A COMPARISON OF INSTRUCTIONAL EMPHASIS OF SPEED, ACCURACY, AND SPEED AND ACCURACY UPON THE PERFORMANCE OF THE BEGINNING FENCER

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ABSTRACT

A COMPARISON OF INSTRUCTIONAL EMPHASIS OF SPEED, ACCURACY, AND SPEED AND ACCURACY UPON THE PERFORMANCE OF THE BEGINNING FENCER

By

Jean Ann Theresa Reilly

The intent of this study was to compare the effect of instructional emphasis in regard to speed, accuracy, and speed and accuracy upon the performance of the beginning fencer in terms of (a) the ultimate execution of a particular fencing skill, and (b) fencing ability in a realistic setting of bout fencing.

Seventy female students originally enrolled in three beginning fencing classes at Michigan State University served as subjects. Each class received different instructional emphasis: Group 1 was taught for speed, Group 2 was taught for accuracy, and Group 3 was taught with equal emphasis on speed and accuracy together. After a five week period, the subjects were measured in a skill with the use of an apparatus constructed by the investigator. Three measures were recorded for each subject; two concerning speed of movement and one of accuracy. A fencing tournament was held during which the subjects from each group fenced subjects from the other groups to determine which instructional method, if any,

produced the most successful fencer.

Three one-way analyses of variance were run to determine if any significant difference in performance existed between the groups as a result of the initial instructional emphasis. A significant difference was obtained at the .01 level between the groups on Response Time 1 and Response Time 2 measures. A Duncan Multiple Range Test was computed, and it was determined that the speed group was significantly different from the accuracy group and the speed and accuracy group on Response Time 1. The speed group was superior to both groups, and the speed and accuracy group performed better than the accuracy group on Response Time 2.

Four one-way analyses of variance were calculated to determine the existence of significance among the means of the criteria measures as a result of the fencing tournament. No significant difference was found between the means of the group performance on the criteria scores.

A chi square analysis of the fencing tournament performance of the subjects within each group on the four criteria were computed with respect to the number of fencers scoring in the upper, middle, and lower one-third groups. No significant difference was found between the various group performances in the fencing tournament.

A correlation matrix was arranged to determine the relationship among the four fencing bout criteria and the three skills tests. Significance was obtained between Response Time 1 and Response Time 2, and between Response

Time 2 and accuracy. No significant relationship was found to exist between the performance measures and the fencing bout criteria.

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To my mother whose love and encouragment will always be a source of motivation.

To my father who gave me the strength and courage to pursue what often seemed impossible.

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CHAPTER I

INTRODUCTION

The learning of a motor skill is the end result of guided instruction and diligent practice. The dependency of the learner on the learned placed the success of the ultimate performance, to a large extent, on the methods employed in implanting the skill. Methods of instruction that facilitate the learning of a motor skill should be the primary concern of the instructor. Within motor skill learning, one of the instructional decisions usually concerns initial emphasis on speed, accuracy, or both speed and accuracy equally. This problem becomes evident when one realizes that many skills demand speed and accuracy in movement for ultimate proficiency.

In past decades, the general tendency in the instruction of motor skills requiring both speed and accuracy in their execution has been the emphasis of accuracy first. The assumption is that it is easier to speed up movements than to correct inaccurate ones (Viteles, 1932). Poppelrueter's law of practice has strongly influenced the learning process employed in the acquisition of a motor skill. According to this law, as stated by Solley (1952):

> ...the best results in motor learning are found when speed is retarded until a reasonable level of accuracy has been obtained and then is gradually increased.

The hypothesis made is that accuracy is better learned at a slow rate of speed than at a quickened pace and is better maintained as speed is increased than learning for speed first and then for accuracy.

On the other hand, Fulton (1942), Hartson (1939), and Knapp and Dixon (1952) are among those investigators who state that speed should receive initial emphasis in the learning of skilled movements. They found that movement patterns differ at different rates of speed. Therefore, they recommended that the initial practice concentration of a motor skill should be placed upon that level of speed required to execute the task during a realistic situation.

"Steadiness and the cultivation of soundness first and speed afterwards is standard teaching in America" (Knapp, 1963). The existence of this trend can be seen in the sport of fencing. Since the opening of the first school of fencing in the fifteenth century, master, Olympic, and amateur fencers have maintained "tradition" within the fencing realm. Tradition lies in the finesse, style, and form used by the fencer in maneuvering his foil. Beginning fencers, in the past, have generally been trained for form, rather than for speed. In observing today's fencing classes, the same type of instructional emphasis is evident.

This method of instruction is supported by the concept that the foil is a practice weapon used to develop accuracy (Castello and Castello, 1962). Beginning fencers are taught to execute fencing skills at a slow rate of speed in order to develop a "kinesthetic" awareness of body positioning and precise, controlled movement patterns of the foil, rather than being taught at a rate of speed which could be useful in a bout situation.

Some fencing coaches, for instance Kaplan (1950) and Yonkee (1955, 1957), stress speed of movement as the essential element necessary for a successful fencer. This stress for speed in executing fencing skills, however, is for the advanced or competitive fencer who has already developed body form and foil control. The fencing coach at Michigan State University, Charles Schmitter, drills his fencers for form first, speed afterwards. His position is that proper form gives a fencer an added advantage in executing a fencing maneuver. For example, the complete extension of the back leg in executing the lunge provides the fencer with a thrust power needed to reach his opponent. On the other hand, there are fencing instructors and coaches who now believe that the development of speed in executing a fencing movement is more essential for the beginning fencer than the development of accuracy. It was reasoned that if ultimate success in fencing is dependent upon who scores the necessary touches first, then initial instructional emphasis should be placed upon speed in executing a

fencing skill.

Controversy exists within the sport of fencing as to the initial instructional emphasis for the learning of fencing skills. It would be desirable if those involved in teaching fencing would begin to develop the most effective methods of instruction according to supportive research data.

This study was designed to discover which instructional method, speed, accuracy, or speed and accuracy, should be used during the initial stages of skill acquisition to produce the most successful fencer.

Statement of the Problem

The purposes of this study were twofold. The first was to make a comparison of instructional emphasis in regard to speed, accuracy, and speed and accuracy upon the ultimate execution of a particular skill in fencing. The second purpose was to determine that instructional method which produced the most successful fencer in a realistic setting of bout fencing.

Hypothesis

It was hypothesized that a particular type of instructional emphasis used during the early stages of learning would yield a significant effect on the performance of the beginning fencer. More specifically, the group that had an initial instructional emphasis on speed was

expected to be more successful in ultimate performance than the speed and accuracy group, which, in turn, was conjectured to be superior to the accuracy group.

Definition of Terms

1. Accuracy
   a. In Instruction - the ability of the fencer to execute a fencing skill with precise form and control while thrusting the foil into a designated target.
   b. In Testing - the ability of the fencer to strike the center of her opponent's target.
2. Beat - "a sharp, controlled blow against the middle or weak portion of the opponent's blade with the object of opening a line or provoking a reaction." (Castello and Castello, 1962)
3. Bout - "a combat between two opponents in which the experience and skill of the adversaries are brought into play with the purpose of scoring touches." (Vince, 1940)
4. Director - the individual who is in charge of the bout, controls the action by telling the fencers when to begin and stop fencing, and makes decision in awarding the touches.

5. "Good" or "Valid" Touch - the point of the foil that goes into the target, striking a valid target area.
6. Loss - a fencer having four touches scored on her by her opponent (according to women's fencing rules).
7. Parry - "a defensive action made with the blade to deflect an attack." (Castello and Castello, 1962)
8. Right of Way - a rule which states that the first fencer who advances her foil in a forward movement by extending her foil arm will be awarded the touch if a hit is made on her opponent's valid target area. The opponent must either parry or retreat to gain the right of way before she can score a touch.
9. Riposte - a counter attack of a lunge used to reach an opponent whose attack has been successfully parried.
10. Speed

    a. In Instruction - the ability of the fencer to execute a fencing skill as quickly as possible.

    b. In Testing - the ability of the fencer to respond as quickly as possible

with a parry to her opponent's beat (Response Time 1). Also, the ability of the fencer to execute the parry riposte as quickly as possible (Response Time 2).

11. Strip - a rubber mat measuring six feet by forty feet upon which the fencers fence. The mats were used as a safety precaution against slipping and sliding on the gym floor while fencing.
12. Valid Target - the top of the collar of the jacket extending to the waist, both front and back, excluding the arms.
13. Win - a fencer scoring four touches on her opponent.

Limitations of the Study

1. The grouping of subjects, in the form of classes, was done through registration procedures at Michigan State University and, therefore, was not random.

2. The scheduled class meetings were not affected as much by the different days of the week on which they met, but rather by the time of the day. It was observed that the Tuesday - Thursday class that met at 10:30 A.M. lacked the vigor possessed by the other two groups, which met at 12:50 P.M. on Monday - Wednesday and Tuesday - Thursday.

3. A pretest to determine each subject's entering level of response time and accuracy in fencing movements should have ideally been obtained. In this way, their post-test performance scores could have been better evaluated in terms of instructional method and entering level of response time and accuracy performance.

4. All absences were re-scheduled by the instructor. However, this did not always guarantee the same exposure for the absentees to the material as for those subjects who attended the regular class.

5. The instructional phase of the study was limited to five weeks, two hours each week. For more adequate development of fencing skills, Castello and Castello (1962) recommend twenty hours.

6. It was observed that the experienced fencers serving as opponents during the testing phase had some effect on the performance of the subject in the manner in which she manipulated the testing foil, e.g., the amount of pressure exerted by the tester's foil against the subject's foil.

7. Due to the large number of subjects (n=70), a three-hour evening session was the only time slot convenient for all concerned to participate in bout fencing competition. The day's activities manifested themselves in the form of fatigue and lack of interest for some subjects.

8. The bouts were arranged according to the availability of fencing strips. As a result, the amount of time that each fencer had between bouts varied.

9. Fencers had to move from one strip to another depending upon the location of a ready strip. This caused some amount of confusion. Separate fencing pools with fifteen fencers in each pool, five from each group, should have been set up at each strip to eliminate the confusion of moving from one place to another.

CHAPTER II

REVIEW OF LITERATURE

This chapter will contain a review of literature pertaining to the theoretical implications of speed and accuracy and research findings on speed and accuracy in industry and motor skill performance. A section relating to the emphasis of speed and/or accuracy in fencing will also be presented.

Theoretical Implications

In performing a task, an individual possesses the capacity to regulate the level of accuracy at which he wishes to operate in conjunction with the rate of work that is required of him (Fitts and Posner, 1967). This is known as the ability to trade speed for accuracy or accuracy for speed. Empirical research on the effects of payoff conditions and criterion times upon speed and accuracy tradeoff have been done by Fitts (1966), Parchella and Pew (1968), and Pew (1969). Fitts (1966) had three groups of subjects perform sixteen identical choice reaction time tasks, the difference being in the incentive provided. The experimental speed group received extra points for fast responses while the experimental accuracy group

received penalties for incorrect responses. The control group practiced for both speed and accuracy and received no feedback. He found that a decline occurred in the rate of information that was transmitted as the number of errors made increased above ten percent. The results showed that the accuracy group, with ten percent errors, performed better than the speed and accuracy group, with thirteen percent errors, and the speed group with twenty-two percent errors. He states, however, that the performance of the speed and accuracy group was the most desirable. Fitts and Posner (1967) related these findings to everyday tasks in that individuals do not perform "slowly enough to avoid all errors, but at a speed which will allow effective communication despite some error." Fitts (1966) also stated that the use of a payoff matrix plus immediate feedback in sets for speed and accuracy in a reaction time task are more beneficial to the subject than the use of verbal instructions alone.

Using the payoff matrix designed by Fitts (1966), Parchella and Pew (1968) studied the relationship between speed and accuracy performance under a wide variety of task conditions. The tasks consisted of responding to four lights, occurring in fifteen combinations, with the middle and the index fingers of each hand. Those performing under speed conditions made faster responses with more errors than those performing under accuracy conditions. In

studying interactions between the payoff matrix, Parchella and Pew suggested that speed coupled with practice caused eventual accuracy improvement and vice versa. Therefore, regardless of the initial combination of instructional stress, e.g., speed first, then accuracy, or accuracy followed by speed, both speed and accuracy will ultimately be improved.

In discussing various studies on the speed versus accuracy tradeoff, Pew (1969) stated that the findings of a non-existent relationship between speed and accuracy is not due to the task itself but to the performance limitations of the subject. Individuals work within boundaries of performance, and the quality of these boundaries is based upon error feedback. Of the studies discussed by Pew, average reaction time of error responses was found to be faster than that for correct responses, thus making these boundaries scattered as opposed to being strictly controlled. This suggests that the subject, to some degree, controls the speed and accuracy level at which he wishes to work.

Hale (1969) presented a more realistic situation in his study of speed-accuracy tradeoffs in a three choice serial reaction task. No immediate payoffs or criterion times were used. Each subject practiced a task similar to the one used for the study until a level of stability was reached. In the first experiment, speed and accuracy were alternately and separately emphasized. The results showed

that skilled subjects could adapt their performance to either criteria, speed or accuracy, without payoffs or criterion times since errors and correct responses progressed by the same amount. Total sequence time was reduced by the subject at the expense of more errors when correct responses were faster, when error responses were faster, and when more and faster errors were made.

Howell (1963) found that subjects were primarily concerned with accuracy, and that they would choose the accuracy criteria when instruction was lacking. There was a critical accuracy level of ninety percent or better that subjects were unwilling to go below. It was, therefore, reasoned that speed must be adjusted to a level which permits the accuracy level to be maintained. If, however, a subject was presented with a speed task, he would lower his accuracy criteria so as not to fall below a critical speed level. Howell also stated that "accuracy remains at a fairly constant level throughout learning; nearly all improvement comes about as a result of increased response speed."

Research on the utilization of a payoff matrix in a choice reaction time task has indicated that the subjects who stress both speed and accuracy obtain better results than speed subjects or the speed and accuracy subjects. In fact, it was stated that a combination of the utilization of payoff matrix and immediate feedback in teaching

would prove to be more advantageous to the student than the sole use of verbal instruction. Further investigation on the effect of a payoff matrix on speed and/or accuracy during performance indicated that neither initial stress of speed or accuracy was more beneficial than the other. Therefore, it was suggested that practice coupled with either initial emphasis on speed or accuracy eventually caused both speed and accuracy to improve.

On the other end of the spectrum, it has been stated that the incorporation of a payoff matrix for speed and accuracy tasks has no effect on performance. In fact, it was stated that skilled subjects could adapt their performance to whatever was required of them without the use of either a payoff matrix or criterion times. It could, therefore, be concluded that the use of a payoff matrix or criterion times in teaching is of questionable value.

Other research, however, would indicate that such a decision is not made by the instructor but by the instructed. The results of an investigation on speed versus accuracy tradeoff indicated that the outcome of a task was not due to the task itself but to the performance limitations of the subject. It has been reasoned that the performance level of speed and accuracy is controlled by the subject. Furthermore, another report has shown that the subject selects for himself an accuracy criteria and a speed criteria. It has been suggested that these criteria

are responsible for the speed and accuracy level at which the subject performs a specific task. Therefore, it would seem that a combination of individual limitations and personally-set criterion levels would overpower the effect of a payoff matrix and externally-set criterion times.

Research Findings on Speed and Accuracy

Management must concern itself with training personnel to produce goods with accuracy and efficiency. With costly production expenditures and labor salaries, errors and wasted time cannot be tolerated. According to W. Douglas Seymore (Fraser, 1962), a researcher in manual skills in industry, a worker must first be trained for accuracy. Training for speed is a "catch up" process which begins with the start of the actual job. Meyers (1925) did a study with thirty-six colored cubes that had to be placed in a certain pattern. Two groups were used, one performing for accuracy, the other performing for speed. At the end of sixty days, Meyers found that the accuracy group was performing "practically perfect" at a faster rate than the speed group.

With task executions requiring both speed and precision, a decision must be made as to how much each aspect should be stressed during training. Sjödahl (1966) stated that thoroughness in performing a task should be stressed over speed during the initial training stages. Gilmer (1961), however, claimed that the decision to train

for either speed, accuracy, or speed and accuracy depended upon the difference which existed between performing the ultimate task at a fast or a slow rate. If this difference is great, the speed task should receive initial emphasis during training.

In a study involving muscular activity in typing, Sturt (1921) found that it was better to insist upon accuracy because speed did gradually increase. Southward, as stated by Sturt (1921), believes that it is impossible to obtain speed unless correct movement patterns are first established. Ussell's (1955) study of different approaches to the teaching of typewriting yeilded no significant differences in the amount of errors made by the speed group and those made by the accuracy group. Therefore, he recommends that speed be taught first since the speed group produced an average of eight to ten words more a minutes than the accuracy group. A similar study done by Kamnetz (1956) showed no significant difference in typing performance between the speed group and the accuracy group.

Within the area of motor skill performance, accuracy has, in the past, received initial emphasis when both speed and accuracy were the desired outcome (Viteles, 1932). Fulton (1942), however, stated that speed should receive initial instructional emphasis in learning skilled movements whether ballistic (free of muscular tension and carried by momentum), or non-ballistic (a continuous action that can be stopped or modified in progress). She found

that the group placing initial instructional emphasis on speed developed accuracy to a higher degree than the group initially trained for accuracy. Fulton (1945) again investigated speed and accuracy in learning movements, with the results showing that the accuracy gained at low speeds was lost when the task was performed at a higher speed. This was due according to Fulton, to "the changes in movements which result from changes in speed."

Knapp and Dixon (1952) stated that slower movements fail to build up kinesthetic sensitivity which is essential for good performance in motor skills. In their study involving the task of juggling ping pong balls, little transfer value was noted when the subject was instructed to move from performing at a slower speed to performing at a faster speed. Hartson (1939) stated that initial emphasis should be placed upon speed in performing a ballistic movement since such a movement cannot be made slowly. He cited an observation from Gilbrith (Hartson, 1939) that when an expert demonstrates a movement in slow motion, "the movement changes its character" because of the difference in motor patterns involved at different speeds of performance. Knapp (1963) said that ballistic movements should be taught at a speed which would be of use to the performer when he executed the ultimate task. This initial speed should be slow but suitable for use during future performance.

A motor skill consisting of stepping forward over a

distance equal to the subject's height and striking a fixed target was used by Solley (1952) to study the effect of verbal instruction of speed and/or accuracy upon learning. Little evidence was found "to support the contention that levels of accuracy gained at low rates of speed are maintained when the rate of speed is increased." Therefore, Solley suggested that Poppelreuter's law of practice, which stresses initial emphasis on accuracy, be replaced. Skills in which speed and accuracy are the factors necessary for successful performance should have initial emphasis placed upon both. In a thrusting experiment by Garrett (1922), it was concluded that any simple coordinated movement would show an inverse relationship between speed and accuracy. In other words, as speed increased, accuracy decreased.

The effect of varied instructional emphasis on the forehand tennis stroke was investigated by Woods (1967). The results of his study showed that the equal instructional emphasis of speed and accuracy contributed to a better forehand tennis stroke than the instructional emphasis on accuracy. In turn, accuracy emphasis was less beneficial, and the instructional emphasis on speed was least beneficial. Johnson's (1957) study on the tennis slice serve of advanced women players showed no relationship between speed and accuracy. No difference was found between the speed group and the accuracy group in performing the tennis slice serve. It is the opinion of Singer (1969) and Updyke (1970)

that sacrificing accuracy in the early stages of learning is better than sacrificing speed. Updyke stated that movement patterns differ at different speeds. To avoid learning two separate skills because of this difference in performance standards, speed should be practiced from the beginning, since further practice would result in accuracy improvement. Lawther (1951) claims that too much speed might cause a loss of control resulting in loss of accuracy.

Some researchers have claimed that in learning for speed, incorrect movement patterns are developed; therefore, initial emphasis should be placed on accuracy. Once the skill pattern is learned with beginning emphasis on accuracy, speed will gradually increase. On the other hand, there were those who stated that since movement patterns differ at different rates of speed, speed should receive initial emphasis. If a fast rate of skill execution is essential for ultimate performance, speed should receive initial instructional emphasis. The placement of initial stress on speed, accuracy, or speed and accuracy seems to vary with the desired outcome. A task requiring accuracy for its successful execution should receive beginning instructional emphasis on accuracy; a task requiring speed should receive beginning instructional emphasis on speed; and those requiring speed and accuracy should receive beginning instructional emphasis on both.

Fencing

Discrepency in the sport of fencing lies in the type of initial instructional emphasis of speed, accuracy, or speed and accuracy essential for ultimate proficiency in a fencing bout. Vince (1940) stated that precision in executing a fencing skill is more important than the speed at which it is executed. If speed was introduced first, "inaccurate and inefficient fencing" would be the result. Therefore, initial instructional emphasis should be placed on accuracy with speed injected after precision and control have been reached. Lidstone (1952) is in agreement with Vince in that precision of movement is a necessary base for fencing skills. Lidstone added alertness, anticipation, and concentration on the part of the fencer as other components necessary for a fencing foundation. Shulman (1967) believes that the necessary control and precision of the fencer lies in the proper grip of the foil.

Knapp (1963) stated that whenever speed is essential for successful performance, speed should be taught as a part of form. He therefore suggested that equal emphasis on speed and accuracy be incorporated in teaching fencing skills. Crosnier (1951) also stressed a combination of speed and accuracy in teaching fencing skills. Fencing skills, such as the lunge, require quickness and accuracy in their execution (Ehrlich, 1943).

Fencing has been considered by some as a "modern high-speed game" (Castello and Castello, 1962). In the

past, fencing coaches such as Nadi (1943) and Yonkee (1955, 1957) stressed speed of movement as an important component for fencing success along with accuracy and shrewd, strategic judgement. Kaplan (1950) stated that by keeping the foil in the correct position, "semi-extended and aligned with the torso so that it covers the right flank from a front view," accuracy was guaranteed. Therefore, a major emphasis on accuracy is not necessary. Lawther (1951) cited an experiment of Ragsdale which also indicated that "fencing skill is acquired more rapidly if practice for speed precedes practice for accuracy,"

In a study done by Singer (1968), the assumption that the mastering of speed and accuracy would produce superior fencers was put to a test. A slight correlation was found to exist between reaction time, response time, and movement accuracy in relation to foil fencing success.

Authoritative opinion varies on the type of initial instructional emphasis placed on the fencer. The coaches of the past and present decades have usually stressed speed first followed by accuracy. This method, however, has been reported as being used with the advanced and/or the competitive fencer, not the beginning fencer. Research is lacking on the effect of initial emphasis of speed, accuracy, or speed and accuracy on the ultimate performance of the beginning fencer.

CHAPTER III

EXPERIMENTAL PROCEDURES

This study was undertaken to make a comparison of instructional emphasis in regard to speed, accuracy, and speed and accuracy upon (a) the ultimate execution of the parry-riposte, and (b) fencing ability in a tournament.

Subjects

Seventy female students enrolled in three beginning fencing classes at Michigan State University served as subjects. Only two students had had any previous fencing experience. Their exposure was so minimal that their entering skill level in fencing was slight, with no difference existing between them and the remainder of the class after the first two weeks of instruction.

Grouping

Instructional emphasis was determined among the classes through a randomized selection procedure. The following represents the groups that were formed: the Monday - Wednesday class met from 12:50 to 1:50 and served as Group 1 (n=23), with initial instructional emphasis being placed upon speed; the Tuesday - Thursday class met from 10:30 to 11:30 and served as Group 2 (n=21), with

initial emphasis placed upon accuracy; and the Tuesday - Thursday class met from 12:50 to 1:50 and served as Group 3 (n=26), with initial emphasis placed upon speed and accuracy.

Equipment

Jackets

The jackets used for the study were made of white army duck, cut to the waist, which buttoned up the side. Jackets from both Santelli and Castello were provided by the Women's Physical Education Department.

Foils

Each subject was assigned a foil to be used throughout the study. The Santelli Regulation Foil and the Castello French International Foil were made available to the subjects, both right and left handed, by the Women's Physical Education Department.

Masks

Each subject was fitted for a foil mask made by either Santelli or Castello, to be used throughout the term.

Gloves

All subjects were instructed to wear either an old cotton or leather glove for the protection of their fencing hand.

Instructional Aids

The following instructional aids were used for ten minutes at the beginning and ten minutes at the end of each lesson. They were used by each of the three groups to emphasize particular class emphasis: speed, accuracy, or speed and accuracy. These instructional aids provided each subject with additional practice drills to improve their skill level in fencing.

Practice Target

Four square-padded targets covered with white canvas were purchased from the Santelli Company. Each target was 16 1/4 inches long, 11 1/2 inches wide, and approximately 2 1/4 inches thick. A 5 3/4 inches by 4 1/2 inches red plastic heart was centrally located on each one. The investigator placed a circle made of green tape with a circumference of 1 inch in the center of the heart.

The height at which the target was to be placed on the wall was determined first by taking the average height of all the subjects. A subject with this average height of 5 feet 5 1/2 inches was asked to lunge against the wall. The point at which the tip of the foil hit the wall during the execution of the lunge was used as the mid-point of the practice target. The base of the target was approximately 3 1/4 feet from the floor.

Jacket Target

Since the fencing jackets used by the subjects in this study were also used by other students, targets that could easily be removed and again replaced were necessary. Circles cut from terry cloth material were used because of the ease with which they could be pinned to the jacket. Each of the twelve circles had a circumference of 3 1/2 inches outlined in dark blue marker to provide a contrast between the cloth and the jacket. A small colored circle with a circumference of 1 1/2 inches was located in the center of the cloth.

Floor Markings

Two tape markings were placed in front of each practice target; line #1 was 6 1/2 feet from the wall and line #2 was 7 1/2 feet away. Each subject was instructed to use that line or a point between the lines as the positioning point for her back foot which enabled her to reach the target when executing a lunge. With each session, the same line was to be used as a guide for the distance to be maintained between herself and the target. In keeping this distance constant, the scores obtained from the practice sessions would not be the result of a distance variable, but rather, the result of the subject's speed, accuracy, or speed and accuracy in executing the lunge. This distance was also used for testing purposes at the end of the term.

Teaching Locale

All classes were held in the assigned fencing room of the Women's Intramural Building at Michigan State University.

Class Instruction

The classes met for sixteen sessions, each lasting one hour. The first and second lessons were used as physical conditioning sessions to prepare the subjects for fencing. Exercises that would "limber up" and strengthen those muscles vital for fencing were introduced. Foil handling, positioning, footwork, and the lunge were presented during the next two sessions. Differentiation among the classes began at this point with the drills that were utilized. The pace of the commands of the drills depended upon the group with which they were used. Form was stressed with Group 2 (accuracy), speed of execution with Group 1 (speed), and a combination of both with Group 3 (speed and accuracy).

The initial emphasis phase prevailed from the fifth through the ninth sessions, with stress being based upon class assignment to either speed, accuracy, or speed and accuracy. Warm-ups at the beginning of each class period consisted of a series of exercises coupled with lunge and footwork drills. The tempo of each drill was set for each class by the instructor, who was the investigator. Group 1 (speed) performed at a much faster pace than did Group 2

(accuracy); while Group 3 (speed and accuracy) performed at a faster rate than Group 2, but at a slower rate than Group 1. For example, Group 1 practiced the execution of the lunge in its entirety as quickly as possible with no emphasis on form. Group 2 practiced the lunge with a separation between the extension and the actual lunging phase of the execution for emphasis of form. Group 3 practiced for both speed of execution and form.

Every day, each subject would pin a card to the back of her jacket to record her scores as an incentive for improving and as a means of reinforcing the method she was being taught. For sessions 5 and 6, practice targets (described under Instructional Aids) were used by the groups.

Group 2 was instructed to aim at the cirlce on the heart, scoring two points for hitting the circle and one point for hitting the heart. A count of the number of lunges executed was also taken. A lunge which lacked proper form, e.g., back foot on the ground, arm fully extended, etc., was not counted. The points scored on that lunge were not counted. This procedure stressed form rather than speed. Therefore, the subjects tried to score high on one lunge instead of scoring low on several lunges. A thirty-second time interval was set to accomplish the task. Group 3 aimed at the specifically marked area and was scored in the same manner with as many points as possible. The number of lunges made within a thirty-second

time interval was recorded. Group 3 was instructed to execute as many lunges as possible, and that their score would be the number of points scored divided by the number of lunges. This method provided practice for speed and accuracy simultaneously in attempting to improve both scores. Group 1 had no markings on the target, and, therefore, nothing specifically at which to aim. This resulted in the execution of the lunge as quickly as possible with no concern for accuracy. The subjects in this group were asked to record the number of lunges executed within a thirty-second time interval.

From sessions seven through nine, each fencer, recording scores as indicated above, performed a beat-lunge against her opponent. Groups 2 and 3 used jacket targets. A score of two points was recorded for hitting the smaller circle and one point for hitting the larger one. One opponent stood against the wall, while the student performing executed the beat and lunged into the circle to score. Group 2 recorded only those points made with precisely executed lunges. Group 3 recorded the number of lunges made and points scored as previously described. Group 1 did not use jacket targets. The subjects of this group were instructed to count the number of beat-lunges they could execute against their opponent. The scoring was the same as that used during the previous practice sessions.

All groups practiced fencing movements with equal emphasis on speed and accuracy for the following five

sessions. Due to the limited number of sessions devoted to the initial emphasis of speed, accuracy, or speed and accuracy concentration, it was decided that the instructor would continue to stress the practice technique unique to each group throughout the remainder of the term during the instructional phase of each lesson. Equal emphasis of speed and accuracy was stressed during drill practice and during the use of the different targets. This procedure provided the subjects with the needed additional practice on their assigned instructional emphasis of speed, accuracy, or speed and accuracy and also exposed them to the combination of speed and accuracy in preparation for bout fencing.

During the tenth and eleventh sessions, all subjects used the practice targets with the heart and circle showing on each, scoring as Group 3 had in previous sessions. Jacket targets were used by all subjects in executing the parry-riposte during practice sessions from the twelfth to the fourteenth meeting. For example, one student would stand against the wall with a jacket target. She executed a beat while her partner, standing on the markings used before, executed the parry and then a riposte into the target area to score. A third student counted the number of points scored, while a fourth student observed the number of lunges. Both scores were recorded.

All students worked in the same sub-groups of either five or six during the practice sessions to insure

continuity in scoring and use of the same target. Only once was absenteeism a problem. In that case, the subjects used the same target but had other subjects outside their sub-group help with the scoring.

All subjects received instruction on the same basic skills. An outline of classroom procedures and the skills taught can be found in the Appendix. The pace of the drills along with different areas of emphasis were the only instructional differences among the groups.

Apparatus

Equipment

The testing apparatus consisted of two Singer, .01 second chronoscopes, a French electrical foil with a Leon Paul Bayonette Socket by Santelli, a Leon Paul body cord by the same company, and a Castello, French International Foil.

General Description

An electrical foil, called the subject's foil (SF), was connected by a body cord to a wired, wooden socket to the timers. A clip attached to the regular foil, called the testing foil (TF), connected the TF to the chronoscopes.

A tripod with a fifteen-inch wooden platform attached to the top served as the supporting base for the TF fencer's arm. The purpose of this platform and tripod

was to minimize fatigue and to insure a constant level of arm height for each subject. A wooden door stop on top of the platform, covered with a towel, provided comfort and freedom of wrist movement for the fencer.

A circle, having a circumference of six inches and made of heavy-duty white plastic, was used as the target for the accuracy scores. Two smaller circles were imposed upon the target with a difference of two inches in circumference between each.

A .01 second chronoscope was initiated when TF beat against SF, and terminated when SF parried TF (Response Time 1.) The second .01 second chronoscope began at the same time as the other timer and recorded when SF hit the target (Response Time 2.) The apparatus is illustrated in Figure 1.

Technical Description of the Electrical Portion of the Apparatus

A ring counter is a logical system having several outputs, only one of which may be "on" at any given time. Initially, a pulse of current at the "set" input turns on output #1. Each pulse at the "shift" input then shifts the ring counter to the next output. Normally, the ring is closed: when the last output turns off, the first switches on.

A three-position open ring counter was formed using two silicon-controlled switches (SCS) and one NPN

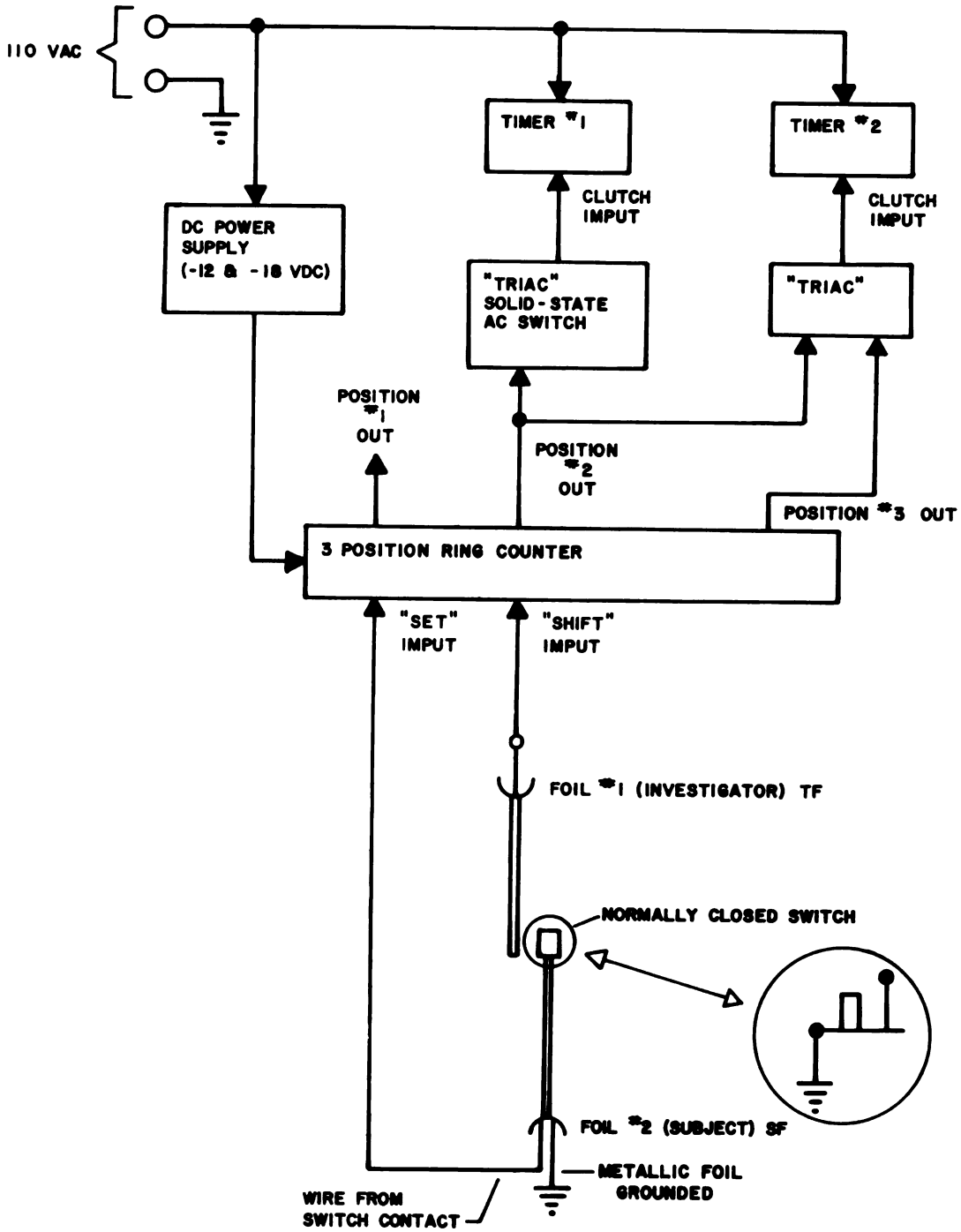

FIGURE 1. Block Diagram of the Apparatus

transistor. A shift pulse is generated each time contact is made between the two metal foils. Assuming output #1 is on, the first such pulse turns on output #2, starting both timers via two AC solid state switches (TRIAC). The second contact between the foils switches on output #3. In this position, only the second timer is left running. Further shift pulses resulting from accidental contacts have no effect because of the "open" construction of the ring (no connection is made between output #3 and output #1). However, when the normally closed switch in the end of foil #2 opens upon contact with the target, a "set" pulse is generated which turns on output #1, stopping the second timer.

A power supply was constructed to provide operating voltages (-12 volts, D C and -18 volts, D C) for the ring counter and TRIACS.* A schematic drawing of the apparatus appears in Figure 2.

Testing Locale

The testing apparatus was arranged in the same fencing room in which class sessions were held. A room in the basement of the Women's Intramural Building was used by the subjects as a waiting room.

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* The design and technical description of the apparatus were done by Bob Wells of the Health, Physical Education and Recreation Department at Michigan State University.

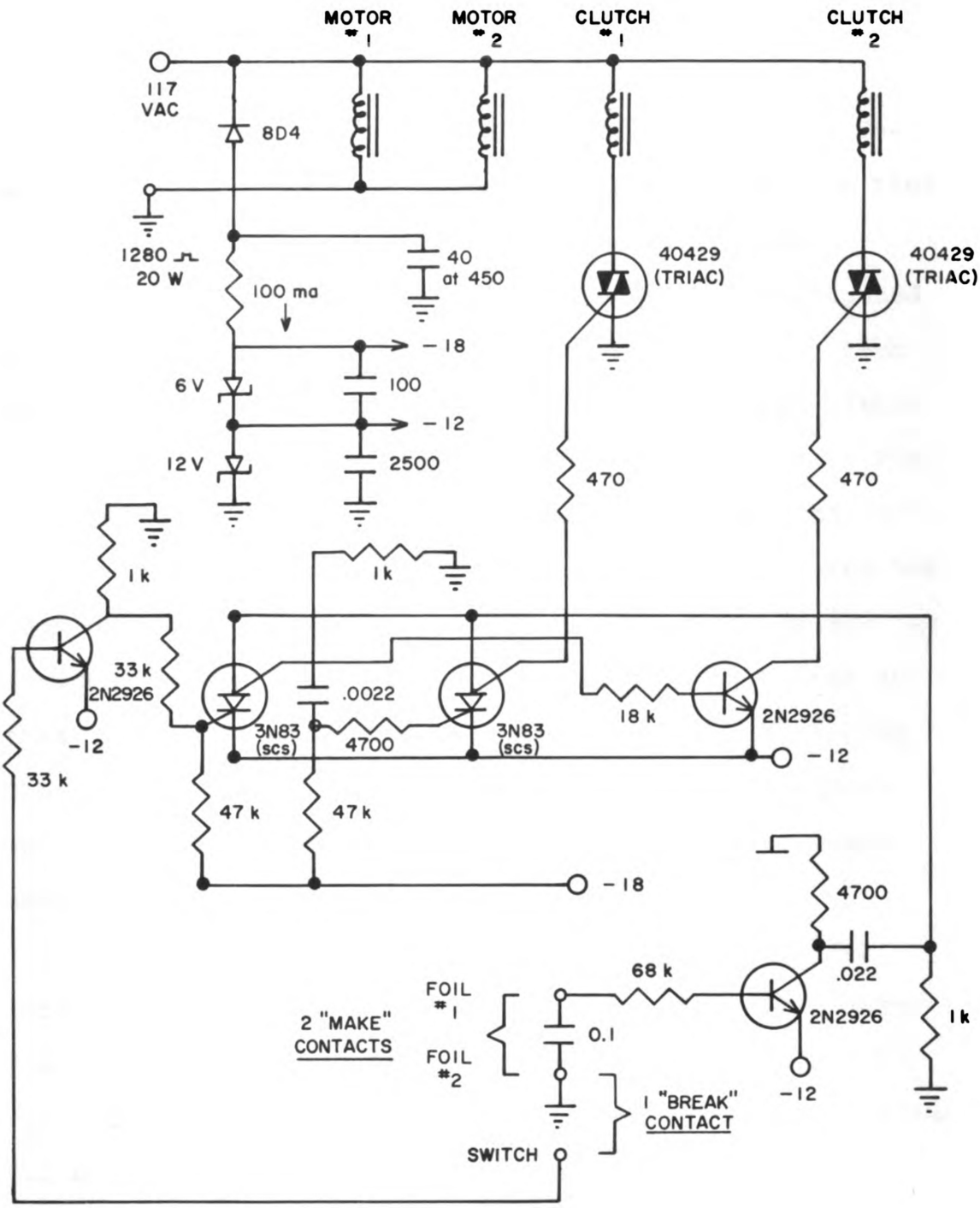

FIGURE 2. Schematic Drawing of the Apparatus

The fencing tournament was held in the upper gymnasium of the Women's Intramural Building.

Testing Procedures

The testing apparatus, already described, was designed to produce scores of two measures of response time as well as one measure of accuracy for all fencers.

Three experienced fencers, all having participated in competitive fencing, were used to hold the TF. Each was randomly assigned to a class. All three fell within the mean range of the heights of the three groups, 5 feet 5 inches to 5 feet 5 1/2 inches; thus, providing the subjects with a target that was similar in height to the targets used during practice sessions. The fencer's arm was strapped into position on the tripod at three points so that the execution of the beat came from the wrist only. The experienced fencer was stationed the same distance away from the subject as the targets used during class meetings.

The parry-riposte was used to measure speed for three reasons. First, a fencer must be able to successfully protect herself from being hit before she can attempt to score on her opponent. Second, the more successful a fencer is at exposing her opponent's target area, the more likely she is to score. Third, the faster the execution of the parry by a fencer, the more apt she is to control the scoring.

The TF moved in three patterns: beat, disengage-beat, and double disengage-beat. Three patterns were used to eliminate anticipation of the beat action by the subjects. Another reason for their usage was to provide as realistic a setting as possible for the parry-riposte execution. A fencer does not use the same pattern when she is aware that her opponent is anticipating the move.

Three body cords were used, one for the subject being tested and two for those waiting outside the fencing room. After the fencer's body cord was attached, the investigator read the following instructions:

"These two lines on the floor represent the lines that you used during the target practice sessions in class. Position your back foot in the same place as you positioned it during class practice.

Your opponent will execute a beat against your foil. You are to parry her beat as quickly as possible and quickly riposte into the circle target on her jacket. Try to be as accurate as possible by hitting the smallest circle.

You will be given ten trials."

One practice trial of a beat was administered to determine if the subject understood the directions; if not, another trial with the same action was permitted.

Three, 4 by 6 inch index cards, each describing a TF pattern, were used. Before each trial, the

investigator held up one of the three cards for the fencer using the TF, but without the subject being able to see it. After three seconds, the card was lowered, and the TF began the action. The sequence of the foil patterns was randomized for each consecutive fencer. A table of random numbers was used to elicit two sequences consisting of ten foil patterns each: 4 beats, 3 disengage-beats, and 3 double disengage-beats. This was done to avoid the possibility of the waiting subjects organizing a sequence of sound patterns evoked by the timers that could be used as an anticipation device for their own performance when being tested.

An assistant recorded the times on a score sheet while the investigator recorded the accuracy scores, a score of five was awarded for a touch in the smallest circle, three for the middle one, and one for the outside circle. A zero was recorded if the circle target was missed. When the assistant reset the clocks, an index card was raised for three seconds, and the next trial began when it was lowered.

No comments were made during the testing unless a "mis-trial" occurred. A mis-trial was called when either of the two timers failed to stop. This happened when the TF made a second contact with SF or when SF failed to touch the target and stop the second timer. A new trial was given so that all subjects had scores for all ten trials.

The subjects were not informed of their performance scores. This was done to avoid any discussion of scores that might take place among the students of the different classes resulting in the forming of premature pessimistic or optimistic attitudes about the tournament outcome. The subjects within each group were not aware of the instructional emphasis used with their group or any other group. This naivety was allowed to continue until after the tournament.

Fencing Tournament

A bout fencing situation was arranged with each fencer fencing five bouts each with subjects from the other two classes. Opponent selection was based upon systematic assignment. Within each class, the subjects were placed in alphabetical order. The list was considered circular by moving from the top of the list to the bottom and back to the top, and so on. An assigned interval of five was used in selecting the ten opponents for each fencer from the list. The investigator moved through the list in the prescribed manner until each subject in Group 1 had five subjects to fence from Group 2. This procedure was repeated between Groups 1 and 3, and Groups 2 and 3. When each fencer was assigned ten fencers as opponents, five from each class, a table of random numbers was used to establish the order in which she was to fence each one. If the number of an assigned opponent for subject one, for

example, appeared in the table, that opponent was scheduled to fence her first bout with subject one. Subject two was scheduled, and this process was continued until all bouts were finished. Two conflicts existed at the end of the list when one fencer was scheduled to fence two opponents during the tenth bout and none during the ninth. The table was again used to reassign the two opponents so that a ninth bout was scheduled.

A time table was set up listing the different strips. The names of the fencers and their opponents were positioned on the time table so that all fencers fenced their first bout before the second one began. Consideration was taken in arranging each bout to make sure that no fencer was scheduled to fence two bouts within the same time slot. The amount of time between each bout varied for each fencer. Fencing films and a video tape playback machine were set up to occupy the fencer's time between bouts. Unfortunately, neither served its purpose due to technical difficulties. The bouts took place on one evening so that all subjects could be present.

Four rubber fencing strips were used to avoid slipping on the waxed gymnasium floor. A varsity fencer was positioned at each strip to act as a director and scorer. The directors were instructed not to re-enact the action that scored the touch for the fencer. This was done to avoid one fencer acquiring strategy from an outside source that would place her opponent at a disadvantage.

The valid target area ranged from the top of the collar to the waist line on the front and back, excluding the arms. A touch was awarded to the fencer who made the first on-target hit after having the "right of way." The first fencer to score four touches on her opponent was credited with the win.

Score sheets were placed at each strip to record the fencer, her opponent, class section, touches made, touches against, and a win or loss for each bout.

Due to absentees and other difficulties which arose (listed under limitations), no fencer participated in the desired ten bouts. Since a competitive fencing match consists of each fencer fencing four bouts, all fencers fencing less than four bouts were eliminated from the tournament portion of the analysis of the data. Thus, an n of 50 was used in analyzing the tournament results with Group 1 having an n of 17, Group 2 having an n of 15, and Group 3 having an n of 18. An average of six bouts was fenced by the subjects in each of the groups. Although this average fell below the expected number of ten bouts, the investigator felt that the available data were still an acceptable measure of a fencer's performance ability in a fencing tournament.

Due to student withdrawals from the class, sixty subjects remained to be tested on the testing apparatus. Group 1 had twenty-one subjects, Group 2 had eighteen subjects, and Group 3 had twenty-one subjects whose data were analyzed in the skills tests.

CHAPTER IV

ANALYSIS OF DATA

The statistical analyses of the data collected on three performance measures and on the outcome of a fencing tournament appear in this chapter. A correlation analysis of all the variables also appears.

Movement Analysis

The mean scores and standard deviations of each group on Response Time 1, Response Time 2, and accuracy are found in Table 1.

TABLE 1

MEANS AND STANDARD DEVIATIONS OF THE APPARATUS SCORES

	Response Time 1		Response Time 2		Accuracy	
Groups*	M	SD	M	SD	M	SD
1	0.2834	0.0594	0.6302	0.1703	2.2000	0.5950
2	0.3955	0.9806	0.9878	0.1251	2.7889	0.9461
3	0.2990	0.0708	0.8560	0.0969	2.6381	0.8145

*Group 1 = speed
Group 2 = accuracy
Group 3 = speed and accuracy

Three one-way analyses of variance were computed to discover any possible significant differences among the means of the different groups with respect to the test measures. These data are summarized in Tables 2, 3, and 4, respectively. The rejection value to determine significance was set at the .05 level. The results in Tables 2 and 3 indicate that both performance measures of response time far exceeded the .05 level of significance. No significant difference was found for accuracy scores between the three groups.

In order to determine which of the three groups were significantly different from each other, the Duncan Multiple Range Test was computed. The results of this analysis can be found in Tables 5 and 6. There was a significant difference between the speed group and the accuracy group

TABLE 2

SUMMARY OF ANALYSIS OF VARIANCE FOR RESPONSE TIME 1

Source	df	SS	MS	F	P
Between groups	2	0.1397	0.0699	14.1541	<0.0005
Within groups	57	0.2813	0.0049		
Total	59	0.4210			

TABLE 3

SUMMARY OF ANALYSIS OF VARIANCE FOR RESPONSE TIME 2

Source	df	SS	MS	F	P
Between groups	2	1.2901	0.6450	35.5548	<0.0005
Within groups	57	1.0341	0.0181		
Total	59	2.3242			

TABLE 4

SUMMARY OF ANALYSIS OF VARIANCE FOR ACCURACY

Source	df	SS	MS	F	P
Between groups	2	3.7387	1.8693	2.9958	0.058
Within groups	57	35.5673	0.6240		
Total	59	39.3060			

and between the speed group and the speed and accuracy group in favor of the speed group on Response Time 1 (Table 5). Table 6 shows a significant difference between all groups on Response Time 2, with the speed group performing better than the speed and accuracy group and the

accuracy group. In turn, the speed and accuracy group was superior to the accuracy group.

TABLE 5

DUNCAN MULTIPLE RANGE TEST ON ORDERED MEANS OF RESPONSE TIME 1

	1	2	3
	.2834	.2990	.3955
		.0156	.1121
			.0965
Rejection value (.05 level)		2.83	2.98
(Rej.) (Se)[a]		.0255	.0268

[a]Se = .009

TABLE 6

DUNCAN MULTIPLE RANGE TEST ON ORDERED MEANS OF RESPONSE TIME 2

	1	2	3
	.6302	.8560	.9878
		.2258	.3576
			.1318
Rejection value (.05 level)		2.83	2.98
(Rej.) (Se)[a]		.0481	.0507

[a]Se = .017

Fencing Tournament Analysis

Four criteria measures were used to evaluate the results of the fencing tournament.

Criteria I: $\frac{\text{Total \# of Wins}}{\text{\# of Bouts}}$

Criteria II: $\frac{\text{Total \# of Touches Made}}{\text{\# of Bouts}}$

Criteria III: $\frac{\text{Total \# of Touches Against}}{\text{\# of Bouts}}$

Criteria IV: $\frac{\text{Total \# of Touches Made}}{\text{Total \# of Touches Against}}$

The selection of these criteria was based on the investigator's previous competitive fencing experience and on the scores recorded during a fencing match. These criteria were established to provide further insight into individual differences among the groups. When a fencer scores four touches on her opponent in competitive fencing, she has won the bout. Through the application of these criteria, a fencer who was able to score three touches before her opponent could score four would be rated a better fencer than a second fencer who scored one touch on the same opponent before losing the bout. Thus, a broader scale was used to determine which instructional emphasis produced the better fencer.

Table 7 lists the mean scores and the standard deviations of the performances on the four criteria for each group.

TABLE 7

MEANS AND STANDARD DEVIATIONS OF CRITERIA MEASURES

	Criteria I		Criteria II		Criteria III		Criteria IV	
GP.	M	SD	M	SD	M	SD	M	SD
1	0.5912	0.2508	2.9794	0.7430	2.4759	0.9303	1.9171	2.3742
2	0.4433	0.2876	2.5367	0.8547	2.9120	0.8719	1.0513	0.6731
3	0.4739	0.2665	2.6494	0.9626	2.7489	0.8046	1.1511	0.6947

The four one-way analyses of variance summaries presented in Tables 8, 9, 10, and 11 yield the data collected on the subjects for the fencing bouts. No significant difference was found among the means of the groups in their bout fencing performance as measured by the four criteria.

The fencing tournament performance of the subjects within each group on the four criteria was analyzed by applying the chi square statistic. It was expected that the subjects within the speed group would be superior in performance to the accuracy group and the speed and accuracy group, and that the speed and accuracy group would

TABLE 8

SUMMARY OF ANALYSIS OF VARIANCE OF CRITERIA I

Source	df	SS	MS	F	P
Between Groups	2	0.2007	0.1004	1.3990	<0.50
Within Groups	47	3.3713	0.0717		
Total	49	3.5720			

TABLE 9

SUMMARY OF ANALYSIS OF VARIANCE OF CRITERIA II

Source	df	SS	MS	F	P
Between Groups	2	1.7347	0.8674	1.1711	<0.50
Within Groups	47	34.8111	0.7407		
Total	49	36.5459			

TABLE 10

SUMMARY OF ANALYSIS OF VARIANCE OF CRITERIA III

Source	df	SS	MS	F	P
Between Groups	2	1.5698	0.7849	1.0393	<0.50
Within Groups	47	35.4964	0.7552		
Total	49	37.0662			

TABLE 11

SUMMARY OF ANALYSIS OF VARIANCE OF CRITERIA IV

Source	df	SS	MS	F	P
Between Groups	2	7.4666	3.7333	1.6752	<0.20
Within groups	47	104.7397	2.2285		
Total	49	112.2063			

perform better than the accuracy group. Tables 12, 13, 14, and 15 represent a comparison between expected and observed outcome of fencers within each of the three groups with regard to the number of fencers scoring in the upper, middle, and lower one-third groups. No relationship was found between the type of initial instructional emphasis and overall fencing ability as measured by the four criteria. The chi square analysis is located in Table 16.

A X^2 of 9.49 or above was necessary for each of the criteria to be significant at the .05 level. No significant difference was found between the various group performances as measured by the four criteria.

TABLE 12

COMPARISON OF FENCING PERFORMANCE ON CRITERIA I

	Fencing Performance		
Groups	Upper	Middle	Lower
1	6 (5.4)	9 (7.5)	2 (4.1)
2	4 (4.8)	5 (6.6)	6 (3.6)
3	6 (5.8)	8 (7.9)	4 (1.3)

TABLE 13

COMPARISON OF FENCING PERFORMANCE ON CRITERIA II

	Fencing Performance		
Groups	Upper	Middle	Lower
1	12 (10.9)	5 (4.4)	0 (1.7)
2	8 (9.6)	6 (3.9)	1 (1.5)
3	12 (11.5)	2 (4.7)	4 (1.8)

TABLE 14

COMPARISON OF FENCING PERFORMANCE ON CRITERIA III

	Fencing Performance		
Groups	Upper	Middle	Lower
1	2 (0.7)	7 (7.5)	8 (8.8)
2	0 (0.6)	7 (6.6)	8 (7.8)
3	0 (0.7)	8 (7.9)	10 (9.4)

TABLE 15

COMPARISON FENCING PERFORMANCE ON CRITERIA IV

	Fencing Performance		
Groups	Upper	Middle	Lower
1	1 (0.3)	2 (0.7)	14 (16.0)
2	0 (0.3)	0 (0.6)	15 (14.1)
3	0 (0.4)	0 (0.7)	18 (16.9)

TABLE 16

FENCING TOURNAMENT ANALYSIS

Criteria	X^2
1	9.18
2	7.83
3	3.88
4	.98

Correlational Analysis of Variables

The correlation matrix in Table 17 was arranged to ascertain the relationships among the four fencing bout criteria and the three performance measures. A .69 correlation, which is significant at the .01 level, was found between Response Time 1 and Response Time 2 measures. Response Time 2 and accuracy were significantly related at the .05 level, with a correlation of .32 obtained.

At the .01 level, Criteria I correlated significantly with Criteria II (.91), Criteria III (-.90), and Criteria IV (.66). Criteria II exhibited a significant relationship at the .01 level with Criteria III (-.83) and Criteria IV (.60). A correlation of -.78 was found between Criteria III and Criteria IV, which is significant at the .01 level.

It should be noted that in some instances a better score is a higher score, while in other instances, a low

score is more desirable. Therefore, some negative correlations were expected in reference to Criteria III, as well as Response Times 1 and 2, in which a low score is a better score.

No significant relationships were found between the performance measures and the fencing bout criteria.

TABLE 17

CORRELATION MATRIX

		1	2	3	4	5	6	7
Response Time 1	1							
Response Time 2	2	.69[a]						
Accuracy	3	.10	.32[b]					
Criteria I	4	-.15	-.16[a]	-.25				
Criteria II	5	-.08	-.18	-.22	.91[a]			
Criteria III	6	.21	.20	.24	-.90[a]	-.83[a]		
Criteria IV	7	-.19	-.13	-.14	.66[a]	.60[a]	-.78[a]	

[a]significance greater than .01 level
[b]significance greater than .05 level

CHAPTER V

SUMMARY, CONCLUSIONS, DISCUSSION and RECOMMENDATIONS

Summary

The purposes of this study were twofold. The first was to make a comparison of instructional emphasis in regard to speed, accuracy, and speed and accuracy upon the ultimate execution of a particular skill in fencing. The second purpose was to determine that instructional method which produced the most successful fencer in a realistic setting of bout fencing.

Seventy female students originally enrolled in three beginning fencing classes at Michigan State University served as subjects. Each class received different instructional emphasis: Group 1 was taught for speed, Group 2 was taught for accuracy, and Group 3 was taught with equal emphasis on speed and accuracy together. After a five week period, the subjects were measured in a skill with the use of an apparatus constructed by the investigator. Three measures were recorded for each subject; two concerning speed of movement and one of accuracy. Each subject was given ten trials. A fencing tournament was held during which the subjects from each group fenced subjects from the other two

groups to determine which instructional method, if any, produced the most successful fencer.

Three one-way analyses of variance were run to determine if any significant difference in performance existed between the groups as a result of the initial instructional emphasis. A significant difference was obtained at the .01 level between the groups on Response Time 1 and Response Time 2 measures. A Duncan Multiple Range Test was computed and it was determined that the speed group was significantly different from the accuracy group and the speed and accuracy group on Response Time 1. The speed group was superior to both groups, and the speed and accuracy group performed better than the accuracy group on Response Time 2.

Four one-way analyses of variance were calculated to determine the existence of significance among the means of the criteria measures as a result of the fencing tournament. No significant difference was found between the means of the group performance on the criteria scores.

A chi square analysis of the fencing tournament performance of the subjects within each group on the four criteria was computed with respect to the number of fencers scoring in the upper, middle, and lower one-third groups. No significant difference was found between the various group performances in the fencing tournament.

A correlation matrix was arranged to determine the relationship among the four fencing bout criteria and the three skills tests. Significance was obtained between

Response Time 1 and Response Time 2, and between Response Time 2 and accuracy. The following criteria were significantly related with each other at the .01 level: Criteria I and II, I and III, I and IV, II and III, II and IV, and III and IV. No significant relationship was found to exist between the performance measures and the fencing bout criteria.

Conclusions

Within the limitations of this investigation, the following conclusions were reached:

1. The initial instructional emphasis of speed, accuracy, or speed and accuracy exhibited no significant difference on the performance of the subjects in the fencing bout tournament.

2. The group receiving initial instructional emphasis on speed was superior to the other two groups on one measure of speed of movement.

3. The speed group was also superior to the speed and accuracy group and the accuracy group on the other speed measure, while the speed and accuracy group performed better than the accuracy group.

4. All groups performed equally well in accuracy.

5. The fencing skills tests and the criteria used to evaluate the bout performance appeared to be independent measures.

6. The four criteria used in this study were found

to be highly related among themselves.

Discussion

The results of this study indicated no significant difference between the type of initial instructional emphasis employed within each group and the performance of the subjects in the fencing tournament. However, the significance found in favor of the speed group on Response Time 1 and Response Time 2 indicates that the speed group executed the parry-riposte skill faster than either of the other two groups. This investigator contends that the faster a fencer can defend herself against her opponent's attack by parrying, the less likely she is to be hit, and the more attempts a fencer has at hitting her opponent's unprotected target on a riposte, the greater the probability of her scoring the four touches first. The lack of significance found between the three groups on the accuracy measure signifies that initial instruction stressing form of execution and control of the foil has no additional influence on the performance of the beginning fencer. The investigator, however, does feel that a larger sample or a prolonged initial instructional emphasis phase might have proven the accuracy group to be better on this skill test since the *F* ratio on this task just missed the acceptable .05 level of significance set for this study.

The investigator noticed that the speed group was more aggressive than the speed and accuracy group. The

accuracy group demonstrated less aggressiveness than the other two groups. This aggressiveness was exhibited in the form of enthusiasm and effort in learning a new skill introduced in the classroom and in participating in fencing bouts. The maneuvers of the speed group followed by the speed and accuracy group in fencing bouts involved more footwork with advances, retreats, and lunges and more attempts to score on the opponent's target. These fencers possessed a certain degree of confidence in their fencing ability and were, therefore, not hesitant in trying new attacks. On the other hand, it was noticed that the majority of the fencers in the accuracy group lacked the mobility as well as the confidence possessed by the other groups. The accuracy group tended to limit their fencing tactics to such skills as the beat and disengage, even when they failed to work, instead of utilizing other attacks that were taught. All subjects demonstrated a degree of "sloppiness," for example, an excessive amount of double touches and jabbing due to insufficient distance between the two fencers, which was credited to their lack of experience and an inadequate amount of instructional time of five weeks.

The correlation matrix displayed no relationship between the three performance measures and the four fencing criteria. The cause for this finding could lie in (a) the inability of the measures and the criteria to represent what they proposed to measure; (b) in the method of

administering the tests of the fencing tournament; or (c) in the non-acceptability of the performance measures as indicators of potential fencing success. A more efficiently run tournament might have yielded a meaningful relationship between the performance measures and the fencing criteria. However, the possibility of the existence of an additional factor which was not measured, but is necessary for the beginning fencer must not be overlooked. Dow (1959) stated that success in fencing lies in "quick, deliberate movements and the ability to outthink and outwit one's opponent." Singer (1968) also recognized the possibility of such a factor existing in his fencing study. Lucia (1961) made the statement that within the sport of fencing "mere physical superiority must be subordinated to the qualities of the mind." This idea of "mind over matter" existing in fencing might be the outcome of prolonged instruction plus intensive practice plus adequate fencing experience which could not be measured in a study involving beginning fencers.

Recommendations

The investigator feels that additional research is needed within the area of initial instructional emphasis and its effect on ultimate performance, especially for the beginning fencer. Therefore, the following recommendations are made in conjunction with the findings of this study:

1. A testing apparatus which is completely

mechanized should be used to avoid any variable factor that might enter into the study from using a human to operate the testing foil.

2. It has been suggested that factors other than those measured by the skills tests and the fencing bout criteria might exist in fencing. The investigator recommends a similar investigation on the same measures for advanced and/or competitive fencers to see if a relationship does in fact exist among these variables with more fencing experience.

3. A study consisting of a comparison between beginning and advanced fencers based upon the same scale for measuring successful performance would also be appropriate to establish whether or not experience brings about a change in that which produces a successful fencer.

4. An additive step to the above recommendations might be the incorporation of a check list upon which the fencer records the basis for her maneuver during a fencing bout. Such a list might reveal information concerning strategy and/or certain personality traits that would influence a fencer's performance other than initial instructional emphasis.

BIBLIOGRAPHY

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1. Castello, James and Hugo Castello. Fencing. New York: Ronald Press Company, 1962.

2. Crosnier, Roger. Fencing with the Foil. New York: A. S. Barnes and Company, 1951.

3. Dow, Elizabeth. "First Lessons in Fencing." Journal of Health, Physical Education, and Recreation, 30:36-37 (1959).

4. Ehrlich, Gerald. "A Method of Constructing Learning Curves for a Motor Skill Involving Total Body Speed and Accuracy." Journal of Applied Psychology, 27:494-503 (1943).

5. Fitts, Paul M. "Cognitive Aspects of Information Processing: III. Set for Speed versus Accuracy." Journal of Experimental Psychology, 71:849-857 (1966).

6. Fitts, Paul M. and Michael I. Posner. Human Performance. California: Brooks/Cole Publishing Company, 1967.

7. Fraser, J. Munro. Industrial Psychology. New York: Pergamon Press, 1962.

8. Fulton, Ruth E. "Speed and Accuracy in Learning a Ballistic Movement." Research Quarterly, 13: 30-36 (March, 1942).

9. Fulton, Ruth E. "Speed and Accuracy in Learning Movements." Archieves of Psychology, 300: 7-53 (June, 1945).

10. Garrett, Henry E. "A Study of the Relation of Accuracy to Speed." Archieves of Psychology, No. 56 (May 1922).

11. Gilmer, B. von Haller. Industrial Psychology. New York: McGraw Hill Book Company, Inc., 1961.

12. Hale, D.J. "Speed-Error Tradeoff in a Three-Choice Serial Reaction Task." Journal of Experimental Psychology, 81:428-435 (1969).

13. Hartson, L. D. "Contrasting Approaches to the Analysis of Skilled Movements." The Journal of General Psychology, 20:263-293 (1939).

14. Howell, William C. and David L. Kriedler. "Information Processing Under Contradictory Instructional Sets." Journal of Experimental Psychology, 65: 39-46 (1963).

15. Johnson, Joan. "Tennis Serve of Advanced Women Players." Research Quarterly, 28:123-131 (1957).

16. Kamnetz, Harvey. "Relative Importance of Emphasis on Speed and Accuracy in Beginning Typing." National Business Education Quarterly, 25:36-37 (October, 1956).

17. Kaplan, Robert. "The Technique and Use of the Arms in Fencing." Athletic Journal, 31:30, 48 (November, 1950).

18. Knapp, B. Skill in Sport. London: Routledge and Kegan Paul Limited, 1963.

19. Knapp, Clyde G. and W. Robert Dixon. "Learning to Juggle: II. A Study of Whole and Part Methods." Research Quarterly, 23:398-401 (December, 1952).

20. Lawther, John D. Psychology of Coaching. New Jersey: Prentice-Hall, Inc., 1951.

21. Lidstone, R. A. Fencing. London: H. F. and G. Witherby Ltd., 1952.

22. Lucia, Edward. "A Course in Foil Fencing." Scholastic Coach, 31:18-19, 54-59 (November, 1961).

23. Meyers, Garry C. "Speed versus Accuracy in the Development of Industrial Skills." Journal of Personnel Research, 4:20-22 (1925).

24. Nadi, Aldo. On Fencing. New York: G. P. Putnam's Sons, 1943.

25. Pachella, Robert G. and Richard W. Pew. "Speed-Accuracy Tradeoff in Reaction Time: Effect of Discrete Criterion Times." Journal of Experimental Psychology, 76:19-24 (1968).

26. Pew, Richard. "The Speed-Accuracy Operating Characteristics." Acta Psychologica, 30:16-26 (1969).

27. Shulman, Sidney. "Guidelines to High School Foil Fencing." Scholastic Coach, 37:14-15 (1967).

28. Singer, Robert N. Motor Learning and Human Performance. New York: The Macmillan Company, 1969.

29. Singer, Robert N. "Speed and Accuracy of Movement as Related to Fencing Success." Research Quarterly, 39:1080-1083 (1968).

30. Sjödahl, Lars. Elementary Industrial Psychology. London: Longmans, 1966.

31. Solley, William H. "The Effects of Verbal Instruction of Speed and Accuracy Upon the Learning of a Motor Skill." Research Quarterly, 23:231-240 (1952).

32. Sturt, Mary. "A Comparison of Speed with Accuracy in the Learning Process." British Journal of Psychology, 12:289-300 (1921).

33. Updyke, Wynn F. and Perry B. Johnson. Principles of Modern Physical Education, Health, and Recreation. New York: Holt, Rinehart and Winston, Inc. 1970.

34. Ussell, Paul J. "A Comparative Study of the Speed and Accuracy Approaches to the Teaching of Typewriting." National Business Education Quarterly, 24:89-90 (October, 1955).

35. Vince, Joseph. Fencing. New York: A. S. Barnes and Company, 1940.

36. Viteles, M. S. Industrial Psychology. New York: Norton, 1932.

37. Woods, John B. "The Effect of Varied Instructional Emphasis Upon the Development of a Motor Skill." Research Quarterly, 38:132-142 (1967).

38. Yonkee, D. Y. "Advanced Techniques for High School Fencers." Scholastic Coach, 27:22-24, 41 (December, 1957).

39. Yonkee, D. Y. "Primer for High School Fencers." Scholastic Coach, 25:62-66 (October, 1955).

APPENDIX

Procedure for Classes

Meeting	Time/Minutes	Activity
1-2	60	conditioning
3	15	warm-up
	15	foil handing and positioning
	30	footwork (on-garde, advance and retreat)
4	15	warm-up
	15	review
	30	distance, lunge, lunge and footwork, extension
5	10	warm-up
	10	wall target practice
	10	lunge and footwork drills
	20	target: closing, lines of engagement, disengage
	10	wall target practice
6	10	warm-up
	10	wall target practice
	10	lunge, disengage drills
	20	1-2 attack, beat attack
	10	wall target practice
7	10	warm-up
	10	lunging at opponent
	10	1-2, beat
	20	parry, riposte
	10	beat lunge against opponent
8	10	warm-up
	10	target practice as above
	10	parry, riposte
	20	parry, riposte 4 or 6
	10	target practice
9	10	warm-up
	10	target practice
	30	testing (for grading purposes)
	10	target practice
10	10	warm-up
	10	target practice
	30	circular parry, bout fencing
	10	target practice

Meeting	Time/Minutes	Activity
11	10	warm-up
	10	target practice
	30	review, counter disengage, bout fencing
	10	target practice
12	10	warm-up
	10	target practice
	30	review, bout fencing
	10	target practice
13	10	warm-up
	10	target practice
	30	cut-over, bout fencing
	10	target practice
14	10	warm-up
	10	target practice
	30	review, bout fencing
	10	target practice
15-16	60	machine testing
17-18-19 (evening session)	270	bout fencing with judges