The Effects of Mental Warm-up on Jump Shooting Accuracy Among Selected Boys' High School Basketball Players

Thomas J. Murphy
THE EFFECTS OF MENTAL WARM-UP ON JUMP
SHOOTING ACCURACY AMONG SELECTED BOYS'
HIGH SCHOOL BASKETBALL PLAYERS

This thesis is approved as a creditable and independent
investigation by a candidate for the degree, Master of Science, and is
acceptable for meeting the thesis requirements for this degree.
Acceptance of this thesis does not imply that the conclusions reached
by the candidate are necessarily the conclusions of the major
department.

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thesis adviser  

head, health, physical education, and recreation department
The purpose of this study was to determine the effect of mental practice, as a warm-up activity, on performance in shooting accuracy as measured by success in the execution of a fifteen foot jump shot at an angle of forty-five degrees. A second purpose was to determine whether a relationship existed between the change in shooting accuracy from pre-test to post-test and academic achievement as measured by each subject's grade point average. The subjects were sophomore and junior members of the Roncalli High School basketball team of Aberdeen, South Dakota. They were divided into two groups through the use of a stratified random allocation procedure. The mental practice form of warm-up consisted of visual instruction, verbal instruction, and imaginary practice. Although the mental practice group experienced greater improvement than members of the control group, these gains in shooting accuracy were not significant at the .05 level. Although not significant ($r_{.05} = .67$), there was a very low positive correlation ($r = .21$) between improvement in shooting accuracy and grade point averages among members of the mental practice group.
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The author also wishes to thank his son, T.J., who gave up many hours of companionship during the writing of this thesis.

TJM
Significance of the Study

Numerous studies have been completed in the area of mental practice. Several of the findings indicated that some type of mental practice will facilitate the learning of motor skills for subjects above the novice level, especially if used in conjunction with physical practice.

The present researcher found no evidence to support the use of mental practice as a type of warm-up prior to performing complicated skills in a specific sport. In view of these findings, the present author believed that a mental practice type of warm-up might be beneficial in improving shooting accuracy.

Kellner has stated that, "Most coaches spend a great deal of time attending clinics, reading books and magazines, and sharing ideas with other coaches."1 He also observed that they become experts on many phases of the game, but fail to develop mental habits in their players which help them perform effectively.2

The present study was conducted to determine whether mental practice might be effective as a form of warm-up in helping players to develop a higher degree of accuracy in shooting the jump shot. The


2Ibid.
present author chose the jump shot in the current study because as Sharman states, "The jump shot is the most effective and potent shot in basketball today."\(^3\)

**Statement of the Problem**

The purpose of this study was to determine the effect of mental practice, as a warm-up activity, on performance in shooting accuracy as measured by success in shooting a fifteen foot jump shot at an angle of forty-five degrees. A second purpose was to determine whether there might be a relationship between the change in shooting accuracy from pre-test to post-test, and academic achievement as measured by the subjects' grade point averages.

**Hypotheses**

1. There is no significant difference in shooting accuracy between members of the experimental and control groups.

2. There is no significant relationship between the change in shooting accuracy and grade point average among members of the experimental group.

**Limitations and Delimitations**

1. Subjects were limited to sophomores and juniors who were members of the sophomore, junior varsity, and varsity basketball teams at Roncalli High School, Aberdeen, South Dakota.

2. No attempt was made to control activity of the subjects outside the experimental situation.

3. It was assumed that members of the experimental group followed directions given for the mental practice warm-up period.

4. No attempt was made to determine whether members of the control group were also using some form of mental practice.

5. The study was conducted during the first six weeks of the basketball season.

Definition of Terms

Mental Practice. "The symbolic rehearsal of a physical activity in the absence of any gross muscular movements."4

Mental-Physical Practice. A combination of physical and mental practice.5

Physical Practice. The actual practice of a specific task.

Verbal Instruction. Spoken instructions. For purposes of this study, verbal instruction will also refer to instructions given by recorded message.

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CHAPTER II
REVIEW OF RELATED LITERATURE

During the past 30 years several studies have been completed relative to the effects of mental practice on various skills. Little research has been done, however, using mental practice as an aid to the improvement of basketball skills.

The review of related literature is divided into three parts: (1) Past research utilizing mental practice, (2) The use of mental practice in basketball, and (3) Mental practice as applied to the warm-up period.

Past Research Utilizing Mental Practice

Twining conducted a study comparing mental practice with physical practice in the learning of a motor skill. The skill involved was a ring-toss. There were three groups of 21 college men. One group was a control group, a second was a mental practice group, and the third group practiced physically. On the first day a pre-test was given to each group which involved tossing 210 rings. During the course of the study subjects were asked to refrain from thinking about, talking about, practicing, or observing the skill between periods. The physical practice group improved 137 percent and the mental practice group improved 36 percent. Twining concluded that both types of

practice yielded statistically significant improvement in performance.  
Boetel compared the effectiveness of three methods of instruction in the learning of tumbling stunts. She used 21 volunteer females who were freshmen in college. There were three groups: a mental practice group, a physical practice group, and a mental-physical group. Each group received instruction three times per week for five weeks. Tumbling stunts were used as test items. The first five meetings for each group were devoted to learning and practicing the stunts. Beginning with the sixth meeting, the stunts were demonstrated and explained verbally to the physical practice group. The subjects practiced each stunt the same number of times. The mental practice group had instructions read to them, viewed a training film, and were told to visualize themselves performing the stunt for a period of six minutes. The mental-physical practice group had practice periods equally divided between physical practice and mental practice. At the end of the training period all subjects were judged by five physical educators. Boetel found no significant difference between the physical practice group and the mental-physical practice group. The mental practice group was found to be significantly inferior to the other groups.

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2Ibid., p. 435.
3Norma Boetel, "The Effects of Physical Practice, Mental Practice, and Mental-Physical Practice on the Learning of Selected Basic Tumbling Stunts" (Unpublished Master's thesis, South Dakota State University, 1965.)
Stebbins attempted to determine the effectiveness of mental practice and physical practice on the learning of a motor skill. He used 93 male volunteers, performing the skill of throwing balls at a distance of 15 feet from a target. There were five different groups: (1) A control group, (2) A mental practice group, (3) A physical practice group, (4) A mental-physical practice group, and (5) A physical-mental practice group. Members of the mental practice group each stood behind a person in the physical practice group and observed as the physical practice subjects threw the balls. Subjects of the mental practice group visualized themselves throwing the ball. The mental-physical group used mental practice for the first ten days and physical practice for the next eight days. The physical-mental group used physical practice during the first ten days, and switched to mental practice for the last eight days. Stebbins concluded that mental practice alone did not produce significant improvement. The greatest improvement was with the two combination methods.

Jones compared directed mental practice with undirected mental practice. He concluded that subjects could best achieve a proper image of the skill if given information and then allowed to form an image

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6Ibid., p. 720.
on their own.\textsuperscript{7}

Several modes of mental practice were considered by Surburg. These included audio instruction, visual instruction, and audio-visual instruction. It was concluded that audio instruction proved to be effective in the learning of motor skills.\textsuperscript{8}

Use of Mental Practice in Basketball

Vandell, Davis, and Clugston attempted to determine the function of mental practice in the acquisition of motor skills.\textsuperscript{9} The skills involved were dart throwing and shooting the free throw in basketball. Males representing three different age levels (junior high school, senior high school, and college freshmen) served as subjects. Each group included 12 subjects and was subdivided into three subgroups: a control group, a physical practice group, and a mental practice group. The control group was given a pre-test on the first day and a post-test on the twentieth day. The physical practice subjects performed the skill each day of the experiment. The mental practice group had a pre-test on the first day and a post-test on the twentieth. During each of the other days they had 15 minutes of mental


practice. On the final test for the subjects who shot free throws, the control group improved two percent, the physical practice group improved 41 percent, and the mental practice group improved 43 percent. The junior high boys and the college freshmen were tested on dart throwing. On the final test the junior high school boys achieved the following: the control group decreased two percent, the physical practice group increased seven percent, and the mental practice group improved four percent. The college freshmen had no change for the control group, an increase of 23 percent for the physical practice group, and the mental practice group improved 22 percent. The authors concluded that mental practice is almost as effective as physical practice in dart throwing and shooting the free throw in basketball.\textsuperscript{10}

Clark investigated the possible influence of mental practice in the execution of the Pacific-Coast One-Hand Foul Shot.\textsuperscript{11} He utilized 36 boys from each of four high schools. These were equally divided among varsity, junior varsity, and novice groups. The physical practice groups attempted five warm-up shots and 25 shots for record each day for 14 days. The mental practice group attempted 25 shots the first day and 25 additional shots the last day. On every other day they read work sheets and then imagined themselves shooting five warm-up shots and 25 other shots. The results showed both physical and

\begin{itemize}
\item \textsuperscript{10}Ibid., p. 250.
\end{itemize}
ment al practi ce gr oups ha d sig nif i can t gai ns. The use of mental practice was nearly as effective as physical practice for varsity and junior varsity groups but not for novice performers.12

Start used underarm free throws as a test item to determine whether subjects could improve by using mental practice.13 There were nine daily sessions, each five minutes in length. The subjects listened to the instructor explain the technique and mentally pictured themselves performing the skill while listening to the instructor. They were then asked to mentally picture themselves shooting free throws. Start found no significant improvement over pre-test scores when the post-test was administered. He further concluded there was no relationship between performance and intelligence.14

Kellner has offered some recommendations for the application of mental practice to the improvement of certain basketball skills in high school varsity basketball players. The first is the fact that a player must have a good self-image to be able to perform up to his ability. Secondly, if a player's self-image is improved, it will improve his performance. In explaining the third principle, he stated that, "The mind does not always know the difference between the real

12 Ibid., p. 568.


14 Ibid., p. 649.
Mental Practice as Applied to the Warm-up Period

Little evidence is available to support the use of mental practice as a warm-up activity.

Drowatzky stated that mental practice may be used in several ways: (1) As an aid in learning new skills, (2) To review strategy, and (3) As a review before performance.16

Singer has reported that mental processes may help to serve as a basis for warm-up.17 He reported that Sharman has recommended staring at the basket from different areas of the basketball floor.18 He also reported that some research has shown that mental practice may be helpful as practice in learning a skill, but the benefit of mental practice as a warm-up before a game is difficult to determine. He added, however, that the importance of mental preparation before competition should never be underestimated.19


18Ibid., p. 271.

19Ibid., pp. 205 and 360.
CHAPTER III

METHODS AND PROCEDURES

Organization of the Study

The collection of data began November 8, 1976, and ended December 16, 1976. The purpose of the study and procedures to be followed were explained to all subjects prior to the administration of the pre-test. The pre-test was administered November 8, 9, 10, and 11. The pre-test consisted of 20 jump shots each day, attempted at an angle of 45 degrees and at a distance of 15 feet from the basket. Upon completion of the pre-test, subjects were assigned to control and experimental groups using a stratified random allocation procedure. The subjects were ranked according to pre-test scores. After ranking, the subjects were split into groups of four. A coin flip was then used to assign subjects to group A or group B. Two subjects from each group of four became members of group A and the other two joined group B. Grade point averages of the members of the two groups were then compared. Since they were very similar (3.03 for group A, and 3.08 for group B), further adjustment of group membership was not required. A coin flip was used to determine whether group A or group B would be the experimental group.

The experimental group received a mental practice form of warm-up four days a week for the duration of the study. The control group received no special treatment. During the time that the experimental group was receiving the treatment, the control group was engaged in
shooting drills supervised by the head varsity basketball coach.

Source of the Data

The subjects were sophomores and juniors who were members of the sophomore, junior varsity, and varsity basketball teams of 1976-1977 at Roncalli High School, Aberdeen, South Dakota. All members who scored below 60 percent of the required number of trials in the pre-test were selected to participate in the present study. They were divided into two groups by using a stratified random allocation procedure. The ages, heights, weights, and grade point averages for each subject are presented in Table I.

Subjects of the control group were compared with subjects of the experimental group to determine if there was a significant difference in change in shooting accuracy following the treatment period. Subjects were compared on both pre-test and post-test results.

Grade point averages were obtained to improve the grouping process in the event that academic performance might be related to one's ability to benefit from the use of mental practice. Grades used to calculate the grade point average were taken from the subjects' records for the 1975-1976 academic year. Grade point averages were based on a four point scale, and were recorded to the nearest tenth.

Administration of the Treatment

The warm-up procedure consisted of visual instruction, verbal instruction, and imaginary practice. The visual instruction was used for only the first four days of the study. The verbal instruction and
### Table I

**Characteristics of Members of the Experimental and Control Groups**

<table>
<thead>
<tr>
<th>Group</th>
<th>Players</th>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
<th>GPA</th>
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</thead>
<tbody>
<tr>
<td>E</td>
<td>J.Z.</td>
<td>15</td>
<td>5' 8&quot;</td>
<td>175</td>
<td>3.1</td>
</tr>
<tr>
<td>E</td>
<td>T.P.</td>
<td>15</td>
<td>6' 2&quot;</td>
<td>145</td>
<td>3.7</td>
</tr>
<tr>
<td>E</td>
<td>G.M.</td>
<td>15</td>
<td>5' 4&quot;</td>
<td>114</td>
<td>2.3</td>
</tr>
<tr>
<td>E</td>
<td>D.B.</td>
<td>16</td>
<td>5'10&quot;</td>
<td>135</td>
<td>3.1</td>
</tr>
<tr>
<td>E</td>
<td>P.B.</td>
<td>15</td>
<td>6' 3&quot;</td>
<td>155</td>
<td>3.4</td>
</tr>
<tr>
<td>E</td>
<td>C.G.</td>
<td>15</td>
<td>5'10&quot;</td>
<td>130</td>
<td>2.6</td>
</tr>
<tr>
<td>E</td>
<td>R.Z.</td>
<td>15</td>
<td>5' 5&quot;</td>
<td>128</td>
<td>3.8</td>
</tr>
<tr>
<td>E</td>
<td>K.C.</td>
<td>16</td>
<td>6' 1&quot;</td>
<td>164</td>
<td>2.4</td>
</tr>
<tr>
<td>E</td>
<td>R.D.</td>
<td>16</td>
<td>6' 0&quot;</td>
<td>176</td>
<td>2.9</td>
</tr>
<tr>
<td>C</td>
<td>D.B.</td>
<td>16</td>
<td>5'10&quot;</td>
<td>145</td>
<td>3.7</td>
</tr>
<tr>
<td>C</td>
<td>S.S.</td>
<td>17</td>
<td>6' 2&quot;</td>
<td>190</td>
<td>2.9</td>
</tr>
<tr>
<td>C</td>
<td>D.L.</td>
<td>16</td>
<td>5'11&quot;</td>
<td>155</td>
<td>3.2</td>
</tr>
<tr>
<td>C</td>
<td>J.W.</td>
<td>15</td>
<td>5'10&quot;</td>
<td>125</td>
<td>3.4</td>
</tr>
<tr>
<td>C</td>
<td>M.H.</td>
<td>17</td>
<td>5'10&quot;</td>
<td>150</td>
<td>2.8</td>
</tr>
<tr>
<td>C</td>
<td>J.B.</td>
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<td>5'10&quot;</td>
<td>135</td>
<td>2.4</td>
</tr>
<tr>
<td>C</td>
<td>B.S.</td>
<td>15</td>
<td>6' 0&quot;</td>
<td>160</td>
<td>3.7</td>
</tr>
<tr>
<td>C</td>
<td>P.R.</td>
<td>15</td>
<td>5' 7&quot;</td>
<td>132</td>
<td>2.3</td>
</tr>
<tr>
<td>C</td>
<td>P.P.</td>
<td>16</td>
<td>5'11&quot;</td>
<td>160</td>
<td>3.3</td>
</tr>
</tbody>
</table>

E = Experimental group  
C = Control group
imaginary practice were administered four times a week for four weeks. The treatment was given in a quiet, darkened room with the subjects sitting on chairs of uniform height. During the first four days, treatment lasted nine minutes each day. After the first four days the treatment lasted four minutes each day.

The visual instruction consisted of the use of an overhead projector to illustrate techniques related to body balance and control, stance, proper grip, position of ball and elbow, release of the ball, the correct jumping procedure, and point of release. Each diagram was explained to the subjects. They were selected from a series of diagrams developed by Sharman. A copy of each diagram used for the present study may be seen in Appendix A.

Verbal instruction involved the use of a tape recording prepared by the researcher which was designed to guide the subjects through each stage of the jump shot. The tape contained statements which were descriptive of the performance of a jump shot. These statements were derived from a rating scale which was developed by the present author and may be seen in Appendix B. The subjects were instructed to imagine themselves performing each part of the jump shot as they heard it being described. A script of the tape is presented in Appendix C.

After listening to the tape recording, the subjects were asked

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to spend some time imagining themselves shooting a jump shot. No visual or verbal cues were used for this part of the treatment.

During this period of time, when the experimental group was receiving the treatment, the control group was engaged in shooting drills under the supervision of the head varsity basketball coach.

Upon completion of the treatment, the subjects were taken to the gymnasium to shoot 20 jump shots from an angle of 45 degrees, at a distance of 15 feet from the basket. Ten consecutive shots were attempted from one side of the basket and were followed by ten consecutive shots from the other side.

The selection of verbal and audio instruction was supported by Surburg who found that these methods were significant factors in the improvement of the forehand tennis drive when used in conjunction with mental practice. Surburg found in his study with junior college men that of the two, verbal instruction was more effective.²

It was hoped that the verbal and audio instruction would enable the subjects to develop a mental picture of the proper form to be used in shooting. Maltz has stated that, "Mental pictures offer us an opportunity to 'practice' new traits ... your nervous system cannot tell the difference between an actual experience and one that is vividly imagined."³


Singer has observed that to improve performance an individual must have a correct image of the task in mind. He needs an image of a correct model with which to compare his performance. Once this is established, he can attempt to improve his performance until it matches the image he has in mind.\footnote{Robert N. Singer, Motor Learning and Human Performance (New York: MacMillan Publishing Co., Inc., 1975), p. 389.}

**Collection of the Data**

Prior to the collection of the data, all subjects were told that the present author could not find conclusive evidence as to whether mental practice was beneficial to the learning of a skill. Also, a rating scale developed by the present author which included the components of proper jump shooting technique was distributed to all subjects. All subjects were initially shown the jump shooting technique diagrams which were presented to members of the experimental group during the first four days of the treatment.

The project began on November 8, 1976, and ended on December 16, 1976. The first four days were used for the pre-test, and the last four days for the post-test. The treatment was administered four days each week from November 15 to December 9. During each day of the treatment all subjects were required to shoot 20 jump shots from an angle of 45 degrees, and at a distance of 15 feet from the basket. Ten shots were taken from each side of the basket. The present author assumed a position where he could observe both the shooter and the
basket. The number of shots made was recorded for all subjects.

A jump shot was chosen because it was believed that a jump shot would allow for greater discrimination between each subject's performance than would a set shot or a free throw. A jump shot could not be recorded as such unless the ball was released while both feet of the performer were off the floor. After observing the shooting by team members prior to the administration of the pre-test the present writer concluded that an angle of 45 degrees, and a distance of 15 feet, would be the most appropriate location for the subjects during the test. He believed that shots of this degree of difficulty would serve to accurately discriminate shooting accuracy among subjects in the present study.
CHAPTER IV

ANALYSIS AND DISCUSSION OF RESULTS

Organization of the Data for Analysis

The data collected in this study were analyzed using two statistical procedures. The first analysis was performed to determine whether any significant change occurred in shooting accuracy from pre-test to post-test between members of the experimental and control groups. For this evaluation the analysis of variance procedure was employed as suggested by the Experiment Station Statistician at South Dakota State University. The .05 level of confidence was accepted as the minimum level needed for rejection of the hypothesis.

The second analysis consisted of the computation of a correlation between the change in shooting accuracy from pre-test to post-test and grade point average among members of the experimental group. The Pearson Product-Moment method was used in this instance.

Analysis of the Data

Analysis of change in shooting accuracy. Shooting accuracy and grade point averages for members of the control group are presented in Table II. The amount of change for each member of this group is also included. It was observed that the average change in shooting accuracy among members of the control group was an improvement of 2.08

<table>
<thead>
<tr>
<th>Players</th>
<th>Pre-Test Average</th>
<th>Post-Test Average</th>
<th>Change in Shooting Accuracy</th>
<th>Grade Point Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.B.</td>
<td>11.3</td>
<td>13.0</td>
<td>1.7</td>
<td>3.7</td>
</tr>
<tr>
<td>S.S.</td>
<td>11.0</td>
<td>12.8</td>
<td>1.8</td>
<td>2.9</td>
</tr>
<tr>
<td>D.L.</td>
<td>10.5</td>
<td>13.3</td>
<td>2.8</td>
<td>3.2</td>
</tr>
<tr>
<td>J.W.</td>
<td>10.3</td>
<td>11.0</td>
<td>0.7</td>
<td>3.4</td>
</tr>
<tr>
<td>M.H.</td>
<td>9.5</td>
<td>12.3</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>J.B.</td>
<td>9.3</td>
<td>11.8</td>
<td>2.5</td>
<td>2.4</td>
</tr>
<tr>
<td>B.S.</td>
<td>9.3</td>
<td>10.5</td>
<td>1.2</td>
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<tr>
<td>P.R.</td>
<td>9.0</td>
<td>11.8</td>
<td>2.8</td>
<td>2.3</td>
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<tr>
<td>P.P.</td>
<td>7.5</td>
<td>10.0</td>
<td>2.5</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Average change in shooting accuracy = 2.08
### TABLE III

NUMBER OF SUCCESSFUL TRIALS AND GRADE POINT AVERAGE FOR MEMBERS OF THE EXPERIMENTAL GROUP

<table>
<thead>
<tr>
<th>Players</th>
<th>Pre-Test Average</th>
<th>Post-Test Average</th>
<th>Change In Shooting Accuracy</th>
<th>Grade Point Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>J.Z.</td>
<td>11.5</td>
<td>12.8</td>
<td>1.3</td>
<td>3.1</td>
</tr>
<tr>
<td>G.M.</td>
<td>11.0</td>
<td>12.3</td>
<td>1.3</td>
<td>2.3</td>
</tr>
<tr>
<td>T.P.</td>
<td>10.8</td>
<td>14.5</td>
<td>3.7</td>
<td>3.7</td>
</tr>
<tr>
<td>D.B.</td>
<td>10.5</td>
<td>13.0</td>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>P.B.</td>
<td>10.0</td>
<td>12.0</td>
<td>2.0</td>
<td>3.4</td>
</tr>
<tr>
<td>C.G.</td>
<td>9.8</td>
<td>12.0</td>
<td>2.2</td>
<td>2.6</td>
</tr>
<tr>
<td>R.Z.</td>
<td>8.3</td>
<td>12.3</td>
<td>4.0</td>
<td>3.8</td>
</tr>
<tr>
<td>K.C.</td>
<td>8.3</td>
<td>12.3</td>
<td>4.0</td>
<td>2.4</td>
</tr>
<tr>
<td>R.D.</td>
<td>6.3</td>
<td>12.0</td>
<td>5.7</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Average change in shooting accuracy = 2.96
successful shots per 20 trials. Table III contains shooting accuracy and grade point averages for members of the experimental group. The amount of change for each member of this group is also included. It was observed that the average change in shooting accuracy among members of the experimental group was an improvement of 2.96 successful shots per 20 trials.

The one way analysis of variance procedure which was used for determination of differences between groups in shooting accuracy is presented in Table IV.

**TABLE IV**

**ONE WAY ANALYSIS OF VARIANCE FOR DETERMINATION OF DIFFERENCES BETWEEN GROUPS IN SHOOTING ACCURACY**

<table>
<thead>
<tr>
<th>Source of Variance</th>
<th>df</th>
<th>ss</th>
<th>ms</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>1</td>
<td>3.467</td>
<td>3.467</td>
<td>2.49</td>
</tr>
<tr>
<td>Remainder</td>
<td>16</td>
<td>22.249</td>
<td>1.390</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>25.716</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*F .05 (1/16) = 4.49

An F ratio of 2.49 was computed, which was less than the critical ratio (4.49) which was required for significance at the .05 level.

Analysis of possible relationships between grade point average and change in shooting accuracy. The grade point averages for members of the experimental group were analyzed to determine whether
any relationship may have existed between change in shooting accuracy and academic achievement. The use of the Pearson Product-Moment procedure yielded a correlation coefficient of .21. For this to be significant at the .05 level, with seven degrees of freedom, a coefficient of .67 was required. Although this was not significant, according to Weber and Lamb, a coefficient of .21 is regarded as a low positive correlation.

Discussion of the Results

Within the limitations of the present study, it can be concluded that the use of a mental practice form of warm-up as opposed to a physical practice warm-up does not significantly improve jump shooting accuracy.

The present author was unable to locate any previous studies with a design similar to that of the present investigation. Several studies comparing the effects of mental practice and physical practice, however, were located. Some investigators had revealed that although mental practice was not significantly better than physical practice its

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use yielded gains in skill acquisition. Other researchers indicated that mental practice did not lead to significant improvement when compared with physical practice.

Boetel included a mental-physical practice group in her study involving the learning of tumbling stunts. This format is similar to that employed by the experimental group of the present study, in that physical performance was immediately preceded by mental practice. Boetel's mental-physical practice group had sessions equally divided between physical practice and mental practice. She found no significant difference between performance by the mental-physical practice group and that of the physical practice group. A third group (a mental practice group) was found to be significantly inferior, in learning tumbling stunts, when compared with the other groups.


9 Norma Boetel, "The Effects of Physical Practice, Mental Practice, and Mental-Physical Practice on the Learning of Selected Basic Tumbling Stunts" (Unpublished Masters thesis, South Dakota State University, 1965.)
Although findings in the present study were not significant, it would appear that the data adds some measure of support to the concept that mental practice may be helpful as a warm-up in the improvement of accuracy in the execution of the jump shot in basketball. Although the experimental group did not improve to a level regarded as significant, it was observed that the average change in shooting accuracy (as shown in Tables II and III) was slightly greater for the experimental group. This would indicate that the experimental group derived at least as much benefit from a mental practice form of warm-up as did the control group which employed a physical practice form of warm-up.

In view of these findings, it may be concluded that a mental practice form of warm-up would be a beneficial alternative to a physical warm-up consisting of shooting drills.

Since the present author was also one of the basketball coaches responsible for subjects within the present study, he had the opportunity to view their progress on a daily basis. It is interesting to note that as the basketball season progressed, members of the experimental group did not exhibit any major deficiencies in shooting form. It was noted, however, that several members of the control group experienced some difficulty with shooting form as the season progressed. Singer has suggested that to improve performance an individual must have a correct image of the task.10

Through the use of visual aids, a correct image was provided to the experimental group on five different occasions, while the control group was exposed to the visual aids on only one occasion. In retrospect, it would be interesting to expose those athletes experiencing shooting form difficulties to the treatment employed in the present study, to determine whether the insight gained through the use of visual aids might have an effect on shooting form. For example, subject R.D. in the experimental group (see Table III) obtained the lowest pre-test score of all subjects and experienced the greatest improvement in accuracy, and from subjective evaluations of his coaches, made considerable improvement in his shooting form.

In the present study grade point average was used as one criteria for grouping since it was believed that it might serve as a measure of the students' ability to benefit from instruction. Only a very low correlation (.21) existed between a students' grade point average and his level of improvement in shooting accuracy. Start concluded that there was no relationship between ability to benefit from the use of mental practice in the development of free throw shooting accuracy and intelligence. Since no completely accurate measure of intelligence or academic achievement has yet been developed, this question remains unanswered. Another factor which may obscure the influence of grade point average on change in shooting accuracy is the

fact that those with higher grade point averages in both groups tended
to have higher pre-test scores. For example, of the top four pre-test
scores, three were obtained by subjects with the highest grade point
averages in both groups. Since their scores were higher initially,
it would seem logical that it would be more difficult for them to
realize significant improvement than for those with lower pre-test
scores.

The first hypothesis which stated there would be no
significant difference in shooting accuracy between members of the
experimental and control groups could not be rejected. Similarly,
it was not possible to reject the second hypothesis, which stated that
there is no significant relationship between the change in shooting
accuracy and grade point average among members of the experimental
group.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of this study was to determine the effect of mental practice, as a warm-up activity, on performance in shooting accuracy as measured by success in shooting a fifteen foot jump shot at an angle of forty-five degrees. A second purpose was to determine whether there might be a relationship between the change in shooting accuracy from pre-test to post-test, and academic achievement as measured by the subjects' grade point averages.

The subjects were sophomores and juniors who were members of the sophomore, junior varsity and varsity basketball teams during the 1976-1977 season at Roncalli High School, Aberdeen, South Dakota. They were divided into two groups by using a stratified random allocation procedure.

The mental practice form of warm-up consisted of visual instruction, verbal instruction, and imaginary practice. The visual instruction, which was used for only the first four days of the treatment, consisted of the use of an overhead projector to illustrate various aspects of jump shooting form. The verbal instruction involved the use of a tape recording prepared by the researcher. After listening to the tape recording, the subjects were asked to spend some time imagining themselves shooting a jump shot.

The project began on November 8, 1976, and ended on December 16,
1976. The first four days were used for the pre-test, and the last four days for the post-test. The treatment was administered four days each week from November 15, 1976, to December 9, 1976.

The analysis of variance procedure was employed to determine whether any significant change occurred in shooting accuracy from pre-test to post-test between members of the experimental and control groups. The .05 level of confidence was accepted as the minimum level needed for rejection of the hypothesis. No significant changes occurred in shooting accuracy between members of the experimental and control groups. A second analysis involved the computation of a correlation between the change in shooting accuracy from the pre-test to post-test and grade point average among members of the experimental group. Results showed only a very low positive correlation.

Conclusions

Within the limitations of this study the following conclusions seem warranted:

1. Mental practice, as a warm-up activity, did not significantly improve shooting accuracy of the experimental group as opposed to the control group.

2. There is a very low positive relationship between the change in shooting accuracy and the grade point averages of members of the experimental group.

Implication

Basketball coaches may wish to consider the use of a mental
practice form of warm-up as an alternative to physical warm-up in the improvement of shooting accuracy.

**Recommendations for Further Research**

In consideration of the results of this study the following recommendations are made:

1. That a similar study be conducted using a larger number of subjects.
2. That similar studies be conducted using groups of athletes with different levels of experience.
3. Athletes with major deficiencies in shooting form should be identified and exposed to the treatment employed in the present study.
4. A similar study should be conducted at a time other than during the basketball season.
5. Replicate the present study adding another experimental group which would engage in a mental practice form of warm-up and a physical practice warm-up on an every other day basis.
6. Replicate the present study adding an additional experimental group which would receive both a mental practice form of warm-up and a physical practice warm-up on the same day.
BIBLIOGRAPHY

BOOKS


PERIODICALS


UNPUBLISHED MATERIAL


BODY BALANCE AND CONTROL

INCORRECT
CENTER OF GRAVITY TOO LOW; PLAYER BECOMES CRAMPED AND TIED UP

CORRECT
ON BALANCE, WITH CENTER OF GRAVITY IN COMPLETE CONTROL

INCORRECT
CENTER OF GRAVITY TOO HIGH; PLAYER BECOMES TOP HEAVY AND OFF BALANCE
STANCE

Correct Head and Feet Position - The head should be in the middle and directly between the feet on all shots for comfort and balance.

One Hand Set Shot

If right-handed, the right foot should be forward and pointing toward basket. The left foot is back and pointing out at approximately 50° to 45° angle.

Two Hand Set Shot

Usually the left foot is slightly forward of the right foot. Feet should be spread enough to be comfortable and on balance.

Jump Shot

Feet should be lined up and perpendicular, approximately the same width as the shoulders. The desired stance is formed by the strongest jumping position.

Incorrect Head Position

When head position is too far forward or backward between the feet, it will place the player in an awkward and off-balance position.

Mean too far forward

Mean too far backward
PROPER GRIP

- Slight space between ball and palm of hand
- Wrist should be cocked while gripping ball before shooting and releasing
- Ball should rest in the pads of the finger tips for proper grip
- Pressure points for correct grip: pads of fingers only should touch the ball
Ball should be held in finger tips, well balanced between thumb and fingers in V position. Fingers should be spread in comfortable position for maximum shooting accuracy.
POSITION OF BALL AND ELBOW

**CORRECT**

The ball should be between the shoulder and eyes, with the elbow in line with the basket and close to the body.

**INCORRECT**

The ball and elbow are too far from the body, creating an unsteady, awkward position.

**INCORRECT**

The elbow and ball are too far in front of the body, which hinders free and relaxed action.
RELEASE OF BALL

CORRECT

BALL SHOULD BE RELEASED
OFF FINGERS IT SHOULD ROLL
OFF FINGER TIPS IN A BACKWARD
MOTION TO CREATE A GOOD
BACKSPIN WHICH PRODUCES A
SOFT TOUCH

SHOULD SNAP WRIST DOWN
TO PRODUCE CORRECT FOLLOW
THROUGH

ELBOW SHOULD BE IN FRONT
OF BALL AND POINTED TOWARD BASKET

WRIST SHOULD BE COCKED

INCORRECT

NO BACKSPIN WHEN BALL
IS PUSHED INSTEAD OF
ROLLING OFF FINGER TIPS

BALL GRIPPED TOO
LOW IN PALM OF
HAND

NO WRIST COCK
STIFF WRIST ACTION

ELBOW BEHIND BALL
INSTEAD OF IN FRONT

STIFF WRIST PRODUCES
INCORRECT FOLLOW THROUGH
JUMP SHOT

Ball should be released at very peak of jump for greatest accuracy and control.

If ball is released on way up or down from peak of jump, accuracy and control will usually suffer.
JUMP SHOT

INCORRECT
A LATERAL JUMP WILL
HINDER MAXIMUM
SHOOTING EFFICIENCY

CORRECT
FOR MAXIMUM
EFFICIENCY, A
PLAYER SHOULD
JUMP STRAIGHT UP
IN LINE WITH THE
BASKET

INCORRECT
A LATERAL JUMP WILL
CREATE A VERY DIFFICULT
OFF - BALANCE SHOT
## JUMP SHOT RATING SCALE

**Directions:** Place a check (✓) mark in front of each category which the shooter performs correctly. Observe at least twenty-five shots. If possible, rate the person more than once, but not on the same day.

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>CATEGORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Body position, balance and control before leaving the floor</td>
<td>A. The knees are slightly bent.</td>
</tr>
<tr>
<td></td>
<td>B. The body is square to the basket or the shooting side may be turned slightly toward the basket.</td>
</tr>
<tr>
<td></td>
<td>C. The foot on the side of the shooting hand is slightly forward in relation to the other foot and is pointed toward the basket.</td>
</tr>
<tr>
<td></td>
<td>D. The feet are approximately shoulder width apart.</td>
</tr>
<tr>
<td></td>
<td>E. The head is directly over the center of the feet.</td>
</tr>
<tr>
<td>2. Grip of the ball</td>
<td>A. The ball is held by the fingers and thumb.</td>
</tr>
<tr>
<td></td>
<td>B. The ball is not in the palm of the hand.</td>
</tr>
<tr>
<td></td>
<td>C. The fingers are spread apart.</td>
</tr>
<tr>
<td></td>
<td>D. The thumb and forefinger form a V.</td>
</tr>
<tr>
<td></td>
<td>E. The non-shooting hand helps to control the ball until just before the shot, then it drops away from the ball.</td>
</tr>
<tr>
<td>3. Ball and elbow position</td>
<td>A. The elbow is directly under the ball.</td>
</tr>
<tr>
<td></td>
<td>B. The hand, forearm, and elbow are all in a straight line with the side of the body.</td>
</tr>
<tr>
<td></td>
<td>C. When the shooter cocks his elbow, the elbow is ahead of the ball and pointed toward the basket.</td>
</tr>
<tr>
<td></td>
<td>D. The ball is held close to the chest before the shot begins.</td>
</tr>
<tr>
<td></td>
<td>E. On a jump shot the ball is carried to a position above the head before shooting the ball.</td>
</tr>
<tr>
<td>4. Release of the ball</td>
<td>A. The ball is released at the top of the jump.</td>
</tr>
<tr>
<td></td>
<td>B. There is a quick elbow extension.</td>
</tr>
<tr>
<td></td>
<td>C. There is a cocking of and then a snap of the wrist and fingers.</td>
</tr>
<tr>
<td></td>
<td>D. The forefinger is the last finger to provide impetus giving the ball backspin.</td>
</tr>
<tr>
<td></td>
<td>E. Reach up toward the target not out toward it (strive for a 45° arc).</td>
</tr>
</tbody>
</table>
5. Follow through
   A. The wrist snaps down and outward
   B. The forefinger points toward the target
   C. The arm is fully extended
   D. The head is facing the target
   E. The shooter lands in the same spot he jumped from (landing slightly ahead of or behind the spot is acceptable)
APPENDIX C
TRANSCRIPT OF THE MENTAL WARM-UP TAPE

First of all, everyone please assume a comfortable position and then close your eyes. As you listen to the tape imagine yourself doing each of these things properly.

Let us begin with body position and control. The feet are approximately shoulder width apart. The foot on the side of the shooting hand is slightly forward and is pointed toward the basket. Before jumping, the feet are lined up almost perpendicular so you have a stronger jumping position. The knees are slightly bent. The head is directly over a point halfway between your feet. The body is square to the basket.

Next, let's examine proper grip of the ball. The ball is held by the fingers and thumb. It is not down in the palm of the hand. The fingers are comfortably spread apart, with the thumb and forefinger forming a V. Both hands help to control the ball but just before the release, the non-shooting hand drops away from the ball.

Now let's consider ball and elbow position. The elbow is directly under the ball. The hand, forearm, and elbow are all in a straight line with the side of the body. When the elbow is cocked, it is ahead of the ball and pointed toward the basket. The ball is held close to the chest until the shot actually begins. As you begin your jump, the ball is carried to a position above the head before shooting the ball.

The ball is released at the top of the jump. There is a quick elbow extension. There is a cocking of the wrist and then a snap
of the wrist and fingers. The forefinger is the last finger to apply force to the ball. This gives the ball backspin. Be sure to reach up toward the target with your arm.

Finally, let's look at the follow through. The wrist snaps down and outward. The forefinger points toward the target. The arm is fully extended. The head is facing the target. The shooter lands in the same spot from which he jumped.

Now, spend some time imagining yourself shooting a jump shot using proper form. Watch the flight of the ball in your minds eye and continue to watch it until after it has passed through the basket.