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Comparison of Three Training Methods for Middle and Long Distance Runners

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COMPARISON OF THREE TRAINING METHODS FOR MIDDLE AND
LONG DISTANCE RUNNERS

by

John A. Mitchell

Bachelor of Science, Valley City State College 1963

A Thesis

Submitted to the Faculty

of the

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in partial fulfillment of the requirements

for the degree of

Master of Science

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This Thesis submitted by John A. Mitchell in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota is hereby approved by the Faculty Advisory Committee under whom the work has been done.

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DISTANCE RUNNERS

Department Physical Education

Degree Master of Science

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Date August 9 1969

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ABSTRACT

The purpose of this study was to determine whether a training program could be found which would enable middle and long distance runners to improve their performances in a short period of time.

Three groups (Fartlek, Interval, and American) of six subjects each were equated with the matched pairs technique. The groups were tested in the spring of 1969 after twelve days of training. The test used in this study was the 880 yard run. The runners participated in a six week conditioning and training period before the retest was administered.

Between group comparisons were made using the mean differences for each group between initial and final test results. A pre-post test comparison was also made within each group. The null hypothesis was assumed in making the comparisons with rejection at the .05 level. This hypothesis was tested with the "t" technique for the significance of the difference between means derived from correlated scores from small samples.

The results of the within group comparisons showed significant improvement in each of the three groups tested. The results of between group comparisons showed that the American and Interval groups improved significantly more than did the Fartlek training group. However; there was no significant difference between the American group and the Interval group.

CHAPTER I

PURPOSE

The main purpose of this study was to evaluate the advantages and disadvantages of methods used by modern track coaches in the training of middle and long distance runners during the early or pre-meet season. The four factors studied were: (1) the effect of the method of training for developing cardio-respiratory endurance quickly, (2) the effect of the training method on the reduction of runner's time in the 880 yard run, (3) the effect of the training method on developing running techniques, (4) the effect of the training method in stimulating interest.

Delimitations

This study does not attempt to explain the causes and reasons for the observed results, but to investigate the actual results as they occurred. It was designed to find an effective type of training to be employed during the early season.

A group of twenty-one athletes from Grand Forks Red River High School, enrolled in the tenth, eleventh, and twelfth grades, were used to obtain the needed information. The collection of data for this study was done during the 1969 track season.

Definition of Essential Terms

Red River High School Track Athletes: Any track athlete that wanted to participate in track during the spring season of 1969.

Middle Distance Races: As referred to in this study, these were the 440 and 880 yard runs.

Distance Race: Mile run.

Early Season: The period of time between the end of the basketball season and the first track meet.

Fartlek or Speed Play: A method of training based on cross country jogging, sprinting, stretching and walking. Running is not done to the extent that the individual becomes exhausted, or walking to the extent that he becomes rested.

Interval: Type of training which involves successive runs, at a set speed, over a pre-determined distance with a regular interval of rest between each two runs.

American: A system of training which designates specific workouts every day. Someone on the coaching staff is present most of the time and guides the athlete through the training period. Very little initiative is left to the athlete in this type of training.

Need for the Study

In North Dakota, track is a comparatively short seasonal sport and it is imperative that a good method for training distance and middle distance runners be found. A system is needed that will bring the athlete to near top running form in the shortest possible time, yet one that will take every precaution to avoid any hindrance to the physiological or psychological development of the boy. Through systematic training, a condition must be developed in which the cardio-respiratory system is capable of adjustment quickly and adequately to the added strain brought about by running. There are many approaches to the

preparation of athletes for competition. Once again, it is a matter of selecting some routine, no part of which is in conflict with fundamental physiological principles involved. Through scientific investigation provided in this study, many advantageous changes in the conditioning programs may be brought about and adopted in high schools in this area. In presenting the results of this investigation, it is hoped that a method of conditioning will be elicited which will aid in the coaching of track and also help athletes become middle and long distance runners in a shorter period of time.

Related Literature

A practical explanation of "The Interval Training System" was given by J. K. Doherty. Interval Training is a system of repeated efforts in which a distance of measured length is run on a track at a timed pace alternately with measured recovery periods of low activity.¹ Interval running consists of running, repeatedly, sectors of 110, 220, 330, 440, 660, or 880 yards interspersed with jogging. The interval between each two sectors should be given careful consideration. The athlete should establish either an objective in minutes for each interval of jogging or an objective of a fixed distance covered in each interval. Interval running activities may be repeated as many times as the physical condition of the athlete warrants.²

¹J. K. Doherty, Modern Training for Running (Englewood Cliffs, N. J.: Prentice Hall, Inc., 1964), p. 87.

²George T. Bresnahan, W. W. Tuttle, and Francis Cretzmeyer, Track and Field Athletics (6th ed.; St. Louis, Mo.: The C. V. Mosby Co., 1964), p. 20.

In the area of this study, the time for training before the first meet is short. It is therefore necessary to use a training method that can help an athlete get into the best possible condition before that first meet. Interval training can do this. Interval training has variety and flexibility of workouts. The distances, pace, and recovery interval can be gradually changed over a period of time for the daily practices. Each individual coach or runner can choose what appeals to him, physically, and emotionally, after careful study of the values inherent in each phase of the system and, equally important, of his needs.¹ The importance of doing something the athlete's way cannot be overlooked, as track is an individual sport. The coach can create interest and variety in his workouts by alternating the distances run from practice to practice. A half-miler's workouts, for example, might consist largely of repeated 440 yard runs but for variety's sake the distances could just as well be 110, 220, 330, 550 or 660 yards on other days.²

Probably the best plan for most athletes to follow would be to run their repeats on pace, meaning to go at a speed and distance in a pre-established time, rather than to attempt a pace that is either slower or faster than the projected race pace. Running on pace develops a combination of speed and endurance in the athlete, and has the added advantage of teaching the runner pace-consciousness. The ability to judge pace is one of the most important factors in distance running.³

¹J. K. Doherty, Modern Training for Running (Englewood Cliffs, N. J.: Prentice Hall, Inc., 1964), p. 87.

²Tom Ecker, "Interval Training," The Athletic Journal, XLIII (March, 1963), 16+.

³Ibid.

From a positive viewpoint, the principles of the "Interval" method of training are: (1) an exact, repeated distance remains unchanged in any single workout, (2) a recovery interval of time occurs during which restful jogging is done, (3) a pace at which the distance is covered is always consistent and timed with a stop-watch, (4) the number of times that the distance is repeated is gradually increased.¹

Interval training, which may be described simply as formal, fast-slow running, is now used by most athletes.² Few coaches realize how simple and basic this type of training is. The time between each two runs is the interval. The interval time (spent in jogging or walking) is the recovery period. Each athlete enjoys a period of time where he is not bound to do some type of hard training. The athlete has a period of relaxation.

Interval running for middle distance prospects seldom exceeds 500 yards and more often is 440 yards or less. In fact, Zatopek, Kuts, Pirie and other long distance runners have trained for 5,000 and 10,000 meters on 330 and 440 yard "interval" training programs.

No one person can be credited with the invention of interval training. Runners of the 1920's did "ins and outs," or took a series

¹J. K. Doherty, "Interval Training," Scholastic Coach, XXV (February, 1956), 18.

²Fred Wilt, "Training Trends in Distance Running," Scholastic Coach, XXXIII (February, 1964), 11.

³Don Canham, "New Middle Distance Training Concepts," Scholastic Coach, XXVI (February, 1957), 14.

of "wind sprints," or did repeated "speed work." Like most systems, interval training evolved gradually over a period of ten years or more.¹

Mihaly Igloi, Hungarian national distance coach, recalled that, in 1932, Kusocinski, the great Polish distance runner, proceeded to run 200 meters 15 times on the running track, following a cross-country workout. Woldemar Gerschler, guided by a physiologist, Dr. Hans Rein-dell, is generally credited with perfecting the system between 1935 and 1940 in his work with Rudi Harbig. In a conversation with Gerschler in 1960, Doherty explained, Gerschler denied sole parenthood, as well as knowledge of the true father.² It seems more apparent, after much reading, that interval training was an evolution to which there were many contributors.

It seems clear, however, that the major credit for establishing and organizing the various elements in interval training should go to Woldemar Gerschler. World attention first came to his methods when, on July 5, 1939, Rudi Harbig set his first world record of 1:46.6 for the 800 meters, and then again, on August 12, set his second record of :46.0 for the 400 meters.³

The Fartlek system of training, meaning "speed play," consists of acquiring an acceptable physical condition through a program of running.⁴ Those who use this system of training, recommend that the running

¹J. Kenneth Doherty, Modern Track and Field (2nd ed.; Englewood Cliffs, N. J.: Prentice Hall, Inc., 1963), p. 177.

²Ibid.

³Ibid., p. 178.

⁴George T. Breshahan, Ph.D., W. W. Tuttle, and Francis Cretzmeyer, Track and Field Athletics (6th ed.; St. Louis, Mo.: The C. V. Mosby Co., 1964), p. 29.

be done over the cross-country course which provides a soft, spongy surface. Where such courses are not available, one could implement a grassy surface of some distance. As an example, road ditches could be used. Distances and speeds are optional, depending on both the capacity and judgment of the runner.

Fartlek is traditionally an informal training procedure. It is carried on away from the track on grass, such as a golf course, with phases of fast running alternated with jogging periods. The athlete in this type of training makes the workout as hard as he feels like making it.

Basically, Interval and Fartlek training are similar with plenty of fast and slow running. In these two systems the athlete accustoms himself, by doing this running, to the way he might feel during a race. His attitude toward fatigue might improve, and, when fatigue is encountered during a race, he is in a much better position to cope with it, having felt it so many times before in training. He is conditioned physically and mentally.¹

The blending of interval running and Fartlek in a training program for a distance runner should depend greatly on the athlete and the availability of a track and suitable Fartlek country.²

In Fartlek training, or "speed play," the athlete should acquire, along with conditioning, enjoyment from his work. The athlete runs at a variety of speeds, as the mood takes him. He must also choose the

¹John Le Masurier, "Interval Running + Fartlek in Training Distance Runners," Scholastic Coach, XXVIII (October, 1958), 40.

²Ibid.

terrain (grass, road, path, beach, forest) so as to provide as pleasant a variety of scenery as possible. Uphill and downhill, as well as level, surfaces should be included. The strain should never be great in Fartlek, since the emphasis is on pure joy in running. Nevertheless, sufficient mileage must be covered in each session, not less than three miles and an average of six miles.¹

Stretches of walking during Fartlek training may be counted as mileage provided that: (a) it is brisk and springy, with the athlete deliberately using up and down movements on his toes, (b) the walking periods are only for two or three minutes at a time, and never longer than five minutes. An important principle to observe is to keep on the move all the time, however slowly. The end of the run should be in the form of limbering down or a cooling off period.² This type of running tends to develop self-dependent and resourceful runners. Numerous long articles on this method have been written, but the whole matter can be simplified by instructing the runners to jog, stride, sprint, and walk from one to two hours, depending on the length of the workout desired. A sample workout is described by Tom O'Connor:

1. Warm up by easy jogging for 10 to 15 minutes.
2. Run at a fast, steady speed for 1 to 1½ miles.
3. Rapid walking for approximately five minutes.
4. Easy running interspersed with 75 yard sprints, repeating until fatigue becomes evident.
5. Run up hill at full speed for 200 yards.
6. Following the hill, run at a fast pace for one minute.
7. Repeat hill work and jog for one mile.³

¹Fred Wilt, Run, Run, Run (Los Altos, California: Track and Field News Inc., 1964), p. 101.

²Ibid.

³Tom O'Connor, "Training the Distance Runner," Scholastic Coach, XXXII (April, 1963), 10.

Fartlek is a Swedish word which may be translated literally as "speed play." The Swedish method of training as advocated by Gosta Holmer, Swedish Olympic coach, is based upon running long distances with untimed variations of pace. It has been stated previously that the Fartlek training is stimulating mentally. Robert Epskamp in his article "Rx for Distance Runners" may have given a good reason: "Since the runner is not dominated by the stop watch or the coach's observation, he has an opportunity to make the training as difficult as he wishes while enjoying his running."¹

J. K. Doherty, Modern Training for Running, listed some advantages and disadvantages of Fartlek training. They are summarized as follows:

Advantages:

1. It develops self-dependent and resourceful runners.
2. Its proponents claim it is physically challenging and mentally invigorating and refreshing.
3. On days when mileage rather than intensity of effort is of primary concern, Fartlek provides a pattern of activity that is as natural to young men as it is to young children and animals.
4. It provides basic endurance training for all endurance events.
5. The daily training session tends to be run on total time and mileage rather than the number of exact distances and exact times and the exact recovery period. Fartlek is a way of removing awareness.
6. The softer running surfaces of woods and field paths encourage greater general relaxation of muscles and therefore lead to less muscle soreness.
7. Fartlek provides a place for practice somewhere, anywhere, at anytime of the day or night.
8. The uncertain footing of open running tends to develop a shorter and more efficient stride--certainly an advantage in the longer distance run.

¹Robert Epskamp, "Rx for Distance Runners," The Athletic Journal, XLIII (March, 1963), 58.

Disadvantages:

1. Immature and inexperienced runners may misuse the freedom of Fartlek, either by not doing enough, or more likely, by attempting to do too much, too fast, too soon.
2. Many advocates of Fartlek tend to glamorize this training with the mention of birds singing, the green of trees and grass, whereas many training programs have paved streets, reeking exhaust fumes, and concrete sidewalks, but even the worst cities have a river bank, golf course and cemeteries.¹

During the early stages of training, a coach must spend much time with his men so they will learn that Fartlek is not just running; the runners must learn how to make best use of speed runs and recovery runs, paced runs, challenges and counter-challenges, and do it on many kinds of terrain, and alone. Above all, Fartlek is an imaginative and pleasant experience.²

The American system of training used in this study is a combination of the Fartlek training system, Interval training system, Oregon System of Training, and Lydiard's system of training middle distance and long distance runners. The Oregon System utilizes the type of training which decreases the time of a certain portion of a longer race over the period of training. The milers train by running quarter mile races at progressively decreasing times. For example, if a miler runs a quarter mile in 68 seconds in the first month of training, he would concentrate on decreasing his time in the quarter mile by two seconds in the second month. The third month the same, the fourth month the same, until the runner reaches the competitive track season. Lydiard requires an early,

¹J. K. Doherty, Modern Training for Running (Englewood Cliffs, N. J.: Prentice Hall, Inc., 1964), pp. 84-86.

²J. Kenneth Doherty, Modern Track and Field (2nd ed.; Englewood Cliffs, N. J.: Prentice Hall, Inc., 1963), pp. 222-223.

rigidly planned training program for middle and long distance runners. Runners are required to run from ten to twenty miles a day. His marathon program is supplemented with calisthenics and gym exercises.¹

Emphasis of the American method in this study deals with the underdistance and the overdistance work. In training for overdistance, the athlete works on stamina and endurance. Putting together training distance segments of 110, 220, 440 and 880 yards is a sound fundamental work picture.² For example, a half miler can do overdistance by running three 1100 yard distances at his half-mile pace or slower with a rest interval between each two runs. In other words, the athlete trains in distances greater than his race distance.

Underdistance training for the athlete is training on distances less than that for which his race will call. In underdistance work the athlete is trying to develop speed and the ability to finish the race at sprint speed.

Even though the American training system has a coach watching every move, and there is a stop watch present, there is enough change in day to day workouts that the athlete need not feel the pressure of constant supervision.

Summary of Review of Related Literature

In summarizing the literature reviewed, one might state a general hypothesis that there was no one discoverer of a specific training

¹Payton Jordan and Bud Spencer, Champions in the Making (Englewood Cliffs, N. J.: Prentice Hall, Inc., 1968), pp. 10-75.

²Ibid., p. 76.

method for middle and long distance runners. Rather, the training systems (Fartlek, Interval and American) evolved from the many coaches that contributed to the sport of track and field.

CHAPTER II

METHODOLOGY

Introduction

Twenty-one students were selected to participate in this study from among the track athletes at Grand Forks Red River High School. The students selected for the investigation were those who wanted to run the middle and long distances.

Method of Selecting Subjects

Methods of procedure, as advocated by leading authorities, were employed as a guide and a background on which to base the research. The entire coaching staff and participants were informed of the procedure, the nature of the study, and the purpose of the study. By doing this, it was hoped that everyone would concentrate more attentively on the objectives and thus improve results.

As stated, a total of twenty-one students volunteered their services for the project. All athletes had been given a physical examination prior to the track season and all twenty-one were fit to participate.

The athletes who volunteered were those who hoped to run distances of 440 yards, 880 yards and one mile.

Test Administration

The 880 yard run test was administered to the athletes near Grand Forks Red River High School, in the early season before the University of North Dakota track was available. An 880 yard distance was marked out by the coaching staff of Red River High School. All the participants were tested at approximately the same time of day. The time trials were taken between the hours of 4:30 p.m. and 6:00 p.m., and the days of testing were Wednesday and Friday, if possible. A warm up period was required for all athletes before the testing took place.

Upon the completion of the initial test, the twenty-one subjects were placed into three equated groups where they trained until the retest was scheduled. The retest came three days before the first meet.

Recording Results

The coaching staff met to discuss the administrative procedures of the project. A scorecard was constructed on which to record the statistical data for each performer. The scorecard is shown on page 30 of Appendix A.

Every day of the week was listed on the data sheet to insure the proper day of recording. As stated before, due to uncertain weather conditions, the day of testing could not be guaranteed.

Pre-Testing Training Period

The participants were given ten days of steady, vigorous, yet moderate conditioning drills, after which each student was required to

run a half mile, alone and timed. The times were recorded and used as a guide in further classification. After two more days of conditioning, the athletes were timed in another half mile run, after having been divided into groups of three, according to the times recorded on the first trial run. They were matched so that the three best times were in the first heat, the next three best times in the second heat and so on down to number twenty-one.

Selection of Personnel for Groups

Three groups were formed, based on times recorded from the second run. The three experimental groups were: (1) "Fartlek," (2) "Interval," and (3) "American." The method of grouping was based on times as follows: The boy with the best time was placed in the "Fartlek" group with the boy with the sixth best time, the boys with the second and fifth best times were placed in the "Interval" group, and the boys with the third and fourth best times were placed in the "American" group. This method of equating was used until all twenty-one boys had been placed into groups.

Fig. 1 - Grouping Procedure

1	2	3
6	5	4
7	8	9
12	11	10
13	14	15
18	17	16
19	20	21

Of the twenty-one participants in this study selected for testing, only eighteen remained active participants. The other three were eliminated because two dropped track participation and the other was

injured so that he could not participate. One member from each of the equated groups was lost. Numbers 18, 20, and 21 were the participants lost. The loss of number 18 allowed number 19 to become 18 and thus each group remained equated with one less participant in each group. The time difference between 19 and 18 was so small that matching with 17 and 16 was possible without significantly affecting group means.

Training Procedure for Each Group

Fartlek--The boys in this group were given more freedom than were those in the other two groups. They worked out on their own most of the time and had very little supervision. A cross country course was mapped out for them to follow and this course was run as many times as the individual desired. The only guidance they had was information pertaining to the theory of the "Fartlek" system of training, which was to run, jog, walk, stretch and do repeats of these activities as the practice course was covered.

Interval--This program stressed repetition of a particular distance to become more proficient. Coaches were advised to give more individual attention to the boys in this group than in either of the other systems. A great deal of time was spent running 330 yard dashes at a set pace and set time. A rest period of two minutes was allotted between runs. The number of runs each day was few in the early part of the training period but this number was increased as the boys became better conditioned. A three-fold purpose was accomplished by running 330 yard dashes in that a feeling of pace was developed and speed was developed, as were stamina and cardio-respiratory endurance.

American--The "American" system, in reference to long and middle distance runners, advocated underdistance and overdistance work. Overdistance was stressed in this method of training as well as in this investigation. The runners repeated distances that were of greater length than the actual race. This was emphasized two days a week to develop endurance, while underdistance received attention one day a week to develop speed and a final "kick." In underdistance running, the participants run repeated distances much less than those of the actual race.

On Wednesday and Friday of each week, time trials for each group were held with the most value placed on the time of the 880 yard run.

Statistical Procedure

In analyzing the differences between the pre-test and the retest results, the writer assumed the null hypothesis. The null hypothesis states that the mean scores are not different and any difference found would be a result of chance and be unimportant.

The "t" technique for testing the significance of the difference between means derived from correlated scores from small samples was used in the within group treatment of the data in this study. The value of the population mean is not known, but with the proper number of degrees of freedom the value of "t" can be determined at selected points in the sampling distribution. This investigator decided to reject the null hypothesis at the .05 level of confidence.¹

¹Henry E. Garrett, Ph.D., Statistics in Psychology and Education (5th ed.; New York: Longmans, Green and Co., 1958), p. 192.

In the analysis of between group comparisons, the "t" technique for testing the significance of the differences between means derived from uncorrelated scores from small samples was suitable for use in this study. The null hypothesis was assumed and the investigator decided to reject the null hypothesis at the .05 level of confidence.

Complete data and the mathematical procedures utilized in the statistical analysis are presented in Appendix B, page 31.

CHAPTER III

ANALYSIS OF DATA

Introduction

The purpose of this study was to determine whether or not specific training programs had any effects on the times of middle and long distance runners. The study involved training through Fartlek, Interval, and the American methods. Test results were compared in a test re-test situation. The subjects were tested after twelve days of training and retested upon the completion of a six week training program.

Results of Within Group Comparisons

American Training: This group had a mean time of 2:28.3, or 148.3 seconds, in the initial test and a mean time of 2:19.7, or 139.7 seconds, in the retest (see Table 1, page 20).

The American training group had a mean difference of 8.6 seconds decrease in running time between the initial test and the final test. A "t" value of 6.90 was significant at the .05 level.

Interval Training: This group had a mean time of 2:28.5, or 148.5 seconds, in the initial test and a mean time of 2:20.5, or 140.5 seconds, in the retest (Table 1, page 20).

The Interval training group had a mean difference of 8.0 seconds decrease in running time between the initial test and the retest. A "t" value of 9.33 was significant at the .05 level.

Fartlek Training: This group had a mean time of 2:28.5, or 148.5 seconds, on the initial test and a mean time of 2:23.8, or 143.8 seconds, in the retest (Table 1).

The Fartlek training group had a mean difference of 4.7 seconds decrease in running time between the initial test and the retest. A "t" value of 4.90 was significant at the .05 level.

TABLE 1

COMPARISON OF MEAN TIMES OF THE TEST - RETEST FOR THE THREE GROUPS

Training Methods	Initial Test	Retest	Mean Difference	"t" Value
American	148.3	139.7	8.6	6.902
Interval	148.5	140.5	8.0	9.335
Fartlek	148.5	143.8	4.7	4.895

Note: All times given are in seconds.
Significant "t" value at .05 level = 2.57

As shown by the analysis of data presented in Table 1, each group exhibited significant improvement in running time during the experimental period.

Tables 2, 3, and 4, pages 21-22 show that the six subjects in each group did show improvement in their test times.

TABLE 2

IMPROVEMENTS IN TIME DURING EXPERIMENTAL PERIOD BY SUBJECTS IN
AMERICAN GROUP

Subjects	Time of Initial Test	Time of Retest	Difference Between Times
1	137	128	9
2	150	144	6
3	147	143	4
4	145	133	12
5	152	141	11
6	159	149	10

Note: All times given in seconds and to the nearest second.

TABLE 3

IMPROVEMENTS IN TIME DURING EXPERIMENTAL PERIOD BY SUBJECTS IN
INTERVAL GROUP

Subjects	Time of Initial Test	Time of Retest	Difference Between Times
1	148	141	7
2	141	136	5
3	142	135	7
4	148	139	9
5	155	144	11
6	157	148	9

Note: All times given in seconds and to the nearest second.

TABLE 4

IMPROVEMENTS IN TIME DURING EXPERIMENTAL PERIOD BY SUBJECTS IN
FARTLEK GROUP

Subjects	Time of Initial Test	Time of Retest	Difference Between Times
1	152	146	6
2	147	145	2
3	141	135	6
4	144	141	3
5	149	146	3
6	158	150	8

Note: All times given in seconds and to the nearest second.

TABLE 5

BETWEEN GROUP COMPARISONS

Groups	Sum of Differences Test-Retest	Average Difference Per Subject	$\frac{S}{D}$	"t" Value	Significant at .05 level
American Fartlek	52.0 28.0	8.67 4.67	1.256 .954	2.534	yes
American Interval	52.0 48.0	8.67 8.0	1.256 .857	.441	no
Fartlek Interval	28.0 48.0	4.67 8.0	.954 .857	-2.592	yes

Note: "t" at .05 level = 2.23

$\frac{S}{D}$ = estimate of sampling error of average difference per subject.

When comparing the results of the average difference per subject between the American and Fartlek groups, there is a significant difference. The average difference per subject for the American group was 8.67. The average difference per subject for the Fartlek group was 4.67. The American group improved more than did the Fartlek group. The "t" value was 2.534, which was significant at the .05 level.

The average difference per subject for the Interval group was 8.0. The average difference per subject for the Fartlek group was 4.67. The Interval group improved more than did the Fartlek group. A "t" value of -2.592 was significant at the .05 level.

The comparison of the results between the American and Interval groups revealed a "t" value of .441, which was not significant at the .05 level. The average difference per subject for the American group was 8.67. The average difference per subject for the Interval group was 8.0. Both groups improved but the American group did not improve significantly more than did the Interval group.

The American and Interval training groups improved significantly more than did the group using the Fartlek system.

In Appendix B, page 31, the data and the formulas used for computations in the between group comparisons can be found. The formulas used were taken from Quinn McNemar.¹

¹Quinn McNemar, Psychological Statistics (New York: John Wiley and Sons, Inc., 1949), p. 225.

CHAPTER IV

DISCUSSION

The results of this study showed that a gradual decrease in times during the course of the track season was a general trend. Each of the training programs produced improvement in the experimental group times from the initial test to the final test.

It was observed that the participants in the Interval training and the American training groups attained a greater decrease in the times recorded. The athletes at Red River High School had been accustomed to these types of training. The writer assumed that this familiarity may have been one of the reasons for a greater decrease in these subjects' times over those in the Fartlek group.

The coaching staff explained the Fartlek system to the subjects in this group at the beginning of their training. During the experimental period, very little time was spent with the participants of the Fartlek group. Those participants in the Fartlek training group showed a smaller decrease in times than did those in the other two groups. The Fartlek training system was new to the athletes. The subjects in this group apparently did not fully understand how to handle this training method. It was observed that the athletes in the Fartlek group seemed to enjoy their training more than did those in the Interval or American groups.

This study had what the writer considered to be two uncontrollable factors, the attitudes of the participants and the weather. It is not known what influence, if any, the weather had on the athletes' training during the early season. It was also not known whether the subjects' attitudes were affected by the weather, by the training method, or by other problems outside of school and track.

On days when weather conditions were not suited for outdoor running, the subjects spent the practice time running in the halls at Red River High School and playing basketball.

In the writer's opinion, there was considerable merit in the training programs in which the subjects participated. Each worked diligently at the program in which he was involved and took a great interest in it. Even though the members of the Fartlek group may not have fully understood their respective program, each worked to attain the best possible results as did the members of the other two groups. The results showed that times recorded by each participant improved. Several of the subjects became more interested when conditioning and improvement became apparent.

The writer was unable to effectively ascertain how work indoors, during bad weather, affected the outcome of the total program. It was believed to be a beneficial factor because the subjects were exercising by running, they were kept happy, and at the same time were able to attain a conditioning tone that was sought.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to compare the effectiveness of three different methods of training middle distance runners during the early season and prior to the first meet. Fartlek, Interval and American systems of training were used with three equated groups of high school middle distance runners. Time in the half mile run was the evaluative instrument. Pre- and post tests in the half mile run were separated by an experimental period six weeks in length.

The data from the initial test and the retest were computed to determine the differences between means. The data collected were used to make within group comparisons and also between group comparisons. The null hypothesis was assumed for this study and the "t" technique for testing the significance of the differences between the means derived from correlated scores from small samples was used to make within group comparisons of the initial test scores with retest scores.

The average differences in times were used for making the between group comparisons.

Conclusions

The following conclusions were believed justified by the analysis of the data obtained in this study:

1. All three groups showed significant improvement at the criterion .05 level in the 880 yard run during the experimental period.
2. The American system produced significantly better results than did the Fartlek.
3. The Interval system produced significantly better results than did the Fartlek.
4. No significant difference was found in results between the American and the Interval training systems.

Recommendations

The following recommendations have been made as a result of this study:

1. Since the study was limited to six subjects per group, this investigator recommends that larger samples be used in similar investigations.
2. It is also recommended that a study be done using the same methods but employing only outdoor training and outdoor facilities.
3. The writer recommends that middle and long distance runners be advised to participate in Fall cross-country programs in the areas where weather conditions are similar to those of North Dakota.
4. The writer recommends that, for investigations of this type, the initial test and retest each be given twice under the same conditions

to facilitate obtaining more accurate times for the statistical treatment of the data.

INDIVIDUAL DATA SHEET

Name:		Class:				
Age:		Group:				
Test Day	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Mon.						
Tues.						
Wed.						
Thurs.						
Fri.						

INITIAL TEST AND RETEST FOR AMERICAN TRAINING GROUP

Subject	Initial Test	Retest	Difference	Difference Squared
1	137	128	9	81
2	150	144	6	36
3	147	143	4	16
4	145	133	12	144
5	152	141	11	121
6	159	149	10	100
	<hr/>	<hr/>	<hr/>	<hr/>
	890	838	$\Sigma=52.0$	$\Sigma=498.0$

Mean Score of Initial Test	148.3
Mean Score of Retest	139.7
Sum of Differences	52.0
Sum of Differences Squared	498.0

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM
CORRELATED SCORES FROM SMALL SAMPLES

Test American Training

$$N = \underline{\quad 6 \quad}$$

$$D = \underline{\quad 52 \quad}$$

$$D^2 = \underline{\quad 498 \quad}$$

$$S_{\bar{D}} \text{ (estimate of sampling error of } \bar{D}) = \frac{S}{D} =$$

$$\sqrt{\frac{\Sigma D^2 - \frac{(D)^2}{N}}{N - 1}} = \sqrt{\frac{498 - \frac{(52)^2}{6}}{5}}$$

$$S_{\bar{D}} = \underline{1.256}$$

$$\bar{D} \text{ (Mean Difference)} = \frac{D}{N} = \frac{52}{6} = 8.67$$

$$t = \frac{\bar{D}}{S_{\bar{D}}} = \frac{8.67}{1.256} = 6.902$$

$$df = N - 1 = 5$$

"t" at .05 level = 2.57

Significant at the .05 level

INITIAL TEST AND RETEST FOR FARTLEK TRAINING GROUP

Subject	Initial Test	Retest	Difference	Difference Squared
1	152	146	6	36
2	147	145	2	4
3	141	135	6	36
4	144	141	3	9
5	149	146	3	9
6	158	150	8	64
	<hr/>	<hr/>	<hr/>	<hr/>
	891	863	$\Sigma=28$	$\Sigma=158$

Mean Score of Initial Test	148.5
Mean Score of Retest	143.8
Sum of Differences	28
Sum of Differences Squared	158

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM
CORRELATED SCORES FROM SMALL SAMPLES

Test Fartlek Training

N 6

D 28

$D^2 =$ 158

$S_{\frac{D}{D}}$ (estimate of sampling error of \bar{D}) = $\frac{S}{D} =$

$\frac{S}{\sqrt{N}}$

$$\sqrt{\frac{\sum D^2 - \frac{(D)^2}{N}}{N - 1}} = \sqrt{\frac{158 - \frac{(28)^2}{6}}{5}}$$

$$\frac{S}{\sqrt{N}} \qquad \qquad \qquad \frac{S}{6}$$

$S_{\frac{D}{D}} =$.954

\bar{D} (Mean difference) = $\frac{D}{N} = \frac{28}{6} = 4.67$

$t = \frac{\bar{D}}{S_{\frac{D}{D}}} = \frac{4.67}{.954} = 4.895$

df $N - 1 = 5$

"t" at .05 level = 2.57

Significant at the .05 level

INITIAL TEST AND RETEST FOR INTERVAL TRAINING GROUP

Subject	Initial Test	Retest	Difference	Difference Squared
1	148	141	7	49
2	141	136	5	25
3	142	135	7	49
4	148	139	9	81
5	155	144	11	121
6	157	148	9	81
	<hr/>	<hr/>	<hr/>	<hr/>
	891	843	$\Sigma=48$	$\Sigma=406$

Mean Score of Initial Test	148.5
Mean Score of Retest	140.5
Sum of Differences	48
Sum of Differences Squared	406

THE SIGNIFICANCE OF THE DIFFERENCE BETWEEN MEANS DERIVED FROM
CORRELATED SCORES FROM SMALL SAMPLES

Test Interval Training

N 6

D 48

$D^2 =$ 406

$\frac{S}{\bar{D}}$ (estimate of sampling error of \bar{D}) = $\frac{S}{D}$ =

$$\frac{\sqrt{\frac{\sum D^2 - \frac{(D)^2}{N}}{N - 1}}}{\sqrt{N}} = \frac{\sqrt{\frac{406 - \frac{(48)^2}{6}}{5}}}{\sqrt{6}}$$

$\frac{S}{\bar{D}} =$.857

\bar{D} (Mean Difference) = $\frac{D}{N} = \frac{48}{6} = 8.0$

$t = \frac{\bar{D}}{\frac{S}{\bar{D}}} = \frac{8.0}{.857} = 9.335$

df $N - 1 = 5$

"t" at .05 level = 2.57

Significant at the .05 level

THE SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS DERIVED FROM
UNCORRELATED SCORES FROM SMALL SAMPLES

Test: 880 yard run

American Training Group $\bar{D} = 8.67$ Fartlek Training Group $\bar{D} = 4.67$

American Training Group $S_{\bar{D}} = 1.256$ Fartlek Training Group $S_{\bar{D}} = .954$

$S_{\bar{D}}$ = (the estimate of the sampling error for the distribution
of differences between the mean differences) =

$$\sqrt{\left(\frac{S_{\bar{D}_1}}{D_1}\right)^2 + \left(\frac{S_{\bar{D}_2}}{D_2}\right)^2} = \sqrt{(1.256)^2 + (.954)^2}$$

$$S_{\bar{D}} = \underline{1.5780}$$

$$\frac{D}{\bar{D}} = \bar{D}_1 - \bar{D}_2 = 8.67 - 4.67 = \underline{4.0}$$

$$"t" = \frac{\frac{D}{\bar{D}}}{S_{\bar{D}}} = \frac{4.00}{1.5780} = \underline{2.534}$$

$$df = (N_1 - 1) + (N_2 - 1) = \underline{10}$$

"t" at .05 level = 2.23

Significant at .05 level

THE SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS DERIVED FROM
UNCORRELATED SCORES FROM SMALL SAMPLES

Test: 880 yard run

American Training Group $\bar{D} = 8.67$ Interval Training Group $\bar{D} = 8.0$

American Training Group $S_{\bar{D}} = 1.256$ Interval Training Group $S_{\bar{D}} = .857$

$S_{\bar{D}}$ = (the estimate of the sampling error for the distribu-
tion of differences between the mean differences) =

$$\sqrt{\left(\frac{S}{\bar{D}_1}\right)^2 + \left(\frac{S}{\bar{D}_2}\right)^2} = \sqrt{(1.256)^2 + (.857)^2}$$

$S_{\bar{D}}$ = 1.5199

$\frac{D}{\bar{D}} = \bar{D}_1 - \bar{D}_2 = 8.67 - 8.00 = .67$

"t" = $\frac{D}{\bar{D}} = \frac{\frac{D}{\bar{D}}}{S_{\bar{D}}} = \frac{.67}{1.5199} = .441$

df = $(N_1 - 1) + (N_2 - 1) = 10$

"t" at .05 level = 2.23

Not significant at .05 level

THE SIGNIFICANCE OF DIFFERENCE BETWEEN MEANS DERIVED FROM
UNCORRELATED SCORES FROM SMALL SAMPLES

Test: 880 yard run

Fartlek Training Group $\bar{D} = 4.67$ Interval Training Group $\bar{D} = 8.0$

Fartlek Training Group $S_{\bar{D}} = .954$ Interval Training Group $S_{\bar{D}} = .857$

$S_{\bar{D}}$ = (The estimate of the sampling error for the distribu-
tion of differences between the mean differences) =

$$\sqrt{\left(\frac{S_{\bar{D}_1}}{D_1}\right)^2 + \left(\frac{S_{\bar{D}_2}}{D_2}\right)^2} = \sqrt{(.954)^2 + (.857)^2}$$

$$S_{\bar{D}} = \underline{1.2845}$$

$$\frac{D}{D} = \bar{D}_1 - \bar{D}_2 = 4.67 - 8.0 = \underline{(-3.33)}$$

$$"t" = \frac{\frac{D}{D}}{S_{\bar{D}}} = \frac{(-3.33)}{1.2845} = \underline{(-2.592)}$$

$$df = (N_1 - 1) + (N_2 - 1) = \underline{10}$$

"t" at .05 level = 2.23

Significant at .05 level

BIBLIOGRAPHY

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Books

- Bresnahan, George T., Ph.D., Tuttle, W. W., and Cretzmeyer, Francis. Track and Field Athletes. 6th ed. St. Louis, Mo.: The C. V. Mosby Co., 1964.
- Doherty, J. K. Modern Training for Running. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1964.
- Doherty, J. Kenneth. Modern Track and Field. 2nd ed. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1963.
- Garrett, Henry E., Ph.D. Statistics in Psychology and Education. 5th ed. New York: London, Green and Co., 1958.
- Jordan, Payton, and Spencer, Bud. Champions in the Making. Englewood Cliffs, N.J.: Prentice Hall, Inc., 1968.
- McNemar, Quinn. Psychological Statistics. New York: John Wiley and Sons, Inc., 1949.
- Wilt, Fred. Run, Run, Run. Los Altos, California: Track and Field News Inc., 1964.

Articles and Periodicals

- Canham, Don. "New Middle Distance Training Concepts." Scholastic Coach, XXVI (February, 1957), 14.
- Doherty, J. K. "Interval Training." Scholastic Coach, XXV (February, 1956), 18.
- Ecker, Tom. "Interval Training." The Athletic Journal, XLIII (March, 1963), 16+.
- Epskamp, Robert. "Rx for Distance Runners." The Athletic Journal, XLIII (March, 1963), 58.
- LeMasurier, John. "Interval Running + Fartlek in Training Distance Runners." Scholastic Coach, XXVIII (October, 1958), 40.

O'Connor, Tom. "Training the Distance Runner." Scholastic Coach,
XXXII (April, 1963), 10.

Wilt, Fred. "Training Trends in Distance Running." Scholastic
Coach, XXXIII (February, 1964), 11.