Six Volleyball Skill Tests as a Predictor of Game Performance

Donetta J. Cothran

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A Thesis
Presented to
The Faculty of the Department
of Physical Education and Recreation
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
Of The Requirements for the Degree
Master of Arts in Education

By
Donetta J. Cothran
July, 1992
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SIX VOLLEYBALL SKILL TESTS
AS A PREDICTOR OF GAME PERFORMANCE

Date Recommended July 17, 1992

Director of Thesis

Date Approved July 31, 1992

Dean of the Graduate College
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The purpose of this study was to investigate the relationship of six selected volleyball skill tests to actual volleyball game performance. The six skill test items were administered to 64 subjects, who were all members of a college level introductory volleyball course. Based on the ratings of a panel of experts, subjects were rated during game play as good, average, or poor performers.

The stepwise discriminant analysis was used to analyze the relationship between skill tests and game performance. Four of the six skill tests were identified as significantly contributing to group membership. These tests, in order of the magnitude of their standardized discriminant function coefficients were: 1. Brumbach Serve Test, 2. AAHPER Wall Volley Test, 3. AAHPERD Wall Spike Test, and 4. AAHPERD Serve Test.

It was concluded that a volleyball skill test battery consisting of these four items would objectively measure volleyball playing ability and discriminate between players of various skill levels. The results of this test battery could be used for classification, diagnosis, motivational purposes, and grading.
CHAPTER 1
STATEMENT OF THE PROBLEM

Introduction

Volleyball is one of the most popular team sports in the world. In many countries, volleyball is the number one ranked indoor competitive sport. Worldwide, it ranks third in the number of participants (Welch, 1966). In the United States, the game has always been popular, but it has experienced a tremendous growth in popularity since 1984. One indication of volleyball’s success is its increasing popularity in the school’s physical education curriculum (Anthony, 1973). With the sport’s increased importance in the school’s curriculum has come an increased need for evaluation tools of student performance.

Verducci (1980) believes “one of the major objectives of physical education is the development of sports skills”. To determine if this objective has been met, a measurement tool is needed. The evaluation of volleyball ability is typically measured by the administration of one or more individual skill tests.

Athletic skill tests, including volleyball skill tests, have been in use since the early 1900’s. The problem then, as now, is the usefulness of these tests. Does an
individual skill test score reflect a person’s ability to perform during a game?

Statement of the Problem
This study was conducted in order to determine if a predictive relationship exists between performance on six volleyball skill tests (Appendix A) and a player’s actual game performance.

Significance of Study
According to Hopkins (1979), "One of the greatest problems that has confronted the physical education and coaching professions has been that of evaluating sports skills test results and their relationship to levels of playing ability." This study could prove useful to the physical education teacher and volleyball coach attempting to distinguish different playing levels among individual players.

Miller (1988) notes that sports skill tests are also used for classification of teams, diagnosis, motivation, practice, and program accountability. These are all noteworthy goals which could be enhanced with an accurate assessment of the worth of sports skills tests.

Hypothesis
This study tested the following null hypothesis:

1. There is no statistically significant relationship
between performance on six volleyball skill tests and the actual game performance of an individual as measured by the Volleyball Rating Scale.

Assumptions

In order to conduct this study, the following assumptions were made:

1. Each subject was assumed to have given maximum effort on each skill test and during game play.
2. It was also assumed that the amount of time between skill testing and the experts’ evaluation was too brief to have influenced a subject’s playing level.
3. Minor variations in the common opponent’s game were assumed to be of no influence on the subject’s scores.
4. Proper technique while performing a skill is an indication of the ability level of the player.

Delimitations of the Study

This study was delimited to the students enrolled in the 1992 Spring semester volleyball classes at Western Kentucky University.

The collection of data was delimited to the six volleyball skill tests listed in Appendix A. Additional data on game performance was collected using the Volleyball Rating Scale described in Appendix B.
Limitations of the Study

The limitations of this study are:
1. The relatively inexperienced, similar volleyball background of the participants.
2. The subjects were not chosen by random sampling.

Definition of Terms
1. AAHPER. American Association for Health, Physical Education, and Recreation.
2. AAHPERD. American Association for Health, Physical Education, Recreation and Dance.
3. Experts. Persons selected by the investigator for their familiarity with and knowledge of the game of volleyball.
4. Volleyball Rating Scale (VRS). An evaluation tool designed by the investigator and used by the experts to rate each player's performance under game conditions.

Summary

Chapter I of this paper introduced the problem of volleyball skill tests as a predictor of actual game performance. This topic was explored with a discussion of its significance, hypothesis, assumptions, delimitations, and limitations. In addition, a list of key definitions was provided.

Chapter II describes a review of the literature relevant to this problem.
CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

Before discussing the methodology of the actual study described in Chapter 1, a review of related literature is necessary. This chapter is divided into the following sections: the game of volleyball, volleyball skills, and the development of volleyball skill tests.

The Game of Volleyball

A volleyball game involves twelve players, six players per side on a court that measures nine by eighteen meters. A net in the middle of the court separates the two teams. Like all team sports, the goal of the game is to limit one's own mistakes and to force errors by the opposing team in an attempt to outscore the opponent.

Kluka and Dunn (1992) state that unlike other team sports, however, volleyball is not a game of possession. It is a game of continual ball movement from one team to the other. The winner is not determined by the length of time played, but rather by the points scored. There are many players in a small area. In fact, the volleyball court is
the smallest regulation team sport court.

Keller (1977) also describes the uniqueness of volleyball as a team sport. Among the factors he lists are: (1) legal contact with the ball is closely monitored. Actual body to ball contact occurs in minute periods of time; (2) the skill of spiking is the only team sport skill where maximum force is applied while the body is completely unsupported; and (3) the rules limit substitutions and require each player to play every position.

In addition, volleyball is the only team sport that does not allow any contact between the opposing teams. It is also the only sport that develops eye-to-forearm coordination.

**Volleyball Skills**

Slaymaker and Brown (1970) believe there are essentially five major individual skills in volleyball: the forearm pass or bump, the overhead pass, the attack or spike, the serve and the block. Team success depends on the individual mastery of these fundamentals. This is true of any sport, but particularly true of volleyball where as Welch (1966) has noted "basic procedures are repeated over and over again endlessly on both attack and defense".

Keller (1977) believes the forearm or bump pass is "the basic method of ball handling...the foundation on which all other plays are built". This pass typically begins each
reception and it is the skill most used during a volleyball game. Wilson (1952) considers passing to be the key to the whole game and that the greatest variation of teams and players occurs in this area.

The most accurate pass is the overhead pass, of which the specialized skill of setting is a part. This pass is typically the second pass in the team's offensive play and it is used to place the ball for the hitter. "Good setting can overcome weak (but not bad) passing and can make an average attacker into a good attacker" states Keller (1977). All players must know how to set, however teams typically designate one or two players who have primary responsibility for setting the attackers.

The forearm and overhead pass are used to position a teammate for the attack. Kluka and Dunn (1992) describe the objective of the spike as converting "horizontal movement (approach) to vertical movement (jump) in order to hit the ball for the team's attack". Elite volleyball players can hit the ball at speeds approaching 100 miles per hour. The attack is the most complex of the volleyball motor skills.

Volleyball is generally a game of reaction to another player's action. Keller (1968) describes the serve as the only play "where a single player is in complete control of every aspect of a specific play". Welch (1966) believes the serve to be more important than the spike to a team's offensive success.
The block is an attempt to stop the other team's attack at the net or to force the attacker to hit to a specific area. It is an effective skill when combined with a coordinated team defense.

Development of Volleyball Skill Tests

Moody (1980) reports that in 1913, the American Playground Association developed the first series of sports skill tests. These Athletic Badge Tests measured skills in four different sports, including volleyball. Barrow, McGee, and Tritschler's (1989) historical analyses of sports skills tests found that extensive development of sports skill tests did not occur until the 1920's. During the next 20 years, a wide variety of skill tests were developed for nearly all sports with appropriate norms for different age and gender groups. With the exception of the AAHPER/AAHPERD initiative in the late 1960's and early 1970's, very little has been done in the sports skill test areas since 1965, despite the dramatic changes that have taken place in rules, equipment, and the involvement of women in athletics.

The various skill tests developed for volleyball consist of a single item or a battery of up to five items. Moody (1980) reports that "by far the most common test item is a wall volley test". The individual player attempts to complete as many passes against a wall as time allows. There are slightly different restrictions placed on the
subject, dependent on the wall volley test chosen. Moody notes the various wall volley tests vary in regard to the use and distance of a restraining line, the height of the volley, the number and duration of trials, and the scoring method.

For example, one of the first tests developed and reported with supporting data was by French and Cooper in 1937. Using high school girls as subjects, French and Cooper's wall volley test used a wall line of 7'6" and a three-foot restraining line. Each subject was allowed ten 15-second trials. The best five trials were totaled to produce the final score.

Using a similar test, Bassett, Glassow, and Locke (1937) presented a standardized wall volley test for college age women. Their test used a wall line 7'6" from the floor and a restraining line three feet from the wall. Scoring was the total successful passes in three different trials.

In 1940, Russell and Lange published another version of the wall volley test, this one for use with junior high girls. Scoring was again the product of three 30-second trials.

Also in 1940, Crogen used the same wall markings as Bassett, Glassow, and Locke (1937) but eliminated the time factor. The subject kept volleying until ten legal hits had been performed. The scoring was based on the number of improper passes in relation to the ten successful passes.
A test for college age men was published by Brady (1945). This wall volley test added a five-foot wide target on the wall and had no restraining line. The best of two 60-second trials produced a subject’s score.

Again using college age women and the wall volley test, Mohr and Haverstick (1955) attempted to determine the variance in using a restraining line of three, five, or seven feet and a 7'6" wall line. This study indicated the best results occurred with a seven-foot restraining line and the use of three 30-second trials.

Prior to 1957, the rules allowed women to set the ball to themselves prior to passing the ball and the wall volley tests also allowed this. In 1962, Clifton studied the effect of this rule change on wall volley tests for women. She used restraining lines of five and seven feet, with a wall line of 7'6". Like Mohr and Haverstick (1955), Clifton found a seven-foot restraining line to be the most valid and reliable. She also recommended using the sum of two 30-second trials as the scoring means.

Cunningham and Garrison (1968) developed a high wall volley test for women. It was unique for the height of its wall line (ten feet) and the use of no restraining line.

In 1969, AAHPER published a wall volley test for use with both boys and girls, seven to eighteen years of age. This test had no restraining line. The wall target was eleven feet above the floor and five feet long. The subject
was allowed one minute to complete as many successful
volleys as possible.

The second most common item in volleyball skill testing
was reported by Moody (1980) to be a serving evaluation.
Much like the wall volley tests, there are numerous tests
from which to choose. Minor variations occur in the scoring
procedure, trials allowed, and the use of a rope to
differentiate between serves of various heights and
velocities.

French and Cooper’s 1937 battery of volleyball skill
tests for women included a serving test with the court
divided into seven areas. Each of the areas had a
designated point value of between one and five points with
the higher score for the more desirable locations. Ten
trials were allowed.

In 1965, Trotter developed a serving test for women
with simplified scoring procedures. Ten trials were again
used as the scoring means, but the service area was divided
into only four areas with point values of one, two, or
three.

The Odeneal Service Test (Odeneal and Wilson, 1962) was
designed for use with boys and used the same four scoring
areas as the Trotter (1965) test, but assigned a point value
of two, three, four, or five points. Ten trials were
administered.

A serving test designed to measure both placement and
velocity of serve was developed by Brumbach (1961). The court was marked off in four parallel areas increasingly distant from the net. The four areas were assigned point values of two, four, six, and four. A rope was stretched four feet above the net. Serves that traveled between the rope and the net received the full point value. Serves which passed over the rope and into the receiving area received half the point value. Each subject was allowed ten trials.

The 1969 AAHPER Serving Test divided the court into five areas with point values of one to four. Ten trials were again used as the scoring means.

The most recent serving test from AAHPERD (1992), involved a divided court with point values of one to four. Ten trials were administered. The scoring method was unique to the service skill tests in that a higher point value was awarded for overhand serves.

In addition to the relatively common wall volley and serve evaluations, some battery of volleyball skill tests include other types of passing evaluations. Most of these passing evaluations involve the accuracy and/or height of the pass.

French and Cooper’s (1937) volleyball battery included a setup-and-pass evaluation and a recovery from the net evaluation. The setup-and-pass instrument involved a player performing an overhead pass, over a six-foot rope and into
the target area. The recovery from the net skill test required a player to retrieve a tossed ball thrown into the net and pass it into the opponent’s court.

In 1963, Liba and Stauff presented a test which emphasized the importance of height and distance accuracy when performing a pass. The subject attempted to pass a ball over two ropes set at eleven and thirteen feet and onto the scoring area. The target had fifteen different areas with varying point values. The subject was given ten trials. Passes were assigned values for height and distance/target. Scores were the product of height and distance values.

Also using ropes in the passing evaluation was the 1969 AAHPER skill battery. In the forearm pass test, a player stood in the rear center of the court and attempted to pass a tossed ball over a rope eight feet high and into a target area near the net. The set-up pass evaluation required a player standing near the net to pass a tossed ball over a rope ten feet high and into a target area ten feet away.

Helman (1971) developed two passing tests that did not require the use of ropes. In both the forearm pass-to-self, and the set-to-self evaluations, a player passes to himself while staying in a fifteen by fifteen foot area. Passes must be at least twelve feet in height to qualify for scoring in the timed trials.

Trotter (1965) also used a pass-to-self evaluation with the passed ball required to pass above the height of the net.
for scoring purposes.

The only objective evaluation of spiking ability found in this review of literature was the wall spike test. Both Helman (1971) and AAHPERD (1992) have developed very similar tests. The subject had 30 or 60 seconds to repetitively spike/hit the ball onto the floor and make the ball bounce off the wall and back to the hitter.

No objective evaluations for testing the individual skill of blocking were found. Subjective ratings of an individual’s blocking skills were most commonly based on demonstration of proper technique.

An objective evaluation tool for game performance of players was not discovered in the review of literature. Game play evaluations have most often been the result of unpublished investigator designed tools or subjective groupings by the investigator. A lack of validated and reliable game play measurement tools led the investigator of this study to design the Volleyball Rating Scale (VRS).

Summary

In Chapter II, the related literature was discussed. The areas of review were the game of volleyball, volleyball skills, and the development of volleyball skills tests.

Chapter III presents the methodology of this study.
CHAPTER III
METHODOLOGY

Introduction

The first two chapters of this paper have discussed the study’s problem and reviewed the relevant literature. In Chapter III, the selection of subjects, the selection and administration of the skill tests, and the development and use of the Volleyball Rating Scale will be discussed.

Selection of Subjects

The subjects used in this study were students of Western Kentucky University enrolled in the Spring term, 1992 volleyball activity classes. During January of 1992, the students were introduced to the investigator and the purpose and methods of the study were explained to the students. Students who agreed to participate completed the informed consent form in Appendix C.

Selection and Administration of Skill Tests

Lamp (1954) conducted a review of the literature concerning the fundamental skills of volleyball. She found the most commonly mentioned skills were the serve, the
volley (overhead pass), the spike, and the underhand (forearm bump) pass. Of these four skills, the volley pass, more commonly referred to as the overhead pass, is the most difficult for a beginning player to master. In fact, a vast majority of beginning players (such as those in this study) cannot perform the skill at an acceptable game play level. The other three major skills (the serve, the spike, and the underhand pass/forearm pass) are the focus of this research.

To evaluate the individual’s ability to serve, three tests were administered: the AAHPER Serving Test (Appendix D), the AAHPERD Serving Test (Appendix E), and the Brumbach Serve Test (Appendix F).

The review of literature found only two objective evaluations of a player’s spiking ability. The Helman Wall Spike and the AAHPERD Wall Spike are very similar exams. The AAHPERD Wall Spike (Appendix G) was used to test spiking ability.

The forearm pass evaluation involved two tests. The AAHPER Wall Volley (Appendix H), and the AAHPERD Pass to Self (Appendix I) were administered to each subject to evaluate forearm passing ability.

During March 1992, the six skill tests were administered to the subjects. The same procedure was followed each day. Class began with a general warm-up and stretching period of approximately five minutes. The
subjects then performed an event-specific warm-up, partner passing, for five minutes. After the warm-up, the students were introduced to the test(s) for that day. The test was described and then demonstrated. Scoring procedures and scoring criteria for the event were also discussed. For the passing tests, each subject was allowed one practice trial. For the serving tests, each subject was allowed three practice trials.

The tests were administered in four class periods. On the first day, the AAHPERD Serving Test and the AAHPERD Pass-to-Self Test were administered. The second day, the two wall tests (the AAHPERD Wall Spike and the AAHPER Wall Volley test) were administered to the subjects. On the third day, the Brumbach Serving Test was administered. The AAHPER Serving Test was given on the fourth day. Students who missed a skill test were tested during a make-up session.

The tests were administered to the subjects by the investigator. The subjects were assigned to testing squads of eight persons. The students worked with a partner who was another student in the class. As one student performed the skill test, the partner monitored the performance and recorded the scores achieved. At the end of each test, the partners reported their individual scores to the investigator.
Development and Use of the Volleyball Rating Scale

In order to determine and rank an individual player’s actual game performance, the Volleyball Rating Scale (VRS) was developed by the investigator. The VRS (Appendix B) evaluates performance of three individual skills: serving, spiking, and the forearm pass. These three skills were designed to reflect the basic skills needed by an individual to successfully participate in a volleyball game. The other two major individual skills, the overhead pass and blocking, were omitted for various reasons. Blocking was eliminated because it is a skill which is only effective when used in conjunction with an effective team defense. The relatively low level of team defensive skills and opposing team’s spiking skills in this beginner class limit the use, effectiveness, and importance of the block.

The overhead pass was eliminated for two reasons. First, the skill is the most difficult individual skill to learn. To become an effective passer with this method takes many months, and possibly years to master. Secondly, due to the importance of setting (a variation of the overhead pass) in evaluation of another player’s spiking skill, the investigator chose to use designated, experienced setters for each team.

In each of the three skills areas, the VRS was subdivided into three ability levels. These three rating areas of good, average, and poor performance include
criteria for distinguishing among players at each skill level in each critical area. The criteria for a rating is based on technique used in performing the skill.

Based on an individual's score in the three different skills, an overall rating was assigned to each player. A "good" player was determined to be those individuals who had rated "good" on at least two of the three skill areas. An "average" player had to achieve a ranking of "average" in at least two skill areas. A "poor" player was an individual who failed to score "average" or "good" in more than one area.

A panel of three experts was selected by the investigator to use the VRS to evaluate and rank the game play of study participants. These experts were chosen for their experience with and knowledge of the game of volleyball. The panel was also experienced with working with beginning level volleyball players.

Subjects were assigned to a six person team, and given numbered jerseys to wear for identification purposes during game play. The team composition consisted of an experienced setter who was a non-member of the class, one or two higher skilled players, two medium skilled players, and one or two lower skilled players. The team assignments were based on the instructor's previous observations of the individual's game performance.

The panel of experts viewed the subjects on one
occasion during the week following the completion of the skill testing phase. Observations were made of the subjects playing against a common opponent team. The common opponent team was selected by the investigator and played against every subject. This team consisted of non-class members with volleyball experience. The common opponent team was used to allow the experts to evaluate all players under as similar as possible conditions.

The games were played on a regulation court using the official net height for men's games. United States Volleyball Association (USVBA) rules were followed with two exceptions. In order to allow the experts to accurately evaluate each player, the normal serving pattern was altered. Each player, regardless of the outcome of the previous point, served three times in a row. For example, Player #1 on the subject team served three times. The next three serves were by Player #1 on the common opponent team. The third server in the game was Player #2 for the subject team who also served three times. This pattern was followed throughout the entire rating period.

The second exception to USVBA rules was a slight alteration in the rotation pattern. Due to the necessity to keep the designated setter on the front row during the subject team's play, players skipped the middle front position. Individuals rotated directly from the left front position to the right front position.
The statistical analysis of the data focused on the ability of the skill test scores to predict game play performance. To accomplish this, a stepwise discriminant analysis procedure was used to interpret the skill test scores and VRS rating data. This analysis was performed with the use of the Statistics Program for Social Sciences (SPSS).

Additionally, the VRS was evaluated as to its reliability in rating game play. The judges' ratings were analyzed for reliability using the intraclass correlation coefficient. This coefficient was calculated with the Statistical Analysis System (SAS).

Summary

Chapter III presented the methodology of the study. The selection of subject, the selection and administration of the skill tests, and the development and use of the Volleyball Rating Scale were discussed.
CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

The previous three chapters presented an analysis of the problem, a review of related literature, and the methodology employed in this study. In this chapter is the presentation and analysis of the data. This topic will be divided into two areas: a statement of statistical hypothesis and statistical treatment of the data.

Statement of the Statistical Hypothesis

There is no statistically significant relationship between performance on six volleyball skill tests and the actual game performance of an individual as measured by the VRS.

Statistical Treatment of Data

The subjects who did not complete all six volleyball skill tests were eliminated from the study. The remaining sixty-five subjects (34 male and 31 female) were identified and their data used for the statistical procedures.
The stepwise discriminant function of the Statistics Package for the Social Sciences (SPSS) was used to interpret the data. The discriminant analysis procedure analyzed the relationship between the three groups of performance play level and the six skill test score variables. The results are presented in Table 1.

Additionally, SPSS computed the canonical discriminant function. The results are presented in Table 2.

The significant discriminant function was used to identify the predicted group membership. This predicted group membership versus the actual group membership is presented in Table 3.

The Statistics Analysis System was used to calculate the reliability coefficients for the VRS. Table 4 presents the reliability scores of the VRS as measured by the intraclass correlation coefficient.

A hand scored analysis of the VRS and its effectiveness is presented in Table 5.

Table 6 presents a summary of the skill test scores achieved by the subjects.

A .05 level of significance was adopted to accept or reject the null hypothesis.

**Summary**

Chapter IV presented and analyzed the data collected in the study. The data was described and listed in numerical
tables. Additionally, the statistical procedures used for analysis were identified.

The next chapter will include a discussion and interpretation of the results, conclusions based on the statistical analysis, as well as recommendations for further study.
<table>
<thead>
<tr>
<th>Step</th>
<th>Action Entered/Removed</th>
<th>Wilks Lambda</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AAHPERD Serve Test</td>
<td>0.62511</td>
<td>0.0000*</td>
</tr>
<tr>
<td>2</td>
<td>Brumbach Serve Test</td>
<td>0.53260</td>
<td>0.0000*</td>
</tr>
<tr>
<td>3</td>
<td>AAHPER Wall Volley Test</td>
<td>0.45494</td>
<td>0.0000*</td>
</tr>
<tr>
<td>4</td>
<td>AAHPERD Wall Spike Test</td>
<td>0.41624</td>
<td>0.0000*</td>
</tr>
</tbody>
</table>

*Significant at the .05 level
<table>
<thead>
<tr>
<th>Function No.</th>
<th>Eigenvalue</th>
<th>Percent Variance</th>
<th>Canonical Correlation</th>
<th>Wilks' Lambda</th>
<th>Chi Square Signif</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.21865</td>
<td>93.63</td>
<td>.7411</td>
<td>.41624</td>
<td>53.028 .0000*</td>
</tr>
<tr>
<td>2</td>
<td>0.08284</td>
<td>6.37</td>
<td>.2766</td>
<td>.92349</td>
<td>4.815 .1858</td>
</tr>
</tbody>
</table>

*Significant at the .05 level
<table>
<thead>
<tr>
<th>Actual Group</th>
<th># of Cases</th>
<th>Predicted Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Group 1</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70%</td>
</tr>
<tr>
<td>Group 2</td>
<td>25</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>28%</td>
</tr>
<tr>
<td>Group 3</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5%</td>
</tr>
</tbody>
</table>

Percent of "Grouped" Cases Correctly Classified: 60.00%
<table>
<thead>
<tr>
<th>SKILL</th>
<th>Mean Square Among Msa</th>
<th>Mean Square Within Msw</th>
<th>Intraclass Correlation Coefficient R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serve</td>
<td>.178</td>
<td>.702</td>
<td>.70</td>
</tr>
<tr>
<td>Spike</td>
<td>1.127</td>
<td>.606</td>
<td>.46</td>
</tr>
<tr>
<td>Pass</td>
<td>1.840</td>
<td>.601</td>
<td>.67</td>
</tr>
</tbody>
</table>

Where $R$ is equal to $\frac{Msa - Msw}{Msa}$
TABLE 5

JUDGES SCORING COMPARISON

<table>
<thead>
<tr>
<th>Skill</th>
<th>3 of 3 Agree</th>
<th>Judges' Scoring</th>
<th>2 of 3 Agree</th>
<th>No Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serve</td>
<td>35</td>
<td>29</td>
<td>44.6%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>53.8%</td>
<td></td>
<td>1.5%</td>
<td></td>
</tr>
<tr>
<td>Spike</td>
<td>25</td>
<td>39</td>
<td>60.0%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>38.5%</td>
<td></td>
<td>1.5%</td>
<td></td>
</tr>
<tr>
<td>Pass</td>
<td>18</td>
<td>46</td>
<td>70.8%</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>27.7%</td>
<td></td>
<td>1.5%</td>
<td></td>
</tr>
<tr>
<td>Skill Test</td>
<td>Mean</td>
<td>S.D.</td>
<td>Range</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>------</td>
<td>------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>AAHPERD Pass-To-Self</td>
<td>28.78</td>
<td>9.30</td>
<td>2-49</td>
<td></td>
</tr>
<tr>
<td>AAHPER Wall Volley</td>
<td>13.63</td>
<td>7.69</td>
<td>3-39</td>
<td></td>
</tr>
<tr>
<td>AAHPERD Serve</td>
<td>21.99</td>
<td>5.36</td>
<td>10-30</td>
<td></td>
</tr>
<tr>
<td>AAHPER Serve</td>
<td>22.15</td>
<td>5.84</td>
<td>7-36</td>
<td></td>
</tr>
<tr>
<td>Brumbach Serve</td>
<td>23.32</td>
<td>7.81</td>
<td>5-40</td>
<td></td>
</tr>
<tr>
<td>AAHPERD Wall Spike</td>
<td>33.55</td>
<td>13.16</td>
<td>10-69</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER V

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

Chapters I through IV presented an analysis of the problem, a review of related literature, the study’s methodology, and a presentation and analysis of data. This chapter consists of a summary of the study, a discussion and interpretation of the results, conclusions based on the statistical analyses, as well as recommendations for further study.

Discussion

The data presented and analyzed in the preceding chapter was used to accept or reject the null hypothesis. This hypothesis proposed there would be no significant relationship between a player’s performance on six volleyball skill tests and performance during game play. Based on the level of significance (.05) of the analysis the null hypothesis was rejected.

There is in fact a significant relationship between a player’s performance on skill tests and game performance. Four of the six skill tests contributed to the ability of the discriminant function to differentiate among players of
varying ability levels. These four skill tests, in order of the magnitude of their standardized discriminant function coefficients were: the Brumbach Serve Test, the AAHPER Wall Volley Test, the AAHPERD Wall Spike Test, and the AAHPERD Serve Test. The contribution of the four variables is very similar with no one single dominant test factor.

This relationship is numerical proof of what logic would seem to say—success on a variety of sub-skills provides a basic structure for success in the total game. Those players who had difficulty performing the skill "alone" would logically have even more difficulty performing the skill when placed on the court with other people.

The discriminant function, however, does not allow for a perfect prediction rate of success (Table 3). Again, this is a logical extension of what we know about the complexity of volleyball as a team sport. Success in the game relies not only on individual technique, but is also influenced by experience, opponents' skills, teammates' skills, and the individual's mental concentration to name but a few other factors.

The predictive relationship is strongest when identifying those players at either end of the performance spectrum. The success rate for identifying low and high performers was 75% and 70% respectively. The success rate drops off dramatically to 40% for the average group.

Reliability of the VRS as a scoring instrument was
established by an analysis of the intraclass correlation coefficient for each of the three skill areas. The intraclass correlation coefficient for the three skill areas was lower than anticipated (Table 4). Baumgartner and Jackson (1991) have noted that low correlation coefficients are probable when the group is homogeneous in ability. The homogeneity of skill of the subjects in this study probably contributed to the low coefficients for the VRS.

When analyzed by a different method, the VRS proved to be of acceptable scoring reliability. With 195 possible evaluation opportunities (65 subjects rated on three different areas), the judges reached complete agreement on a player’s rating 40% of the time. Two of the three judges agreed on a player’s rating 58.5% of the time. This means that the judges were able to agree (Agreement defined as at least two of the three judges reaching the same rating of a player.) on the subject’s rating in over 98% of the observations.

Conclusion

For this particular population, there is a significant relationship between a subject’s performance on volleyball skill tests and game performance.

Recommendations for Further Study

Based upon the results of this limited study, a number of subsequent research areas have emerged:
1. Would similar results occur with a larger population? What effect would a population of younger or older players have on the results?

2. Would comparable results be obtained if the subjects had a more varied volleyball experience levels?

3. Are there other volleyball skill tests, or other factors that would improve the predictive relationship?

4. What alterations to the Volleyball Rating Scale would allow the experts to more objectively and correctly identify a subject's game performance level?

5. Would multiple observations of the subject during game-like conditions affect the judges' ratings?
APPENDIX A

LIST OF SKILL TESTS
COMPLETE LISTING OF TESTS

SERVING TESTS
1. AAHPER Serving Test
2. AAHPERD Serving Test
3. Brumbach Serving Test

FOREARM PASS TESTS
1. AAHPER Wall Volley
2. AAHPERD Pass-to-Self

SPIKING TEST
1. AAHPFRD Wall Spike
APPENDIX B

VOLLEYBALL RATING SCALE
### VOLLEYBALL RATING SCALE

<table>
<thead>
<tr>
<th>RATING</th>
<th>SKILL</th>
<th>FOREARM PASS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serve</td>
<td>Spike</td>
<td></td>
</tr>
<tr>
<td>1. Overhand</td>
<td>1. Uses an approach or jumps/positions</td>
<td>1. Proper ready position</td>
</tr>
<tr>
<td>G</td>
<td>2. Places ball for hit</td>
<td>2. Anticipates and moves</td>
</tr>
<tr>
<td>O</td>
<td>3. Follow through</td>
<td>3. Flat forearm platform</td>
</tr>
<tr>
<td>C</td>
<td>4. Topspin/knuckle</td>
<td>4. Contacts Forearm</td>
</tr>
<tr>
<td>D</td>
<td>4. Weight transfer</td>
<td>5. Sufficient height and accuracy to setter</td>
</tr>
<tr>
<td></td>
<td>5. Arm close to full extension</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rating</th>
<th>Serve</th>
<th>Spike</th>
<th>Forearm Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1. Overhand but uses fist or closed hand</td>
<td>1. Minimum or no jump but tries to move to ball</td>
<td>1. Poor ready position</td>
</tr>
<tr>
<td>V</td>
<td>2. Serve is in, but little control</td>
<td>2. Ball behind head or off to side</td>
<td>2. Reaches instead of moving</td>
</tr>
<tr>
<td>E</td>
<td>3. Arm fails to extend</td>
<td>3. Timing off</td>
<td>3. Contacts forearms</td>
</tr>
<tr>
<td>G</td>
<td>4. Uses little or no weight transfer</td>
<td>4. Uses fist &amp;/or fails to extend</td>
<td>4. Pass lacks height or accuracy</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rating</th>
<th>Serve</th>
<th>Spike</th>
<th>Forearm Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>1. Underhand</td>
<td>1. No jump or movement to ball</td>
<td>1. Standing position</td>
</tr>
<tr>
<td>O</td>
<td>2. Overhand but such poor mechanics that no chance of success</td>
<td>2. Slaps ball-no wrist/arm control</td>
<td>2. No attempt to move to balls hit</td>
</tr>
<tr>
<td>O</td>
<td>3. Ball is out-of-bounds or a free ball for other team</td>
<td>3. Wont attempt to spike when attack is appropriate</td>
<td>3. Poor arm extension &amp; improper platform</td>
</tr>
<tr>
<td>R</td>
<td></td>
<td>4. Pass lacks height and accuracy</td>
<td></td>
</tr>
<tr>
<td>PLAYER=</td>
<td>SERVE</td>
<td>PASS</td>
<td>SPIKE</td>
</tr>
<tr>
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</tbody>
</table>

1=Good, 2=Average, 3=Poor
INFORMED CONSENT

I, ___________________________ without duress and of my own free will consent to participate in the volleyball skill test study conducted by Donetta Cothran. I understand that physical exercise represents a stress to the body and as such I further understand that I am therefore placing myself in potential danger by subjecting myself to such a situation. I am aware of the fact that even though the person in charge of this class has attempted to the best of her abilities to minimize risk, the fact remains that a very real danger exists regardless.

It is my understanding that I will take six different volleyball skill tests and will also be evaluated by a panel of experts during game play. The purpose of these evaluations is to evaluate the effectiveness of volleyball skill tests as a predictor of game success.

I have read this information and understand it. Any questions which may have occurred to me have been answered to my satisfaction. I understand that I am free to withdraw from this program without prejudice at any time I desire. The information which is obtained will be treated as privileged and confidential and will not be released or revealed without my expressed written consent. The information obtained, however, may be used for a statistical or scientific purpose with my right of privacy retained.

____________________________________
Signature of Participant and Date

____________________________________
Signature of Witness and Date
APPENDIX D

AAHPER SERVING
AAHPER SERVING

EQUIPMENT: Volleyballs, volleyball net and standards, court marked as indicated in diagram.

DESCRIPTION: Server X stands opposite the marked court in the proper serving position. He may use any legal serve in hitting the ball over the net into the opposite court.

RULES: 1. The server is given ten trials. 2. When the ball hits the net and does or does not go over, it counts as a trial but no points are given.

SCORING: The score is the total number of points made, determined by where the ball lands in the opposite court. For all balls that strike on a line, the higher score of the areas concerned is awarded.
APPENDIX E
AAHPERD SERVING TEST
AAHPERD SERVING TEST

EQUIPMENT: Volleyballs, net and standards.

DESCRIPTION: Server X stands in the service court area. Each player serves 20 serves from the regulation distance.

RULES: 1. Serves can be either overhand or underhand. 2. Serves that contact the net count as a serve and are scored as an out-of-bounds serve.

SCORING: The score is the total number of legal serves which land in the court times the serve value. Underhand serves have a value of one point. Overhand serves have a value of 1.5 points.
APPENDIX F

BRUMBAUGH SERVING
BRUMBACK SERVING TEST

EQUIPMENT: Volleyballs, volleyball net and standards, court marked as indicated in diagram, and a 30-foot rope.

DESCRIPTION: Server X stands opposite the marked court in the proper serving position. He may use any legal serve in hitting the ball over the net into the opposite court. There is a rope extended across the length of the court and four feet above the net.

RULES: The server is given ten trials. 2. When the ball hits the net and does or does not go over, it counts as a trial but no points are given.

SCORING: The score is the total number of points made, determined by where the ball lands in the opposite court. For balls that pass between the net and the rope four feet above, full point value is awarded. For balls that pass over the rope, half the point value is awarded.
APPENDIX G

AAHPERD WALL SPKF
AAHPERD WALL SPIKE

EQUIPMENT: Volleyballs, stopwatch, a court space with a large wall and a restraining line parallel to and 6 feet from the wall.

DESCRIPTION: The ball is started with a toss to self. The spiking hand is open and the ball is contacted from a height above the shoulder. As the player spikes it, the ball hits the floor and, after making contact with the wall, rebounds directly to the player. The student repeats the action each time the ball returns.

RULES: 1. If control is lost, the ball is restarted and the spikes are added to the score. 2. The ball must be spiked as it returns from the wall; it cannot legally be spiked from a bounce off the floor. 3. If a violation occurs, the student is instructed to catch the ball and restart it with a toss to self.

SCORING: This is a 60 second timed test. The score is the total number of balls that are hit and hit the floor and then the wall. The balls that are hit off the tosses count. The hits must be legal hits and not "thrown" balls.
APPENDIX H

AAHPER WALL VOLLEY
AAHPER WALL VOLLEY

EQUIPMENT: A solid smooth wall with one-inch wide line marked on it which is five feet long and is 11 feet above and parallel to the floor and vertical lines extending upward from each end of the line that are three or four feet long, volleyball, stop watch, scoring sheet.

DESCRIPTION: The player with the volleyball in hand stands facing the wall. On signal "go" the ball is tossed against the wall into the area bounded by the lines. On the rebound the ball is then volleyed into the marked area and is continued to be volleyed consecutively for one minute.

RULES: 1. The ball is held in the hands prior to the toss at start of test. 2. The tossed ball and each volley must strike the wall above the five-foot line and between the two vertical lines. 3. On a miss or a catch the test continues by the player again tossing the ball against the wall and volleying on the rebound. 4. The player continues to toss and/or volley until the expiration of one minute.

SCORING: Score is the total number of legal volleys executed within one minute. Tosses do not count in the score.
BIBLIOGRAPHY


Keller, V. (1968). *Point, game, and match: Championship*


