THE EFFECT OF MENTAL AND PHYSICAL PRACTICE UPON THE LEARNING OF FOOTWORK OF BEGINNING COLLEGE BADMINTON PLAYERS AT THE KANSAS STATE TEACHERS COLLEGE

A Thesis

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by

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ABSTRACT

SETIAWAN, Iwan: The Effect of Mental and Physical Practice upon the Learning of Footwork of Beginning College Badminton Players.

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Dr. George Milton
Dr. William A. Harper
Dr. Ray Heath

Purpose: The purpose of this study was to determine the effectiveness of mental and physical practice upon the learning of footwork of beginning college badminton players.

Method of Research: Fifty-four college males and females enrolled in beginning badminton classes at Kansas State Teachers College were assigned to one of three groups; mental practice, physical practice, and a control group. The French-Stalter Diagonal Test was employed to assess the major variables of the study at the beginning and the termination of the study. The mental practice and physical practice groups responded to the "Flash a Light" test each class period. The t-test was utilized for statistical computation.

Conclusions:

(1) Beginning college badminton players who participate in either mental or physical practice of the "Flash a Light" test do not improve significantly in footwork.

(2) Beginning college badminton players do not improve significantly in footwork through class participation.

Approved for the Major Department

Approved for the Graduate Council

ACKNOLEDGEMENT?

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Emporia, Kansas

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Chapter 1

INTRODUCTION

The sport of badminton has been taught successfully by a number of different methods. The innovative teacher is concerned with efficient methods of teaching that will enable each individual to attain a higher degree of skill. In order to accomplish this goal, the physical educator constantly needs to discover and develop methods of teaching to assist the student in the process of learning a motor skill. Methods of teaching are dependent upon and determined by methods of learning. Therefore, if the nature of learning were clearly understood, more effective use could be made of teaching methods.

One aspect of learning a task often neglected by teachers as a teaching method is that of mental practice. Although mental practice studies have dealt with a variety of motor tasks which contribute to the improvement of sport skills, few studies are available pertaining to mental and physical practice of learning footwork in badminton.

Oxendine refers to the value of mental practice when he says:

> The intelligence of people should be recognized and brought into use when a task is being taught.... It is reasonable to expect that human beings do some thinking when they go through the motions of the particular activity (14:223).

Kelsey (12) investigated the values of mental practice for increasing endurance in sit-ups, five minutes per day for twenty days. Start (19) found that children of low average intelligence could make effective use of mental practice on the underhand basketball free throw. Other investigations such as Twinning (23), Clark (3), and Corbin (2) have attempted to isolate the effects of mental practice in learning motor skills. There seemed to be general agreement in these investigations that mental practice was a factor in learning specific motor skills.

Previous investigations of the effect of mental practice on the learning of motor skills have resulted in varying conclusions. While some investigations have shown physical practice to be superior to mental practice, others have shown mental practice and combinations of mental and physical practice to be equal or superior to physical practice.

In spite of the fact that some of the recent investigations indicate a relationship between mental practice and the learning of motor skills, physical educators have been reluctant to employ mental practice as a technique in the learning of a motor skill in an actual class situation. This area appeared to be an appropriate problem for investigation.

One of the problems facing every teacher in teaching badminton skills is to encourage a beginning player to develop footwork techniques and body control, which involves the ability to change direction quickly and efficiently. A badminton player must make many quick movements and must learn to maneuver for positions. Good footwork is an integral component of skillfully played badminton. Rigden emphasized the importance of rapid movements when she related:

> Body control, which involves the ability to change direction quickly and gracefully, can be helped through the practice of the group activity of a simple forward and backward running combination (15:79).

SIGNIFICANCE OF THE STUDY

Educators have long studied the relative effectiveness of various methods and procedures for learning. Methods that afford the best use of time, facilities, and equipment are important to those who are teaching in situations where large classes and lack of equipment and facilities are common elements.

Numerous studies have been conducted concerning the effects of mental and physical practice upon skill learning. Most of these studies have dealt with basketball, football, tennis, or some form of muscular endurance. The investigator was unable to locate research relating to mental and physical practice involving response to "Flash a Light" in learning footwork in badminton.

Rigden (15) related that students in large classes can be given an opportunity to learn effective footwork techniques and body control through imaginative planning by the teacher. In order for a player to get within reach of the shuttlecock, good footwork is essential. Powerful and deceptive strokes are of little value if a player is not in the correct place soon enough to stroke the shuttle effectively.

The beginning of good footwork is for the player to be in an alert starting position. In order for the player to move to the baseline, he should take a sideways skipping action with the feet kept close to the floor. To hit a forehand or overhead stroke in the deep right court, the player skips diagonally back to the right, with the right foot leading, and finishes with the left side partially turned toward the net with the left foot forward. To play a back hand drive or clear from the deep left court, the player skips diagonally back, left foot leading, and with the right side to the net and the right foot diagonally forward.

In training the beginner for these footwork movements there appears to be a need for a special instrument where the player could be directed from place to place. Therefore, the investigator designed the "Flash a Light" test (see Appendix B) as an instrument for learning footwork in badminton. The alternating flash of a light could replace a shuttlecock as an object for initiating footwork movements when maneuvering for position on the badminton court. The player could be moved from one position to the other by the alternating flashing of the lights. Perhaps,

mental practice and physical practice in response to "Flash a Light" could be employed as a teaching method in partial answer to the crowded facilities and limited equipment that prevail in many schools. This might provide an opportunity for individualized instruction and more effective learning to occur in the acquisition of footwork in badminton.

STATEMENT OF THE PROBLEM

The purpose of this study was to determine the effectiveness of mental and physical practice upon the learning of footwork of beginning college badminton players. More specifically, the following questions were investigated:

1. Do beginning badminton players in college physical education classes improve their footwork by class participation?

2. Do beginning badminton players in college physical education classes improve their footwork by using mental practice in response to the "Flash a Light"?

3. Do beginning badminton players in college physical education classes improve their footwork by using physical practice in response to the "Flash a Light"?

Hypotheses of the Study

In order to investigate the above questions, the following hypotheses were tested:

1. There is no improvement in footwork in beginning college physical education badminton classes.

2. There is no improvement in footwork in beginning college physical education badminton classes using mental practice in response to the "Flash a Light."

3. There is no improvement in footwork in beginning college physical education badminton classes using physical practice in response to the "Flash a Light."

Limitations of the Study

The following were considered limitations of this study:

1. It was impossible to entirely eliminate the effects of mental practice for those students in the physical practice group since a mental reaction was necessary before movement could occur.

2. There was no method of determining if students performed mental practice with maximum effort and concentration.

DEFINITION OF TERMS

The following definitions are used for discussion and interpretation in this study:

Practice

Practice refers to the repetition of responding physically or mentally to the "Flash a Light" test for sixty seconds during each class meeting for the six weeks practice period.

Mental Practice

Mental practice refers to the process of imagining, without overt movement, performance of the specific task of responding to the "Flash a Light" test. The subject was asked to visualize himself successfully performing the task.

Physical Practice

Physical practice refers to the actual overt physical performance of responding to the "Flash a Light" test.

Footwork

Footwork refers to the act of changing positions from place to place by a skipping action, with the feet close to the floor.

Beginning Badminton Player

A beginning badminton player refers to the student who has had no previous badminton instruction or one who has never played in organized badminton competition.

Control Group

Control group refers to the students taking both the pre- and post-test and participating in regular class activities without responding to the "Flash a Light" test.

"Flash a Light"

"Flash a Light" refers to the random flashing of three 100 watt electric light bulbs strung five inches above the badminton net and five feet apart, and parallel to the net.

Chapter 2

REVIEW OF RELATED LITERATURE

The review of related literature will be handled in two parts. Part one will review the mental and physical practice. Part two will review the related literature in badminton.

Mental Practice and Physical Practice

In 1916, Washburn (24) published his observation dealing with the phenomenon of imagining in movement. He made some observations which provide a basis for the current study of the effects of mental practice of the development of motor skills. Washburn suggested that "tentative movements" or movements of slight magnitude actually occurred during imagining. This implied that imagined or central experience was of some value in developing such things as motor skills.

In one of many studies completed in the 1930's, Freeman (7) reported that actual implicit muscular activity occurred during mental activity. Freeman suggested the possibility that coordination could be improved as a result of muscular activity. This study intended to verify

Washburn's earlier notion that actual "slight" muscular contractions occur during mental activity. No evidence was presented that would scientifically support the notion that this implicit muscular activity would increase skill in the performance of a motor task.

In 1932, Jacobson (10) conducted a thorough study of muscular phenomena during imagining. Jacobson used electronic devices to measure nervous and muscular changes during the imagining of muscular activity. He trained subjects to relax so as not to have extraneous muscular activity affecting the electrical device. Subjects who imagined bending their arms showed an electronic reaction. Jacobson's research substantiated studies of Washburn's that muscular activity occurred during mental imagining.

Jacobson also suggested that imagining not only caused muscular activity but may also have caused movements of the eyeballs. A final conclusion suggested that imagining causes different contractions in different people. Although this investigation presented much evidence in this area, steps had still not been made to resolve the question of whether this muscular activity could improve the performance of a motor skill.

In 1949, Twinning's (23) study of thirty-six college men practicing a ring-tossing task emphasized accuracy. The subjects were divided into three groups and were tested by throwing 210 rings on the first and twenty-second days. In addition, one group practiced by throwing seventy rings each day between the pre- and post-test days. A second group was asked to mentally throw the rings for fifteen minutes daily, but to refrain from any simulated movements. A third group did not have any type of practice between the pre- and post-test days. Twinning found that the no-practice group showed no significant improvement when tested on the final test day. The group with the daily ring-tossing practice showed the greatest improvement. The mental practice group showed significant improvement at the final test but not as much as the regular physical practice group. He concluded that both physical and mental practice aid in learning the ring toss.

In 1960, Clark (3) used the basketball free throw in a mental rehearsal study. High school boys practiced the one-hand foul shot. The subjects were equated into mental and physical practice groups on the basis of intelligence, arm strength, and basketball-playing experience.

Both groups were given instructions followed by twenty-five shots for score. After the fourteen days of practice, Clark administered a retest to both groups. He found that both the physical practice and the mental practice groups showed highly significant gains in shooting ability. The physical practice group showed only a slight advantage over the mental practice group.

Start (19) conducted a study in 1960 designed to test the relationship between intelligence and the effect of mental practice on the performance of a motor skill. The subjects were eleven-year-old English boys. The boys were classified for intelligence on the basis of the English secondary school examination. The boys were then given ten underhand basketball throws. Each boy's score on this task was recorded as his initial score. Some of the boys in each level of intellectual performance mentally practiced the motor skill for five minutes a day for nine days. The ten shot skills test was then readministered. The Fisher "t" test was applied to the data to test the significance of mean differences. Post scores were significantly higher than were the pre-scores on basketball shooting, indicating mental practice significantly improved the motor skill

performance. There was no significant difference in gain between higher and lower group in the performance of the skill.

Start interpreted the data as meaning that intelligence of a subject did not affect his ability to make use of mental practice in the development of a specific motor skill. The fact that the skill was very difficult for the boys and the group size was quite small may detract from the validity of these results and conclusions.

In 1961, Kelsey (12) studied the effect of mental practice on muscular endurance. The investigator also wanted to determine whether the gains, if any, from mental practice equaled those gains brought about by physical practice. He concluded that muscular endurance of the abdominal wall and thigh flexors was significantly increased after twenty days of mental practice. The statistical analysis supported this conclusion, and it was suggested that physical practice should be used whenever possible because of its superior effects in facilitating increases in muscular endurance.

Some of the most recent studies in the area of mental practice have been conducted by Start. In 1964,

Start (20) investigated the relationship between kinesthesis and mental practice. Twenty-one male teachers college students read partial and whole descriptions of a gymnastics task on the horizontal bar. After reading this passage, the subjects mentally practiced what they had read. They practiced the task for a five minute period for six consecutive days. The subjects were asked not to practice mentally or physically during the course of the experiment, other than during practice sessions.

The scores on the gymnastics task, as rated by judges, were correlated to the scores on the Wiebe Test of Kinesthesis. Start concluded that scores on the specific gymnastic task after mental practice did not correlate significantly with scores on the test of kinesthesis.

The fact that there was only a small number of subjects was a limiting factor. The lack of controls was also noticed. Finally, the main weakness of the study was indicated by the fact that one skill does not necessarily improve kinesthesis, even if mental practice had developed that skill. The fact that the skill was unique to the subjects is a limiting factor as there is no evidence that mental practice facilitates development of an unfamiliar skill.

In 1964, Egstrom (6) had six groups of college men learn a novel paddle-ball task. Subjects practiced for ten days, with each group following a different combination of manual drill and conceptualization. He found that the groups which showed the greatest improvement were the group following a regular physical practice schedule for the full period and the group regularly alternating between mental and physical practice. He also reported that a group which followed a mental practice schedule for the first half of the experiment and then changed to physical practice showed improvement in both phases of the experiment. However, a solid program of conceptualization during the last part of the experiment did not prove beneficial after the first part had been spent in manual practice. He suggested that a technique of alternating between physical and mental practice in regular physical education activities would result in effective learning and would also reduce the pressure on facilities and equipment in today's programs.

In 1965, Corbin (2) had 120 college men practice a novel juggling task which required them to toss and catch a wand by use of two other wands which were held in each hand. The wand being manipulated was not touched by the

subjects during the performance. Four groups of subjects practiced for twenty-one days under conditions of physical practice, mental practice, combination of physical-mental practice, and control group. Corbin found that the schedule of physical practice proved most effective. In addition, the data offered some support for a schedule which combined mental-physical practice. It was reported in this study that the skill level of the subjects was not a factor in determining the most effective technique of practice. In Corbin's study, mental practice did not appear to be of value when used as an exclusive practice technique. He suggested that prior experience was needed before mental practice would prove valuable. This conclusion is supported by Trussel (22), who reported that mental rehearsal was ineffective except in combination with physical practice. Her study involved a ball-juggling task which was new to all her subjects.

Mental practice under certain conditions has been shown to be beneficial as a method of learning and improving motor performance. Generalization of the research studies regarding mental practice had been made by Oxendine as follows:

1. Mental rehearsal is more valuable in motor learning than is generally assumed. Research has consistently shown that mental practice groups learn and perform at a higher level than do control groups.

2. Mental practice should be used in combination with overt practice. There is no evidence which would suggest that exclusive use of mental practice proves superior to exclusive use of physical practice.

3. Some experience or acquintance with a particular motor task is necessary before mental practice can be fully effective. Most studies have reported that the novice does not profit as much from mental practice as does the individual who has some skill in the particular task. Apparently this is because the inexperienced person is unable to focus his concentration on the appropriate movement responses.

4. Mental practice apparently results in below-threshold muscular responses which usually accompany the overt performance of the particular task. These responses, however, are so slight as to be negligible for physical-conditioning purposes.

5. Some evidence suggests that mental rehearsal which is rigidly directed by the instructor may prove less effective than rehearsal sessions in which the learner is allowed greater freedom of imagery. After a certain amount of guidance, students apparently need some freedom in organizing their own patterns for conceptualization.

6. Mental practice can be effectively used with students of widely varying intelligence levels. Within the range of abilities usually found in school, intelligence does not seem to be a factor in determining one's ability to profit from mental practice (14:232).

Related Literature in Badminton

The literature pertaining to footwork in badminton is limited. Agility, which enables an individual to rapidly change position and direction, is an important facet in learning footwork in badminton. Davidson and Gustavson state that:

> badminton... demands the utmost in skill stamina of the best trained athlete. Highly competitive badminton requires quickness of reflex, quickness of mind and quickness of movements (5:4).

They stress the importance of learning footwork to move the body around the court in all directions, so that it is possible to hit the shuttle freely with the maximum amount of power and control and the minimum amount of effort. They further point out that good strokes are difficult to produce when the feet are not properly placed, and that footwork is the vital factor in directing the body into position so that it can function easily without strain.

Their ability in starting and turning quickly is of more importance than sheer straight-away speed, although both are desirable. Davidson and Gustavson emphasized that the skilled player should realize that by moving into position quickly, he will have more time for the actual stroking of the shuttle.

In the booklet, Beginning Badminton, Friedrich and Rutledge (9) point out that badminton play to be effective requires an understanding and practice of efficient movement patterns that involve the entire body; and that, since badminton is such a fast-moving game, in which the player is forced to move from place to place on the court in a short length of time, footwork is especially important.

Friedrich and Rutledge (9) give support to the idea that positive transfer of learning occurs from basic skills to sport activity in the statement, "Footwork must be practiced. A good way to develop speed and agility a foot is through rope-skipping."

In a study of change of direction, Young (25) found that general strength and leg strength did not have any great effect on the change of direction factor inherent in various dodge runs. Velocity did affect the factor. Cureton (4) would tend to endorse this former conclusion in his statement that "agility is the ability to handle the body quickly and precisely, not necessarily with maximum force or power."

Poole (13) pointed out that the object of good footwork is to move as efficiently as possible to all areas

of the court. There are six basic spots to which the player must be able to move effectively, play his shot, and return to the center of the court. Footwork is very important, for the player can neither hit the shuttle efficiently nor control the opponent if the player cannot easily get into position to hit. An important point to remember is that the last step before the shuttle is struck should always be taken with the right foot. Most of the players move forward much better than backward, the base or ready position should be 2-3' back of the middle of the court and astride the center line.

French-Stalter (8) developed a diagonal footwork test (see Appendix A) and shuttle test for testing footwork in badminton. The shuttle test was designed as follows: Each subject had four trials of fifteen seconds each in sliding steps in a direction parallel from a spot marked on the side boundary line (singles) to the opposite side boundary line (singles), moving back and forth between these two lines. The score was the total number of times a boundary line was touched in fifteen seconds. The final score was the total of the four trials.

Chapter 3

RESEARCH PROCEDURES

In order to compare the effects of mental and physical practice on footwork in beginning college badminton classes, the procedures described in this chapter were followed. The subjects were divided into three groups: mental practice, physical practice, and a control group. Pre- and post-tests were given to the three groups. The test results were statistically analyzed to determine if mental and physical practice improved footwork in beginning college badminton classes.

SELECTION OF SUBJECTS AND CLASS OPERATION

The subjects selected in this study were fifty-four undergraduate college students, twenty-two males and thirty-two females, in beginning co-education badminton classes at the Kansas State Teachers College, Emporia, Kansas, during the Fall semester of 1971. The subjects had no previous badminton instruction and had not played in organized badminton competition. The subjects were randomly selected

from the class population and divided into three groups: Mental practice, physical practice and a control group. There were eighteen subjects in each group. Three badminton classes were used for this study. The three classes that were selected for this study were those that were scheduled to meet in the same gymnasium. These classes were selected in an attempt to eliminate extraneous variables created by location, since classes met at two other stations on the campus. The class met fifty-minute periods twice weekly for one semester. The study was conducted the first six weeks of the Fall semester. Those students who missed one or more practice periods were excluded from the study. Of the sixty-five subjects selected for participation, fifty-four were able to complete the study. Seven subjects were dropped due to incompletion of the practice period, and four subjects were dropped because of missing the pre- or post-test.

SELECTION OF TESTS

French-Stalter Diagonal Test

The French-Stalter Diagonal test (see Appendix A) was found to be the best test for this study as the

pre- and post-testing device. The purpose of the test is to measure the ability to execute a badminton footwork skill and the maneuverability on the court. The diagonal footwork test was selected in preference to the French-Stalter Shuttle Test because the movements of maneuvering on the court during the test were similar to responding to the "Flash a Light" test used in the mental and physical practice groups.

The French-Stalter Diagonal test, which was used as a pre- and post-test in this study, was designed as follows: Each subject had four trials of fifteen seconds each to run diagonally forward to his right from a spot marked on the center court to the intersection of the right side boundary line (singles) and the short service line. The subject ran parallel to the net to the opposite left side boundary line (singles); then diagonally across the starting mark to the right rear intersection with the right side boundary line (singles) and the back doubles service court line. From here the subject ran parallel to the intersection to the back service line (doubles) and then diagonally to the front right corner crossing the starting mark. The movements were to be continued until the fifteen

seconds were terminated. The subject was given one point for each time a corner spot was touched and a point for each crossing of the starting mark. Six points were scored for each completed trip. The subject's score was the total number of corners touched plus the crossing of the starting mark for a period of fifteen seconds. The final score was the total of the four trials.

The response to "Flash a Light" test was administered to the mental and physical practice groups in an attempt to improve footwork. This test was devised by the investigator (see Appendix B).

Validity and Reliability

The French-Stalter Diagonal test is one of a battery of badminton skill tests. The test battery was administered to fifty-nine women major and minor students in physical education, and yielded the following validities and reliabilities.. The validity coefficient was .402 and the reliability .872 for four trials.

The criterion used for the diagonal footwork test was the composite rating of four judges rating four players during a ten-minute period according to seven categories of

expert, very good, good, average, fair, poor, and very poor. The coefficient of agreement between the four judges was .756.

The French-Stalter Diagonal test had not been administered previously to any of the subjects in the badminton classes. The investigator directed all practices and administered the tests giving verbal cues, and timing, and administration of trials.

ADMINISTRATION OF TESTS AND TRAINING SEQUENCE

The French-Stalter Diagonal test was administered to all subjects at the beginning and at the termination of the six weeks study in order to obtain pre- and post-test scores. After the pre-test was given to the subjects at the beginning of this study, the subjects were assigned randomly to one of the following groups: Mental practice, physical practice, and a control group. The three groups and the training routine for each were as follows:

Group One: Mental Practice

Each mental practice session was administered for sixty seconds at the beginning of each class. The control and physical practice groups attended the regular program of

badminton instruction from their instructor during administration of mental practice. The subjects were asked to mentally imagine themselves moving from the center of the court to the square on the floor underneath the randomly selected flashing lights. Each time the subject was to return to the center base before proceeding to the next flashing light.

The lights were flashed every four seconds following a randomly selected flash a light list (see Appendix B). After the subjects had completed the sixty seconds covert imagery practice, they were asked to attend the regular instructional badminton class. On the basis of their responses to the mental practice the investigator offered coaching aids which would benefit the subject in attainment of better kinesthetic imagery and in understanding the mechanics of the task.

Group Two: Physical Practice

After the mental practice group had completed their practice, the subjects in the physical practice group were called individually to do their assignment. The subject was asked to respond physically to the "Flash a Light" test for sixty seconds. During each practice, the subject performed

footwork movements and maneuvering about the court in the maximum number of trials possible. Instructions were given by the examiner to aid the subject in improving his performance.

Restrictions of time required that the training sessions be brief without being rushed. The investigator directed all practices with verbal cues and timed each trial with a stop watch. The average time required for both mental and physical practice was ten minutes per class. Subjects were not permitted to watch one another while doing the task. Subjects were encouraged to improve their own trial score but not necessarily to compete with one another.

Group Three: Non-Practice or Control

Following the diagonal pre-test, the subjects assigned to the control group were asked not to do either the mental or physical practice of the "Flash a Light" test. However, the subjects were required to attend the badminton instructional class with the same number of class practice sessions as the mental and physical practice groups.

The Post-Test

The French-Stalter Diagonal test was used for the post-test in this study. The instructions and procedures for the post-test were identical to those used in the pre-test. No warming-up was permitted. The subjects were reminded of the task and asked to give a maximum performance on each of four trials. The same criteria for the French-Stalter Diagonal test were imposed at the post-test as had been used in the pre-testing. The average of the four trials was used as the post-test score.

STATISTICAL TREATMENT

The experimental data used in this study were collected in order to compare the effects of mental and physical practice on performance of the "Flash a Light" test. Comparisons were made between the mental and the control groups, the physical and the control groups, and between the mental and the physical groups. In addition, the differences between the pre- and post-test were computed for each group separately. And further, in order to take into account any possible initial differences in the sample, the analysis of co-variance was also employed

in this study to allow for the correlation between pre- and post-test scores. Through co-variance analysis one is able to effect adjustments in final and terminal scores which will allow for differences in some initial variable.

The .05 level of significance was selected to test the hypothesis in order to determine if a significant difference existed between the three groups. The t-test was employed to calculate the differences in means. The ungrouped data formula for the t-test was used because of the relatively small number, eighteen, in each of the three groups. Tate (21) indicated that the t-test is applicable to samples of any size. The following formula, as explained by Tate (21) was used for computation:

$$t = \frac{M_1 - M_2}{\sqrt{\left(\frac{\Sigma x_1^2 - \Sigma x_2^2}{n_1 + n_2 - 2}\right)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

where: M_1 = mean of first group
M_2 = mean of second group
Σx_1 = sum of squares for first group
Σx_2 = sum of squares for second group
n_1 = number of population for first group
n_2 = number of population for second group

The data were programmed and computed through the services of the Kansas State Teachers College Data Processing Center. An IBM 1401 computer was used.

Chapter 4

ANALYSIS OF THE DATA

In order to determine the effect of six weeks practice on the "Flash a Light" test, the means from the French-Stalter Diagonal test for the mental practice group, the physical practice group and the control group were computed to determine if there was a significant difference between the pre-test of the three groups. Computation was also made between the post-test of the three groups. In addition, the differences between the pre- and the post-test were computed for each group separately.

Table 1 shows the means found on the pre- and the post-test as well as the mean difference. The percentage of increase has also been tabulated in the table on the following page.

Table 1

The Percentage of Means for the Three Groups on the French-Stalter Diagonal Test

Groups	Pre	Post	Mean Difference	%
Mental	41.444	45.278	3.834	9.25
Physical	43.888	48.055	4.167	9.49
Control	43.111	46.222	3.111	7.21

The mental practice group had a mean increase of 3.834, the physical practice group had a 4.167 mean increase, and the control group had a 3.111 for the mean increase. This was a 9.25 percent gain for the physical practice group, while a 7.21 percent gain was found for the control group.

The difference of the pre-test scores between each group was compared in order to determine if the difference was large enough to be significant at the .05 level of significance. In order to determine if the difference was large enough to be significant, the means were compared and a t-score was obtained.

Table 2 contains the results of this computation for the pre-test score between the mental practice group and the control group. The test for the homogeneity of variances was determined and it was found that the two variances were equal. Therefore, the pooled variance formula was used to compute the value of "t" in which thirty-four degrees of freedom (df) was used.

Table 2

Comparison of Pre-Test Scores between the Mental and the Control Groups

Groups	Number	Standard Deviation	Mean Score	t
Mental	18	5.7	41.4	0.99
Control	18	3.9	43.1	

* 2.04 required for significance at the .05 level at 34 df

The obtained t-ratio of 0.99 was not significant at the .05 level and this indicated that the subjects within the groups had an equal capability on footwork skill in badminton.

Table 3 shows the results of the computation of the t-test score between the physical and the control groups. The test for the homogeneity of variances was determined and it was found that the two variances were not equal. The pooled variance formula was used to compute the value of "t" in which seventeen degree of freedom (df) was used.

Table 3

Comparison of Pre-Test Scores between the Physical and the Control Groups

Groups	Number	Standard Deviation	Mean Score	t
Physical	18	6.03	43.89	0.45
Control	18	3.9	43.11	

* 2.11 required for significance at the .05 level at 17 df

The obtained t-ratio of 0.45 was not significant at the .05 level and this indicated that the subjects within the groups had an equal capability on footwork skill.

Table 4 shows the mean values between the mental and the physical groups. The pooled variance formula for t-value was used to compute the value of "t" in which thirty-four degrees of freedom (df) was used because the homogeneity of the two variances as equal.

Table 4

Comparison of Pre-Test Scores between the Mental and the Physical Groups

Groups	Number	Standard Deviation	Mean Score	t
Mental	18	5.68	41.44	1.22
Physical	18	6.03	43.89	

* 2.04 required for significance at the .05 level at 34 df

The obtained t-ratio of 1.22 was not significant at the .05 level and this indicated that the subjects within the groups had an equal capability on footwork skill.

The difference of the post-test scores between each group was compared in order to determine if the difference was large enough to be significant at the .05 level of significance. The significant difference was calculated by using the means for computation of the t-test.

Table 5 contains the results of this computation for the post-test between the mental practice and the control groups. The test for the homogeneity of variances was determined and it was found that the two variances were not equal. The pooled variance formula was used to compute the value of "t" in which seventeen degrees of freedom (df) was used.

Table 5

Comparison of Pre-Test Scores between the Mental and the Control Groups

Groups	Number	Standard Deviation	Mean Score	t
Mental	18	6.4	45.28	0.53
Control	18	3.7	46.22	

* 2.11 required for significance at the .05 level at 17 df

The obtained t-ratio of 0.53 was not significant to show the difference in improvement between the groups.

The results of the computation for the post-test between the physical practice and the control groups are shown in Table 6. The test for the homogeneity of variances was determined and it was found that the variances were not equal. The pooled variance formula was used to compute the value of "t" in which seventeen degrees of freedom (df) was used.

Table 6

Comparison of Pre-Test Scores between the Physical and the Control Groups

Groups	Number	Standard Deviation	Mean Score	t
Physical	18	6.4	48.05	1.02
Control	18	3.7	46.22	

* 2.11 required for significance at the .05 level at 17 df

The obtained t-ratio of 1.02 was not significant to show the difference in improvement between the groups.

Table 7 has the results of the computation for the post-test between the mental and the physical groups. The test for the homogeneity of variances was determined and it was found that the two variances were equal. The pooled variance formula was used to compute the value of "t" in which thirty-four degrees of freedom (df) was used.

Table 7

Comparison of Pre-Test Scores between the Mental and the Physical Groups

Groups	Number	Standard Deviation	Mean Score	t
Mental	18	6.4	45.28	1.26
Physical	18	6.4	48.05	

* 2.04 required for significance at the .05 level at 34 df

The obtained t-ratio of 1.26 was not significant to show the difference in improvement between the mental and the physical groups.

In addition, the difference between the pre- and the post-test were computed for each group separately. This was to determine if there was any significant in improvement for each group at the .05 level of significance.

The results of the computation for the pre- and the post-test scores of mental practice are shown in the Table 8. The test for homogeneity of variances was determined and it was found that the two variances were equal. The pooled variance formula was used to compute the value of "t" in which thirty-four degrees of freedom (df) was used.

Table 8

Comparison between Pre- and Post-Test Scores for the Mental Group

Test	Number	Standard Deviation	Mean Score	t
Pre-	18	5.7	41.4	1.84
Post-	18	6.4	45.3	

* 2.04 required for significance at the .05 level at 34 df

The obtained t-ratio of 1.84 was not significant and this indicated that the subjects within the groups had not improved enough in learning footwork by using the "Flash a Light" test for the six weeks practice periods.

Table 9 contains the results of the computation for the pre-test and the post-test of the physical practice

group. The test for homogeneity of variances was determined and it was found that the two variances were equal. The pooled variance formula was used to compute the value of "t" in which thirty-four degrees of freedom (df) was used.

Table 9

Comparison between Pre- and Post-Test Scores for the Physical Group

Test	Number	Standard Deviation	Mean Score	t
Pre-	18	6.0	43.9	1.95
Post-	18	6.4	48.0	

* 2.04 required for significance at the .05 level at 34 df

The obtained t-ratio of 1.95 was not significant and this indicated that the subjects within the groups had not improved enough in learning footwork by using the "Flash a Light" test for the six weeks practice periods.

Table 10 shows the results of the computation for the pre- and post-test scores of the control group. The pooled variance was employed to compute the value of "t" in

which a seventeen degrees of freedom (df) was used because the test for the homogeneity of variance was found not equal.

Table 10

Comparison between Pre- and Post-Test Scores for the Control Group

Test	Number	Standard Deviation	Mean Score	t
Pre-	18	3.9	43.1	2.08
Post-	18	3.8	46.2	

* 2.11 required for significance at the .05 level at 17 df

The obtained t-ratio of 2.08 was not significant and this indicated that the subjects within the groups had not improved in learning footwork.

The co-variance distribution had been computed to determine if there was any significant difference among the results of the mental practice group, the physical practice group, and the control group at the .05 level for the distribution of F. In Table 11 on the following page, the analysis of co-variance of the mental practice group, the physical practice group and the control group can be found.

Table 11

Co-variance of the Mental, Physical and Control Groups

Source of Variance	Residuals			F
	Degree of Freedom	Sum of Squares	Mean of Squares	
Between groups	2	10.72	5.36	0.83
Within groups	50	320.88	6.04	
Total	52	331.60	11.78	

* 3.18 required for significance at the .05 level for the distribution of F at 2 for between the groups and at 50 for within the groups

The table F-ratio of 0.83 was not significant at the .05 level and this indicated that the subjects of the three groups had no significant improvement in learning footwork even when initial differences were taken into consideration.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This study was undertaken on the theory that most students generally operate below their potential ability to move effectively in responding to the badminton shuttlecock, and further, that it may be possible for students to learn to play better badminton by broadening their concept of the value of footwork through the use of the selected the "Flash a Light" test.

In order to be able to make a comparison between students having experiences with the "Flash a Light" test through mental practice or physical practice and those who have not, three beginning co-education badminton classes at the Kansas State Teachers College were utilized. The groups were taught using the same methods of instruction in badminton skills, rules, and strategy. In addition, the mental and the physical practice groups participated in sixty seconds of the footwork study by using the "Flash a Light" test. The test was administered at the beginning of each class period for twelve successive class periods.

As determined by the t-test formula for the ungrouped data, the three groups were not significantly different in learning footwork in badminton. However, the percentage of means from the groups showed there was an improvement in learning footwork in badminton. The percentage of increase for the groups who participated in the "Flash a Light" test were greater than was the percentage of increase for the control group.

In order to take into account any possible initial differences in the sample, the analysis of co-variance was employed to compare the difference among the means in the mental practice group, the physical practice group and the control group. In comparing the groups, the difference among the adjusted means yielded on F-value of 0.83, which was not considered significant at the .05 level of significance.

The percentage increase has indicated the improvement of footwork by using the "Flash a Light" test, but the t-ratio and the co-variance techniques did not show significant difference at the .05 level. The results, however, do indicate that footwork might have improved significantly in badminton playing ability if the sample size had been larger.

CONCLUSIONS

Within the limitations of this study, the following conclusions appear justified:

1. Beginning college badminton players who participate in either mental or physical practice of the "Flash a Light" test do not improve significantly in footwork.

2. Beginning college badminton players do not improve significantly in footwork through class participation.

RECOMMENDATIONS

Based on the findings of the present study, the following recommendations for additional studies are made:

1. A replication of this study should be conducted using a larger sample of subjects in each group and extending the study for the entire semester.

2. A study should be conducted using the "Flash a Light" test to determine if footwork is improved when advanced players are used as subjects.

3. A study should be conducted using the "Flash a Light" test involving subjects with the same instructor.

4. Further studies should be done using the "Flash a Light" test to establish its reliability and validity.

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APPENDIX A

FRENCH-STALTER DIAGONAL TEST

1. Equipment

   a. One stop watch
   b. Racket

2. Floor markings

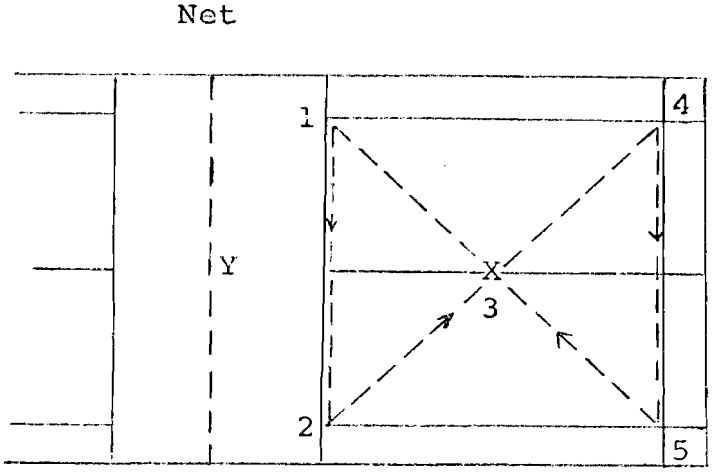
   Use the corners formed by the side boundary lines (singles) of a regulation badminton court where they intersect with the short service line and with the back line of the doubles service court.

3. Test

   The player to be tested shall stand facing the net on a spot marked X on the center line midway between the short service line and the back doubles service court line with racket in hand. On signal, he runs diagonally right and forward to the intersection of the side boundary line (singles) and the short service line to the intersection with the opposite side boundary line (singles); turns with a pivot (so the body will always be in position to return a shuttle sent to his forhand side); runs diagonally across the starting mark, called X, to rear right to the intersection with the opposite side boundary line (singles) with the back doubles service court line; turns with a pivot and runs parallel to the back service line (doubles); turns with a pivot and runs diagonally to front right corner crossing starting mark as test is to be continued for a period of fifteen seconds. The scorer, designated as Y on the diagram, shall stand anywhere between the short service line and the net with back to net. Eight players may be tested at one time on four regulation badminton courts, a space approximately that of a regulation tennis court.

4. Scoring

Score one point for each corner and credit a point for each crossing of the starting mark, called X. The score will be the total points of corners and crossings of the starting mark for a period of fifteen seconds. Each player is to be given four trials of fifteen seconds each. Record all the trials. The final score is the total of the four trials. The scorer and player to be tested are to alternate, assuring each of a rest period between trials.



PATH OF PLAYER IN DIAGONAL TEST

Figure 1

APPENDIX B

"FLASH A LIGHT" TEST

1. Equipment

   a. One stop watch
   b. Racket
   c. Three clear white 100 watt electric light bulbs, strung five inches above the net and five feet apart from each other, are controlled with three switches on one bracket. Number of light bulbs from left to right are I, II, and III.

2. Floor Marking

   a. Use the side boundary lines (singles) of a regulation badminton court.
   b. Place three (1'6") square bases along the floor, with masking tape, three feet from net and five feet between each other. Number of squares from left to right are 1, 2, and 3.
   c. Place a rectangle (1' x 2') as a center base ten feet from the number 2 square base and seven feet six inches from the side boundary lines (singles).

3. Practice

   a. Physical Practice

      The subject with a racket on hand shall stand facing the net on a center base. By leading of the random flashing of three electric light bulbs, the subject will be asked to move by skipping his feet close to the floor to the square base (2) where the light (II) will be on, step on it with one foot and move the racket assuming as striking a shuttlecock, then the light will be off. Return to the center base and be ready to move to the square base again where the light will be flashed after the subject step on the center base. This movement is to be continued for sixty seconds.

b. Mental Practice

The subjects to be trained will sit facing the net on the floor behind the back single boundary line. They will be asked to imagine themselves doing movements as physical practice, by using the leading alternate flash light every five seconds for sixty seconds.

4. Scoring

One point for each square base which is stepped by the subject during the movements, and the final score is total of the square bases which are stepped by the subject during the movements for sixty seconds.

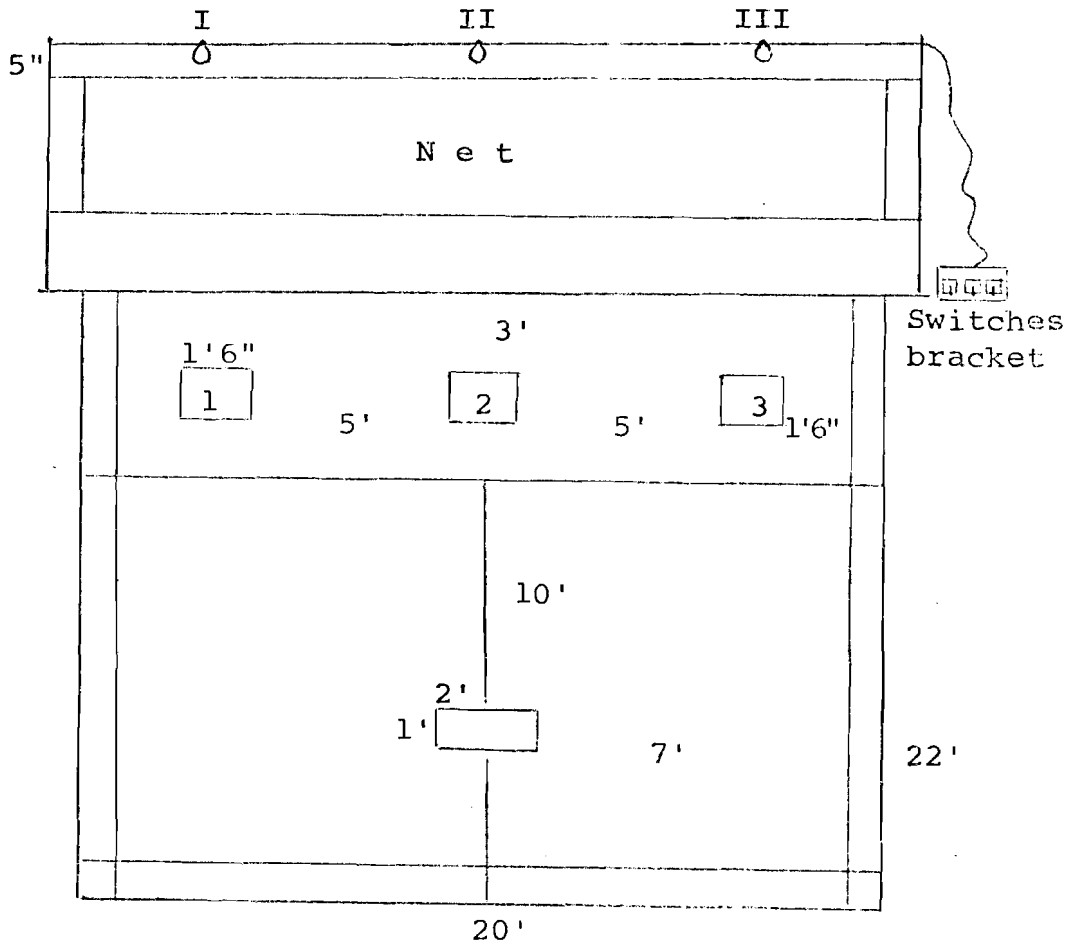


Figure 2

A LIST OF RANDOM NUMBER OF FIASHING A LIGHT

No.	Number of Light	No.	Number of Light
1	II	16	II
2	I	17	I
3	II	18	III
4	III	19	II
5	I	20	I
6	II	21	I
7	III	22	III
8	II	23	II
9	III	24	II
10	I	25	I
11	I	26	II
12	III	27	I
13	III	28	II
14	II	29	III
15	I	30	I