To the Graduate Council:

I am submitting herewith a thesis written by John O. Moore, Jr., entitled "The Effects of Different Times of Mental Practice During the Acquisition of a Perceptual Motor Skill." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Physical Education.

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The Graduate School

THE EFFECTS OF DIFFERENT TIMES OF MENTAL PRACTICE DURING THE ACQUISITION OF A PERCEPTUAL MOTOR SKILL

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J.O.M.

ABSTRACT

Theorists and researchers of mental practice disagree on the optimal duration of mental practice sessions, i.e., (a) Twining (1949) suggested less than 5 minutes was best, (b) Shick (1970) suggested that 3 minutes is better than 1 minute, and (c) Feltz and Landers (1983) suggested that less than 1 minute or between 15 and 25 minutes was best. The present study examined the relative effects of 45 seconds and 2 minutes of mental practice on the acquisition of a dart throwing task. Sixty male students served as subjects for this study. Prior to the first day of testing, each subject was randomly assigned to one of four practice conditions: (a) 45 seconds mental practice, (b) 2 minutes mental practice, (c) 45 seconds controlled activity (i.e., performing a word find puzzle), and (d) 2 minutes controlled activity (i.e., performing a word find puzzle). All subjects performed a combination of either mental practice and physical practice or a distracting task and physical practice. Subjects began the experiment by physically throwing four sets of six darts, followed by their respective experimental procedure for the designated time. Subjects continued this sequence until a total of 16 sets of six darts were thrown and three mental practice trials or controlled activity sessions were completed.

The mean dart throwing score for each of the four practice blocks was calculated. A 2 x 2 x 4 (group x time x blocks) repeated measures design analysis of variance was performed on the data. Subjects were nested in group and time.

The results indicated that 45 seconds of mental practice was not significantly superior to 2 minutes of mental practice in facilitating the acquisition of a dart throwing task ($p > .05$). The results also revealed: (a) that 45 seconds of mental practice was not significantly superior to 45 seconds of a controlled activity in the acquisition of a dart throwing task, and (b) there were no significant differences in performance on a dart throwing task between a group receiving 2 minutes of mental practice and a group performing a controlled activity for 2 minutes.

It was concluded under the conditions of the present study that neither of the experimental mental practice lengths (i.e., 45 seconds and 2 minutes) significantly enhanced the acquisition of a dart throwing task. It was further concluded that mental practice, for the two stated lengths (i.e., 45 seconds and 2 minutes), did not result in significantly superior dart throwing performance when compared to no practice (i.e., performing a word find puzzle) for comparable lengths of time.

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CHAPTER I

INTRODUCTION

In an individual's quest for proficiency in a perceptual motor skill or sport related skill, practice of some type is almost always a necessity. Physical practice is the most productive and the most commonly used method of acquiring this proficiency, but research has demonstrated that mental practice also assists in the learning of a perceptual motor skill (Corbin, 1976b; Feltz and Landers, 1983; Vandell, David, and Clungston, 1943). When mental practice and physical practice are used together, however, the greatest gains are made on motor skill performance (Cratty, 1973; Singer, 1972; Weinberg, 1982). Schmidt (1975) indicated that an important contribution of mental practice is that it allows a performer the chance to reflect on past movements and to synthesize a new movement strategy, if it is needed. Ryan and Simons (1981) determined that people can effectively improve performance through relatively short mental practice sessions (e.g., 30 seconds).

Richardson (1967a, p. 95) stated the classical definition of mental practice as "the symbolic rehearsal of a physical activity in the absence of any gross muscular movements." From a meta-analysis of the mental practice literature, Feltz and Landers (1983) determined that mentally practicing a motor skill influences performance somewhat better than no practice at all.

The numerous mental practice studies conducted until now have used a wide variety of independent variables, ranging from type of

task used to experimental design characteristics (Feltz and Landers, 1983). One area that is of great practical importance, yet has not been focused on in any great detail is the length of time needed for each mental rehearsal trial. Previous studies have allowed mental practice of a task to vary from 30 seconds (Ryan and Simons, 1982) to 30 minutes (Vandell et al., 1943). This wide spectrum suggests a need for more research concentrating specifically on lengths of mental practice sessions in acquiring perceptual motor skills. Studies in this particular area would be helpful in determining if an optimal mental practice trial time does exist.

The current research that considers the idea of an optimal mental practice trial length is sparse. Twining (1949) suggested that 5 minutes is the maximum amount of time a person can mentally concentrate on a motor task without becoming mentally fatigued or bored. He conjectured this based on introspective comments by his subjects. Schick (1970) found that 3 minutes of mental practice on volleyball skills was superior to 1 minute in terms of serving test scores. Harby (1952), as cited in Corbin (1972), contended that there is a most favorable length of mental practice time, but "his data are not convincing" (Corbin, 1972, p. 106). Oxendine (1968), also cited in Corbin (1972), suggested that an optimal mental rehearsal interval may exist, but no results were gathered because the study was not specifically designed to analyze that possibility.

The meta-analysis conducted by Feltz and Landers (1983) using the most recent mental practice literature indicated that less than

1 minute or between 15 and 25 minutes of mental practice produced the largest gains in motor task performance (Feltz and Landers, 1983). These studies, although somewhat conflicting in their findings, point to short mental practice sessions (5 minutes or less) as being more successful than extended sessions in facilitating the acquisition of a perceptual-motor skill. Therefore, the present study focused upon comparing two previously stated "optimal" mental practice lengths (i.e., 45 seconds and 2 minutes) and determining if one enhances the acquisition of a motor skill significantly more than does the other.

I. STATEMENT OF PROBLEM

The purpose of this study was to determine for college age men if there was a difference between a group receiving 45 seconds of mental practice and a group receiving 2 minutes of mental practice in the acquisition of a dart throwing task. Feltz and Landers (1983) suggested that for mental practice to be most effective, the mental practice trials should be either 1 minute or less or between 15 and 25 minutes. Twining (1949) concluded that mental rehearsal sessions of less than 5 minutes were best for acquiring perceptual motor skills. The following research hypotheses were tested in this study:

1. A group receiving 45 seconds of mental practice will score significantly better across blocks than a group receiving 2 minutes of mental practice on the experimental dart throwing task.

2. A group receiving 45 seconds of mental practice will score significantly better across blocks than a group receiving 45 seconds of

no mental practice (i.e., performing a word find puzzle) on the experimental dart throwing task.

3. A group receiving 2 minutes of mental practice will score significantly better across blocks than a group receiving 2 minutes of no mental practice (i.e., performing a word find puzzle) on the experimental dart throwing task.

II. LIMITATIONS OF STUDY

The study was limited to male students enrolled in activity classes at the University of Tennessee, Knoxville, Spring Quarter, 1984. Epstein (1980) suggested that the use of mental practice by female subjects in conjunction with the experimental task (i.e., dart throwing) may cause an undesired distracting effect due to the lower ability level of females. There were a few specific circumstances that were difficult to control in the course of the study, therefore, limitations were set on the ability to generalize the findings. The limitations were as follows:

1. During a given amount of mental practice time, the number of imagined practice trials a subject completed varied from individual to individual. Some subjects mentally practiced more rapidly than others.

2. Although subjects were instructed not to think of or practice the experimental task in any way or at any time other than when asked to do so, the experimenter was not capable of controlling the subject's thoughts entirely.

3. The type and degree of imagery an individual used when mentally practicing may have differed from subject to subject. Explicit

instructions were given, but subjects could have possibly used differing types of naturally occurring imagery (Epstein, 1980; Schick, 1970; Weinberg, 1982). Controlling a subject's thought processes too rigidly inhibits the ability to conceptualize the task (Singer, 1972).

III. ASSUMPTIONS

It was assumed that the students who participated in this study were naive to the dart throwing task to the degree that the groups did not significantly differ on the initial four sets of six darts in the pretest. Furthermore, it was assumed that the subjects attempted to perform the task to the best of their ability.

IV. DEFINITION OF TERMS

The following terms are defined in the manner that they were used in the present study. When appropriate, both theoretical and operational definitions are stated.

Amount of Mental Practice: A relative quantity of time for mental rehearsal of a dart throwing task (i.e., 45 seconds or 2 minutes) allowed during the respective practice conditions.

Dart Throwing Task: The overhand throwing of a specified number of darts (i.e., a total of 16 sets of 6) with the preferred hand at a circular target 3 meters from the subject at a height of 1.72 meters, measured from the floor to the center of the target.

Mental Practice/Mental Rehearsal: "The symbolic rehearsal of a physical activity in the absence of any gross muscular movements"

(Richardson, 1967a, p. 95). In the present study, subjects mentally practiced a dart throwing task for either 45 seconds or 2 minutes per trial.

No Mental Practice Period: The relative amount of time (i.e., 45 seconds or 2 minutes) spent by the control group in an activity (e.g., performing a word-find puzzle) other than mentally or physically practicing the experimental task.

Novel Task: A relatively unfamiliar perceptual motor activity for the subject to perform (e.g., dart throwing) which served as an indicator of the potential effects of mental practice.

Optimal Length of Mental Practice Trial: The most efficient amount of time spent mentally practicing a perceptual-motor skill, measured in terms of resulting dart throwing performance.

Perceptual-Motor Skill: A task involving muscular movement with "a high degree of cue detection, evaluation, and decision making" (Singer, 1972, p. 12). In the present study, dart throwing was used as the perceptual-motor task.

Target: A paper marked with five concentric circles, with each band-width increasing by a radius of 3.5 centimeters. The "bull's eye" had a diameter of 3.5 centimeters and the circles alternated black and white, beginning with a black center (Appendix B). From the floor up to the center of the target was a distance of 1.72 meters. A dart landing in the center circle was scored as 1 point, while a dart landing the outermost circle was worth 5 points.

IV. SIGNIFICANCE OF STUDY

The idea that mental practice aids in motor skill acquisition has been documented in previous research studies (Corbin, 1967; Feltz and Landers, 1983; Richardson, 1967a; Schick, 1970; Twining, 1949). A most efficient or optimal mental practice trial length has not been determined, however. If an optimal length of mental rehearsal is found to exist when learning a motor skill, physical educators and coaches who use mental practice in their teachings would be able to work more productively with students. Practitioners would no longer have to use unproven times for their student/athletes to mentally practice. Time allotted for classes and practices could be utilized more efficiently. In situations where limited facilities are available, students could mentally practice while waiting to physically practice (Cratty, 1973; Singer, 1972; Weinberg, 1982).

The significance of the present study is evidenced by the discrepant findings of previously completed studies concerned with determining an optimal length of time to mentally practice. Twining (1949) suggested that under 5 minutes is best when using mental rehearsal, while Feltz and Landers (1983) stated that less than 1 minute and between 15 and 25 minutes were the ideal lengths of time for mentally practicing motor skills. It was the intent of the present study to compare two potentially "optimal" mental practice times (i.e., 45 seconds and 2 minutes) and determine if one is significantly superior. The results may help clear up previous inconsistencies in the literature as to the best length of time to use mental practice.

The results may also provide coaches and physical educators who utilize mental practice in their teaching with information that allows the most productive teaching to take place.

CHAPTER II

REVIEW OF LITERATURE

The idea that mental practice may be used successfully as a facilitator in acquiring motor skills has been raised in over 100 research studies since the beginning of the twentieth century (Feltz and Landers, 1983). According to Richardson's (1967a) classic review of literature, mental practice procedures are linked with improved performance on motor tasks. Feltz and Landers' (1983) meta-analytic review also suggested that mental practice of a motor skill is somewhat better than no practice at all, in terms of skill acquisition. Though the positive effect of mental practice on motor skill acquisition has been documented throughout the literature (e.g., Corbin, 1967; Schick, 1970; Weinberg, 1982), there have been relatively few research studies primarily focused on determining an optimal length of time to use mental rehearsal. The literature reviewed appears in chronological order and is not categorized due to the wide variety and inconsistencies of the experimental variables manipulated.

Vandell, Davis, and Clungston (1943) conducted a study to determine the effects of mental practice on the acquisition of two perceptual motor skills: basketball free throw shooting and dart throwing. One experiment had senior high school boys (N = 12) shooting 35 standard free throws for both the pretest and posttest. Percent improvement was measured between the first and twentieth day's scores. Subjects were divided into groups of four and tested under one of three

conditions: (a) physical practice, (b) mental practice, and (c) no practice for 18 days between pretest and posttest. The physical practice group shot 35 free throws on each of the intervening days, the mental practice group performed no physical practice, but received 15 minutes of mental rehearsal on the task on days two through 19, and the no practice group had no experimental instructions of any kind between pretest and posttest. All three practice conditions resulted in improved performance on the free throw shooting task from day one to day 20. The group using daily mental practice sessions improved most (43%), followed by the physical practice group (41%), and the no practice group (2%). The authors deduced from the findings that mental practice was nearly as effective as physical practice under these experimental conditions. Due to the small number of subjects used and a lack of statistical analysis, the results were not necessarily significant.

In their other experiments, Vandell et al. (1943) used junior high school boys (N = 12) and college freshman males (N = 12) with dart throwing as the task. In both of these studies, subjects were assigned to groups and had practice as in the initial experiment. In these two studies, the most improvement from pretest to posttest came from daily physical practice sessions (7% and 23%, respectively). The groups in both experiments receiving mental practice improved the next largest amount (4% and 22%), followed by the no practice groups (-2% and 0%). Again, small samples were used and no statistical analysis of the data was performed.

Twining (1949) used a ring toss task in his study of mental practice and motor skill acquisition. The experimental design and testing procedure used were similar to that of Vandell et al. (1943), but Twining's study lasted 22 days and only college males were included (N = 36). The pretest and posttest each consisted of tossing 210 rope rings at a round wooden peg ten feet away. Specitic instructions were given to each subject on tossing mechanics before the pretest. Subjects were randomly divided into groups of 12 and were tested under one of three conditions: (a) no practice of any kind between pretest and posttest, (b) physically practicing 70 tosses every day from the second through the 21st day, and (c) no physical practice, but mentally practicing the ring tossing task for 15 minutes daily on the intervening days between pretest and posttest. The mental practice group was instructed to "visualize all the sensations" (Twining, 1949, p. 434) they went through in the pretest and not to perform any actual movements during the mental practice sessions. The group receiving daily physical practice sessions improved 137% from pretest to posttest. The mental practice group improved 36.2% during the course of the experiment. Both of these increases were statistically significant. The change in performance by the control group was due to chance. Twining (1949) concluded that under the conditions of this study physical practice and mental practice were both effective in the learning of a motor task.

Twining (1949) also discovered through introspective comments by the subjects that real concentration on mental practice lasted only for

the initial five minutes of each 15 minute trial. After that time, the effects of mental practice waned.

Richardson (1967, p. 95) stated the accepted classical definition of mental practice as, "the symbolic rehearsal of a physical activity in the absence of any gross muscular movements." Richardson (1967a) determined from his review of literature that mental practice was related to improved motor task performance. Richardson (1967a) found, however, that the greatest gains in skill acquisition were made when mental practice and physical practice were alternated. In reviewing studies dealing with lengths of mental practice sessions (e.g., Twining, 1949), Richardson (1967a) concluded that five minutes was the maximum time mental practice could be successfully used. Maintaining concentration was reported as difficult after that point. Richardson (1967b) found in his follow-up review that the more familiar the learner was with the task, the more mental practice was expected to help. Clark (1960), as cited in Richardson (1967b), stated that prior experience with the task possibly allowed the subject a chance to form a clear and precise model of what was to be performed.

Richardson (1967b) also expounded on some methodological problems that occurred in previous mental practice studies. A few potential corrections were stated for solving these problems. Controlling the frequency of mental practice trials for individual subjects for a given practice time was viewed as a consistency problem. When compared with physical practice groups, mental practice groups "usually engaged in more trials per unit time" (Richardson, 1967b, p. 268).

Subjects were found to be unique in the speed at which they mentally practiced. Keeping a "mental practice sheet" for each subject where every trial of the mental practice task was recorded was utilized in some of the reviewed studies. Uncontrolled practices and distractions were also cited as potential problems in testing the effects of mental practice on motor skill acquisition. Keeping the total experimental time down to a few hours and making the actual mental practice trials short (5 minutes or less) were proposed for remedying those methodological problems (Richardson, 1967b).

Corbin (1967) conducted a research study to determine if mental practice facilitated the learning of a novel motor task for high school age boys (N = 30) after subjects had experience with the physical task. The task (i.e., wand juggling) was not totally novel, however. All subjects had five days of physical practice before randomly being put into experimental groups. The three practice groups (n = 10) were as follows: (a) control, (b) mental practice, and (c) physical practice. The control group practiced physically the initial five days and then received no practice or instructions for the next 13 days. The mental practice group physically practiced for five days and then mentally practiced the task 30 trials a day for 13 days. The mental rehearsal instructions were read to the subjects daily. The physical practice group performed 30 physical trials of the task for all 18 practice days. Juggling tests were given on days 1, 5, 19, and 20. The first two tests were given to note changes in group performance as a result of physical practice with the task. The tests on the final

two days were given to determine if changes occurred in performance from the first day as a result of any of the practice conditions. The physical practice group significantly improved on all tests and in every instance outperformed the control and mental practice groups. The mental practice group was not significantly different from the control group on the first criterion test, but was significantly greater than the control group on the second test. Corbin (1967) concluded that physical practice was the superior type of practice in motor skill acquisition, but mental practice also facilitated performance after subjects received some controlled physical practice.

Schick (1970) reported that 3 minutes of mental practice was superior to 1 minute of mental practice in acquiring certain volleyball skills. College females (N = 68) enrolled in volleyball classes were used as subjects. The two experimental practice groups differed only in that one group (n = 34) received 1 minute of daily mental practice on the selected tasks, while the second group (n = 34) received 3 minutes of mental practice each day. Both groups also practiced the wall volley and the serving tests during every class period for the 5 week study. The respective mental practice trials occurred on the student's own time. In comparing the two groups on the wall volley test, no significant differences were found on the posttest scores. The group receiving 3 minutes of mental practice did, however, score significantly higher ($p < .05$; $\underline{F} = 2.98$) than the 1 minute group on the serving skills posttest. This latter finding partially supported Schick's (1970) hypothesis that the group having more mental practice would perform significantly better on the posttests.

Schick (1970) also studied type of imagery (i.e., internal or external) used by subjects during both skills tests as a subproblem. Subjects filled out a questionnaire developed by the author concerning visual perspectives used when mentally practicing the skills tests. Schick (1970) was interested in determining if subjects used internal or external imagery. When using internal imagery, the subject saw "only those parts of her own body and the surrounding areas which she would see if she were actually performing the skill" (Schick, 1970, p. 90). External imagery was characterized by a third person perspective. Subjects imagined they were watching a video tape of the skills tests being performed. In visualizing the initial stances for both skills tests, nearly all students reported using external imagery. They saw an entire person, whether it was their own body or another figure. In describing the serving test, most students continued to utilize external imagery. It was as if they were watching another person serve. When visualizing the wall volley test, however, a majority of students reported switching to internal imagery once the test had begun. Subjects only saw what they normally would if they actually performed the test. Schick (1970) concluded from these results that students differed on perspectives used depending upon the skill being tested. No reasons for these differences were suggested in this study.

Corbin (1972) discussed the length of mental practice sessions, suggesting that "reactive inhibition" was a potential problem when using mental rehearsal. Corbin (1972, p. 104) defined this

phenomenon as, "the tendency of task repetition to interfere with task learning or performance." Corbin (1972) implied that after a certain (optimal) point, practice of any kind no longer aided in motor task performance. Corbin (1972) cited Harby (1952) and Oxendine (1968) in further suggesting that there is an optimal mental practice time. Neither of these studies were specifically designed to analyze that point, however, so no directional results were gathered.

Wrisberg and Ragsdale (1979) conducted two experiments to determine the effects of introducing mental practice at different times on two motor tasks. One task was considered fundamentally motor (i.e., stabilometer), while the other task (i.e., McCloy Blocks Test) was mostly cognitive. The subjects in the initial experiment (N = 60) were college males and females, with the practice groups divided equally by gender. Random assignment of subjects was used, with participants practicing under one of the following conditions: (a) mental practice, (b) physical practice, and (c) control. Both practice conditions were given detailed instructions before testing began. The control group performed a vowel cancelling task. In this first experiment, practice conditions were introduced early in the learning of the task (i.e., after a single task trial) and lasted for 3 minutes. The results on the stabilometer task showed that the physical rehearsal group performed significantly better than both the mental rehearsal and control groups. The latter two did not significantly differ from each other. On the block test, however, both the physical and mental practice conditions performed significantly superior when compared to the control group.

There was no difference in the scores of the physical and mental practice conditions.

In the second experiment, the same practice conditions were introduced to different subjects (N = 80), but later in the study. Also, warm up groups for both the stabilometer and block test groups were added. The warm up controls for the stabilometer group attempted to balance a wooden dowel on their fingers. The block test warm up group sorted cards as quickly as possible into three stacks. The results on the cognitive block test indicated that physical rehearsal was significantly superior to all the other practice conditions, which did not significantly differ from each other. The physical practice group also performed significantly better than the other practice conditions on the stabilometer task. The mental practice group was not significantly different from the control group. Wrisberg and Ragsdale (1979) concluded that mental practice, when introduced early on a highly cognitive task, resulted in performance comparable to that due to physical practice.

Mendoza and Wichman (1978) studied the effects of mental practice on the acquisition of a dart throwing task. Subjects (N = 32) were randomly assigned to one of the following practice conditions: (a) no practice control, (b) mental rehearsal only, (c) mental practice accompanied by simulated dart throwing movements, and (d) direct physical practice. A pretest of 25 throws was given on the first day, followed by 6 days of practice by the experimental groups. The three experimental groups were told to report twice a day for separate 15

minute practice sessions. The control group was not to report back until the 25 dart posttest. Subjects in the mental practice only group were instructed to sit comfortably with eyes closed and vividly imagine throwing darts at the target. Awareness of all sensory input (e.g., feeling, hearing) was stressed. The mental/motor practice group received the same general instructions, but with each imagined throw, they were to perform their natural throwing motion while standing behind a restraining line. The direct physical practice group threw darts for the 15 minute sessions and attempted to improve as much as possible. Gain scores were calculated for each subject by subtracting initial performance scores from the final performance scores. Direct physical practice resulted in the greatest mean improvement in scoring (34.3%). The mental and mental motor groups (21.6% and 23.5%, respectively) also improved significantly more than the control group (6.5%). There was no significant difference between the two mental practice groups and the physical practice group was significantly better than all other practice conditions. Mendoza and Wichman (1978) determined from this study that physical practice was the best method for acquiring motor skills, but that mental practice of some type also facilitates motor skill acquisition.

Epstein (1980) compared types of imagery used during mental practice (i.e., internal versus external) in the acquisition of a dart throwing task. She randomly assigned college age male and female subjects (N = 75) to one of the following three practice groups: (a) internal imagery, (b) external imagery, and (c) control. A baseline

score of 30 darts was performed by each subject, as was a posttest of 30 darts after the respective practice sessions were completed. The instructions for the external imagery group suggested a visual orientation with a third person perspective on task performance. It was stressed for the subject to "get outside your body and actually see yourself doing the things I describe" (Epstein, 1980, p. 214). The internal imagery group was instructed to use kinesthesia and a first person perspective. The general instructions were similar, however. The control group counted backwards from a four digit number as a distracting task. The two mental rehearsal groups each received a two minute mental practice period, followed by the actual throwing of ten sets of three darts. Subjects received 15 seconds of mental practice between each set of three darts. A one minute mental practice reinforcement period was next, followed by another 30 dart session with intervening 15 second mental rehearsal trials. The results indicated that no significant differences were found across the experimental groups. Moreover, neither type of mental rehearsal resulted in performance significantly superior to that experienced by the control group. Epstein (1980) determined in a separate analysis that performance by male subjects was significantly superior to that of female subjects. Epstein (1980) further proposed that mental rehearsal was actually distracting to female subjects, but not to males.

Weinberg (1982) reviewed the existing mental practice literature and indicated that mental rehearsal was generally effective in enhancing motor skill performance. He concluded that for the greatest gains

to be made using mental practice, it should be used in conjunction with physical practice. Factors such as task type and the subject's previous experience and conceptualizing ability were directly related to the effectiveness of mental practice. Weinberg (1982) acknowledged the idea of an optimal mental practice length and cited several studies on the topic (i.e., Harby, 1952; Richardson, 1967a; Schick, 1970; Twining, 1949). No definite time was suggested in this study, but Weinberg (1982) stated that the length needed for optimal mental practice performance may depend on the nature of the task, as well as the individual characteristics of the performer.

Feltz and Landers (1983) reviewed 60 previous studies on mental practice using a meta-analysis procedure. The variables manipulated in the reviewed studies were categorized as: (a) subject characteristics, (b) type of task, and (c) design characteristics. Gains from using mental practice were found to be greatest with tasks that could be symbolically rehearsed. "Mental practice facilitates motor performance only to the extent that cognitive factors are inherent in the activity (Feltz and Landers, 1983, p. 45). Thus, motor activities low in symbolic components (e.g., stabilometer) should not benefit as greatly from mental practice as task which are highly symbolic (e.g., McCloy Blocks Test). The time of introduction of mental practice in the acquisition of a motor skill was researched by the authors, and the conclusion was made that learning occurred using mental practice in both initial and later stages of introduction. Feltz and Landers (1983) suggested that in the beginning, mental practice may give the learner

a general overview of the "cognitive elements" of the task. After physical practice of the task, mental practice may then aid in the development of muscular feedback. The most efficient length of mental practice was determined as being either under one minute or between 15 and 25 minutes. This wide range of times suggested a need for more research specifically aimed at determining an optimal length of time to use mental practice. Feltz and Landers (1983) concluded that mental practice improved motor performance somewhat better than no practice as all.

In summary, it has been documented in the literature that mental practice leads to some degree of improvement in motor skill acquisition (Corbin, 1967; Feltz and Landers, 1983; Richardson, 1967a; Schick, 1970; Twining, 1949; Wrisberg and Ragsdale, 1979). A variety of experimental variables have been manipulated and a number of different tasks have been used. There remains a question concerning an optimal length of mental practice, however. Some research indicated five minutes or less is most efficient (e.g., Twining, 1949; Schick, 1970), while Feltz and Landers (1983) suggested most gains are made in mental practice sessions of one minute or less or between 15 and 25 minutes.

CHAPTER III

PROCEDURE

This study was designed to investigate the relative effects of two lengths of mental practice on the learning of a dart throwing task. The procedure used in this study involved the following five areas: (a) selection of subjects, (b) selection of task, (c) selection of performance apparatus, (d) selection of mental practice trial lengths, and (e) testing procedures.

I. SELECTION OF SUBJECTS

The subjects for this experiment were sixty male undergraduate students enrolled in Physical Education activity courses at the University of Tennessee, Knoxville, Spring Quarter, 1984. Epstein (1980) suggested that the use of mental practice by female subjects in conjunction with the experimental task (i.e., dart throwing) may cause an undesired distracting effect due to the female's lower ability level. Consequently, only male subjects were used in the present study. All subjects were randomly selected from a pool of volunteers. None of the subjects were paid for their services. Each subject was given and asked to sign an informed consent statement before participating in the experiment (Appendix A). The consent form with the personal information was kept by the researcher. The subject also signed a master time schedule which was kept by the researcher.

II. SELECTION OF TASK

The decision to use dart throwing as the task to measure potential effects of mental practice was based on several completed mental practice studies. Gentile et al. (1975) stated that throwing darts is a basic limb transport/manipulation movement. Feltz and Landers (1983) also deemed dart throwing an acceptable task in mental practice measurement because of its' symbolic components. The largest gains have been demonstrated using mental rehearsal with activities that have inherent cognitive factors.

Epstein (1980) used dart throwing in her study of the effects of internal versus external mental rehearsal in perceptual motor skill requisition. Her specifications for board size, height, and distance of the subject from the target were those stated by McClintock (1977), but were not specifically stated.

Mendoza and Wichman (1978) and Wichman and Lizotte (1983) conducted mental practice studies which utilized dart throwing as the dependent measure. The specifics concerning target size and distance of the subject from the board were identical in both of these studies. The target consisted of seven concentric rings increasing in radius by 3.5 centimeters each time. The "bull's eye" was 3.5 centimeters in diameter. Each ring was given a numerical value, with the innermost ring being 7 points and the outermost ring 1 point. The top edge of the target was 1.6 meters above the floor. Subjects stood 3 meters from the board when throwing.

Rules of the Game (1974), an official sports/game encyclopedia, stated that for a regulation game of darts, the target should be 1.72 meters high to the center of the "bull's eye." The board/target is 45.7 centimeters in diameter and is divided into 20 triangular "sectors." The player should stand 2.44 meters from the target behind a restraining line.

III. SELECTION OF PERFORMANCE APPARATUS

Standard distances, heights, and sizes were not selected until the literature was reviewed, consistencies were found, and pilot practice sessions administered. The desired target was to be attention focusing, but not distracting. A regular dartboard was considered too distracting due to the numerous sections and differing colors.

During piloting of the project, a target consisting of concentric rings was evaluated. The total number of circles were evaluated and determined, as was the size of band-widths. Targets with 5 and 7 rings consistently progressing in size were examined. Rings with radii of 1.75 centimeters, 3.5 centimeters, and 5.08 centimeters were evaluated. Three sets of six darts were thrown at each combination of dimensions to determine the appropriate target size needed for the study. Seven ring targets were used in two previous studies (Mendoza and Wichman, 1978; Wichman and Lizotte, 1983), however, a five ring target was selected for the present study because a majority of the practice throws (78%) landed in the five ring area. The two additional rings were thus deemed superfluous. The rationale for

making the radius of each ring increase by 3.5 centimeters was based on the literature (Mendoza and Wichman, 1978; Wichman and Lizotte, 1983). Pilot testing substantiated the idea of these dimensions as suitable.

Once the target dimensions were finalized, the distance from the subject to the target had to be determined. The selection of the criterion distance was made after reviewing the literature which dealt with dart throwing in conjunction with mental practice and after pilot testing with a small sample population (N = 5). Distances of 3, 4, 5, and 7 meters were evaluated. Many times subjects were unable to hit the target and backboard from seven meters, so the distance was reduced. Each subject then threw three sets of six darts from three and four meters and two sets of six from five meters. Upon finishing, comments were requested concerning the most comfortable throwing distance. Two subjects felt best at three meters, while two preferred four meters. Initially, they all had to get a "feel" for the darts. Once acclimated, the mean score per trial improved at the distance subjects indicated as most comfortable. Subjects commented that adjusting arches and experimenting with throwing styles made a difference. There was a concensus that more adjustments were needed when moving from four to five meters than from three to four meters.

The pilot testing seemed to suggest that at four meters, too many physical practice trials and, therefore, mental practice trials would be needed to etch a memory trace pattern to enable throwing to become consistent (Schmidt, 1982). The focus of this study was the effect of

mental practice in addition to physical practice in perceptual motor skill acquisition. The literature indicates that if too much mental practice is used (over 5 minutes), psychological fatigue sets in and no further mental practice gains are evidenced (Richardson, 1967a; 1967b; Schick, 1970; Twining, 1949). Three meters was chosen because of the scoring consistency of the sample population at that distance. An inordinate number of physical practice trials, with corresponding mental practice trials would not be necessary for scores to level off. It was also assumed that no problems with psychological fatigue would occur.

A height of 1.72 meters from the floor to the center of the target was chosen because it is the official height in a regulation dart game (Wilkinson and Midgley, 1974). This height was a bit below eye level of the average male which should allow for a natural throwing motion.

The decision to finish the experimental procedure for each subject in one day was based on the ideas of Perry (1939) and Morrisett (1956), as cited in Richardson (1967b) and Epstein (1980), respectively. If the total time with each subject is limited to a relatively short period (i.e., approximately 40 minutes), then greater control can be executed over subject's unintentional mental practice. A shorter total experimental time also reduces the chances of distractions that may occur during the investigation (Richardson, 1967b).

The materials used in the study were six standard metal head plastic darts and a target made up of five concentric rings (Appendix B). The center ring or "bull's eye" had a diameter of 3.5 centimeters. The total diameter was 17.5 centimeters. The rings

alternated black and white, with the center being black. The distance from the floor to the middle of the target was 1.72 meters. Subjects stood 3 meters form the target behind a restraining line when throwing.

IV. SELECTION OF MENTAL PRACTICE TRIAL LENGTHS

The mental practice trial times were chosen (i.e., 45 seconds and two minutes) because the literature indicated that short mental practice sessions (five minutes of less) are most efficient (Corbin, 1972; Richardson, 1967a; Twining, 1949). Forty-five seconds was specifically chosen to test the findings of Feltz and Landers' (1983) review. They stated that the most optimal times to use mental practice in acquiring a motor skill were one minute or less and between 15 and 25 minutes. The time of two minutes was selected as the other mental practice time because it was within the accepted standard optimal range (five minutes or less) (Corbin, 1972; Richardson, 1967a; Schick, 1970; Twining, 1949). Both two and three minute mental practice sessions were examined. It was determined through pilot testing that mental rehearsal became difficult near the end of the three minute period, but subjects remained focused throughout the two minute sessions.

V. TESTING PROCEDURE

All assessments of data were made on a carefully scheduled basis by the researcher. Prior to the first day of testing, subjects were randomly assigned to one of four practice conditions. All subjects

attempted to throw four separate blocks of four sets of six darts as near as possible to the center of the target. After each of the first three blocks, the subject engaged in an intervening practice condition (i.e., mental practice or a word find puzzle) for either 45 seconds or two minutes. The procedures for the practice conditions are indicated below:

Condition I: (n = 15) Three separate 45 second mental practice trials interspersed between four physical practice blocks (i.e., four sets of six darts).

Condition II: (n = 15) Three separate two minute mental practice trials interspersed between four physical practice blocks (i.e., four sets of six darts).

Condition III: (n = 15) Three separate 45 second trials working on a word find puzzle (Appendix C) interspersed between four physical dart throwing blocks (i.e., four sets of six darts).

Condition IV: (n = 15) Three separate two minute trials woking on a word find puzzle interspersed between four physical dart throwing blocks (i.e., four sets of six darts).

When the subject arrived at the testing center, he was instructed to stand behind the restraining line and throw to the best of his ability, four sets of six darts at the target. Upon finishing the initial block of throws, the researcher read the appropriate instructions that were to be followed throughout the testing session (Appendix D).

The subject was required to be present one day for approximately 30 to 45 minutes. All subjects attempted the initial physical practice

block, followed by an instruction period and an appropriate intervening activity (i.e., mental practice or a word find puzzle) for a specified length of time (45 seconds or two minutes). This procedure was repeated twice more. Following the last intervening activity, subjects attempted one final physical practice block. Before being dismissed, subjects were asked several questions pertaining to the testing experience that they had just completed (Appendix D).

After each dart throw, the researcher recorded the score (Appendix E). Each ring was given a numerical value, a "bull's eye" counted one point and each expanding ring increased in value by one. A dart that landed on the target sheet, but missed the target, resulted in a score of six. Darts missing the target altogether, but striking the backboard were scored as seven. Throws that landed exactly on the line between circles were alternately scored as the lower then the higher of the two possibilities. Darts which did not stick in the target long enough to allow the researcher a chance to record it, were returned to the subject at the end of the set. Subjects were given a chance to throw those darts again. From the resulting scores, the mean and standard deviation for each block were calculated and recorded.

CHAPTER IV

RESULTS

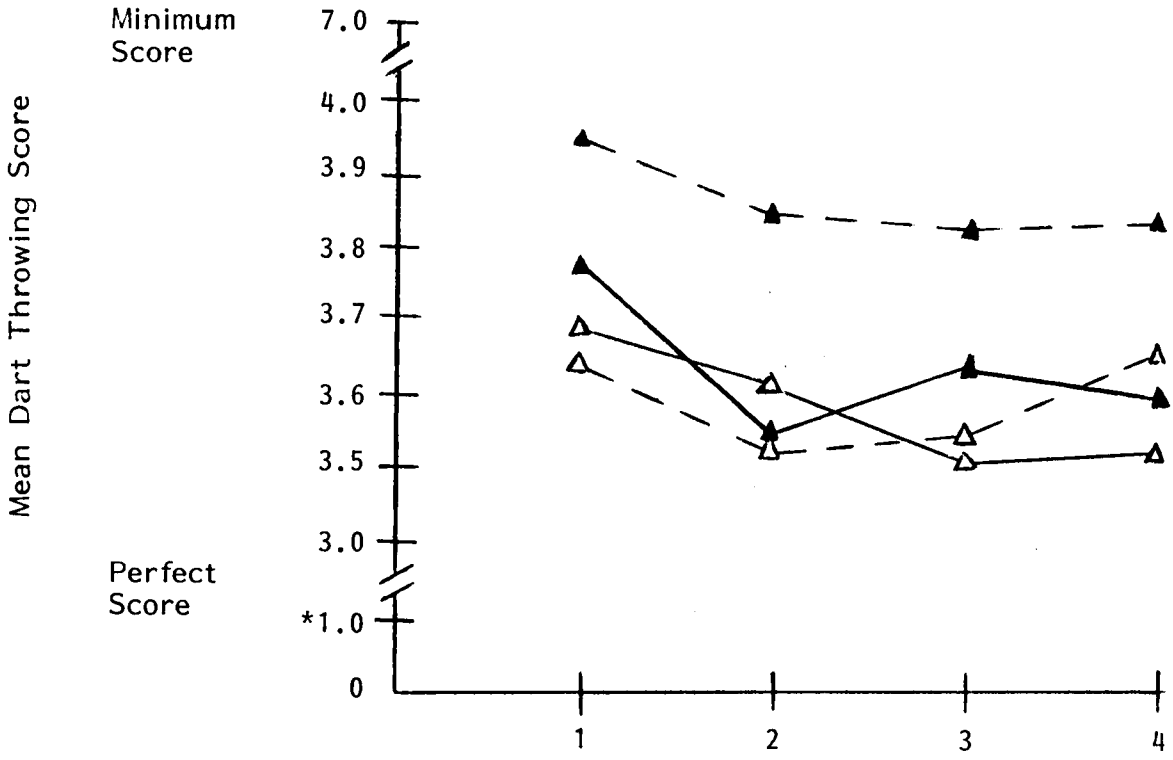
The data were collected and analyzed in order to determine if either 45 seconds or 2 minutes of mental practice resulted in significantly superior performance in the acquisition of a dart throwing task. A 2 x 2 x 4 Repeated Measures Design ANOVA (group x time x blocks) with subjects nested in group and time (Table 1) provided the statistical framework to test the hypotheses. Based on the meta-analysis by Feltz and Landers (1983), it was hypothesized that a group receiving 45 seconds of mental practice would perform significantly better on the dart throwing task than a group receiving 2 minutes of mental practice. It was also hypothesized that both of the groups receiving mental practice (45 seconds and 2 minutes, respectively) would score significantly better (i.e., closer to the perfect mean score of 1) on the dart throwing task than the corresponding control groups which engaged in a distracting task (i.e., a word find puzzle) for a parallel length of time. The means and standard deviations for the statistical groupings on the experimental dart throwing task are presented in Figure 1 and Table 2.

The analysis produced no statistically significant differences among main or interaction effects (Table 1). Thus, the directional hypotheses were not supported. The group receiving 45 seconds of mental practice did not perform significantly better on the dart throwing task than the group receiving 2 minutes of mental practice

TABLE 1

ANALYSIS OF VARIANCE PROCEDURE

Source of Variance	df	Mean Square	F	p
Between				
Group	1	1.378	1.07	.31
Time	1	.793	.61	.44
Group * Time	1	.777	.60	.44
S (Group * Time)	56	1.291	--	--
Within				
Block	3	.238	2.31	.08
Group * Block	3	.025	.24	.87
Time * Block	3	.035	.34	.80
Group * Time * Block	3	.043	.42	.74
S (Group * Time) * Block	168	.103	--	--
Total	239			



FOUR TRIAL BLOCKS

MP 45 sec	3.68 (.54)	3.60 (.74)	3.52 (.76)	3.53 (.74)
MP 2 min	3.63 (.52)	3.52 (.58)	3.55 (.51)	3.64 (.53)
NMP 45 sec	3.77 (.65)	3.53 (.53)	3.61 (.56)	3.58 (.64)
NMP 2 min	3.94 (.72)	3.83 (.63)	3.81 (.67)	3.82 (.67)

*A mean score of 1 is considered perfect.

FIGURE 1

MEAN DART THROWING BY BLOCKS

TABLE 2

DESCRIPTIVE STATISTICS FOR DART THROWING PERFORMANCE

Source of Variance		N	Mean	SD
Group				
1		120	3.583	.6157
2		120	3.734	.6294
Time				
1		120	3.601	.6347
2		120	3.716	.6142
Group * Time				
1	1	60	3.582	.6823
1	2	60	3.583	.5469
2	1	60	3.620	.5884
2	2	60	3.849	.6527

(Figure 1). Furthermore, the two groups receiving 45 seconds and 2 minutes of mental practice, respectively, did not score significantly lower (i.e., better) than the groups receiving no mental practice (i.e., performing a word find puzzle) for comparable lengths of time (Figure 1, Table 2). In addition, the assumptions (p. 5) that the groups were not significantly different at the outset of practice were confirmed.

CHAPTER V

DISCUSSION OF RESULTS

It has been documented in numerous research studies that mental practice aids in motor skill acquisition (Corbin, 1967; Feltz and Landers, 1983; Mendoza and Wichman, 1978; Richardson, 1967a; Schick, 1970; Twining, 1949; Wrisberg and Ragsdale, 1979). There are contradictory findings, however, concerning the most efficient or optimal length of time to use mental rehearsal. Twining (1949) concluded that 5 minutes was the uppermost limit a subject could effectively use mental practice; Feltz and Landers (1983) suggested that less than 1 minute or between 15 and 25 minutes was the most favorable time to mentally practice a task.

The present study compared two mental practice lengths (i.e., 45 seconds and 2 minutes), each of which fell within one of the aforementioned conflicting time periods. It was hypothesized that 45 seconds of mental practice would result in superior performance (i.e., lower mean score) on a dart throwing task when compared to 2 minutes of mental practice. This initial hypothesis was stated directionally as a result of the projection of Feltz and Landers (1983) from their meta-analysis. The findings of the present study, however, did not reveal any statistically significant differences between the performances of the two groups as a result of the mental practice treatments (Figure 1, p. 31). Neither of the groups scored significantly lower (i.e., closer to the perfect mean score of 1) on the task after utilizing mental rehearsal.

The performance of both mental rehearsal groups tended to improve after the initial mental practice trial and the group receiving 45 seconds of mental practice continued to make progress (i.e., lower its' mean score) after the second mental practice trial, also. Following the final mental rehearsal trial, however, the 45 second group began to falter slightly in performance (Figure 1, p. 31). The group which received 2 minutes of mental practice per session began to score increasingly higher (i.e., perform more poorly) after the second mental practice trial. Following the final mental rehearsal session, the 2 minute group performed worse on the task than it did initially. This overall trend toward improvement in performance of the 2 minute group was not statistically significant, though (Figure 1, p. 31).

Several theoretical possibilities exist which may aid in explaining why the 45 second sessions did not result in superior performance on the dart throwing task when compared to the 2 minute sessions. The possibilities to be discussed in the present study are as follows: (a) undifferentiated mental practice lengths, (b) inadequate mental practice time, and (c) insufficient number of accompanying physical practice trials.

A potential reason for the two mental practice times not resulting in significantly different performances may be that they are too close in length. The 75 second difference between the two times may not have been enough to evoke two unique performances. There may not have been enough differentiation between the experimental trial times to allow mental practice to result in graduating effects.

Feltz and Landers (1983) suggested that 45 seconds was an optimal length of time to use mental practice in motor skill acquisition. In light of the results of the present study, however, it may be that 45 second mental rehearsal trials do not allow the potential effects of this procedure to set in. Clark (1960), as cited in Richardson (1967a), suggested that too short periods (i.e., 45 seconds) may not permit subjects a chance to become familiar enough with the mental practice procedure. Forty-five seconds of mental practice on the dart throwing task did not result in a significant change in mean performance and it may be that this short length of time did not permit subjects to reach that "optimal" point in mental practice which causes significant positive changes in performance. Although not statistically significant, group scoring improved (i.e., was lower) during the first two mental practice trials. Following the third mental rehearsal session, however, the dart throwing performance of the 45 second group began to falter. The brevity of these 45 second sessions may not have allowed the full effects of mental practice to surface or the meta-analysis of Feltz and Landers (1983) may be inaccurate.

Richardson (1967a) and Weinberg (1982) both suggested that a combination of physical practice and mental practice is best for acquiring motor skills. Subjects in the present study physically threw a total of 16 sets of six darts each in addition to the mental rehearsal trials. It may have been that throwing 96 darts was only enough physical practice to allow subjects to move from what Fitts (1964) and Fitts and Posner (1967) termed the "cognitive phase" to the very early

"intermediate stage" of learning. The former stage is characterized by inconsistent movements, with the performer attempting only to understand the basic premise of what is to be done. In the latter phase, the learner has determined the most successful way to perform the task and is capable of making self-corrections. In the present study, the limited amount of physical practice that subjects received may be responsible for their inability to advance fully across these stages and, consequently, responsible for no group improving its performance significantly. Corbin (1972) stated that mental practice should be based on "real experience" (i.e., physical practice) to be effective. All subjects reported having had prior experience with darts, but even in conjunction with the initial four sets of six darts, no group performance increased significantly. The length of the physical practice trials may have been too short or, perhaps, physical practice alone should have occurred for a number of days before mental rehearsal was introduced for significant changes to have surfaced. The additional physical practice might potentially allow the throwing motor pattern to be more deeply imprinted (Schmidt, 1982). This imprint is needed for mental practice to be most effective.

It was also hypothesized that: (a) the 45 second mental practice group would significantly outperform the 45 second control group and (b) the 2 minute mental practice groups would improve significantly more than the 2 minute no practice group (i.e., control). These hypotheses were based upon the numerous studies suggesting that mental practice is better than no practice at all in the acquisition of a

perceptual motor skill (Corbin, 1967; Feltz and Landers, 1983; Richardson, 1967a; Twining, 1949). Neither of these hypotheses were statistically supported by the results of this study, however. Both of the 45 second treatments tended to show improvement on the task from the beginning to the end of practice, but neither group improved significantly within the practice time. The pair of 2 minute groups were erratic in scoring following their respective treatments. After the last treatment that each of the 2 minute groups received, the performance of both began to deteriorate.

There are two potential reasons why neither of the mental practice groups significantly outperformed their corresponding control group: (a) the two control groups may not have attended to the distracting task, and (b) there was an insufficient amount of accompanying physical practice. The control groups were instructed to work on the word find puzzle for a designated time, but if those subjects mentally practiced the dart throwing task instead of concentrating on the word find puzzle at the appropriate times, then no difference in group performances should have been expected. However, through subjective questioning after the testing procedure, it was determined that subjects did, in fact, attend to the distracting task as instructed. One subject even found a nautical term on the sheet that was not listed.

A second possible explanation why mental practice did not significantly facilitate the acquisition of the dart throwing task was because of the limited amount of physical practice that groups

received. Corbin (1972) stated that ample physical practice was necessary for the effects of mental practice to be evident. If all groups had received more physical practice trials there would have been potentially a significant difference in performance between the mental practice and control groups.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

I. SUMMARY

Theorists and researchers of mental practice disagree on the optimal duration of mental practice sessions, i.e., (a) Twining (1949) suggested less than 5 minutes was best, (b) Shick (1970) suggested that 3 minutes is better than 1 minute, and (c) Feltz and Landers (1983) suggested that less than 1 minute or between 15 and 25 minutes was best. The purpose of this study was to determine if 45 seconds of mental practice was significantly superior to 2 minutes of mental practice in facilitating the acquisition of a dart throwing task for college age men.

Sixty male undergraduate students enrolled in Physical Education activity classes, Spring Quarter, 1984, at the University of Tennessee, Knoxville, served as subjects for this study. All subjects were randomly selected from a pool of volunteers. All assessments of the data were made on a carefully scheduled basis by the experimenter. Prior to the first day of testing, each subject was randomly assigned to one of four practice conditions: (a) 45 seconds mental practice, (b) 2 minutes mental practice, (c) 45 seconds controlled activity (i.e., performing a word find puzzle), and (d) 2 minutes controlled activity (i.e., performing a word find puzzle).

The study required the subject to be present one day for approximately 30-45 minutes. All subjects performed a combination of

mental practice and physical practice or a combination of a distracting task and physical practice. All subjects began the experiment by physically throwing four sets of six darts. Physical practice continued between experimental treatments until a total of 16 sets of six darts had been thrown. The mental practice groups received three separate sets of mental rehearsal on the dart throwing task for 45 seconds or 2 minutes, respectively. The control groups worked on a word find puzzle at three different points in time for either 45 seconds or 2 minutes sessions.

It was hypothesized that a group receiving 45 seconds of mental practice would perform significantly better than a group receiving 2 minutes of mental practice on the acquisition of a dart throwing task. It was also hypothesized that the the groups receiving mental practice (i.e., 45 seconds and 2 minutes) would perform significantly better on the dart throwing task than the two groups performing a distracting task (i.e., word find puzzle) for the same corresponding times.

The mean dart throwing score for each of the four practice blocks was calculated. A three way (group x time x blocks) repeated measures design analysis of variance was performed on the data. Subjects were nested in group and time.

The results of the present study indicated that 45 seconds of mental practice was not significantly superior to 2 minutes of mental practice in facilitating the acquisition of a dart throwing task ($p > .05$). The present data also indicated: (a) that 45 seconds of mental practice was not significantly superior to 45 seconds of a

controlled activity, and (b) that 2 minutes of mental practice was not significantly superior to 2 minutes of a controlled activity in facilitating the acquisition of a dart throwing task.

II. CONCLUSIONS

Based on this study the following conclusions were drawn:

1. Forty-five seconds of mental practice is not significantly superior to 2 minutes of mental practice in facilitating the acquisition of a dart throwing task.

2. Mental practice, for the two experimental lengths (i.e., 45 seconds and 2 minutes), does not result in superior dart throwing performance when compared to no practice (i.e., performing a word find puzzle) for the same corresponding length of time.

III. RECOMMENDATIONS

The results of this study suggest the need for the following additional research:

1. Studies using longer mental practice sessions, but keeping within the limits suggested by Twining (1949) (i.e., 5 minutes or less).

2. Studies which keep the same experimental times as the present study, but extend the number of blocks of mental and physical practice.

3. Studies comparing two other mental practice times that fall within the present conflicting periods (i.e., less than 1 minute and less than 5 minutes) but are more discrepant in length (e.g., 30 seconds versus 4 minutes).

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APPENDICES

APPENDIX A

INFORMED CONSENT

INFORMED CONSENT

I understand that the purpose of this study is to determine if one mental rehearsal trial length is superior to another specified mental rehearsal trial length in acquiring a dart throwing ability.

I confirm that my participation as a subject is entirely voluntary. No coercion of any kind has been used to obtain my cooperation. I understand that no portion of my grades or academic standing is dependent upon participation in this experiment.

I understand that I may withdraw my consent and terminate my participation without penalty at any time during the investigation.

As a participant in this study, I understand that I will be asked to throw a specified number of darts with my preferred hand at a fixed target from a constant distance. I may have explained to me a procedure that has been shown effective in helping people perform motor tasks better. I understand that I will be required to meet once with the experimenter for approximately 45 minutes in Room 144 of the Health, Physical Education, and Recreation building.

I understand the above task explanation concerning subject requirements. I also understand that any further questions I might have will be answered to my satisfaction by the experimenter.

I understand that all my responses and scores will remain completely confidential.

I wish to give my cooperation as a subject.

Date_____ Signed_____
Witness_____
Campus Address:_____
Local phone number:_____

Do you have any physical limitations? Yes No
If yes, please describe:_____
Do you wear glasses? Yes No
During physical activity? Yes No
For distance? Yes No
Do you wear contacts? Yes No
During physical activity? Yes No
For distance? Yes No
Other explanation:_____
Have you played darts before? Yes No
If yes, please describe the type and amount of previous experience._____
Practice Day_____ Date_____ Time_____

John Moore
Room 368, HPER Building
974-5111 or 974-1277

APPENDIX B

TARGET

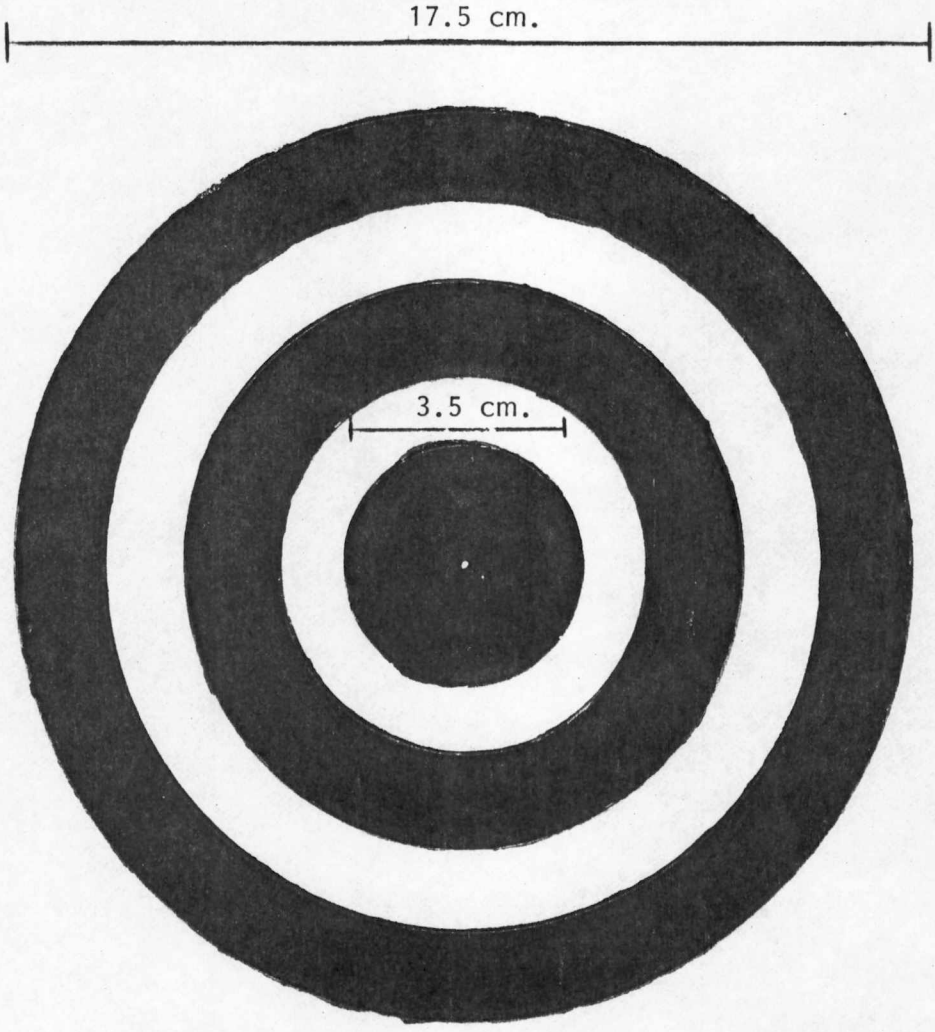

FIGURE 2

TARGET

APPENDIX C

WORD FIND PUZZLE

Ahoy, mate!

Things nautical can be found among the letters in this puzzle. Salty words read forward, backward, up, down or diagonally. As you find each, circle it and check it off the list below.

P	I	H	S	N	A	M	A	E	S	E	A	M	E	N	S	R	S	L	R	E	P	I	Q	P	N	P	E
I	I	E	O	E	B	D	A	V	I	T	B	A	S	R	T	U	T	O	O	T	A	L	U	O	A	N	G
H	S	L	S	L	V	O	Y	A	G	E	Z	E	O	E	E	D	R	G	C	S	S	R	Y	M	R	E	R
S	P	M	O	P	D	E	A	L	N	Y	C	B	H	T	E	D	A	B	O	H	S	T	A	T	O	T	A
M	O	M	T	T	W	S	N	T	E	D	E	A	E	S	R	E	P	O	U	E	A	R	O	L	L	U	H
I	L	W	U	D	O	E	T	S	A	A	R	L	R	A	S	R	X	O	R	E	T	R	O	P	S	A	T
R	S	U	O	P	L	X	U	X	E	N	K	A	I	H	A	N	D	K	S	T	E	O	T	L	A	T	S
T	A	C	K	L	E	T	G	O	T	A	C	S	F	C	H	O	R	E	E	N	I	G	N	E	I	I	A
T	K	M	O	C	B	A	T	T	E	N	S	H	A	T	C	H	R	E	N	I	L	E	E	K	T	S	M
S	F	R	O	L	A	N	D	R	K	H	D	H	O	X	T	S	C	U	P	P	E	R	C	O	A	S	T
L	U	T	L	M	A	T	E	A	C	N	T	Y	O	R	A	E	G	E	O	L	E	E	D	N	U	O	S
E	E	L	D	A	O	L	S	M	O	Z	U	R	O	R	W	L	E	S	O	I	D	H	G	A	W	N	F
E	L	A	D	E	I	C	S	P	R	A	Y	B	E	O	E	D	L	P	P	I	R	T	X	P	M	A	R
H	A	U	L	T	N	R	E	T	N	A	L	I	A	B	A	L	L	A	S	T	Y	R	A	U	T	S	E
W	O	B	K	C	E	R	W	M	A	R	O	O	N	R	F	Y	Y	R	T	X	E	G	A	N	N	O	T
N	O	I	S	I	L	L	O	O	F	R	A	H	W	A	O	M	E	S	S	S	A	P	M	O	C	Z	S
E	T	U	O	R	H	I	A	H	G	N	A	H	S	H	G	A	L	L	E	Y	D	N	I	W	A	O	A
Y	A	W	A	W	O	T	S	W	S	T	R	O	U	G	H	H	E	A	D	I	N	G	S	O	S	B	M
S	I	G	N	A	L	S	E	O	R	O	O	O	E	U	O	E	M	L	A	C	E	B	T	T	T	I	O
E	G	D	I	R	B	O	I	L	E	R	V	K	G	N	R	E	E	U	U	P	M	A	E	S	O	N	O
N	I	A	T	P	A	C	T	L	C	Y	E	Y	E	S	N	L	N	F	S	T	O	R	M	O	F	N	R
S	D	R	A	W	E	T	S	A	O	G	R	O	U	N	D	E	D	F	R	E	E	F	S	G	F	A	D
E	N	U	T	P	E	N	Q	W	C	I	L	A	Y	O	V	E	R	C	D	R	A	D	A	R	L	C	R
G	N	I	S	I	U	R	C	T	A	R	E	V	A	E	H	U	C	A	N	V	A	S	A	A	E	L	A
D	R	A	W	R	O	F	M	O	O	B	G	R	B	S	S	S	G	N	I	S	S	O	R	C	R	E	W

You should have found these words:

1. Abeam
2. Ashore
3. Astern
4. At anchor
5. Ball
6. Ballast
7. Battens
8. Bay
9. Becalm
10. Below
11. Berth
12. Binnacle
13. Blow
14. Boiler
15. Boom
16. Bow
17. Bridge
18. Brig
19. Bunk
20. Cadet
21. Canvas
22. Captain
23. Cargo
24. Cast off
25. Chart
26. Chore
27. Coast
28. Collision
29. Compass
30. Course
31. Crew
32. Crossings
33. Cruising
34. Davit
35. Deck
36. Deep
37. Docks
38. Draft
39. Engineer
40. Estuary
41. Eye
42. Fire hose
43. Foghorn
44. Forward
45. Fuel
46. Galley
47. Gear
48. Grounded
49. Gunner
50. Gyro
51. Hand
52. Hatch
53. Haul
54. Headings
55. Heave
56. Heel
57. Helm
58. Hold
59. Hook
60. Hull
61. Keel
62. Knot
63. Lade
64. Land
65. Lantern
66. Lash
67. Layover
68. Leaks
69. Lee
70. Liner
71. List
72. Load
73. Logbook
74. Lookout
75. Loran
76. Luff
77. Map
78. Maroon
79. Mast
80. Master
81. Mate
82. Mend
83. Mess
84. Mist
85. Mop
86. Neptune
87. Net
88. Oar
89. Pass
90. Pier
91. Pilot
92. Ply
93. Pole
94. Pond
95. Poop
96. Port
97. Pump
98. Purser
99. Radar
100. Ram
101. Ramp
102. Reefs
103. Rip
104. Rocket
105. Roger
106. Roll
107. Route
108. Rover
109. Rudder
110. Salty
111. Scupper
112. Seam
113. Seamanship
114. Seamen
115. Seven seas
116. Sextant
117. Shanghai
118. Sheet
119. Ship
120. Sign
121. Signals
122. Slop
123. Snug harbor
124. S O S
125. Sound
126. Spars
127. Spray
128. Stack
129. Star
130. Steers
131. Stewards
132. Storm
133. Stowaway
134. Strap
135. Surf
136. Swab
137. Tackle
138. Tar
139. Taut
140. Ties
141. Tonnage
142. Toot
143. Tow
144. Tramp
145. Trim
146. Trip
147. Trough
148. Tug
149. Voyage
150. Wallow
151. Wardroom
152. Warp
153. Watch
154. Wharf
155. Wheel
156. Wind
157. Wreck

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APPENDIX D

SPECIFIC INSTRUCTIONS FOR GROUPS

INSTRUCTIONS FOR MENTAL PRACTICE GROUPS

Please be seated and put your hands comfortably in your lap. I am now going to introduce you to mental practice or mental rehearsal. It is just that--repeating an action in your mind. It has been used extensively to help athletes improve various skills.

There are no physical movements, whatsoever, in this activity. I want you to relax, and when I tell you to, form some mental images that are related to the dart throwing task that you just finished. Think of everything you saw, felt, or did just a minute ago when you threw those darts. When you are remembering this, stay perfectly still.

First, imagine stepping to the throwing line. Try to recall how the darts felt in your hand. (pause) Now think about your arm motion, (pause) the release. Watch the dart's flight and notice your follow through. (pause) Lastly, watch the dart's landing in the center of the target. Try to hear the dart hitting the board. Are there any questions? (pause)

Let me review: (1) imagine stepping to the line, (2) feel the darts in your hand, (3) focus on the target, (4) feel the throw and release, (5) watch the dart's flight all the way to the center of the target, and (6) listen to the dart hit the board.

Now, I want you to close your eyes and mentally imagine throwing darts at the target. I want you to do this for (45 seconds/2 minutes). Take your time when practicing. You are not required to

perform a certain number of mental throws. Mentally throw at a comfortable speed.

As you finish each mental practice throw, lift your hand/finger slightly to let me know you have completed one full trial. Relax your hand then, and continue to mentally practice. Repeat this after each full mental practice trial. Any questions? (pause) I'll tell you when to stop and what to do next. Ready? Begin.

INSTRUCTIONS FOR CONTROL GROUPS

Please be seated and make yourself as comfortable as possible. I am going to read some instructions to you as I will to all subjects.

I am going to give you a sheet that is similar to many word find puzzles that you may have seen in a number of books and magazines. Please read the instructions carefully. If you have any questions, please ask them after you have finished reading.

[HAND OUT SHEET]

Any questions? (pause) When I say "begin," work on this puzzle until I say "stop." Put your pencil down at that time. Don't rush doing the puzzle. There is not a certain number of words you must find, but continue working until I say stop.

Ready? Begin.

APPENDIX E

EXPERIMENTER'S SCORE SHEET

I.D. _____ Date _____

Group 1. MP 2. Control Time _____

Time 1. 45 sec. 2. 2 min

Blocks:

				TOTAL
_____	_____	_____	_____	MEAN
_____	_____	_____	_____	S.D.

VITA

John Owens Moore, Jr., was born in Texarkana, Arkansas, on September 2, 1961, to Mr. and Mrs. John O. Moore.

He attended elementary schools in that city and was graduated from Arkansas High School in June, 1979. The following August he entered Centenary College, Shreveport, Louisiana, and in May 1983 he received a Bachelor of Science degree in Health and Physical Education. In the spring of 1983 he accepted a graduate teaching assistantship in the school of Health, Physical Education, and Recreation at the University of Tennessee, Knoxville, and began study toward a Master of Science degree. He expects to receive the Master of Science degree in August 1984.