recording the middle time was noted. At the finish of the event this watch was used to record the time of all the students. The watch was not stopped, but allowed to run continuously, and as the students crossed the finishing line, the time was called out to the nearest second. A recorder was assigned to each student and noted the time called out.

Times were called out and recorded in minutes and seconds, but converted to seconds for the purpose of this study.

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[2]L. W. McCraw and J. W. Tolbert, "A Comparison of The Reliabilities of Scoring Tests of Physical Ability," Research Quarterly XXIII, 1, (March 1952), 73-81.

The times at the end of the first lap were read to the students as they ran past. Two attempts were allowed, the second attempt on another day.

80 meter Hurdles. The procedure used in this event was similar to that used in the 100 yards. The students ran two at a time and the same starting and timing techniques were followed.

Eight international type hurdles, two feet six inches in height, were spaced out for each student.

There was a choice of hurdle spacing. The students could space the hurdles either eight yards apart, or eight meters apart. The distance from the starting line to the first hurdle remained constant at twelve meters. Those students who preferred the eight yard spacing ran first. The hurdle spacings were adjusted to eight meters and those who preferred that spacing then ran.

As has been explained in Chapter I, page 26, the choice of hurdle spacing allows the poor and superior performers to perform to their best ability, and neither is at a disadvantage.

High Jump. During the course of instruction, the students were taught to jump using either the Western Roll or the Straddle styles of jumping and they were obliged to use one of these styles in the tests. A starting height was set by mutual agreement among the students, one that the weakest performer could clear, and the bar was raised one inch at a time until all the students failed to clear it.

The students were allowed to commence jumping at any height, and could pass at any height if they wished. Students who had three consecutive failures, that is, who had knocked the bar down three times in succession, were not eliminated as in the IAAF rules, but were allowed a fourth attempt at this height. If they cleared the bar at this fourth attempt they were not permitted to continue jumping at the next height, but the height they cleared was credited to them.

Regulation high jump uprights and metal cross bars were used. Performances were measured by a steel tape and recorded to the quarter of an inch below the point on the tape in line with the lowest point of the upper side of the cross bar.

Long Jump. The students were allowed six trials in this event, and the best trial was recorded. Measurements were made with a steel tape from the nearest mark made in the sand by the student on landing, to the nearer edge of the take-off board to the sand pit.

Distances were recorded to the nearest inch. The sand was raked smooth and level after each jump to improve accuracy of measurement. It was also often necessary to dampen the sand to ensure a clean break at the landing point.

If the student left the ground beyond the nearer edge of the take-off board to the pit, this was recorded as a "no-jump" and not measured. It did count as one of the six trials allowed each student.

Putting the Shot. The students were allowed six trials in this event, and the best trial was recorded. A concrete throwing circle was used, and distances were measured with a steel tape to the nearest inch. The zero of the tape was placed at the nearest mark made by the shot to the circle. The tape was held through the center of the circle and the distance read from the tape at the inside edge of the circle.

Eight pound, thirteen ounce shots were used.

The students were permitted to throw from a standing position, or with a "glide" across the circle.

Throws in which the students failed to put the shot according to the IAAF rules were recorded as "no-throws", counted as one of the six trials, and the distance was not measured.

Throwing the Discus. The students were allowed six trials in this event, and the best trial was recorded. A concrete throwing circle and 2.2 pound discuses were used.

Measurements were made in the same way as described for Putting the Shot, but only at the completion of the event. During the event, metal numbered pegs were used to mark the throws of the students. Measurements were made to the nearest inch, but recorded to the nearest six inches.

The students were permitted to throw from a standing position or with a turn across the circle.

A 200 foot steel tape was used.

"No-throws", usually caused by the students overbalancing out of the circle, were recorded as such,

not measured, and counted as one of the six allowed trials.

Throwing the Javelin. The students were allowed six trials in this event, and the best trial was recorded. One pound, six and one-fourth ounce javelins were used, and thrown from behind straight white scratch lines marked in white lime on the field. The distances thrown were marked with metal numbered pegs, and the best throw was measured with a steel tape from the nearest mark made by the point of the javelin to the inside edge of the line from which it was thrown. The distance was recorded to the nearest six inches.

Students who crossed the line while throwing, or who caused the javelins to land flat (not point first) had the attempts recorded at "no-throws" in the same way as discus and shot.

A 200 foot tape is necessary.

Metal Swedish "Seefab" javelins were used.

The Data

All the performances were recorded on prepared charts. For the purpose of this study, the 880 yard

times were converted to seconds, and all the measured distances were converted to inches, except in the javelin and discus, where distances were left in feet.

The data were then tabulated and organized ready for the calculation of the tables and the statistical tests described in Chapter IV.

Summary

Female physical education students at Rhodes University, South Africa, participated in track and field tests during the years 1957, 1958, 1959, 1960, 1961, 1964, 1965, and 1966. The events in which performances were recorded were: 100 yards, 880 yards, 80 meter hurdles, High Jump, Long Jump, Putting the Shot, Throwing the Discus, and Throwing the Javelin.

Except where specified, these tests were conducted according to IAAF rules on a standard 440 yard track, and using regulation equipment.

Testing was carried out by staff members of the physical education department, and for each student, usually consisted of two separate test days during one

week in September each year, with the events divided between the two days.

The best performance of each student in each event was recorded and converted to a form suitable for use in the calculations to follow.

CHAPTER IV

THE ANALYSIS AND INTERPRETATION OF THE DATA

Introduction

It was the purpose of this study to (a) construct increased increment scoring tables for selected track and field events using the initial performances of female college physical education students, and (b) to test their validity using the number of points gained or lost by the students from the first to the second trial.

The principle upon which the tables were constructed assumes that as performance levels in track and field improve, it becomes progressively more difficult to improve, and that the rate of improvement is according to an exponential curve. The validity of this assumption was tested by comparing the number of points awarded for the average improvement of the high, average, and low performers in each event between their first and second trials.

The first recorded performance of every student in each of the eight track and field events was therefore used in the construction of the tables. Then those students who had recorded second and third trials in events were arranged into rank order in each event according to performances recorded in the first trial. The students were then divided into three ability groups, designated high, average, and low ability groups.

The points scored by each student in her first, second, and third trials were read from the increased increment scoring tables, and the number of points gained or lost between the first and second trials, the second and third trials, and the first and third trials were calculated. Analysis of variance was used to determine the significance of any differences in the average gain or loss of points of each of the three ability groups from the first to the second trial in each event in an attempt to test the validity of the theory on which the increased increment tables were constructed. If points can be awarded according to an exponential curve, then each of the three ability

groups should have scored a similar number of points in each event, although actual performance changes would be different.

The small number of students who recorded third trials was due to several factors:

1. The number of students who actually reached the third year of study and majored in physical education was usually small.

2. The arrangement of events in the program was changed from time to time in an effort to improve instruction. The 880 yards event was substituted for the mile event during the years from which performances have been taken.

3. It was decided to accept the first recorded performance of a student as a first trial, regardless of whether it was recorded in the first, second, or third year of instruction. This procedure did not affect the significance of the number of points gained or lost, since this was theoretically in proportion to the position of the student on the scale.

4. Performances recorded during the years 1962 and 1963 were unavailable.

The Nature of Performances Recorded

The number of students who recorded first, second, and third trials, and the means and standard deviations of performances in each event are shown in Table 7.

Consideration of the means shows that in all events there was overall progress between trials. This progress was slight for the running events and the long jump, but more marked in the high jump, shot put, and discus throw. This is an expected pattern, since it is logical to assume that there would be greater improvement in the technical events which were less dependent on natural ability, and where a new skill was being learned. The javelin throw did not conform to this pattern. Improvement in this event was slight and the distances thrown were less than in the discus throw, whereas they should have been further. This was probably due to the poor background in throwing of the majority of the students, a general feature of girls. Those people who have not developed throwing ability when young usually make little progress with the javelin.

TABLE 7

The Number of Students who Recorded Performances in the Trials, and the Means and Standard Deviations of the Performances[a]

	First Trial			Second Trial			Third Trial		
	N	M	S.D.	N	M	S.D.	N	M	S.D.
100 yards	141	13.57	1.08	63	13.40	0.84	28	13.25	0.89
880 yards	103	188.32	15.36	39	182.87	13.12	6	-	-
80M. Hurdles	100	15.94	1.64	28	15.72	1.52	-	-	-
High Jump	134	3.87	0.31	51	4.00	0.33	16	4.15	0.30
Long Jump	140	13.14	1.25	58	13.67	1.28	22	13.73	1.44
Shot Put	142	23.92	2.74	56	25.19	3.11	19	26.04	3.84
Discus Throw	90	66.68	10.16	43	71.57	12.22	-	-	-
Javelin Throw	90	61.63	11.77	43	63.72	11.38	-	-	-

[a]Times are shown in seconds; distances are in feet.

The introduction of throwing the cricket ball into the first year program might help to overcome this difficulty. The javelin throw is the only track and field event that employs a true throwing action with the elbow leading the movement. Lack of true elbow-first throwing ability does not affect the learning of the shot put, and the discus throw, since neither of these employ a true throwing action.

The standard deviations of the running events and the long jump indicated high variability in the performances, especially in the first trials of the 100 yards dash. The three throwing events also showed high variability in relation to the low means recorded. The high jump had a comparatively low standard deviation indicating little variability in that event.

Table 8 shows the numbers, means, and standard deviations of the performances of the students in their ability groups. It can be seen that the high ability groups declined in performance either from the first to the second trial, or from the first to the third trial, in the 100 yards dash, the 880 yards run, the high jump, the long jump, and the javelin throw.

TABLE 8

Means and Standard Deviations of Performances of the Three Ability Groups at the Time of the Trials[a]

Event	Ability Group	First Trial			Second Trial			Third Trial		
		N	M	S.D.	N	M	S.D.	N	M	S.D.
100 Yards	High	23	12.47	0.51	23	12.70	0.51	11	12.74	0.47
	Average	19	13.36	0.17	19	13.28	0.50	8	12.95	0.53
	Low	21	14.23	0.49	21	14.29	0.52	9	14.13	0.89
880 Yards	High	13	171	5.36	13	175	10.02	-	-	-
	Average	12	184	2.36	12	183	14.54	-	-	-
	Low	14	193	6.02	14	191	9.01	-	-	-
80M Hurdles	High	10	14.40	0.63	10	14.34	0.53	-	-	-
	Average	9	15.97	0.23	9	15.42	0.54	-	-	-
	Low	9	17.89	1.00	9	17.56	1.03	-	-	-
High Jump	High	13	4.35	0.15	13	4.38	0.25	8	4.32	0.34
	Average	21	3.96	0.11	21	3.92	0.23	5	4.00	0.09
	Low	17	3.58	0.11	17	3.81	0.26	3	3.94	0.04

TABLE 8--Continued

Event	Ability Group	First Trial			Second Trial			Third Trial		
		N	M	S.D.	N	M	S.D.	N	M	S.D.
Long Jump	High	18	14.91	1.16	18	14.70	1.06	10	14.69	1.16
	Average	19	13.43	0.23	19	13.78	0.80	5	13.57	0.86
	Low	21	12.08	0.71	21	12.69	1.05	7	12.46	1.04
Shot Put	High	18	27.51	2.91	18	27.82	3.82	8	28.49	3.83
	Average	19	23.82	0.40	19	24.67	1.35	5	26.17	0.70
	Low	19	21.72	1.04	19	23.21	1.49	6	22.67	2.71
Discus Throw	High	15	80.43	9.82	15	80.97	13.26	-	-	-
	Average	14	65.29	2.00	14	70.18	7.66	-	-	-
	Low	14	57.29	4.60	14	62.89	6.34	-	-	-
Javelin Throw	High	15	73.70	10.25	15	72.17	10.72	-	-	-
	Average	15	57.87	3.08	15	62.37	7.86	-	-	-
	Low	13	48.31	3.99	13	55.54	8.55	-	-	-

[a]Times are shown in seconds; distances are in feet.

improvements by this group in the shot put, discus, and hurdles were very slight. The overall impression is that the high ability groups either declined or failed to improve. This may have been due to the fact that students in this group realized that they were certain of gaining a satisfactory number of points in the examinations, even if they neglected track and field to some extent and allowed their performances to decline. They could afford to concentrate their energies in other areas offering greater reward for improvement.

The average ability groups showed a mixed pattern of improvement and decline. Improvement is evident in the 100 yards dash, the 880 yards run, the 80 meter hurdles, the shot put, the discus throw, and the javelin throw, with little change or fluctuations occurring in the high jump and long jump.

There is marked improvement by the low ability groups in the high jump, the discus throw, and the javelin throw; slight improvement in the 880 yards and the 80 meter hurdles, and fluctuations in the 100 yards, the long jump and the shot put. It is understandable that the low ability groups were keen

to improve their performances to gain more points.

This general pattern of the high ability groups showing no improvement or declining, the average ability groups showing slight improvement with fluctuations, and the low ability groups showing marked gains with fluctuations, tends to support the principle on which increased increment scales are based. It should be noted however, that changes in performance levels were often outweighed by the variability of performances as indicated by the standard deviations. In the 880 yards, for instance, there was a decline of only one second between the first and second trials of the average ability group, but the standard deviation increased by just over twelve seconds. A similar situation occurred in the discus throw with the average ability group, and with the high ability group.

Another interesting pattern shown in Table 8 is the tendency of some ability groups to decline between the first and the second trial, but to improve again between the second and the third trial. This happened in the 100 yards with the low ability group; in the high

jump with the average ability group; and in the shot put with the low ability group. The reverse, however, happened with the high ability group in the high jump; and with the average and low ability groups in the long jump. In these three cases there was an improvement followed by a decline. This fluctuating pattern tends to invalidate the principle on which increased increment scales are based.

The Construction of the Increased Increment Scoring Tables

The method used to construct the increased increment scoring tables in this study was suggested by Bovard, Cozens, and Hagman.[1] They suggest that the equation to be used is parabolic or exponential in nature, with an exponent of two. Although McCloy[2] calculated exponents for each event, Bovard, Cozens,

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[1] J. F. Bovard, F. W. Cozens, and E. P. Hagman, Tests and Measurements in Physical Education (Philadelphia: W. B. Saunders and Company, 1949), 318-324.

[2] C. H. McCloy, The Measurement of Athletic Power (New York: A. S. Barnes and Company, 1932), 24-27.

and Hagman[3] indicate than an exponent of two will give a "best-fit" curve suitable for all events.

Using performances recorded as first trials, the means and standard deviations were calculated for each of the eight events. Although the origin of the parabolic curve is always at five standard deviations below the mean,[4] it was decided to set the zero point of the tables in this study at three standard deviations below the mean. Three standard deviations below the mean would normally include 49.87% of the possible scores below the mean.[5] The difficulty of deciding how far to extend the tables above the means was less easily solved. The original intention was to set the upper limit, or 1000 point mark, at five standard deviations above the mean, but it was noticed that in the javelin throw, with a mean of 61.63 feet and a standard deviation of 11.77 feet, 1000 points would be scored.

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[3]Bovard, Cozens, and Hagman, op. cit., 319.

[4]Bovard, Cozens, and Hagman, op. cit., 320.

[5]E. F. Lindquist, A First Course in Statistics (Cambridge, Massachusetts: Houghton Mifflin Company, 1942), 86.

with a throw of approximately 120 feet. Since there were students in the University already throwing that distance, it did not allow enough room for future improvement in student standards.

The world records for the events were unsuitable since they were too far removed from the students' performances. The South African Women's Records were considered suitable, and an approximation of these records was used as the 1000 points mark. The South African Women's Records,[6] the performance decided upon to represent 1000 points, and the standard deviation distances of the 1000 points marks above the means of the students' performances are shown in Table 9.

Using the 1000 points marks listed in Table 9, and the means and standard deviations of the students' performances in the first trials, listed in Table 7, scoring tables were constructed according to the example listed as Problem 3 in the book by Bovard, Cozens, and Hagman.[7]

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[6]South African Athletics Annual, 1965, (obtainable from G. LeRoux, Orangestraat 7, Sunnyside, Johannesburg), 104.

[7]Bovard, Cozens, and Hagman, op. cit., 323.

TABLE 9

South African Women's Records; Performances Required for 1000 Points; and the Standard Deviation Distances of the Required Performances above the Mean[a]

	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot Put	Discus Throw	Javelin Throw
S. A. Record	10.7	2:11	11.0	5'6½"	20'1½"	48'7½"	158'9"	161'8½"
1000 Point Performance	10.6	2:10	11.0	5'6"	20'0"	48'0"	158'0"	160'0"
S. D. Distance Above the Mean	2.739	3.796	3.012	5.296	5.478	8.795	6.896	8.358

[a]Time in seconds; 880 yards in minutes and seconds; distances in feet and inches.

The following steps were followed in the construction of the tables:

1. The difference in performance between the means of the students and the 1000 points marks were found by subtraction.

2. The performance differences were divided by the standard deviations to find the number of standard deviation units the 1000 points mark was above the mean in each event.

3. Since the origin of the curve is five standard deviations below the mean, the total length of each curve was found by adding to five the number of standard deviation units the 1000 points mark was above the mean. (See 2. above) This figure represented the X value in the formula $Y = KX^2$ (See Chapter II, Page 39).

4. The constant K was calculated from the formula: $Y = 1000 = KX^2$.

5. Since the zero point was set at three standard deviations below the mean, it was necessary to calculate a constant S. This value must be subtracted from Y since no points were awarded below three standard deviations below the mean. Thus a second formula

for Y was obtained: $Y = 0 = KX^2 - S$. The X value in this formula would be two, because the zero is two standard deviations from the origin of the curve.

6. Using the two formulae for Y, values for K and S were calculated.

The 100 yards event is used here to illustrate the calculations.

1. $Y = 1000 = K(7.739)^2 - S$
2. $Y = 0 = K(2)^2 - S$.

Subtract

$1000 = 59.889\ K - 4K = 55.889K$.

$\therefore K = 17.893$.

Substitute for K in equation 2.

$0 = 4(17.893) - S$

$\therefore S = 71.572$.

Thus the 1000 points mark, or 10.6 seconds, is represented by the formula:

$1000 = (7.739)^2 \times 17.893 - 71.572$.

Points for each tenth of a second above 10.6 seconds were found by dividing 0.1 seconds by the standard deviation 1.0844, to find the standard deviation value of a tenth of a second, and this value,

0.092, was then subtracted from the X value. Calculations were performed for each X value until the X value was two, and the points scored were zero. At an X value of five, the performance value should be the same as the mean.

Points in each event were calculated for the intervals as shown in Table 10.

TABLE 10

Intervals for Which Points Were Calculated on the Increased Increment Tables

Event	The Interval
100 yards	every tenth of a second.
880 yards	every second.
80M. Hurdles	every tenth of a second.
High Jump	every half an inch.
Long Jump	every inch.
Shot Put	every three inches.
Discus Throw	every six inches.
Javelin Throw	every six inches.

A Comparison of the IAAF and the Increased Increment Scoring Tables

One of the reasons for constructing scoring tables based upon the actual performances of the students was the assumption that there would be a more realistic relationship in the points scored by students in different events. Table 11 shows the points awarded by the IAAF tables and the increased increment tables for the standards set for the first year students, and the points awarded by both tables for the means of the first trials.

It is clear that the IAAF tables give a more consistent points score than the increased increment tables, both for the empirically set standards and for the calculated means. One of the reasons for the wide variation in the points scored by the increased increment tables, is the large differences in the standard deviation distances of the 1000 points marks above the means.

TABLE 11

Points Awarded by IAAF Tables and Increased Increment Tables for First Year Standards and Means of First Trials[a]

Event	100 yards	880 yards	80M Hurdles	High Jump	Long Jump	Shot Put
Standard	14.0	3:30	16.0	3'8"	12'6"	22'0"
IAAF Tables	415	283	466	345	436	444
Constructed Tables	309	121	343	144	153	78
Means	13.6	3:08	15.9	3'10½"	13'2"	23'11"
IAAF Tables	473	492	474	420	431	496
Constructed Tables	372	289	353	206	201	109

[a]times in seconds; 880 time in minutes and seconds, distances in feet and inches.

Referring again to Table 9, it can be seen that in the 100 yards dash, the standard deviation distance of 1000 points above the mean was only 2.739, but in the three throwing events, the distance was over 8.0 in each case.

This is the reason why the points scored by the means of the high jump, long jump, and shot put on the increased increment tables is very low in number.

The IAAF tables are therefore apparently more suitable for use with the students than the constructed increased increment tables. Had world records been used for the 1000 points marks, it is more than likely that the situation would have been aggravated. It is obvious that the performances selected for the 1000 points marks were unsuitable, and the tables would probably have given a better comparison of performance between events had the University records been used. It could also be argued that the tables prove that the Rhodes University students are well below average in the throwing events and the jumping events, and that this would be brought home to them by use of the increased increment tables.

There is another reason for the discrepancies in points scored by the standards on the IAAF tables. It would appear that the standards should be adjusted. It is obvious that the standard in the 880 yards can be raised, while the 80 meter hurdles standard, set only one tenth of a second below the mean, could be lowered. In setting the standards, there has always been conflict in the author's mind between having marks that were attainable by a certain percentage of the students, and marks that were roughly equivalent to each other. The construction of the increased increment tables has not helped to resolve this conflict.

Testing the Validity of the Increased Increment Scoring Tables

Establishing the ability groups. Those students who had recorded a second or third trial were isolated and ranked in order of performance on the first trial. These performances were divided into three groups of high, average, and low ability, and the groups were kept as near equal in size as possible, but convenient breaks in performance levels were also used. The numbers of

students who recorded second and third trials is shown in Table 7, and the number of students in each ability group can be found in Table 8.

Points gained and lost. The points scored by the performances were read from the increased increment scoring tables, and the number of points gained or lost by each student from one trial to the next was found by subtraction. These gains and losses were then used to find the mean gain or loss of points by the ability groups in each event, and the variability of points gain or loss existing within each group represented by the standard deviation.

The average points gain or loss and the standard deviations are shown in Table 12. The tendency for the high ability groups to decline in performance noted in Table 8 is again evident. From the first to the second trial the high ability groups declined in the average number of points scored in the 100 yards dash, the 880 yards run, the long jump, and the javelin. Points gained in the 80 meter hurdles and discus were very small. The loss of points in the 100 yards and 880 yards is particularly marked.

TABLE 12

Means and Standard Deviations of the Increased Increment Points" Gain and Loss of the Three Ability Groups Between the Three Trials

Event	Ability Group	First to Second Trial		Second to Third Trial		First to Third Trial	
		M	S.D.	M.	S.D.	M.	S.D.
100 Yards	High	-44.9	66.5	- 8.4	65.3	-51.3	68.5
	Average	+16.0	75.7	+52.3	55.3	+68.1	77.8
	Low	- 7.8	46.7	+22.6	89.6	+12.9	74.9
880 Yards	High	-35.4	73.9	-	-	-	-
	Average	+18.3	113.7	-	-	-	-
	Low	+24.4	67.9	-	-	-	-
80M Hurdles	High	+ 6.4	62.7	-	-	-	-
	Average	+58.2	53.3	-	-	-	-
	Low	+26.7	58.8	-	-	-	-

TABLE 12--Continued

Event	Ability Group	First to Second Trial		Second to Third Trial		First to Third Trial	
		M.	S.D.	M.	S.D.	M.	S.D.
High Jump	High	+14.7	80.9	+16.5	116.5	+32.8	43.4
	Average	-16.2	66.7	+ 9.0	52.4	+28.0	35.6
	Low	+78.0	62.9	+44.0	33.1	+134.7	11.7
Long Jump	High	-21.2	86.0	+28.3	52.8	-36.4	99.7
	Average	+32.9	63.8	-21.2	59.7	+14.8	61.3
	Low	+44.2	77.7	-20.0	59.8	+46.6	43.6
Shot Put	High	+11.6	49.9	+ 6.5	20.5	+34.0	54.4
	Average	+18.2	25.9	+40.0	29.5	+47.6	17.6
	Low	+26.7	25.5	+15.3	29.1	+25.5	25.9
Discus Throw	High	+ 7.7	54.1	-	-	-	-
	Average	+28.6	41.1	-	-	-	-
	Low	+26.0	28.9	-	-	-	-

TABLE 12--Continued

Event	Ability Group	First to Second Trial		Second to Third Trial		First to Third Trial	
		M.	S.D.	M.	S.D.	M.	S.D.
Javelin Throw	High	- 8.5	44.4	-	-	-	-
	Average	+23.5	35.7	-	-	-	-
	Low	+31.8	35.1	-	-	-	-

The average ability groups made fairly steady gains from first trial to second trial in all events except the high jump. Gains were particularly high in the 80 meter hurdles, the long jump, and to a lesser extent, the discus throw.

The low ability groups also made steady gains in points between the first and second trials, except in the 100 yards dash, where a loss occurred. The biggest gains were made in the high jump, long jump, and javelin throw.

From this analysis of points gained or lost between the first and second trials, it is clear that there is much inconsistency and variation. Study of the standard deviations shows that there was also tremendous variation within the ability groups, and that this variation was not consistent. The average ability group in the 880 yards made an average gain of 18.3 points, but the standard deviation of 113.7 shows that some students improved markedly in this group, while some declined markedly. Consideration of the actual figures for this group shows that one student declined 254 points.

Moving to the shot put we see that the average ability group had a very similar mean gain of 18.2 points, but this time the standard deviation was only 25.9. The actual figures show that the greatest gain by a student was 53 points, and the greatest loss was only 31 points.

There was obviously much variation within groups and between groups. The least variability within groups appears to have occurred in the shot put, and the greatest variability in the 880 yards, high jump, and long jump.

Similar inconsistencies and variations within groups are apparent in the figures for second to third trials, and for first to third trials.

The reason for many students showing a marked decline in performance could be due to a wide variety of factors. When they first enter university they are keen to do well in all activities and having had a comparatively active life at school, are still basically fit. During the course of their university careers; the students realize that they can pass the physical education practical examinations without scoring highly

in track and field; they become more sophisticated and less inclined to participate in track and field activities; they develop physical secondary sex characteristics and lose the natural early teen-age fitness; they realize that only exceptional students can gain a first-class pass and settle for a comfortable second or third-class pass.

The wide variations within groups would possibly indicate that testing track and field performance once a year is not a reliable method of judging the true progress and ability of the students. Menstrual or emotional problems could have influenced the results adversely on the particular day of the trials.

Testing the significance of the differences in the average number of points gained or lost by the three ability groups between first and second trials. Analysis of variance[8] was used to test the null hypothesis that there was no significant difference in the average number of points gained or lost by each ability group in each event from the first trial to the second trial.

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[8]H. E. Garrett, Statistics in Psychology and Education, Fourth Edition (New York: Longmans, Green and Company, 1953), 273.

The F values for variance in each event are shown in Table 13. A significant difference at the 1% level of confidence was obtained in the high jump. Significant F values at the 5% level of confidence were obtained in the 100 yards dash, the long jump, and the javelin throw. Only in the 880 yards run, the 80 meter hurdles, the shot put, and the discus throw were F values low enough to accept the null hypothesis that there were no significant differences in the points gained or lost.

It is therefore apparent that the exponential learning curve on which the table construction was based, could only be valid for half of the eight events tested in this particular study. Reference to the discussion of Table 12 however, shows that even in those four events it is doubtful if the principle holds true, since within group variance completely dominated between group variance.

In the 880 yards run, there are obviously differences between the means of points gained and lost from first to second trial, but these are overshadowed by the large within group variances, particularly in the average ability group.

TABLE 13

An Analysis of Variance of the Points Gained and Lost by the Three Ability Groups Between First and Second Trials for each Event

Event	Between Means			Within Groups			Total		F
	df	SS	S.D.^{2}	df	SS	S.D.^{2}	df	SS	
100 Yards	2	39820	19910	60	256180	4270	62	296000	4.662[a]
880 Yards	2	28367	14183.5	36	290582	80717	38	318949	1.757
80M Hurdles	2	12833	6416.5	25	95936	3837.44	27	108769	1.672
High Jump	2	84654	42327	48	245949	5124	50	330603	8.26[b]
Long Jump	2	46106	23053	55	337412	6135	57	383518	3.757[a]

TABLE 13--Continued

Event	Between Means			Within Groups			Total		F
	df	SS	S.D.^{2}	df	SS	S.D.^{2}	df	SS	
Shot Put	2	2132	1066	53	69971	1320	55	72103	0.80
Discus Throw	2	3781	1890.5	40	76222	1906	42	80003	0.99
Javelin Throw	2	13037	6518.5	40	64600	1615	42	77637	4.036[a]

[a]Significant at the 0.05 level of confidence.

[b]Significant at the 0.01 level of confidence.

In the 80 meter hurdles there are obvious differences between the means of the groups, and the standard deviations are high. In the shot put and discus throw the high ability groups scored a low number of points gained compared to the other two groups, but the large variation within the groups again overshadowed the differences.

The tendency of performers within the same ability group to differ widely in the amount of improvement or decline between trials has already been noted. Had the students performed according to the theory on which the tables were constructed, the majority of students in the high ability group would have improved slightly; the majority in the low ability group would have improved considerably; and the majority in the average ability group would have improved an amount somewhere between the two extremes. Each of these gains, when averaged in groups, would have scored a similar number of points.

The students in this study did not improve according to the theoretical pattern. Not only were there wide fluctuations in the amount of improvement by students

at the same ability level, but there was also the tendency of certain students in certain events to show either fluctuations or a steady decline in performance.

Summary

The data collected in this study were used for two purposes:

1. To construct increased increment scales in eight track and field events for women, using the first recorded trial of female college physical education students.

2. To test the validity of the principle on which the increased increment scales were based, using the difference in the number of points gained or lost by high, average and low ability groups from first to second trials.

The performances of the students were classified into first, second, or third trials, and the means and standard deviations were computed. Inspection of the means showed that there was an overall slight improvement in performance from first to second and second to third trials, with improvement more evident

in the high jump, the shot put, and the discus throw. This was attributed to the greater learning opportunities offered by these events compared with the other events in which natural ability plays a larger part. Improvement in the javelin however, was only slight, and this may have been due to a lack of general throwing ability among the students.

The standard deviations of the throwing events, the running events, and the long jump indicated that the variability was often a more significant factor than the actual improvements. There was much less variability in the high jump.

An analysis of performances according to the ability groups gave the impression that the high ability groups either maintained a status quo or declined in performance; the average ability groups showed a mixed pattern of improvement and decline; the low ability groups showed marked improvement in some events, slight improvements in some events, and fluctuations in other events.

More significant than these general tendencies was the increase in variability of some groups from

the first to the second trial, particularly in the 880 yards run and the discus throw.

Several ability groups either improved from the first to the second trial and declined from the second to the third trial, or declined from the first to the second trial and improved from the second to the third trial.

Actual performances did not, in fact, show the pattern of improvement one would have expected if they had been in accordance with the principle on which the increased increment scales were based.

The increased increment scales were constructed according to a parabolic curve with an exponent of two. The curve originated at five standard deviations below the mean, but zero was placed for convenience at three standard deviations below the mean. The 1000 points mark was set at performances closely approximating the South African Women's Records for the eight events. Two constants, K and S, to determine the length of each curve and to set the zero at minus three sigma, were calculated from these two formulae:

$$Y = 1000 = K(X)^2 - S.$$

$$Y = 0 = K(X)^2 - S.$$

The constants were substituted in the formula and points for each required performance between zero and 1000 points were calculated.

A comparison of the increased increment scales and the IAAF tables showed the latter to be less variable in the number of points awarded to the means of the students' first trial performances, and the empirically set standards used in the University physical education department. This was due to the wide variations in the standard deviation distances of the 1000 points marks above the means used to construct the increased increment tables. The increased increment tables do, however, reflect the weaknesses of the physical education students' performances in comparison with the South African records. Inspection of the means and the points scored by the standards showed that certain standards could be adjusted.

The average points gain or loss by the high, average, and low ability groups in each event from the first trial to the second trial were calculated. The wide differences between groups and the great variability of points gained

or lost within groups was immediately apparent. It was seen that some ability groups declined in performance, and the reasons were discussed. The variations present between groups and within groups did not support the principle of the increased increment scales.

The differences between the means of the ability groups were tested for significance by analysis of variance. Four events showed F values too high to accept the null hypothesis that the difference in points gained or lost was due to chance. In the four groups where F values indicated that differences were not significant, inspection of the means and the standard deviations showed that the differences between means had been obscured by the large variability existing within the groups.

It was evident from this study that the students did not show performance improvements consistent with the theory on which the increased increment tables were based.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Problem. The problem under consideration in this study was the effectiveness of using increased increment scoring tables with college female physical education students in eight selected track and field events. The subjects were students at Rhodes University, Grahamstown, South Africa, during the years 1957, 1958, 1959, 1960, 1961, 1964, 1965, and 1966; and the eight events selected were the 100 yards dash, the 880 yards run, the 80 meter hurdles, the high jump, the long jump, the shot put, the discus throw, and the javelin throw.

Scoring tables were constructed using the first recorded trial of each student, and the validity of the theory upon which the scoring tables were constructed was tested by comparing the differences in the number of points gained and lost by superior, average, and poor performers from the first trials to the second trials.

If the theory was valid, the number of points gained or lost by each of the aforementioned ability groups would be approximately equal, since points were awarded according to a parabolic curve which awarded an increasing number of points as performance improved. Theoretically, it should become increasingly more difficult to improve as performance improves.

Background to the Study. Physical education students at Rhodes University are required to reach a certain level of achievement in track and field athletics, represented by a certain number of points on the IAAF scoring tables. These tables have been used with the students for some years, but have not been entirely satisfactory because they are based on the metric system, and are scaled in relation to world record performances. The first factor made the tables difficult to use, and the second appeared to result in the students scoring relatively low totals of points in the technical events, such as the shot put, the discus throw, the javelin throw, and the high jump, compared with the points scored in the other events which rely more of natural ability. It was felt that

tables constructed using English measurements, and based upon the actual ability of the students, would be easier and more effective to use.

A review of the literature indicated that suitable scales might be constructed based upon a parabolic curve with an exponent of two, and that such scales would be suitable for use with heterogeneous ability groups. If the scales were proved valid, it would be possible to grade students according to improvement, rather than in relation to absolute standards.

Collecting the Data. Each year in September the students participated in a practical track and field examination conducted in a similar manner to the pentathlon event held at championship track and field meetings. Each student performed in the events she had been taught during the instructional program, and all performances were recorded. Two attempts were allowed in the running events. The 100 yards dash and 80 meter hurdles were timed to a tenth of a second, and the 880 yards run to the nearest second. Six attempts were allowed in the throwing events and the long jump,

and in the high jump three attempts were allowed at each height except the final height, where a fourth attempt was allowed which, if successful, did not qualify the student to continue jumping. The high jump and long jump were measured to the nearest inch, the shot put to the nearest three inches; and the discus throw and javelin throw to the nearest six inches.

The data recorded in these examinations were used in this study. Depending upon the number of years students spent in the physical education department and the arrangement of the program, students recorded one, two or three trials in the various events.

Analysis of the Data. The means of performances recorded in first, second, and third trials showed that there was overall progress in all events. Progress was slight in the running events and the long jump, and more marked in the shot put, discus throw, and high jump. This pattern could reflect the greater learning opportunities present in the technical events compared with the other events. Improvement in the javelin was slight, probably due to the lack of true throwing ability among the students. Variance was high in the

running events, relatively high in the throwing events, but comparatively low in the high jump.

Division of the students into three groups of high, average, and low ability according to first trial performances, and a comparison of the performances of the three groups between trials, revealed much variation in progress patterns. Generally speaking, it appeared that the high ability groups did not improve; the average ability groups showed slight improvement; and the low ability groups made relatively large improvement. Within this general pattern, variability was high in some events, and more significant than group mean changes.

Constructing the Scoring Tables. Increased increment scoring tables were constructed using the first trial performances of the students. The range of the scales was chosen with zero at three standard deviations below the mean and 1000 points at a mark approximately equivalent to the South African Women's Records. Maintaining the origin of the curve at five standard deviations below the mean, points were calculated for performances within the range according

to formulae shown previously.

Comparison of IAAF and Constructed Tables. A comparison of the points scored by the performance means and arbitrarily set standards on the IAAF tables and the constructed tables showed the IAAF tables to be more consistent in the points awarded for the different events. From this point of view they would be more suitable to use with the students.

Analysis of the Points Gained and Lost by the Ability Groups. The average number of points gained or lost by each ability group in each event from first trial to second trial revealed a similar pattern to the performance analysis. The high ability groups declined in points scored; the average ability groups made slight gains; and the poor ability groups made steady gains. Variability was high and more marked than the mean number of points gained or lost.

Changes in student interest, motivation, physique, and attitude, and a lack of reliability in the method of testing only once a year, were considered as possible reasons for the variability in performances recorded by the students.

Testing the Significance of Points Gained or Lost. The average number of points gained or lost from first trial to second trial by each ability group in each event was compared using analysis of variance. No significant differences were found in the 880 yards run, the 80 meter hurdles, the shot put, and the discus throw. In all events however, it was felt that differences between the means were overshadowed by the large variances existing within the groups. This led to the conclusion that the theory upon which the increased increment tables were based could not be accepted as valid for the students in the study.

Conclusions

1. The analysis and interpretation of the data collected in this study shows that there were wide differences in the progress of individual students in the eight selected track and field events.

2. Ability group characteristics tended to support the increased increment theory of progressive decline in

improvement as ability improves, but the extremely wide variation of individuals within the groups would make it impossible to predict the improvement of an individual athlete, based upon a first trial performance, with any degree of reliability.

3. The tables constructed in this study would be more suitable to use with athletes who are engaged in regular track and field competition. The range of points chosen made them unsuitable for use with college physical education students.

4. The lack of improvement in the running events suggests that they should receive more attention in the second and third years of the program.

5. The lack of reliability in the performances recorded might be improved by testing the students more frequently than once a year.

6. The introduction of the event, throwing the cricket ball, into the first year program might assist the learning of the javelin throw in the second year of the program.

7. Revision of the minimum standards that students are expected to reach in each event should receive attention.

The means of performances and the number of points scored on the particular tables chosen should be considered.

Recommendations

The conclusions reached in this study tend to invalidate the theory on which increased increment scales are based. Since the majority of track and field scoring tables are constructed according to an increased increment principle, further research into the increased increment theory would appear justified.

The weakness of the increased increment theory lies in the fact that individuals are being graded according to group characteristics. Intensive study of learning processes in recent years has accentuated the importance of individual differences in any learning situation.[1] Although a group of people may produce a particular type of learning curve in an activity,

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[1] R. M. W. Travers, Essentials of Learning (New York: The MacMillan Company, 1963), 281-292.

individual variations about this curve are often very great. This was evident in this study.

Further research is required in many situations, in various activities, and with different groups of subjects, to resolve what is really a philosophical question. Is it justifiable to judge the progress of an individual according to a hypothetical group characteristic?

It is possible that it would be fairer to the individuals concerned if scoring tables of the T-Score type were constructed for various levels of competition. There would be one for Olympic athletes, and one for physical education students.

Another aspect not allowed for in increased increment scales is the difference in potential of different individuals. Theoretically, a person running the 100 yards in 14.0 seconds should make greater improvement than a person running the 100 yards in 12.0 seconds. This might be true if the two individuals were identical in all respects, but this is highly improbable. It could happen that the

person running 14.0 seconds has less room for improvement than the one running 12.0 seconds. In order to judge a person's progress according to his own ability, each person's potential must be known and an individual scale constructed. More research into what improvement we can expect of individuals is necessary before grading according to progress made can be used effectively.

It would be interesting to see if the use of the scoring tables constructed in this study to grade the students at Rhodes University would change the performance patterns. Would they serve as a motivating factor? The author intends to study this aspect in the future.

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APPENDIX A

APPENDIX A

THE INCREASED INCREMENT SCORING TABLES

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
1000	10.6	2:10	11.0	5'6"	20'0"	48'0"	158'0"	160'0"
999	-	-	-	-	-	-	-	-
998	-	-	-	-	-	-	-	-
997	-	-	-	-	-	-	-	-
996	-	-	-	-	-	-	-	-
995	-	-	-	-	-	-	-	-
994	-	-	-	-	-	-	-	-
993	-	-	-	-	-	-	-	-
992	-	-	-	-	-	-	157'6"	159'6"
991	-	-	-	-	-	-	-	-
990	-	-	-	-	-	-	-	-
989	-	-	-	-	-	-	-	-
988	-	-	-	-	-	-	-	-
987	-	-	-	-	-	-	-	-
986	-	-	-	-	19'11"	47'9"	-	159'0"
985	-	-	-	-	-	-	157'0"	-
984	-	2:11	11.1	-	-	-	-	-
983	-	-	-	-	-	-	-	-
982	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
981	-	-	-	-	-	-	-	
980	-	-	-	-	-	-	-	158'6"
979	-	-	-	-	-	-	-	-
978	-	-	-	-	-	-	156'6"	-
977	-	-	-	-	-	-	-	-
976	-	-	-	-	-	-	-	-
975	10.7	-	-	-	-	-	-	-
974	-	-	-	-	-	-	-	-
973	-	-	-	-	19'10"	-	-	158'0"
972	-	-	-	5'5½"	-	47'6"	-	-
971	-	-	-	-	-	-	-	-
970	-	-	-	-	-	-	156'0"	-
969	-	2:12	-	-	-	-	-	-
968	-	-	11.2	-	-	-	-	-
967	-	-	-	-	-	-	-	157'6"
966	-	-	-	-	-	-	-	-
965	-	-	-	-	-	-	-	-
964	-	-	-	-	-	-	-	-
963	-	-	-	-	-	-	155'6"	-
962	-	-	-	-	-	-	-	-
961	-	-	-	-	-	-	-	-
960	-	-	-	-	19'9"	-	-	157'0"
					-	47'3"	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
959	-	-	-	-	-	-	-	-
958	-	-	-	-	-	-	-	-
957	-	-	-	-	-	-	-	-
956	-	-	-	-	-	-	155'0"	-
955	-	-	-	-	-	-	-	-
954	-	2:13	-	-	-	-	-	156'6"
953	-	-	-	-	-	-	-	-
952	-	-	11.3	-	-	-	-	-
951	-	-	-	-	-	-	-	-
950	10.8	-	-	-	-	-	-	-
949	-	-	-	-	-	-	154'6"	-
948	-	-	-	-	-	-	-	156'0"
947	-	-	-	-	19'8"	-	-	-
946	-	-	-	-	-	47'0"	-	-
945	-	-	-	5'5"	-	-	-	-
944	-	-	-	-	-	-	-	-
943	-	-	-	-	-	-	-	-
942	-	-	-	-	-	-	154'0"	-
941	-	-	-	-	-	-	-	155'6"
940	-	-	-	-	-	-	-	-
939	-	-	-	-	-	-	-	-
938	-	2:14	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
937	-	-	-	-	-	-	-	-
936	-	-	11.4	-	-	-	153'6"	155'0"
935	-	-	-	-	19'7"	-	-	-
934	-	-	-	-	-	46'9"	-	-
933	-	-	-	-	-	-	-	-
932	-	-	-	-	-	-	-	-
931	-	-	-	-	-	-	-	-
930	-	-	-	-	-	-	-	154'6"
929	-	-	-	-	-	-	153'0"	-
928	-	-	-	-	-	-	-	-
927	-	-	-	-	-	-	-	-
926	-	-	-	-	-	-	-	-
925	10.9	-	-	-	-	-	-	-
924	-	-	-	-	-	-	-	-
923	-	2:15	-	-	19'6"	-	-	154'0"
922	-	-	-	-	-	-	152'6"	-
921	-	-	-	-	-	46'6"	-	-
920	-	-	11.5	-	-	-	-	-
919	-	-	-	5'4½"	-	-	-	-
918	-	-	-	-	-	-	-	-
917	-	-	-	-	-	-	-	153'6"
916	-	-	-	-	-	-	152'0"	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
915	-	-	-	-	-	-	-	-
914	-	-	-	-	-	-	-	-
913	-	-	-	-	-	-	-	-
912	-	-	-	-	-	-	-	-
911	-	-	-	-	-	-	-	-
910	-	-	-	-	-	-	-	153'0"
909	-	-	-	-	19'5"	-	-	-
908	-	2:16	-	-	-	-	151'6"	-
907	-	-	-	-	-	46'3"	-	-
906	-	-	-	-	-	-	-	-
905	-	-	11.6	-	-	-	-	-
904	-	-	-	-	-	-	-	152'6"
903	-	-	-	-	-	-	-	-
902	-	-	-	-	-	-	-	-
901	11.0	-	-	-	-	-	151'0"	-
900	-	-	-	-	-	-	-	-
899	-	-	-	-	-	-	-	-
898	-	-	-	-	-	-	-	152'0"
897	-	-	-	-	-	-	-	-
896	-	-	-	-	19'4"	-	-	-
895	-	-	-	-	-	-	-	-
894	-	2:17	-	-	-	46'0"	150'6"	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
893	-	-	-	5'4"	-	-	-	-
892	-	-	-	-	-	-	-	151'6"
891	-	-	-	-	-	-	-	-
890	-	-	-	-	-	-	-	-
889	-	-	11.7	-	-	-	-	-
888	-	-	-	-	-	-	150'0"	-
887	-	-	-	-	-	-	-	-
886	-	-	-	-	-	-	-	151'0"
885	-	-	-	-	19'3"	-	-	-
884	-	-	-	-	-	-	-	-
883	-	-	-	-	-	-	-	-
882	-	-	-	-	-	45'9"	-	-
881	-	-	-	-	-	-	149'6"	-
880	-	-	-	-	-	-	-	150'6"
879	-	2:18	-	-	-	-	-	-
878	-	-	-	-	-	-	-	-
877	-	-	-	-	-	-	-	-
876	11.1	-	-	-	-	-	-	-
875	-	-	-	-	-	-	149'0"	-
874	-	-	11.8	-	-	-	-	150'0"
873	-	-	-	-	19'2"	-	-	-
872	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
871	-	-	-	-	-	-	-	-
870	-	-	-	-	-	-	-	-
869	-	-	-	-	-	-	-	-
868	-	-	-	-	-	45'6"	-	-
867	-	-	-	-	-	-	148'6"	149'6"
866	-	-	-	5'3½"	-	-	-	-
865	-	-	-	-	-	-	-	-
864	-	2:19	-	-	-	-	-	-
863	-	-	-	-	-	-	-	-
862	-	-	-	-	-	-	-	-
861	-	-	-	-	-	-	-	149'0"
860	-	-	-	-	-	-	148'0"	-
859	-	-	11.9	-	19'1"	-	-	-
858	-	-	-	-	-	-	-	-
857	-	-	-	-	-	-	-	-
856	-	-	-	-	-	45'3"	-	-
855	-	-	-	-	-	-	-	148'6"
854	-	-	-	-	-	-	147'6"	-
853	-	-	-	-	-	-	-	-
852	11.2	-	-	-	-	-	-	-
851	-	-	-	-	-	-	-	-
850	-	2:20	-	-	-	-	-	-
							-	148'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
849	-	-	-	-	-	-	-	-
848	-	-	-	-	19'0"	-	147'0"	-
847	-	-	-	-	-	-	-	-
846	-	-	-	-	-	-	-	-
845	-	-	-	-	-	-	-	-
844	-	-	12.0	-	-	45'0"	-	147'6"
843	-	-	-	-	-	-	-	-
842	-	-	-	5'3"	-	-	-	-
841	-	-	-	-	-	-	146'6"	-
840	-	-	-	-	-	-	-	-
839	-	-	-	-	-	-	-	-
838	-	-	-	-	-	-	-	147'0"
837	-	-	-	-	-	-	-	-
836	-	-	-	-	18'11"	-	-	-
835	-	2:21	-	-	-	-	146'0"	-
834	-	-	-	-	-	-	-	-
833	-	-	-	-	-	-	-	-
832	-	-	-	-	-	44'9"	-	146'6"
831	-	-	-	-	-	-	-	-
830	-	-	-	-	-	-	-	-
829	11.3	-	12.1	-	-	-	-	-
828	-	-	-	-	-	-	145'6"	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
827	-	-	-	-	-	-	-	-
826	-	-	-	-	-	-	-	146'0"
825	-	-	-	-	-	-	-	-
824	-	-	-	-	18'10"	-	-	-
823	-	-	-	-	-	-	-	-
822	-	-	-	-	-	-	145'0"	-
821	-	2:22	-	-	-	-	-	-
820	-	-	-	-	-	44'6"	-	145'6"
819	-	-	-	-	-	-	-	-
818	-	-	-	-	-	-	-	-
817	-	-	-	5'2½"	-	-	-	-
816	-	-	-	-	-	-	-	-
815	-	-	-	-	-	-	144'6"	-
814	-	-	12.2	-	-	-	-	145'0"
813	-	-	-	-	-	-	-	-
812	-	-	-	-	18'9"	-	-	-
811	-	-	-	-	-	-	-	-
810	-	-	-	-	-	-	-	-
809	-	-	-	-	-	-	144'0"	-
808	-	-	-	-	-	-	-	144'6"
807	-	2:23	-	-	-	44'3"	-	-
806	11.4	-	-	-	-	-	-	-

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
805	-	-	-	-	-	-	-	-
804	-	-	-	-	-	-	-	-
803	-	-	-	-	-	-	-	-
802	-	-	-	-	-	-	143'6"	144'0"
801	-	-	-	-	-	-	-	-
800	-	-	-	-	18'8"	-	-	-
799	-	-	12.3	-	-	-	-	-
798	-	-	-	-	-	-	-	-
797	-	-	-	-	-	-	-	-
796	-	-	-	-	-	-	143'0"	143'6"
795	-	-	-	-	-	44'0"	-	-
794	-	-	-	-	-	-	-	-
793	-	2:24	-	-	-	-	-	-
792	-	-	-	5'2"	-	-	-	-
791	-	-	-	-	-	-	-	143'0"
790	-	-	-	-	-	-	-	-
789	-	-	-	-	-	-	142'6"	-
788	-	-	-	-	18'7"	-	-	-
787	-	-	-	-	-	-	-	-
786	-	-	-	-	-	-	-	-
785	-	-	12.4	-	-	-	-	142'6"
784	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
783	11.5	-	-	-	-	43'9"	142'0"	-
782	-	-	-	-	-	-	-	-
781	-	-	-	-	-	-	-	-
780	-	-	-	-	-	-	-	-
779	-	2:25	-	-	-	-	-	142'0"
778	-	-	-	-	-	-	-	-
777	-	-	-	-	18'6"	-	141'6"	-
776	-	-	-	-	-	-	-	-
775	-	-	-	-	-	-	-	-
774	-	-	-	-	-	-	-	-
773	-	-	-	-	-	-	-	141'6"
772	-	-	-	-	-	-	-	-
771	-	-	-	-	-	43'6"	-	-
770	-	-	12.5	-	-	-	141'0"	-
769	-	-	-	-	-	-	-	-
768	-	-	-	5'1½"	-	-	-	141'0"
767	-	-	-	-	-	-	-	-
766	-	-	-	-	-	-	-	-
765	-	2:26	-	-	18'5"	-	-	-
764	-	-	-	-	-	-	140'6"	-
763	-	-	-	-	-	-	-	-
762	-	-	-	-	-	-	-	140'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
761	-	-	-	-	-	-	-	-
760	11.6	-	-	-	-	-	-	-
759	-	-	-	-	-	43'3"	-	-
758	-	-	-	-	-	-	140'0"	-
757	-	-	-	-	-	-	-	-
756	-	-	12.6	-	-	-	-	140'0"
755	-	-	-	-	-	-	-	-
754	-	-	-	-	-	-	-	-
753	-	-	-	-	18'4"	-	-	-
752	-	-	-	-	-	-	-	-
751	-	2:27	-	-	-	-	139'6"	-
750	-	-	-	-	-	-	-	139'6"
749	-	-	-	-	-	-	-	-
748	-	-	-	-	-	43'0"	-	-
747	-	-	-	-	-	-	-	-
746	-	-	-	-	-	-	-	-
745	-	-	-	-	-	-	139'0"	139'0"
744	-	-	-	5'1"	-	-	-	-
743	-	-	-	-	-	-	-	-
742	-	-	12.7	-	18'3"	-	-	-
741	-	-	-	-	-	-	-	-
740	-	-	-	-	-	-	-	-

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
739	-	-	-	-	-	-	138'6"	138'6"
738	11.7	2:28	-	-	-	-	-	-
737	-	-	-	-	-	-	-	-
736	-	-	-	-	-	42'9"	-	-
735	-	-	-	-	-	-	-	-
734	-	-	-	-	-	-	-	138'0"
733	-	-	-	-	-	-	138'0"	-
732	-	-	-	-	-	-	-	-
731	-	-	-	-	18'2"	-	-	-
730	-	-	-	-	-	-	-	-
729	-	-	-	-	-	-	-	-
728	-	-	12.8	-	-	-	-	137'6"
727	-	-	-	-	-	-	137'6"	-
726	-	-	-	-	-	-	-	-
725	-	-	-	-	-	-	-	-
724	-	2:29	-	-	-	42'6"	-	-
723	-	-	-	-	-	-	-	137'0"
722	-	-	-	-	-	-	-	-
721	-	-	-	5'0½"	-	-	137'0"	-
720	-	-	-	-	-	-	-	-
719	-	-	-	-	18'1"	-	-	-
718	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
717	-	-	-	-	-	-	-	136'6"
716	11.8	-	-	-	-	-	-	-
715	-	-	-	-	-	-	-	-
714	-	-	12.9	-	-	-	136'6"	-
713	-	-	-	-	-	42'3"	-	-
712	-	-	-	-	-	-	-	-
711	-	2:30	-	-	-	-	-	136'0"
710	-	-	-	-	-	-	-	-
709	-	-	-	-	-	-	-	-
708	-	-	-	-	18'0"	-	136'0"	-
707	-	-	-	-	-	-	-	-
706	-	-	-	-	-	-	-	135'6"
705	-	-	-	-	-	-	-	-
704	-	-	-	-	-	-	-	-
703	-	-	-	-	-	-	-	-
702	-	-	-	-	-	-	135'6"	-
701	-	-	-	-	-	42'0"	-	-
700	-	-	13.0	-	-	-	-	135'0"
699	-	-	-	-	-	-	-	-
698	-	2:31	-	-	-	-	-	-
697	-	-	-	5'0"	17'11"	-	-	-
696	-	-	-	-	-	-	135'0"	-
695	-	-	-	-	-	-	-	134'6"

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
694	11.9	-	-	-	-	-	-	-
693	-	-	-	-	-	-	-	-
692	-	-	-	-	-	-	-	-
691	-	-	-	-	-	-	-	-
690	-	-	-	-	-	41'9"	134'6"	134'0"
689	-	-	-	-	-	-	-	-
688	-	-	-	-	-	-	-	-
687	-	-	-	-	-	-	-	-
686	-	-	13.1	-	17'10"	-	-	-
685	-	2:32	-	-	-	-	-	-
684	-	-	-	-	-	-	134'0"	133'6"
683	-	-	-	-	-	-	-	-
682	-	-	-	-	-	-	-	-
681	-	-	-	-	-	-	-	-
680	-	-	-	-	-	-	-	-
679	-	-	-	-	-	41'6"	-	133'0"
678	-	-	-	-	-	-	133'6"	-
677	-	-	-	-	-	-	-	-
676	-	-	-	-	-	-	-	-
675	-	-	-	-	17'9"	-	-	-
674	-	-	-	4'11½"	-	-	-	-
673	12.0	-	13.2	-	-	-	-	132'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
672	-	2:33	-	-	-	-	133'0"	-
671	-	-	-	-	-	-	-	-
670	-	-	-	-	-	-	-	-
669	-	-	-	-	-	-	-	-
668	-	-	-	-	-	41'3"	-	132'0"
667	-	-	-	-	-	-	-	-
666	-	-	-	-	-	-	132'6"	-
665	-	-	-	-	-	-	-	-
664	-	-	-	-	17'8"	-	-	-
663	-	-	-	-	-	-	-	131'6"
662	-	-	-	-	-	-	-	-
661	-	-	-	-	-	-	132'0"	-
660	-	-	-	-	-	-	-	-
659	-	2:34	13.3	-	-	-	-	-
658	-	-	-	-	-	-	-	-
657	-	-	-	-	-	41'0"	-	131'0"
656	-	-	-	-	-	-	-	-
655	-	-	-	-	-	-	131'6"	-
654	-	-	-	-	-	-	-	-
653	-	-	-	-	17'7"	-	-	-
652	12.1	-	-	4'11"	-	-	-	130'6"
651	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
650	-	-	-	-	-	-	-	-
649	-	-	-	-	-	-	131'0"	-
648	-	-	-	-	-	-	-	-
647	-	-	-	-	-	-	-	130'0"
646	-	2:35	13.4	-	-	40'9"	-	-
645	-	-	-	-	-	-	-	-
644	-	-	-	-	-	-	-	-
643	-	-	-	-	17'6"	-	130'6"	-
642	-	-	-	-	-	-	-	-
641	-	-	-	-	-	-	-	129'6"
640	-	-	-	-	-	-	-	-
639	-	-	-	-	-	-	-	-
638	-	-	-	-	-	-	-	-
637	-	-	-	-	-	-	130'0"	-
636	-	-	-	-	-	-	-	129'0"
635	-	-	-	-	-	40'6"	-	-
634	-	-	-	-	-	-	-	-
633	-	2:36	13.5	-	-	-	-	-
632	-	-	-	-	17'5"	-	129'6"	-
631	12.2	-	-	-	-	-	-	128'6"
630	-	-	-	4'10½"	-	-	-	-
629	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
628	-	-	-	-	-	-	-	-
627	-	-	-	-	-	-	129'0"	128'0"
626	-	-	-	-	-	-	-	-
625	-	-	-	-	-	40'3"	-	-
624	-	-	-	-	-	-	-	-
623	-	-	-	-	-	-	-	-
622	-	-	-	-	17'4"	-	-	127'6"
621	-	2:37	-	-	-	-	128'6"	-
620	-	-	13.6	-	-	-	-	-
619	-	-	-	-	-	-	-	-
618	-	-	-	-	-	-	-	-
617	-	-	-	-	-	-	-	127'0"
616	-	-	-	-	-	-	128'0"	-
615	-	-	-	-	-	-	-	-
614	-	-	-	-	-	40'0"	-	-
613	-	-	-	-	-	-	-	-
612	-	-	-	-	17'3"	-	-	-
611	13.3	-	-	-	-	-	-	126'6"
610	-	-	-	-	-	-	127'6"	-
609	-	-	-	-	-	-	-	-
608	-	2:38	-	4'10"	-	-	-	-
607	-	-	13.7	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
606	-	-	-	-	-	-	-	-
605	-	-	-	-	-	-	-	126'0"
604	-	-	-	-	-	-	-	-
603	-	-	-	-	-	39'9"	127'0"	-
602	-	-	-	-	-	-	-	-
601	-	-	-	-	17'2"	-	-	-
600	-	-	-	-	-	-	-	125'6"
599	-	-	-	-	-	-	-	-
598	-	-	-	-	-	-	126'6"	-
597	-	-	-	-	-	-	-	-
596	-	2:39	-	-	-	-	-	-
595	-	-	-	-	-	-	-	125'0"
594	-	-	13.8	-	-	-	-	-
593	-	-	-	-	-	-	-	-
592	-	-	-	-	-	39'6"	126'0"	-
591	12.4	-	-	-	-	-	-	-
590	-	-	-	-	17'1"	-	-	124'6"
589	-	-	-	-	-	-	-	-
588	-	-	-	-	-	-	-	-
587	-	-	-	4'9½"	-	-	125'6"	-
586	-	-	-	-	-	-	-	-
585	-	-	-	-	-	-	-	124'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
584	-	2:40	-	-	-	-	-	-
583	-	-	-	-	-	-	-	-
582	-	-	-	-	-	39'3"	-	-
581	-	-	13.9	-	-	-	125'0"	-
580	-	-	-	-	17'0"	-	-	123'6"
579	-	-	-	-	-	-	-	-
578	-	-	-	-	-	-	-	-
577	-	-	-	-	-	-	-	-
576	-	-	-	-	-	-	-	-
575	-	-	-	-	-	-	124'6"	123'0"
574	-	-	-	-	-	-	-	-
573	-	-	-	-	-	-	-	-
572	-	2:41	-	-	-	-	-	-
571	12.5	-	-	-	-	39'0"	-	-
570	-	-	-	-	16'11"	-	124'0"	122'6"
569	-	-	-	-	-	-	-	-
568	-	-	14.0	-	-	-	-	-
567	-	-	-	-	-	-	-	-
566	-	-	-	-	-	-	-	-
565	-	-	-	4'9"	-	-	123'6"	122'0"
564	-	-	-	-	-	-	-	-
563	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
562	-	-	-	-	-	-	-	-
561	-	-	-	-	-	38'9"	-	-
560	-	2:42	-	-	16'10"	-	-	121'6"
559	-	-	-	-	-	-	123'0"	-
558	-	-	-	-	-	-	-	-
557	-	-	-	-	-	-	-	-
556	-	-	14.1	-	-	-	-	-
555	-	-	-	-	-	-	-	121'0"
554	-	-	-	-	-	-	122'6"	-
553	-	-	-	-	-	-	-	-
552	-	-	-	-	-	-	-	-
551	12.6	-	-	-	-	38'6"	-	-
550	-	-	-	-	16'9"	-	-	120'6"
549	-	-	-	-	-	-	-	-
548	-	2:43	-	-	-	-	122'0"	-
547	-	-	-	-	-	-	-	-
546	-	-	-	-	-	-	-	120'0"
545	-	-	-	4'8½"	-	-	-	-
544	-	-	14.2	-	-	-	-	-
543	-	-	-	-	-	-	121'6"	-
542	-	-	-	-	-	-	-	-
541	-	-	-	-	-	38'3"	-	119'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
540	-	-	-	-	16'8"	-	-	-
539	-	-	-	-	-	-	-	-
538	-	-	-	-	-	-	121'0"	-
537	-	-	-	-	-	-	-	-
536	-	2:44	-	-	-	-	-	119'0"
535	-	-	-	-	-	-	-	-
534	-	-	-	-	-	-	-	-
533	-	-	-	-	-	-	-	-
532	12.7	-	-	-	-	-	120'6"	-
531	-	-	14.3	-	-	38'0"	-	118'6"
530	-	-	-	-	16'7"	-	-	-
529	-	-	-	-	-	-	-	-
528	-	-	-	-	-	-	-	-
527	-	-	-	-	-	-	120'0"	-
526	-	-	-	-	-	-	-	118'0"
525	-	-	-	-	-	-	-	-
524	-	2:45	-	4'8"	-	-	-	-
523	-	-	-	-	-	-	-	-
522	-	-	-	-	-	-	119'6"	117'6"
521	-	-	-	-	16'6"	37'9"	-	-
520	-	-	-	-	-	-	-	-
519	-	-	14.4	-	-	-	-	-

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
518							119'0"	117'0"
517								
516								
515								
514								116'6"
513	12.8	2:46					118'6"	
512					16'5"	37'6"		
511								
510								
509								116'0"
508			14.5				118'0"	
507								
506								
505				4'7½"				115'6"
504								
503							117'6"	
502		2:47			16'4"	37'3"		
501								
500								115'0"
499								
498								
497								

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
496	-	-	14.6	-	-	-	117'0"	-
495	-	-	-	-	-	-	-	-
494	12.9	-	-	-	-	-	-	-
493	-	-	-	-	-	-	-	114'6"
492	-	-	-	-	16'3"	37'0"	-	-
491	-	-	-	-	-	-	116'6"	-
490	-	2:48	-	-	-	-	-	-
489	-	-	-	-	-	-	-	114'0"
488	-	-	-	-	-	-	-	-
487	-	-	-	-	-	-	-	-
486	-	-	-	-	-	-	116'0"	-
485	-	-	-	4'7"	-	-	-	-
484	-	-	14.7	-	-	-	-	113'6"
483	-	-	-	-	16'2"	-	-	-
482	-	-	-	-	-	36'9"	-	-
481	-	-	-	-	-	-	115'6"	-
480	-	-	-	-	-	-	-	113'0"
479	-	2:49	-	-	-	-	-	-
478	-	-	-	-	-	-	-	-
477	-	-	-	-	-	-	-	-
476	13.0	-	-	-	-	-	115'0"	-
475	-	-	-	-	-	-	-	112'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
474	-	-	-	-	-	-	-	-
473	-	-	-	-	16'1"	36'6"	-	-
472	-	-	14.8	-	-	-	-	-
471	-	-	-	-	-	-	114'6"	112'0"
470	-	-	-	-	-	-	-	-
469	-	-	-	-	-	-	-	-
468	-	2:50	-	-	-	-	-	-
467	-	-	-	-	-	-	-	-
466	-	-	-	4'6½"	-	-	114'0"	111'6"
465	-	-	-	-	-	-	-	-
464	-	-	-	-	16'0"	-	-	-
463	-	-	-	-	-	36'3"	-	-
462	-	-	-	-	-	-	-	111'0"
461	-	-	14.9	-	-	-	113'6"	-
460	-	-	-	-	-	-	-	-
459	-	-	-	-	-	-	-	-
458	13.1	-	-	-	-	-	-	-
457	-	2:51	-	-	-	-	-	110'6"
456	-	-	-	-	-	-	113'0"	-
455	-	-	-	-	15'11"	-	-	-
454	-	-	-	-	-	36'0"	-	-
453	-	-	-	-	-	-	-	110'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
452	-	-	-	-	-	-	-	-
451	-	-	-	-	-	-	112'6"	-
450	-	-	-	-	-	-	-	-
449	-	-	15.0	-	-	-	-	-
448	-	-	-	-	-	-	-	109'6"
447	-	-	-	4'6"	-	-	-	-
446	-	2:52	-	-	15'10"	-	112'0"	-
445	-	-	-	-	-	35'9"	-	-
444	-	-	-	-	-	-	-	109'0"
443	-	-	-	-	-	-	-	-
442	-	-	-	-	-	-	-	-
441	-	-	-	-	-	-	111'6"	-
440	13.2	-	-	-	-	-	-	-
439	-	-	-	-	-	-	-	108'6"
438	-	-	15.1	-	-	-	-	-
437	-	-	-	-	15'9"	-	-	-
436	-	2:53	-	-	-	35'6"	111'0"	-
435	-	-	-	-	-	-	-	108'0"
434	-	-	-	-	-	-	-	-
433	-	-	-	-	-	-	-	-
432	-	-	-	-	-	-	110'6"	-
431	-	-	-	-	-	-	-	107'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
430	-	-	-	-	-	-	-	-
429	-	-	-	-	-	-	-	-
428	-	-	-	4'5½"	15'8"	-	-	-
427	-	-	15.2	-	-	35'3"	110'0"	-
426	-	-	-	-	-	-	-	107'0"
425	-	2:54	-	-	-	-	-	-
424	-	-	-	-	-	-	-	-
423	13.3	-	-	-	-	-	-	-
422	-	-	-	-	-	-	109'6"	106'6"
421	-	-	-	-	-	-	-	-
420	-	-	-	-	-	-	-	-
419	-	-	-	-	15'7"	-	-	-
418	-	-	-	-	-	35'0"	-	106'6"
417	-	-	-	-	-	-	109'0"	-
416	-	-	15.3	-	-	-	-	-
415	-	2:55	-	-	-	-	-	-
414	-	-	-	-	-	-	-	-
413	-	-	-	-	-	-	108'6"	105'6"
412	-	-	-	-	-	-	-	-
411	-	-	-	-	15'6"	-	-	-
410	-	-	-	4'5"	-	-	-	-
409	-	-	-	-	-	34'9"	-	105'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
408	-	-	-	-	-	-	108'0"	-
407	-	-	-	-	-	-	-	-
406	-	-	-	-	-	-	-	-
405	13.4	-	15.4	-	-	-	-	104'6"
404	-	2:56	-	-	-	-	-	-
403	-	-	-	-	-	-	107'6"	-
402	-	-	-	-	15'5"	-	-	-
401	-	-	-	-	-	-	-	104'0"
400	-	-	-	-	-	34'6"	-	-
399	-	-	-	-	-	-	107'0"	-
398	-	-	-	-	-	-	-	-
397	-	-	-	-	-	-	-	103'6"
396	-	-	-	-	-	-	-	-
395	-	-	-	-	-	-	-	-
394	-	2:57	15.5	-	-	-	106'6"	-
393	-	-	-	-	15'4"	-	-	103'0"
392	-	-	-	4'4½"	-	34'3"	-	-
391	-	-	-	-	-	-	-	-
390	-	-	-	-	-	-	106'0"	-
389	13.5	-	-	-	-	-	-	-
388	-	-	-	-	-	-	-	102'6"
387	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
386	-	-	-	-	-	-	-	-
385	-	-	-	-	15'3"	-	105'6"	-
384	-	2:58	15.6	-	-	-	-	102'0"
383	-	-	-	-	-	34'0"	-	-
382	-	-	-	-	-	-	-	-
381	-	-	-	-	-	-	105'0"	-
380	-	-	-	-	-	-	-	101'6"
379	-	-	-	-	-	-	-	-
378	-	-	-	-	-	-	-	-
377	-	-	-	-	15'2"	-	-	-
376	-	-	-	-	-	-	104'6"	101'0"
375	-	-	-	4'4"	-	33'9"	-	-
374	-	2:59	-	-	-	-	-	-
373	13.6	-	15.7	-	-	-	-	-
372	-	-	-	-	-	-	104'0"	100'6"
371	-	-	-	-	-	-	-	-
370	-	-	-	-	-	-	-	-
369	-	-	-	-	-	-	-	-
368	-	-	-	-	15'1"	-	-	100'0"
367	-	-	-	-	-	-	103'6"	-
366	-	-	-	-	-	33'6"	-	-
365	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
364	-	3:00	-	-	-	-	-	99'6"
363	-	-	15.8	-	-	-	103'0"	-
362	-	-	-	-	-	-	-	-
361	-	-	-	-	-	-	-	-
360	-	-	-	-	15'0"	-	-	99'0"
359	-	-	-	-	-	-	-	-
358	-	-	-	4'3½"	-	33'3"	102'6"	-
357	-	-	-	-	-	-	-	-
356	13.7	-	-	-	-	-	-	98'6"
355	-	-	-	-	-	-	-	-
354	-	3:01	-	-	-	-	102'0"	-
353	-	-	15.9	-	-	-	-	-
352	-	-	-	-	14'11"	-	-	98'0"
351	-	-	-	-	-	-	-	-
350	-	-	-	-	-	33'0"	101'6"	-
349	-	-	-	-	-	-	-	-
348	-	-	-	-	-	-	-	97'6"
347	-	-	-	-	-	-	-	-
346	-	-	-	-	-	-	-	-
345	-	3:02	-	-	-	-	101'0"	-
344	-	-	-	-	14'10"	-	-	97'0"
343	-	-	16.0	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
342	-	-	-	-	-	32'9"	-	-
341	-	-	-	4'3"	-	-	100'6"	-
340	13.8	-	-	-	-	-	-	96'6"
339	-	-	-	-	-	-	-	-
338	-	-	-	-	-	-	-	-
337	-	-	-	-	-	-	100'0"	-
336	-	-	-	-	14'9"	-	-	96'0"
335	-	3:03	-	-	-	-	-	-
334	-	-	-	-	-	32'6"	-	-
333	-	-	16.1	-	-	-	99'6"	95'6"
332	-	-	-	-	-	-	-	-
331	-	-	-	-	-	-	-	-
330	-	-	-	-	-	-	-	-
329	-	-	-	-	-	-	-	95'0"
328	-	-	-	-	14'8"	-	99'0"	-
327	-	-	-	-	-	-	-	-
326	-	3:04	-	-	-	32'3"	-	-
325	-	-	-	-	-	-	-	94'6"
324	13.9	-	-	4'2½"	-	-	98'6"	-
323	-	-	16.2	-	-	-	-	-
322	-	-	-	-	-	-	-	-
321	-	-	-	-	-	-	-	94'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
320	-	-	-	-	14'7"	-	98'0"	-
319	-	-	-	-	-	-	-	-
318	-	-	-	-	-	32'0"	-	-
317	-	-	-	-	-	-	-	93'6"
316	-	3:05	-	-	-	-	97'6"	-
315	-	-	-	-	-	-	-	-
314	-	-	-	-	-	-	-	93'0"
313	-	-	16.3	-	14'6"	-	-	-
312	-	-	-	-	-	-	97'0"	-
311	-	-	-	-	-	-	-	-
310	-	-	-	-	-	31'9"	-	92'6"
309	14.0	-	-	-	-	-	-	-
308	-	-	-	4'2"	-	-	96'6"	-
307	-	3:06	-	-	-	-	-	-
306	-	-	-	-	-	-	-	92'0"
305	-	-	-	-	14'5"	-	-	-
304	-	-	-	-	-	-	96'0"	-
303	-	-	16.4	-	-	-	-	91'6"
302	-	-	-	-	-	31'6"	-	-
301	-	-	-	-	-	-	-	-
300	-	-	-	-	-	-	95'6"	-
299	-	-	-	-	-	-	-	91'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
298	-	3:07	-	-	14'4"	-	-	-
297	-	-	-	-	-	-	-	-
296	-	-	-	-	-	-	95'0"	-
295	-	-	-	-	-	31'3"	-	90'6"
294	14.1	-	16.5	-	-	-	-	-
293	-	-	-	4'1½"	-	-	-	-
292	-	-	-	-	-	-	94'6"	90'0"
291	-	-	-	-	-	-	-	-
290	-	-	-	-	14'3"	-	-	-
289	-	3:08	-	-	-	-	-	-
288	-	-	-	-	-	-	94'0"	89'6"
287	-	-	-	-	-	31'0"	-	-
286	-	-	-	-	-	-	-	-
285	-	-	-	-	-	-	-	89'0"
284	-	-	16.6	-	-	-	93'6"	-
283	-	-	-	-	14'2"	-	-	-
282	-	-	-	-	-	-	-	-
281	-	-	-	-	-	-	-	88'6"
280	-	3:09	-	-	-	30'9"	93'0"	-
279	14.2	-	-	-	-	-	-	-
278	-	-	-	4'1"	-	-	-	-
277	-	-	-	-	-	-	-	88'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
276	-	-	-	-	-	-	92'6"	-
275	-	-	16.7	-	14'1"	-	-	-
274	-	-	-	-	-	-	-	87'6"
273	-	-	-	-	-	30'6"	-	-
272	-	-	-	-	-	-	92'0"	-
271	-	3:10	-	-	-	-	-	-
270	-	-	-	-	-	-	-	87'0"
269	-	-	-	-	-	-	-	-
268	-	-	-	-	14'0"	-	91'6"	-
267	-	-	-	-	-	-	-	86'6"
266	-	-	16.8	-	-	-	-	-
265	14.3	-	-	-	-	30'3"	-	-
264	-	-	"	-	-	-	91'0"	-
263	-	3:11	-	4'0½"	-	-	-	86'0"
262	-	-	-	-	-	-	-	"
261	-	-	-	-	13'11"	-	90'6"	-
260	-	-	-	-	-	-	-	85'6"
259	-	-	-	-	-	-	-	-
258	-	-	-	-	-	30'0"	-	-
257	-	-	16.9	-	-	-	90'0"	85'0"
256	-	-	-	-	-	-	-	-
255	-	-	-	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
254	-	3:12	-	-	13'10"	-	-	-
253	-	-	-	-	-	-	89'6"	84'6"
252	-	-	-	-	-	-	-	-
251	14.4	-	-	-	-	29'9"	-	-
250	-	-	-	-	-	-	-	84'0"
249	-	-	-	-	-	-	89'0"	-
248	-	-	17.0	4'0"	-	-	-	-
247	-	-	-	-	13'9"	-	-	-
246	-	3:13	-	-	-	-	88'6"	83'6"
245	-	-	-	-	-	-	-	-
244	-	-	-	-	-	29'6"	-	-
243	-	-	-	-	-	-	-	83'0"
242	-	-	-	-	-	-	88'0"	-
241	-	-	-	-	-	-	-	-
240	-	-	-	-	13'8"	-	-	82'6"
239	-	-	17.1	-	-	-	-	-
238	-	3:14	-	-	-	29'3"	87'6"	-
237	14.5	-	-	-	-	-	-	82'0"
236	-	-	-	-	-	-	-	-
235	-	-	-	-	-	-	87'0"	-
234	-	-	-	3'11½"	-	-	-	-
233	-	-	-	-	13'7"	-	-	81'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
232	-	-	-	-	-	-	-	-
231	-	-	17.2	-	-	29'0"	86'6"	-
230	-	3:15	-	-	-	-	-	81'0"
229	-	-	-	-	-	-	-	-
228	-	-	-	-	-	-	86'0"	-
227	-	-	-	-	13'6"	-	-	80'6"
226	-	-	-	-	-	-	-	-
225	-	-	-	-	-	-	-	-
224	-	-	-	-	-	28'9"	85'6"	80'0"
223	14.6	-	-	-	-	-	-	-
222	-	3:16	17.3	-	-	-	-	-
221	-	-	-	-	-	-	85'0"	-
220	-	-	-	3'11"	13'5"	-	-	79'6"
219	-	-	-	-	-	-	-	-
218	-	-	-	-	-	-	-	-
217	-	-	-	-	-	28'6"	84'6"	79'0"
216	-	-	-	-	-	-	-	-
215	-	-	-	-	-	-	-	-
214	-	3:17	17.4	-	13'4"	-	84'0"	78'6"
213	-	-	-	-	-	-	-	-
212	-	-	-	-	-	-	-	-
211	-	-	-	-	-	28'3"	-	78'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
210	14.7	-	-	-	-	-	83'6"	-
209	-	-	-	-	-	-	-	-
208	-	-	-	-	-	-	-	77'6"
207	-	-	-	-	13'3"	-	83'0"	-
206	-	3:18	17.5	3'10½"	-	-	-	-
205	-	-	-	-	-	28'0"	-	77'0"
204	-	-	-	-	-	-	-	-
203	-	-	-	-	-	-	82'6"	-
202	-	-	-	-	-	-	-	76'6"
201	-	-	-	-	13'2"	-	-	-
200	-	-	-	-	-	-	82'0"	-
199	-	-	-	-	-	-	-	76'0"
198	-	3:19	17.6	-	-	27'9"	-	-
197	14.8	-	-	-	-	-	81'6"	-
196	-	-	-	-	-	-	-	75'6"
195	-	-	-	-	13'1"	-	-	-
194	-	-	-	-	-	-	-	-
193	-	-	-	3'10"	-	-	81'0"	75'0"
192	-	-	-	-	-	27'6"	-	-
191	-	-	-	-	-	-	-	-
190	-	3:20	-	-	-	-	80'6"	74'6"
189	-	-	17.7	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
188	-	-	-	-	13'0"	-	-	-
187	-	-	-	-	-	-	80'0"	74'0"
186	-	-	-	-	-	27'3"	-	-
185	-	-	-	-	-	-	-	-
184	14.9	-	-	-	-	-	79'6"	73'6"
183	-	3:21	-	-	-	-	-	-
182	-	-	17.8	-	12'11"	-	-	-
181	-	-	-	-	-	-	79'0"	73'0"
180	-	-	-	3'9½"	-	27'0"	-	-
179	-	-	-	-	-	-	-	-
178	-	-	-	-	-	-	-	72'6"
177	-	-	-	-	-	-	78'6"	-
176	-	3:22	-	-	12'10"	-	-	-
175	-	-	-	-	-	-	-	72'0"
174	-	-	17.9	-	-	26'9"	78'0"	-
173	-	-	-	-	-	-	-	-
172	15.0	-	-	-	-	-	-	71'6"
171	-	-	-	-	-	-	77'6"	-
170	-	-	-	-	12'9"	-	-	-
169	-	-	-	-	-	-	-	71'0"
168	-	3:23	-	3'9"	-	26'6"	77'0"	-
167	-	-	-	-	-	-	-	70'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
166	-	-	18.0	-	-	-	-	-
165	-	-	-	-	12'8"	-	76'6"	-
164	-	-	-	-	-	-	-	70'0"
163	-	-	-	-	-	-	-	-
162	-	-	-	-	-	26'3"	76'0"	-
161	-	3:24	-	-	-	-	-	69'6"
160	15.1	-	-	-	-	-	-	-
159	-	-	18.1	-	12'7"	-	75'6"	-
158	-	-	-	-	-	-	-	69'0"
157	-	-	-	-	-	26'0"	-	-
156	-	-	-	3'8½"	-	-	75'0"	68'6"
155	-	-	-	-	-	-	-	-
154	-	3:25	-	-	-	-	-	-
153	-	-	-	-	12'6"	-	74'6"	68'0"
152	-	-	-	-	-	-	-	-
151	-	-	18.2	-	-	25'9"	-	-
150	-	-	-	-	-	-	74'0"	67'6"
149	-	-	-	-	-	-	-	-
148	15.2	-	-	-	-	-	-	67'0"
147	-	3:26	-	-	12'5"	-	73'6"	-
146	-	-	-	-	-	-	-	-
145	-	-	-	-	-	25'6"	-	66'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
144	-	-	18.3	3'8"	-	-	73'0"	-
143	-	-	-	-	-	-	-	-
142	-	-	-	-	12'4"	-	-	66'0"
141	-	3:27	-	-	-	-	72'6"	-
140	-	-	-	-	-	25'3"	-	65'6"
139	-	-	-	-	-	-	-	-
138	-	-	-	-	-	-	72'0"	-
137	15.3	-	18.4	-	-	-	-	65'0"
136	-	-	-	-	12'3"	-	71'6"	-
135	-	-	-	-	-	25'0"	-	-
134	-	3:28	-	-	-	-	-	64'6"
133	-	-	-	3'7½"	-	-	71'0"	-
132	-	-	-	-	-	-	-	64'0"
131	-	-	-	-	12'2"	-	-	-
130	-	-	18.5	-	-	-	70'6"	-
129	-	-	-	-	-	24'9"	-	63'6"
128	-	-	-	-	-	-	-	-
127	-	3:29	-	-	-	-	70'0"	63'0"
126	15.4	-	-	-	12'1"	-	-	-
125	-	-	-	-	-	-	-	-
124	-	-	-	-	-	24'6"	69'6"	62'6"
123	-	-	18.6	-	-	-	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
122	-	-	-	3'7"	-	-	69'0"	62'0"
121	-	3:30	-	-	12'0"	-	-	-
120	-	-	-	-	-	-	-	61'6"
119	-	-	-	-	-	24'3"	68'6"	-
118	-	-	-	-	-	-	-	-
117	-	-	-	-	-	-	-	61'0"
116	-	-	18.7	-	11'11"	-	68'0"	-
115	15.5	3:31	-	-	-	-	-	60'6"
114	-	-	-	-	-	24'0"	67'6"	-
113	-	-	-	-	-	-	-	-
112	-	-	-	-	-	-	-	60'0"
111	-	-	-	3'6½"	11'10"	-	67'0"	-
110	-	-	-	-	-	-	-	59'6"
109	-	-	18.8	-	-	23'9"	66'6"	-
108	-	3:32	-	-	-	-	-	59'0"
107	-	-	-	-	-	-	-	-
106	-	-	-	-	11'9"	-	66'0"	-
105	15.6	-	-	-	-	23'6"	-	58'6"
104	-	-	-	-	-	-	65'6"	-
103	-	-	18.9	-	-	-	-	58'0"
102	-	3:33	-	-	-	-	-	-
101	-	-	-	3'6"	11'8"	-	65'0"	57'6"
100	-	-	-	-	-	23'3"	-	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
99	-	-	-	-	-	-	64'6"	57'0"
98	-	-	-	-	-	-	-	-
97	-	-	19.0	-	-	-	-	-
96	-	3:34	-	-	11'7"	-	64'0"	56'6"
95	15.7	-	-	-	-	23'0"	-	-
94	-	-	-	-	-	-	63'6"	56'0"
93	-	-	-	-	-	-	-	-
92	-	-	-	-	-	-	-	55'6"
91	-	3:35	-	3'5½"	11'6"	22'8"	63'0"	-
90	-	-	19.1	-	-	-	-	55'0"
89	-	-	-	-	-	-	62'6"	-
88	-	-	-	-	-	-	-	54'6"
87	-	-	-	-	11'5"	-	62'0"	-
86	-	-	-	-	-	22'6"	-	-
85	15.8	3:36	-	-	-	-	-	54'0"
84	-	-	19.2	-	-	-	61'6"	-
83	-	-	-	-	-	-	-	53'6"
82	-	-	-	3'5"	11'4"	22'3"	61'0"	-
81	-	-	-	-	-	-	-	53'0"
80	-	-	-	-	-	-	60'6"	-
79	-	3:37	-	-	-	-	-	52'6"
78	-	-	19.3	-	11'3"	22'0"	60'0"	-

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
77	-	-	-	-	-	-	-	52'0"
76	-	-	-	-	-	-	-	-
75	15.9	-	-	-	-	-	59'6"	51'6"
74	-	3:38	-	-	-	21'9"	-	-
73	-	-	-	3'4½"	11'2"	-	59'0"	51'0"
72	-	-	19.4	-	-	-	-	-
71	-	-	-	-	-	-	58'6"	50'6"
70	-	-	-	-	-	21'6"	-	-
69	-	-	-	-	11'1"	-	58'0"	50'0"
68	-	3:39	-	-	-	-	-	-
67	-	-	-	-	-	-	57'6"	49'6"
66	16.0	-	19.5	-	-	21'3"	-	-
65	-	-	-	-	11'0"	-	57'0"	49'0"
64	-	-	-	3'4"	-	-	-	-
63	-	3:40	-	-	-	-	56'6"	48'6"
62	-	-	-	-	-	21'0"	-	48'0"
61	-	-	19.6	-	10'11"	-	56'0"	-
60	-	-	-	-	-	-	-	47'6"
59	-	-	-	-	-	-	55'6"	-
58	-	3:41	-	-	-	20'9"	-	47'0"
57	16.1	-	-	-	10'10"	-	55'0"	-
56	-	-	-	-	-	-	-	46'6"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
55	-	-	19.7	3'3½"	-	-	54'6"	-
54	-	-	-	-	-	20'6"	-	46'0"
53	-	3:42	-	-	10'9"	-	54'0"	-
52	-	-	-	-	-	-	-	45'6"
51	-	-	-	-	-	-	53'6"	45'0"
50	-	-	19.8	-	-	20'3"	-	-
49	-	-	-	-	10'8"	-	53'0"	44'6"
48	16.2	3:43	-	-	-	-	-	-
47	-	-	-	3'3"	-	20'0"	52'6"	44'0"
46	-	-	-	-	-	-	-	43'6"
45	-	-	-	-	10'7"	-	52'0"	-
44	-	-	19.9	-	-	-	-	43'0"
43	-	3:44	-	-	-	19'9"	51'6"	-
42	-	-	-	-	10'6"	-	-	42'6"
41	-	-	-	-	-	-	51'0"	42'0"
40	16.3	-	-	3'2½"	-	19'6"	50'6"	-
39	-	-	20.0	-	-	-	-	41'6"
38	-	3:45	-	-	10'5"	-	50'0"	-
37	-	-	-	-	-	19'3"	-	41'0"
36	-	-	-	-	-	-	49'6"	40'6"
35	-	-	-	-	-	-	49'0"	-
34	-	3:46	20.1	-	10'4"	19'0"	-	40'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
33	-	-	-	-	-	-	48'6"	39'6"
32	16.4	-	-	3'2"	-	-	-	-
31	-	-	-	-	10'3"	-	48'0"	39'0"
30	-	..	-	-	-	18'9"	47'6"	38'6"
29	-	3:47	20.2	-	-	-	-	-
28	-	-	-	-	10'2"	-	47'0"	38'0"
27	-	-	-	-	-	18'6"	46'6"	37'6"
26	-	-	-	-	-	-	-	-
25	16.5	3:48	-	3'1½"	-	18'3"	46'0"	37'0"
24	-	-	20.3	-	10'1'	-	45'6"	36'6"
23	-	-	-	-	-	-	-	36'0"
22	-	-	-	-	-	18'0"	45'0"	-
21	-	3:49	-	-	10'0"	-	44'6"	35'6"
20	-	-	20.4	-	-	-	-	35'0"
19	-	-	-	3'1"	-	17'9"	44'0"	34'6"
18	-	-	-	-	9'11"	-	43'6"	-
17	16.6	3:50	-	-	-	-	-	34'0"
16	-	-	-	-	-	17'6"	43'0"	33'6"
15	-	-	20.5	-	9'10"	-	42'6"	33'0"
14	-	-	-	-	-	17'3"	42'0"	-
13	-	3:51	-	-	-	-	-	32'6"
12	-	-	-	3'0½"	9'9"	-	41'6"	32'0"

APPENDIX A--Continued

Points	100 Yards	880 Yards	80M Hurdles	High Jump	Long Jump	Shot	Discus	Javelin
11	-	-	20.6	-	-	17'0"	41'0"	31'6"
10	-	-	-	-	-	-	40'6"	31'0"
9	16.7	3:52	-	-	9'8"	16'9"	40'0"	30'6"
8	-	-	-	-	-	-	-	-
7	-	-	-	-	-	16'6"	39'6"	30'0"
6	-	-	20.7	3'0"	9'7"	-	39'0"	29'6"
5	-	3:53	-	-	-	-	38'6"	29'0"
4	-	-	-	-	-	16'3"	38'0"	28'6"
3	16.8	-	-	-	9'6"	-	37'6"	28'0"
2	-	-	20.8	-	-	16'0"	37'0"	27'6"
1	-	3:54	-	2'11¼"	9'5"	-	36'6"	27'0"