THE EFFECT OF PROGRAMMED RELAXATION EXERCISES ON THE SHOOTING OF BASKETBALL FREETHROWS

A Thesis Presented

to

The Graduate Faculty

University of Wisconsin - La Crosse

In Partial Fulfillment

of the Requirements for the

Master of Science Degree

---

by

Walter C. Iselin, Jr.

May, 1979

ABSTRACT

ISELIN, Walter C., Jr. The effect of programmed relaxation exercises on the shooting of basketball freethrows. M.S. in Physical Education, 1979. 53 p. (Dr. Karen Toburen).

The present investigation examined the effectiveness of programmed relaxation exercises in conjunction with mental practice on the performance of shooting basketball freethrows. The Ss were (N = 24) female intercollegiate basketball players from the University of Wisconsin-La Crosse. The investigation utilized audio tapes for the administration of 2 parts of the study, the mental practice section and the programmed relaxation exercises. Ss in the experimental group participated in 10 sessions of relaxation training combined with mental and physical practice. Ss in the control group experienced 10 sessions with only mental and physical practice. Data were analyzed by means of the SPSS program ANOVA (special program ANCOVA) to examine relationships between programmed relaxation exercises combined with mental and physical practice, in comparison to mental and physical practice only. An ANCOVA, with the pre-test being used as the covariate, was utilized. Results of the ANOVA procedure revealed a significant difference in the performance of shooting freethrows by female intercollegiate basketball players who participated in the programmed relaxation exercise with mental and physical practice. The F ratio obtained in the analysis of the freethrow shooting

scores between groups was 9.343, significantly higher than the F ratio of 3.47 needed for rejection. Therefore, the Ho that there was no significant difference in the mean scores obtained in the shooting of basketball freethrows between the experimental and control groups was rejected.

UNIVERSITY OF WISCONSIN - LA CROSSE
School of Health, Physical Education and Recreation
La Crosse, Wisconsin 54601

Candidate: Walter C. Iselin, Jr.

We recommend acceptance of this thesis in partial fulfillment of this candidate's requirements for the degree:

Master of Science in Physical Education

The candidate has completed his oral report.

Thesis Committee Member	5/24/79 Date
Thesis Committee Member	July 9, '79 Date
Thesis Committee Chairperson	July 3, 1979 Date

This thesis is approved for the School of Health, Physical Education and Recreation.

Dean, School of Health, Physical Education and Recreation	7-27-79 Date

DEDICATED ...

To my family ...

my wife, Kathy

my son, Kerry Mark, and

my daughter, Anne-Marie.

They are what I live for; they have taught me what life is all about.

ACKNOWLEDGMENTS

There are many people who directly or indirectly contributed to this project and to each one of them the writer extends sincere appreciation.

My deepest appreciation is extended to Dr. Karen Toburen, my thesis committee chairperson, for her thoughtful critiques, enthusiasm, and sincere interest in this project.

Gratitude is also expressed to Dr. Bill Chen and Dr. Tom Hood, committee members, for their input. A special thanks to Dr. Norman Shealy, Dr. Jack Curtis, and Dr. Ralph Jones for their assistance at different times throughout the project.

To my wife, Kathy, I express my deepest love for all the time and support she showed from beginning to end. A very special acknowledgment to my son, Kerry Mark, and my daughter, Anne-Marie, as they had to put up with a part-time father for the year.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

The present educational era has prompted coaches and physical educators to develop and utilize many new types of coaching and teaching devices. The emergence of programmed relaxation exercises in the field of athletics and physical education is in its infancy.

There have been numerous studies conducted to determine if there is a significant relationship between mental imagery and the performance of various athletic skills. Few studies have included the use of programmed relaxation exercises in combination with mental and physical practice.

Purpose of the Study

This study was to evaluate the effectiveness of the use of programmed relaxation exercises combined with mental and physical practice on the performance of shooting free-throws by female intercollegiate basketball players.

Statement of the Problem

This study attempted to determine whether or not the use of programmed relaxation exercises combined with mental and physical practice produced an increased number of baskets. To investigate the problem, one question was posed:

After completing the designated training, will subjects in the experimental group (relaxation training plus mental and physical practice) score higher than subjects in the control group (mental and physical practice) on a freethrow shooting test?

Hypothesis

In an attempt to answer this question, the following null hypothesis was posed:

There will be no significant difference between the experimental and control groups in the scores obtained in the shooting of basketball freethrows.

Limitations

The study had the following limitations:

(1) All the subjects had previously learned the basketball skill utilized in the study.

(2) All the subjects were motivated to perform.

(3) There was no knowledge of the subjects' previous use of relaxation or mental practice.

Delimitations

The study had the following delimitations:

(1) The study was limited to female basketball team members at the University of Wisconsin-La Crosse.

(2) All the subjects practiced the same number of freethrows throughout the period of time the study was being conducted.

(3) The subjects in the control group avoided any use of the programmed relaxation exercises.

(4) All subjects had normal or corrective vision and wore the same corrective equipment during testing.

Definition of Terms

For purposes of this study the following definitions were adopted:

(1) Directed Mental Practice: Mental practice combined with one of the following: (a) reading descriptions of the skill, (b) listening to descriptions of the skill, or (c) verbalizing about the skill (Bell, 1970).

(2) Mental Practice: Refers to "the symbolic rehearsal of a physical activity in the absence of any gross muscular movements" (Richardson, 1967, p. 95).

(3) Programmed Relaxation Exercises: A series of seven standard relaxation exercises designed to put the subject into a relaxed state. The seven phases used are: (1) "I am relaxed"; (2) "My arms and legs are heavy and warm"; (3) "My heartbeat is calm and regular"; (4) "My breathing is free and easy"; (5) "My abdomen is warm"; (6) "My forehead is cool"; and (7) "My mind is quiet and still" (Shealy, 1976, p. 62).

(4) Undirected Mental Practice: The learner visualizes that she is performing the skill and imagines the movements associated with the task, without the use of any methods to direct the thinking of the subject (Bell, 1970).

CHAPTER II

REVIEW OF RELATED LITERATURE

A review of the scientific literature revealed an abundance of studies related to mental practice. However, the literature was void of studies dealing directly with the effectiveness of programmed relaxation combined with mental and physical practice.

The writer determined it was appropriate to investigate a variety of components that affect mental practice. The components identified as being most relevant to this study were: (1) opinions of authorities on the subject of mental practice; (2) directed mental practice versus undirected mental practice; (3) varying combinations of mental and physical practice; (4) effects of mental practice on neuromuscular activity.

Opinions of Authorities on the Subject of Mental Practice

Mental practice is the symbolic rehearsal of a skill without any gross muscular movements present (Richardson, 1967). Bell (1970) stated that mental practice can be accomplished through one of two methods, directed and undirected. Undirected mental practice is when the learner visualizes that he/she is performing the skill and imagines the movements associated with the task. Bell (1970) stated

that with directed mental practice researchers used written or spoken methods in directing the thinking of their subjects. Performers were asked to either write down or verbally describe movements or associated feelings with the particular motor skill.

There are many factors influencing the effectiveness of mental practice on the acquisition of a motor skill. Lawther (1968) noted that the effectiveness of mental practice was dependent on two variables; and, that mental practice should be used to supplement physical practice. The variables Lawther listed were: a) the nature of the skill being practiced, and b) the skill level of the learner. Singer (1975) supported the same two variables listed by Lawther and then added three more. The first being the amount of physical practice compared to mental practice, second was the intelligence level of the learner, and third was the subject's kinesthetic sense.

In referring to six different studies, Drowatzky (1975) stated that improvement on a variety of motor skills was accomplished through the use of mental practice. He hastened to add that although improvement is realized through mental practice, it is not as effective as physical practice.

Another factor related to the effectiveness of mental practice is the influence of neuromuscular movements on the muscle groups involved in the task. Several groups

of authors made reference to the effects of mental practice on muscular performance. Morehouse and Miller (1959) stated that:

> Thinking about muscular performance has been shown to produce an increase in the tension of the muscles which would participate in actual performance. This phenomenon suggests that learning and perfection of skills can proceed through reading and thinking about the technique of the event. Thus, a golfer during the winter season may improve his swing by studying texts written on the subject (p. 69).

Schneider and Karpovich in 1949 stated:

> Mental work, including such things as simple calculations, reading, and recitation, has a definite influence on muscular tonus . . . Electrical tests for muscular contractions show minute contractions in speech muscles when one thinks of words which involve their use. Imagination and the recollection of voluntary acts always lead to changes in the muscles which would partake in those acts (p. 233).

Drowatzky (1975) concluded that the following guidelines would be beneficial when using some form of mental practice as a teaching technique to improve performance: (1) the learner must have had some previous experience with the skill involved; (2) the learner should be instructed in the correct procedure of mental practice; (3) the skill being performed should be simple rather than complex; (4) a combination of mental and physical practice is more beneficial than mental practice alone; and (5) the undirected procedure is superior to the directed one.

Directed versus Undirected Mental Practice

The pioneer study of mental practice was conducted by Vandell, Davis, and Clugston (1943) to determine the function of mental practice in the acquisition of motor skills. The subjects were all males chosen from three grade levels: junior high school, senior high school, and college freshmen.

The selection of subjects and their division into groups was determined by a series of standardized tests including intelligence, educational age, chronological age, motor ability, and physique (height, weight, growth, eyes). The reason for this method of selection was to eliminate those subjects who deviated noticeably from the so-called average.

Male junior high school students and male college freshmen were involved with the skill of dartthrowing, while senior high school subjects employed the basketball freethrow. The research study consisted of three groups of twelve subjects from each age/grade level. The three groups performed during the twenty-day testing period as follows:

Group I participated in the pre-test and post-test only which consisted of physical practice testing of twenty-five throws on day one and day twenty.

Group II participated by perfocming twenty-five throws on each of the twenty days (physical practice only).

Group III performed actual physical practice of twenty-five throws on the first (pre-test) and the last day (post-test) with mental practice periods of thirty minutes on days two through nineteen. The mental practice was undirected and Group III did not physically participate in any freethrow activity on days two through nineteen.

It was concluded by Vandell, et al., that

> daily mental practice (undirected) of a motor skill results in improvement in the later actual physical performance of that particular motor skill to such an extent that mental practice appears as effective as actual physical practice (p. 247).

Twining (1949) conducted an experiment to examine the effects of a motor skill (ring toss) developed through mental practice as compared to physical practice. The mental practice was defined as rehearsing the first day's activity, which was referred to as undirected mental practice.

The subjects, who were 36 college men, were selected at random and placed into one of three groups. Twelve subjects who made up Group I threw 210 rings on the first and twenty-second days (pre-test and post-test dates). Group II contained twelve subjects who threw 210 rings on the first day (pre-test), 70 rings each day from the second through the twenty-first day, and 210 rings on the twenty-second day (post-test). The twelve subjects in Group III threw 210 rings on the first and twenty-second days (pre-test and post-test days) and from the second through the

twenty-first days they mentally rehearsed their first day's activity for fifteen minutes a day.

Twining (1949) reported that subjects in the control group demonstrated no significant gain in performance; that the group which practiced physically improved 137.3%, which was significant; and the group that mentally practiced also improved significantly, 36.2%. It was concluded that both physical practice and mental practice are effective in promoting learning of a simple motor skill.

In a more recent study conducted by Jones (1965) undirected mental practice was found to be an effective method of learning a motor task. In comparing two methods of mental practice, undirected and directed, Jones used 71 male college students as subjects. The subjects were divided into two groups. One group received undirected mental practice while the other group received directed mental practice. Both groups practiced three times a week for two weeks. The motor task studied was a gymnastic hock swing upstart. After six practices the subjects were tested on the skill and those who failed were given further mental practice and then retested. The criterion was the length of time it took to pass the test.

On the first test, 56% of the total subjects passed the test. The undirected mental practice group had a significantly higher percentage of subjects passing the test than the directed mental practice group. These same results

occurred during subsequent testing and mental practices.

Even though all physical practice involved some type of imagery, there are a number of investigators who have attempted to direct the mental practice of their subjects. The various techniques they used included reading a description of the skill, listening to a description of the skill, verbalizing about the skill, watching a film of the skill, watching another individual perform the skill, or any combination of these.

Clark (1960) had conducted a study concerned with the effects of directed mental practice on the performance of a Pacific Coast one-hand foul shot as compared to the physical practicing of the same skill. Using three groups of students with various skill levels, the subjects were equated for arm strength, intelligence, varsity level, junior varsity level, or novice experience. Chance drawing was used to assign the equated subjects to the mental and physical practice groups. Both a pre-test and post-test were administered and included the shooting of 25 basketball freethrows. The mental practice group read an instruction sheet each of the fourteen days before mentally practicing five warm-up shots and then twenty-five shots. The physical practice group performed five warm-up shots followed by twenty-five shots on each of the fourteen days. The gains achieved by the mental practice group were nearly the same as those by the physical practice group. Subjects using

directed mental practice had an average gain of 15% for the varsity group and 23% for the junior varsity group, while the physical practice group had gains of 16% and 24% for the varsity and junior varsity level groups, respectively. In contrast to these gains, mental practice was not as effective as physical practice for the novice group. Gains of 44% for the physical practice group and gains of only 26% for the mental practice group were realized. Clark's results supported an earlier study (Vandell, et al., 1943) which concluded that mental practice was nearly as effective as physical practice for varsity and junior varsity level subjects but not as effective for the novice performer. Corbin (1967) and Wills (1965) also supported the conclusion reached by Clark.

Start (1960) studied the relationship between I.Q. level and directed mental practice. He selected 35 twelve-year-old boys from a secondary school in Lancashire, England. The subjects had no previous basketball experience and were asked to practice mentally for five minutes during nine different practice sessions. The directed mental practice consisted of having the subjects mentally picture themselves shooting an underarm basketball freethrow after it had first been explained to them. Subjects were divided into two groups on the basis of I.Q. levels which were obtained from the Northern Tests of Educability, England. A pre-test and post-test of ten freethrows were

administered. The scores were slightly higher on the post-test but the improvement was not significant. Start concluded that there was no evidence of a relationship existing between the improvement in motor performance (i.e. the underhand basketball freethrow) and the I.Q. level of the subjects after directed mental practice.

The effects of several different directed mental practice techniques were compared by Surburg (1968) who used the tennis forehand drive as the motor skill. The subjects were 183 male junior college students. The subjects were divided into six experimental groups and one control group. The six experimental groups were exposed to different techniques. Two of the experimental groups listened to the audio accompaniment of a filmstrip and one of the two groups also engaged in a ten-minute mental practice session immediately following the audio presentation. The other experimental groups saw the filmstrip and heard the audio recording. Likewise, one of these two groups received the ten-minute mental practice session immediately after the audio and filmstrip presentation. The remaining two experimental groups saw only the filmstrip and one of these two also received ten minutes of mental practice immediately following their viewing of the filmstrip. The three groups that received the ten-minute mental practice sessions were instructed to conceptualize the movements involved in the tennis forehand drive.

The experimental subjects practiced three times per week for an eight-week period. The mental practice groups showed significant improvement. However, the audio presentation used in conjunction with the mental practice proved to be the most effective method for development of the tennis forehand drive.

The conclusion of this study, which was that mental practice is an effective method for improving a gross motor skill, supported previous findings by Twining (1949); Clark (1960); Kelsey (1961); Wills (1965); and Corbin (1967).

In conclusion, the research conducted by Vandell, et al., Twining, and Jones found that undirected mental practice was superior to directed mental practice.

Combinations of Mental and Physical Practice

Several investigators have studied the results of various combinations of mental and physical practice. Egstrom (1964) studied the effects of six conceptualizing schedules on the learning of a novel gross motor skill. The subject, while holding a wooden paddle in his nonpreferred hand, was to strike a small rubber ball that was ejected from a tube every twelve seconds. The subjects were to strike the ball at a large target mounted twenty feet away. There were 120 college male subjects assigned to six groups. Group I practiced physically twelve times; Group II used a combination of six physical and six mental

practices; and Group III had the reverse, six mental and then six physical practices. Group IV alternated mental and physical practices for twelve days; Group V practiced mentally for twelve days; and Group VI acted as the control group with no practice. Mental practice consisted of five minutes of introspective rehearsal of the skill which had been performed during the pre-test.

Both mid-training and post-training tests were given. All five experimental groups made significant gains from the pre-test to the mid-training test. After the post-test had been given and comparisons made, Group IV, which had interspersed mental and physical practices for twelve days, had increased their performance more than the group having mental practice without physical practice.

Several studies examined the effectiveness of mental practice on female subjects. Burns (1962) used 325 volunteer female subjects from three grade levels with a variety of backgrounds and varying degrees of skill and experience in physical education. Subjects were randomly selected at each grade level and were put into one of four groups; either a control group, a physical practice group, a mental practice group, or a group alternating mental with physical practice. Using the dart throw as the motor skill, the physical practice group threw thirty darts each of the fifteen days. The mental practice group read instructions each day followed by mentally throwing thirty darts while

in a sitting position facing the target. The last group combined the mental and physical practices by alternating the method daily for the fifteen day test period. All four groups were pre-tested and post-tested. Means of each group were calculated and the differences among the group means were not great enough to indicate a significant difference at the .05 level of significance.

Kelly (1965) likewise studied female subjects and mental practice. Kelly placed 139 tenth grade girls into five groups. All the subjects had previous knowledge of the overhand volleyball serve because they had been enrolled in junior high school physical education classes which were taught by the investigator. The five groups used were as follows: (1) control group which had no practice, but a substitution of table tennis; (2) verbal-mental practice group which involved reading a verbal cue checklist and them imagining twenty trials; (3) physical practice group which actually performed twenty trials; (4) physical-mental practice group which engaged in physical practice for four to six minutes and in imagery for four to five minutes; and (5) imagery-mental practice group which used a series of photographs of the skill and was instructed to imagine themselves performing twenty trials. The conclusion drawn from the study was that the verbal-mental practice, physical practice, and physical-mental practice groups performed significantly better than the other groups.

Another study that used varying combinations of mental and physical practice was conducted by Stebbins (1965). He randomly assigned 93 male volunteers to one of five treatment groups as follows: (1) control, (2) mental practice, (3) physical practice, (4) mental-physical practice, and (5) physical-mental practice. Physical practice consisted of throwing rubber balls at a target and the score was the sum of the point values. The target was located fifteen feet away and practice periods lasted eighteen days. Mental practice consisted of having the subjects stand next to someone physically performing the skill and picture themselves throwing the ball for twenty-five trials. Subjects involved in the physical practice group threw the ball twenty-five times a day. Reversing the schedule of the mental-physical practice group, the physical-mental practice group engaged in physical practice for ten days and then mental practice for the last eight days. Results of the study indicated that the combinations of physical-mental and mental-physical practice groups were superior to mental practice alone or the control group. Also, the physical practice group was not significantly different from the combination type treatment groups and the mental practice did not show any improvement. The author indicated that the method of mental practice could have been detrimental to the performer. The mental practice subject was instructed to stand next to a subject physically performing the skill and therefore this

person could have served as a distraction to the subject during mental practice.

A more recent study involving the combination of mental practice with physical practice was done by Schick (1970). Concerned with the effects of mental practice on the improvement of volleyball skills and the serve, Schick conducted three substudies. The first substudy involved comparing mental practice with no physical practice. The other two substudies compared different amounts (three minutes and one minute) of daily mental practice along with equal amounts of physical practice on each skill.

Substudy I involved ten college women who were not participating in any form of volleyball class, either educational or recreational. However, all of the subjects had received previous instruction in volleyball skills. The subjects were put into one of two groups; either a control group or a mental practice group. Mental practice was divided into two three-minute sessions, one for the serve and the other for the volley. This experiment lasted two weeks. Pre-tests and post-tests were administered and results were analyzed by use of a *t* test. There was no significant difference between the groups for the wall volley, but the post-test scores on serving for the mental practice group were significantly better than the group with no mental practice.

Investigating the combined effects of physical and mental practice, Schick (1970) used 68 female college students in three nonprofessional volleyball classes as his subjects. All subjects received physical practice in class while the mental practice was done on the subjects' own time. Subjects were divided into two groups. Group I had one minute of undirected mental practice on each of the two skills while Group II had three minutes of undirected mental practice on each skill. On the wall volley skill, there was not a significantly higher score for the group receiving the greater amount of mental practice. However, in comparing the two groups on the serve, the three-minute mental practice group was significantly better than the one-minute group.

Substudy III used the same treatments as those in Substudy II except for the length of time the experiment was conducted; Substudy II ran for five weeks and Substudy III for three weeks. Subjects were 36 female college students enrolled in a nonprofessional volleyball class. Due to the conflicting results of the three substudies, no significant conclusions were drawn as to the effectiveness of mental practice on the wall volley or the serve.

The studies reviewed utilizing combinations of mental and physical practice supported the finding that the use of mental practice combined with physical practice produced greater results than mental practice alone.

Mental Practice and Level of Skill

As early as 1960, Clark studied the effects of mental practice on basketball freethrow shooting with varsity, junior varsity, and novice high school players. This study was discussed in an early section of this chapter. An important conclusion from the study by Clark was that physical and mental practice were equally effective with varsity and junior varsity high school players, but a novice group seemed to profit more from physical practice. However, the reader is reminded that Clark's findings were not statistically significant.

Corbin (1967) stressed the importance of the skill level of the subject on the motor skill being performed. Corbin stated, "It seems logical to suggest that covert rehearsal can be effective only if it's based on previous experience in the skill task to be performed" (p. 148).

Smyth (1975) in a recent study concerned herself with whether mental practice is more effective in the initial stages of acquiring a skill, or when the task is familiar to the subject. She used the motor skill of mirror drawing. Subjects were randomly assigned to one of seven different groups. Four of the seven groups were first shown the equipment and received an explanation of how it was used. The same four groups received different treatments as follows: (1) physical practice of five trials; (2) no practice; (3) mental practice; and (4) mental-physical

practice. All mental practice subjects were instructed to imagine themselves drawing a star using information only from the mirror.

Results of the study were: that the physical practice group was significantly better than all other groups, that the mental-physical group was significantly better than the no practice group, and that there were no other differences between groups. Smyth concluded, "Mental practice was not shown conclusively to be effective for the initial learning of a mirror drawing task" (p. 202).

Studies investigating the impact of the skill level of the performer on the effectiveness of mental practice have generally concluded that the learner must go beyond the novice stage for mental practice to be effective.

Effects of Mental Practice on Neuromuscular Activity

Studies of mental practice and its effects on motor learning were constructed on the premise that mental practice elicits neuromuscular reactions. This was an assumption which the author felt required support for a meaningful interpretation of mental practice research.

Research several decades ago (Jacobson, 1930; Freeman, 1931; Golla, 1921; Travis, 1924; Tuttle, 1924; Bills, 1927; Davis, 1939; and Shaw, 1940) discovered "that by placing electrodes on muscle groups and recording the electrical activity of the subjects while they imagined themselves

performing a task, the muscular activity during the mental activity was localized to the muscle groups that would be involved in the actual performance of the imagined activity" (Sage, p. 410).

Jacobson (1930) used a small number of subjects and studied the muscle reactions of specific muscles involved in a movement while the actual movement was being performed. He then repeated the procedure while the same movement was only imagined. Jacobson concluded that "when the subject imagines that he is steadily bending one of his arms, electrical phenomena simultaneously occur in the biceps region of that arm" (Vol. 94, p. 22).

Freeman (1931) concerned with the presence of neuro-muscular activity during mental work conducted an investigation of this area. He constructed a rather primitive apparatus made up of levers that were placed over the biceps muscles of the arms and the belly of the quadriceps. The movable ends of these levers were connected in a way to enable the recording of any movements on a moving photographic paper. The subjects were then asked to perform some simple mathematical problems. They were then asked to mentally practice a simple motor skill which would involve only a few movements of muscles in a localized area, such as flexing the finger. When asked to mentally perform the same exercise, there was noticeable excitation in many muscle groups. As the subjects repeated the same mental

practice, there was less general activity in the muscle group and more specific activity in the muscles that were involved with the imagined movement.

Shaw (1940) also investigated the effects of mental practice on neuromuscular activity. He used subjects who imagined themselves lifting 100 to 500 grams with their wrists, and subjects who imagined themselves trying. Shaw used a cathode-ray oscillograph on his three subjects while they imagined themselves lifting varying amounts of weight. The oscillograph revealed that muscular activity varied directly with the amount of weight the subjects imagined themselves lifting.

A more recent study conducted to assess the electromyographic responses during mental practice was done by Schramm (1967). The study involved twelve female subjects who covertly and overtly practiced elbow flexion and extension with a ten pound weight attached. The subjects were randomly assigned to six different groups. These groups were determined by the six possible orders of presenting the three methods of instruction - verbal, written, and demonstration. Electromyographic readings were taken from eight superficial arm muscles. The investigator was primarily interested in comparing the results of the electromyograph during imagining both before and after the subjects had practiced physically the extension and flexion of the elbow.

Results indicated that the neuromuscular activity during mental practice was more pronounced after the subjects had been through the physical task being tested. Nine of the twelve subjects had an increased muscular response after physical performance, while two gained a greater response before the physical performance. The other subject didn't have a difference that was noticeable.

Conclusions of Schramm were: (1) neuromuscular activity does take place in those muscles which are concerned with the imagined movement, and (2)

> after an individual overtly, kinesthetically experiences a task he is to imagine, there appears to be more neuromuscular activity during mental practice than before he physically experiences the movement (p. 62).

Summary

The purpose of this chapter was to gain insight into the benefits of mental practice and the variables affecting mental practice.

In reviewing the related literature the author found that a controversy still remained over which is more beneficial, directed mental practice or undirected mental practice. Previous experience of the learner on the motor skill and the type of motor task being tested appeared to have a bearing on the effectiveness of mental practice. Varying combinations of mental and physical practice and the use of mental practice to cause neuromuscular activity has

proved to be significant.

Richardson's (1967) conclusions, made after an extensive review of mental practice literature, stressed the importance of mental practice. He stated that:

> despite a variety of methodological inadequacies the trend of most studies indicates that mental practice procedures are associated with improved performance on the task (p. 102).

After reviewing seven studies, Richardson concluded there was a positive trend but there was no statistical significance. A projected explanation for these studies not producing significant results was that in four of the seven studies the subjects' familiarity with the skill being tested was limited. The other studies used a limited number of subjects.

Richardson, after examining eleven other mental practice studies, found them to be statistically significant.

Literature reviewed in this chapter indicated: a) subject familiarity with the skill being tested; b) the use of undirected mental practice; and c) a large group of subjects were important factors in enabling mental practice to be effective.

CHAPTER III

METHODS

Introduction

This chapter was presented in seven sections to facilitate clarity. The first section included the selection and grouping of subjects while the second section dealt with the number and length of practices. The procedures for the pre-test and post-test, the equipment used, and procedures used during the treatment are described in sections three, four, and five. Section six contains a description of the statistical tool used for an analysis of data. The final section is a summary of this chapter.

Selection and Grouping of Subjects

Subjects for the study were 24 female collegiate basketball players at the University of Wisconsin-La Crosse during the spring semester of 1979. All of the subjects had previous competitive experience and all had a performance knowledge of the physical principles of the skill being tested. Subjects were randomly assigned to one of two groups with the use of the RANDORD program of the Time Shared Basic Computer Program.

Number and Length of Practice Sessions

Group I received five minutes of mental practice

followed by physically practicing twenty-five freethrows. Group II received five minutes of programmed relaxation exercises in addition to the mental and physical practice administered to Group I. The study was conducted for a period of five days during which time the respective treatments were administered twice daily at 9:00 A.M. and 12:00 P.M.

The decision to practice twice a day and to have five minutes of the programmed relaxation exercises was based on the amount of time needed to develop effective relaxation skills (Shealy, 1977).

A review of the literature revealed five practice days to be the most beneficial from the standpoint of maintaining optimal subject interest (Whitehill, 1965).

The length of the mental practice sessions was five minutes. This length of practice concept was supported by previous research. Twining (1949), Trussell (1952), and Whitehill (1965) all concluded from their research that periods longer than five minutes duration had questionable value.

Establishing the number of freethrows at 25 for the physical performance test was determined by two factors. First, was to limit the number of attempts to avoid subject fatigue and second was to maintain a sufficient number of attempts to discriminate between subjects.

Pre-test and Post-test Measurement

The procedure followed was consistent for both groups during the pre-test and post-test. Subjects were paired up with someone from their respective group, assigned a basket, and instructed to shoot a total of 25 freethrows. During the 25 attempts, the two subjects alternated turns after shooting two freethrows each. The shooting order within groups and pairs of subjects was held constant throughout the week.

Score value was determined by assigning a value of one to each basket successfully made and zero for each missed basket. The subject's score was the sum of the number of baskets successfully made from the 50 trials attempted during both the pre-test and the post-test. Both of these tests were administered during the same time period on the two testing dates.

Equipment for the Pre-test and Post-test

The standard basketball freethrow line was used as the subjects' boundary line, while the height and physical make-up of the basket and the backboard were regulation equipment. The McGregor X10L leather basketball was used. Each subject utilized the same basket and partner for each trial. Due to the number of subjects and the time available, six different baskets were used.

Treatment Procedures

The following treatment procedures were followed by Group I, the control group, which was composed of 12 subjects and Group II, the experimental group, which was composed of 12 subjects.

Group I, the control group, reported directly to the basketball gymnasium located in Wittich Hall. A section of the gymnasium had mats placed on the floor to increase the comfort of the subjects. The subjects were instructed to: (1) place themselves in a relaxed position lying on their backs, keeping their arms and legs uncrossed; (2) close their eyes; (3) listen and concentrate on the audio tape which was played.

Group I then listened to the audio tape designed and narrated by Dr. Norman Shealy, Director of the La Crosse Pain and Rehabilitation Center, La Crosse, Wisconsin. This tape was directed mental practice describing the subjects imagining the physical performance of the freethrow (see Appendix A). After listening to the tape, the subjects were then instructed to physically practice the freethrow in pairs respective to their randomly assigned groups.

During the same time period, Group II, the experimental group, reported to another room in the same building. This room also had mats on the floor for the comfort of the subjects. These subjects were given the same instructions as Group I. They were to: (1) place themselves in a

relaxed position lying on their backs, keeping their arms and legs uncrossed; (2) close their eyes; (3) listen and concentrate on the audio tape which was played. This tape was also designed and narrated by Dr. Norman Shealy; however, the tape used for Group II included programmed relaxation exercises that lasted for a period of five minutes followed by the directed mental practice of the subjects imagining the physical performance of the freethrow (the same narration as Group I). The narrative of these audio tapes appears in Appendix B. At the conclusion of the tape, the subjects in Group II were instructed to physically practice shooting 25 freethrows.

Statistical Treatment

Analysis of covariance was utilized to examine the data. A covariate of the pre-test was used to determine if there was a significant difference between the groups in average number of freethrows made on the post-test. The purpose for this was to insure that any differences that existed in the pre-test scores of the two groups would be taken into consideration. The SPSS program ANOVA (special program ANCOVA) was used for the analysis of data in this study. The level of significance established for accepting or rejecting the null hypothesis was .05.

Summary

This chapter included an explanation by the researcher of the selection and grouping of subjects, the number and length of practice sessions, the pre-test and post-test measurement, the equipment used for testing, the treatment procedures, and the statistical treatment.

CHAPTER IV

RESULTS AND DISCUSSION

Examination of the physical and mental practice literature revealed that insufficient information was available regarding the preparation of the performer for mental practice. The study was designed to examine whether programmed relaxation exercises were effective in preparing an individual for mental practice. Thus, utilizing a mental practice setting, supplemental relaxation exercises would result in superior performance. Any effects on mental practice are reflected in improved physical performance on the certain motor task. The analysis of data was organized according to the following three categories: (1) data collected; (2) analysis of data; and (3) discussion of the results of that statistical data.

Results

A list of the subjects and their pre-test and post-test scores is displayed in Table 1. Note that twelve subjects in each group completed both the pre-test and post-test. The numerical difference between the pre-test and post-test scores for each subject is also indicated. It may be observed that nine of the twelve subjects in the experimental group and eight of the twelve subjects in the control group showed

improved freethrow shooting performances on the post-test. Table 1 also included the mean scores for the control and experimental groups on the pre-test, post-test, and the group differences between the pre-test and post-test.

As illustrated in Table 1, the combined pre-test scores of the experimental group were 188 freethrows completed as compared to 176 successful freethrows for the pre-test total of the control group. The similarity of pre-test scores indicated a relatively even skill level between the two groups.

The post-test score for the experimental group was 227 freethrows made which represented a net gain of +39 over the pre-test scoring. The post-test score of 184 for the control group represented a +8 gain for that group's pre-test scores.

The data generated from the pre-test/post-test were examined using an analysis of covariance procedure. ~~Table 2~~ The [illegible] contains the results of the analysis of covariance for the freethrow scores. The pre-test scores were used as the covariate. To be significant at the .05 level, a critical value of 3.47 was needed; at the .01 level, a value of 5.78 was needed. The F value was calculated to be 9.343 indicating a significant difference between the post-test scores for the two groups after adjustments had been made for the pre-test scores of each group.

Table 1

Pre-test and Post-test Scores for Both the Experimental and Control Groups

Experimental Group (II)				Control Group (I)			
Subject	Pre	Post	Post Minus Pre	Subject	Pre	Post	Post Minus Pre
1	6	13	+7	1	17	15	-2
2	19	18	-1	2	16	11	-5
3	17	13	-4	3	15	12	-3
4	19	18	-1	4	22	14	-8
5	13	21	+8	5	11	12	+1
6	17	20	+3	6	11	14	+3
7	16	20	+4	7	16	19	+3
8	11	17	+6	8	11	16	+5
9	14	20	+6	9	15	20	+5
10	18	20	+2	10	16	20	+4
11	20	24	+4	11	14	17	+3
12	18	23	+5	12	12	14	+2
Totals 12	188	227	+39	12	176	184	+8
$\bar{X}$	15.66	18.91	3.25		14.66	15.33	.66

Table 2

Analysis of Covariance of Freethrow Scores

Source	df	Sum of Squares	MS	F	p
Covariate (Pre-test)	1	4.370	4.370	.231	.636
Main Effects Group	1	176.615	176.615	9.343	.006
Residual	21	396.973	18.903		
Total	23	577.958	25.129		

F .05 = 3.47

F .01 = 5.78

p .01

Based on an F value of 9.343, the null hypothesis was rejected. The null hypothesis stated that there would be no significant difference in the scores obtained in the shooting of basketball freethrows between the experimental and control groups. When the post-test scores were adjusted for pre-test ability, the female basketball players receiving relaxation exercises and mental practice techniques showed significantly greater improvement than did the comparable group receiving only mental practice.

Discussion and Interpretation

A pre-test of 25 freethrows was administered in order to establish baseline data. No significant difference was found between the mean scores established by the two groups. Thus, it appeared that the subjects in the two groups possessed approximately the same freethrow shooting abilities at the beginning of the study.

Statistical analysis of the data revealed a significant difference between the two groups. The relaxation, mental, and physical practice group yielded greater achievement results than did the mental and physical practice group. Based on the results obtained, the null hypothesis was rejected.

The review of related literature revealed that the following factors affect the results of mental practice: (1) motivation of the subjects; (2) length of mental practice

sessions; (3) number of sessions; (4) number of trials; and (5) the skill level of the learner.

As members of the University of Wisconsin-La Crosse Women's Basketball Team and being interested in improving their shooting performances, the subjects of this study were all highly motivated. This would tend to meet Richardson's stipulation that motivation is of great importance for mental practice to be effective (p. 270).

The optimal length of the mental practice session, which was determined to be five minutes, was based on previous research. Twining (1949), Trussell (1952), and Whitehill (1965) all concluded from their research that periods of longer than five minutes' duration were questionable as to their value to mental practice. It was suggested that periods longer than five minutes are not beneficial to mental practice possibly because the activation level can go below that which is appropriate for performance of the skill.

The number of sessions (10) utilized in this study was supported by the amount of time needed to develop effective relaxation skills (Shealy, 1977). In addition, the selection of 25 freethrows for the physical performance portion of the study was supported by Vandell, Davis, and Clugston (1943). The use of 10 sessions should enable the subject to derive significant benefit from the relaxation exercises in order to improve physical performance. The 10

sessions were combined into a five-day period to insure greater control over the subjects. All subjects were available for this week because classes were not in session and they were not involved in any intercollegiate contests.

Clark (1960) and Corbin (1967) found there is some evidence that familiarity with the skill being practiced will increase the effect of mental practice. Other research has pointed out that the greater the skill level of the learner, the greater the effect of mental practice on the physical performance of that skill. The subjects involved in this study were highly skilled in the basketball freethrow and the study was conducted during the subjects' competitive season. These factors may have played an important part in helping attain the significant findings of this study.

In the review of literature it was noted that a void of research on relaxation exercises and their effect on performance of a physical skill does exist. However, based on the case studies reported and the present study, relaxation exercises when combined with mental practice appear to be a training technique that warrants further research and investigation.

It is felt that with the use of relaxation the learner increases his/her concentration level and gains greater motor control. As a result, subjects should be able to improve their physical performance.

Physical educators and coaches who are faced with the problem of the physical facilities being over-scheduled are offered an alternative to the physical practice setting. By using mental practice combined with relaxation exercises they may reduce the time needed to physically practice freethrows, for example, and use that time to work on other aspects of their sport.

Further research is needed to determine the skills within a given sport that may be more amenable to improvement utilizing relaxation and mental practice techniques. Based on the other conditions which must be met before mental practice and relaxation techniques are effective, it seems likely that certain skills will exhibit greater performance gains using these techniques.

CHAPTER V

CONCLUSIONS

Summary

The present investigation examined the effectiveness of programmed relaxation exercises in conjunction with mental practice on the performance of shooting basketball freethrows. The subjects for the study were 24 female intercollegiate basketball players from the University of Wisconsin-La Crosse.

The investigation utilized tapes edited by Dr. Norman Shealy, Director of the Pain and Rehabilitation Center of La Crosse, Wisconsin, which were used for the administration of two parts of the study, the mental practice session and the programmed relaxation exercises. Subjects in the experimental group participated in ten sessions of relaxation training combined with mental and physical practice. The subjects in the control group experienced ten sessions with only mental and physical practice.

Data were analyzed by means of the SPSS program ANOVA (special program ANCOVA) to examine relationships between programmed relaxation exercises, combined with mental and physical practice, in comparison to mental and physical practice only. An analysis of covariance, with the pre-test being used as the covariate, was utilized.

Results of the ANOVA procedure revealed a significant difference in the performance of shooting freethrows by female intercollegiate basketball players who participated in the programmed relaxation exercises with mental and physical practice. The F ratio obtained in the analysis of the freethrow shooting scores between groups was 9.343, significantly higher than the F ratio of 3.47 needed for rejection. Therefore, the null hypothesis that there was no significant difference in the mean scores obtained in the shooting of basketball freethrows between the experimental and control groups was rejected.

Conclusions

Based on the null hypothesis which was listed and within the limitations of the study, the following conclusion seems justified:

1. Those subjects who utilized the relaxation exercises combined with mental and physical practice significantly improved their freethrow shooting performance.

Recommendations

The present investigation led to the following recommendations for future study:

1. Examine different age groups regarding concentration and physical performance.

2. Adopt a research design utilizing various combinations of mental practice, physical practice, and/or relaxation exercises.
3. Examine other physical skill performances in a closed environment for evidence regarding improved scoring after periods of programmed relaxation exercises.

REFERENCES CITED

Bell, V. L. Sensorimotor learning from research to teaching. Pacific Palisades, Calif.: Goodyear Publishing Company, Inc., 1970.

Burns, P. L. The effect of physical practice, mental practice and mental-physical practice on the development of a motor skill. (Masters thesis, Pennsylvania State University, 1962.)

Clark, L. V. Effect of mental practice on the level of a certain motor skill. Research Quarterly, 1960, 31, 560-569.

Corbin, C. B. The effects of covert rehearsal on the development of a complex motor skill. Journal of General Psychology, 1967a, 76, 143-150.

Corbin, C. B. Effects of mental practice on skill development after controlled practice. Research Quarterly, 1967b, 38, 534-538.

Deckner, W. C., & Nideffer, R. M. A case study of improved athletic performance following use of relaxation procedures. Perceptual and Motor Skills, 1970, 30, 821-822.

Drowatzky, J. N. Motor learning principles and practices. Minneapolis: Burgess Publishing Company, 1975.

Egstrom, G. H. Effects of an emphasis on conceptualizing technique during early learning of a gross motor skill. Research Quarterly, 1964, 35, 472-481.

Freeman, G. L. The spread of neuromuscular activity during mental work. The Journal of General Psychology, 1931, 5, 479-493.

Garber, R. F. A study to determine the effects of mental practice in the acquisition of a motor skill. (Master of Education Problem, Pennsylvania State College, 1951.)

Jacobson, E. Electrical measurements of neuromuscular states during mental activities. American Journal of Physiology, 1930, 94, 22-34.

Jacobson, E. Muscular phenomenon during mental imagery. American Journal of Psychology, 1932, 44, 677-694.

Johnson, J. D. The effect of selected conceptualizing techniques upon the early learning of a gross movement. (Ph. D. thesis, University of Southern Calif., 1965.)

Jones, J. G. Motor learning without demonstration of physical practice, under two conditions of mental practice. Research Quarterly, 1965, 36, 270-276.

Kelly, D. A. The relative effectiveness of selected mental practice techniques in high school girls' acquisition of a gross motor skill. (Masters thesis, University of Washington, 1965.)

Kelsey, I. B. Effects of mental practice and physical practice upon muscular endurance. Research Quarterly, 1961, 32, 47-54.

Lawther, J. D. The learning of physical skills. Englewood Cliffs, N.J.: Prentice-Hall, 1968.

Morehouse, L. E., & Miller, A. T. Physiology of exercise. (3rd ed.) St. Louis: C. V. Mosby, 1959.

Richardson, A. Mental practice: A review and discussion, Part I. Research Quarterly, 1967, 38, 95-107.

Richardson, A. Mental practice: A review and discussion, Part II. Research Quarterly, 1967, 38, 263-273.

Sage, G. H. Introduction to motor behavior a neuropsychological approach (2nd ed.). Reading, Mass.: Addison-Wesley, 1977.

Schick, J. Effects of mental practice on selected volleyball skills for college women. Research Quarterly, 1970, 41, 88-94.

Schneider, E. C., & Karpovich, P. V. Physiology of muscular activity (3rd ed.). Philadelphia: W. B. Saunders Company, 1949.

Schramm, V. An investigation of the electromyographic responses obtained during mental practice. (Masters thesis, University of Wisconsin-Madison, 1967.)

Shaw, W. A. Imaginary exercise. Newsweek, 1939, 14, 30-31.

Shealy, C. N. 90 days to self-health. New York: The Dial Press, 1977.

Singer, R. N. Motor learning and human performance (2nd ed.). New York: Macmillan, 1975.

Smyth, M. M. The role of mental practice in skill acquisition. Journal of Motor Behavior, 1975, 7, 199-206.

Start, K. B. Kinesthesis and mental practice. Research Quarterly, 1964, 35, 316-320.

Start, K. B. Relationship between intelligence and the effect of mental practice on the performance of a motor skill. Research Quarterly, 1960, 31, 644-649.

Stebbins, R. B. Comparison of the effects of physical and mental practice in learning a motor skill. Research Quarterly, 1967, 39, 714-720.

Surburg, P. R. Audio, visual and audio-visual instructions with mental practice in developing the forehand tennis drive. Research Quarterly, 1968, 39, 728-734.

Trussell, E. M. Mental practice as a factor in the learning of a complex motor skill. (Masters thesis, University of California, 1952.)

Tuttle, W. W. The effect of attention on mental activity on the patellar tendon reflex. Journal of Experimental Psychology, 1924, 7, 401-419.

Twining, W. E. Mental practice and physical practice in learning a motor skill. Research Quarterly, 1949, 20, 432-435.

Vandell, R. A., Davis R. A., & Clugston, H. A. The function of mental practice in the acquisition of motor skills. Journal of General Psychology, 1943, 29, 243-250.

Whitehill, M. P. A comparison of different variations of mental practice on the ability of boys to learn a motor skill. (Masters thesis, University of Oregon, 1964.)

APPENDICES

APPENDIX A

TRANSCRIBED MENTAL PRACTICE PROCEDURE

FOR GROUP I

The following is a word-for-word transcription of the tape used by Group I which was developed by Dr. Norman Shealy, Director of the La Crosse Pain and Rehabilitation Center specifically for this study.

"With yourself relaxed now, see yourself standing on the floor at a basketball game. You are now up for a freethrow. See yourself take your position at the freethrow line, and as you repeat the following phrases see yourself accomplishing your goal. I see myself now, addressing the basket. I visualize the official handing me the basketball. I take a deep breath and relax, assessing the distance and my coordination. I focus upon my point of aim. I bring the ball to my anchor point. I start the motion of the ball to the basket. I feel the ball leaving my fingertips and I watch as the ball goes directly to its target through the center of the rim of the basket. And I see myself make my point. I repeat this image to myself - over and over and over again. (pause-15 seconds) I go through the sequence in my mind, seeing it, feeling myself accomplish my goal. (pause-1 minute and 15 seconds) If my mind wanders I bring it back again and again to my object, my goal. I see myself practicing and making a perfect freethrow shot. (pause-1 minute and 30 seconds) I recognize that practicing in this

APPENDIX B