CHAPTER V
SUMMARY
CONCLUSIONS AND RECOMMENDATIONS
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SUMMARY

Any human performance can be viewed as the expression of a number of components called performance factors. These factors are too complex and exclusive as to be unwidely and almost indefinable. Any performance might be analyzed, formally or informally, to determine its components in terms of general or specific factors. Natural ability is the promising potential, but fundamentals are the foundation of excellence in action. Any achievement is sports largely based on the finer aspects of combination of fundamental skills. Like in any other competition, a high degree of individual performance in basketball depends upon an individual’s mastery over the fundamental skills of the game. Effective attacking team play depends largely on each individual’s performing skill as well as in every tactical move.

The measurement of sports skills and motor abilities is one of the fundamental aspects of the measurement of human performance. Fleishman (1964) provided the modern foundation for work in the area including delineation between skills and abilities. According to Fleishman, a skill is a learned trait based on the abilities that a person has; abilities are more innate than skills; skills are more sport specific, whereas abilities are more general.
Individual players who develop the proper and quick execution of fundamental skills exemplify the beauty of team play. The achievement level depends on the proficiency level in all ingredients (fundamental skills) of the game. Mastery over controlling the ball, perfect passing that includes a sense of correct timing, correct pace or speed, accuracy, perfect receiving / trapping the ball, good goal shooting, intelligent positioning, good anticipation, accurate timing, excellent reaction, perfect dribbling, accurate passing and rhythmical display of all possible elements of the game are the determining factors to run the game in one’s own favour.

Many basketball skill tests have been developed since 1934. They are Johnson Basketball Test (1934), Knox Basketball Test (1947), Stroup Basketball Test (1955), Harrison Basketball Test (1969), AAHPERD Basketball Test (1984).

Many improvements in measurement technique, rules and regulations, playing procedure, various developments in identification and classification of skills and their patterns are necessary to construct a new skill test battery.

The main objective of this study was to construct a new skill battery to assess the playing ability of women basketball players and the second objective was to develop the norms for the newly constructed skill test.

The present study was conducted in three phases. In the first phase of the study, a package of preliminary test items were identified which was later limited to an effective test battery. The Preliminary Test Package (PTP)
included the following ten test items with the combination of different fundamental skills, which are best suited for performance and achievement.

The study shows that all the ten test items in the Highly Reliable Package, which were taken from the Preliminary Test Package consisting of different fundamental skills namely dribbling, passing, shooting, defensive movement and speed.

5.1 RESTATEMENT OF THE PROBLEM

The purpose of the study was to construct a test battery to assess the basketball playing ability of women players in the states of Kerala and Tamil Nadu. The problem under investigation is titled “Construction of a Test Battery to Assess the Basketball Playing Ability of Women Players”.

5.2 PRELIMINARY TEST PACKAGE (PTP)

T1  Rebounding, Dribbling, Passing and Shooting for Speed Test.
T2  Ball Handling and Passing Accuracy Test.
T3  45 Degree Shooting Accuracy Test.
T4  Zig-Zag Dribble Test.
T5  Zig-Zag Defensive Movement Test.
T6  Total Body Movement Test.
T7  Passing Accuracy Test.
T8  Zero Degree Shooting Accuracy Test.
T9  Up and Down Dribble Test.
T10 Up and Down Defensive Movement Test.
All the test items of the Preliminary Test Package (PTP) were designed by the investigator in consultation with experts, on the basis of the study of related literature and also based on the researcher’s own experience.

A pilot study was carried out using the PTP with 20 basketball players of age 18 - 25 years, who had represented the state or university, as subjects. The data obtained on the administration of Preliminary Test Package (PTP) test items were subjected to statistical analysis to compute the reliability. The Intra class reliability coefficient was computed by applying Two Way Repeated Measures ANOVA Model as recommended by Safrit and Wood (1989). The reliability estimates of PTP test items, the ICC-R Value ranged from 0.991 to 1.00.

According to Barrow and McGee (1964) reliability level is acceptable only if the co-efficient is at or above 0.80 (cited in Bosco and Gustafson 1983). The statistical analysis was done and all the ten test items of the Preliminary Test Package (PTP) having higher reliability were termed as Highly Reliable Package (HRP) test items and are given below.

5.3 METHODOLOGY

The purpose of this study was to construct a test battery to assess the basketball playing ability of women basketball players of age between 18 and 25 years. To achieve the purpose of this study, 150 subjects who have represented the state or university were selected from the states of Kerala and Tamil Nadu. The newly constructed test batteries were administered on them
by the investigator three times with a break of one day in between. The same tests were administered on them independently by other three qualified testers after three days. The selected subjects were assessed subjectively by a panel of three experts. The data thus collected in this manner were analyzed statistically to test the reliability, objectivity, validity of these tests and to construct norms.

5.3.1 DESIGN OF THE STUDY

One of the most commonly used methods to solve the problems is ‘Normative Survey’. This method includes comparison measurement, classification, evaluation and generalization. In these types of surveys, the intent of the research is typically to establish performance to know to which the performance of other can be compared.

In this study Intra-class Co-efficient with Two Way Repeated Measures ANOVA design (Safrit and Wood 1989) was used for the confirmation of reliability and objectivity.

5.3.2 SAMPLE OF THE STUDY

A sample of 20 subjects was taken for the pilot study and 150 for the construction of the skill test battery. A sample of 300 subjects was taken for the third phase of the study related to the development of the Norms for the Final Test Battery.

5.3.3 VARIABLES OF THE STUDY

The variables of the study are categorized as dependent and independent variables as presented below.
5.3.3.1 DEPENDENT VARIABLE

The dependent variable of the study is “Basketball Playing Ability” which measures performance by speed and accuracy.

5.3.3.2 INDEPENDENT VARIABLES

Highly Reliable Package Test Items developed and standardized by the investigator.

5.3.4 TOOLS USED FOR THE STUDY

The tools used for the study was Highly Reliable Package Test Items, which was developed and standardized by the investigator. HRP consists of ten test items. They were given below.

5.3.5 HIGHLY RELIABLE PACKAGE (HRP) TEST ITEMS

T1 Rebounding, Dribbling, Passing and Shooting for Speed Test.
T2 Ball Handling and Passing Accuracy Test.
T3 45 Degree Shooting Accuracy Test.
T4 Zig-Zag Dribble Test.
T5 Zig-Zag Defensive Movement Test.
T6 Total Body Movement Test.
T7 Passing Accuracy Test.
T8 Zero Degree Shooting Accuracy Test.
T9 Up and Down Dribble Test.
T10 Up and Down Defensive Movement Test.

The present study involved with three phases.
In phase I, the selection of the test items, the pilot study and the selection of the subjects were done to identify the Highly Reliable Package (HRP) by eliminating tests which were not reliable.

In phase II, finding the criterion variable through expert rating, choice of testers and instruments were done.

In phase III, the investigation involved with the administration of test items and collection of data, statistical analysis of the data obtained and construction of the norms.

5.3.6 THE FIRST PHASE OF THE STUDY

During the first phase of the study, a pilot study was conducted with the Preliminary Test Package (PTP) on a sample of 20 women basketball players of Mahatma Gandhi University and 10 test items were selected as Highly Reliable Package (HRP). After the identification of the HRP test items, they were administered to a sample of one hundred and fifty basketball players who represented the state or university during the month of November and December in the All India Inter University Tournament held at Amravati University, Maharashtra in 2008. Subjects were within the age group of 18 to 25 years. Objectivity of the test item was also obtained by administering the test by two testers on the same sample on the same day. The reliability of the test items was obtained by the test – retest method. The playing ability of each subject was determined by subjective ratings during the competition in the following areas such as Dribbling, Passing, Rebounding and shooting.
Summary, Conclusions and Recommendations

Subjective ratings were done by a panel of three experts for ten points. The average score of the three experts was taken as the final score. Proper motivational measures had been taken to ensure the best performance by the subjects on test items.

5.3.7 THE SECOND PHASE OF THE STUDY

In the second phase of the study the criterion variable was found through expert rating, choice of testers and instruments were done. These tests were administered on a sample of one hundred and fifty women basketball players, who represented the state or university teams from the states of Kerala and Tamil Nadu. The data was collected during the All India Inter University Tournament for Women held at Amravati, Maharashtra from 10th to 17th December 2008. The state or university players were chosen as the subjects for the study.

During the third phase of the study, a sample of 300 basketball players of age between 18 and 25 years, who had represented the state or university from Kerala and Tamil Nadu were selected as subjects to construct Norms for the items of the Final Test Battery (FTP). Data was collected during the All India Inter University Tournaments held at Amravati University, Amravati, Maharashtra from 10th to 17th December 2008 and at St. Peters College, Kolencherry, Mahatma Gandhi University, Kottayam, from 11th to 19th December 2009 respectively.
5.3.8 THE THIRD PHASE OF THE STUDY

The data obtained on the administration of Highly Reliable Package (HRP) tests was subjected to statistical analysis, applying Intra-class Coefficient with Two-Way Repeated Measures ANOVA Model for confirmation of Reliability and Objectivity of the HRP test items, Pearson Product Moment Correlation (PPM) for confirmation of Concurrent Validity, Factor Analysis for Identification of Final Test Battery (FTB), Hull Scale Norms Technique developing performance Hull Scale Norms for each of the test items of the Final Test Battery (FTB). Based on the Hull Scale Norms Six- Sigma Scale was developed to calculate the mean performance (playing ability) scores and with their performance scores, respective ‘Grades’ were developed.

5.4 STATISTICAL TECHNIQUES

The major statistical techniques used for the study are

1. Intra-class Correlation Coefficient with Two-Way Repeated Measures ANOVA Model to test the reliability and objectivity of the test items.

2. Pearson Product moment Correlation Method to test the validity and the inter-relationship among all the Highly Reliable Package (HRP) test items.

3. Factor Analysis - Principal Component Analysis and Varimax Rotation (Unrotated and Rotated Factor Loadings) for the extraction of factors, speed and co-ordination, speed and passing accuracy and speed and shooting accuracy and for the identification of the Final Test Battery (FTB).
4. Hull Scale Norms Technique was used to develop the ‘Norms’ for the Final Test Battery (FTB).

5. To test the significant difference of the Mean Performance Scores (Playing Ability Scores) between the successful and unsuccessful players on the Final Test Battery (FTB), t-test was used.

6. Six-Sigma Scale was used to calculate the Playing Ability Scores and with this composite score, an alphabetical and an interpretative ‘Grading Scale’ was developed for interpreting the Basketball Playing Ability (BPA).

5.5 MAJOR FINDINGS OF THE STUDY

The major findings of the study shows that all the ten test items in the Highly Reliable Package, which were taken from the Preliminary Test Package consisting of different fundamental skills namely dribbling, passing, shooting, defensive movement and speed.

Intra class reliability (R) for internal consistency of the three trials of the HRP Test Items was established by employing Repeated Measures Two-Way ANOVA Model as described by Safrit and Wood (1989).

- The reliability coefficients of HRP test items, (ICC) R value ranged from 0.968 to 0.997, which was very high in nature which compares with other established Basketball Skill Tests, such as Johnson Basketball Test which had reliability coefficient ranging from 0.73 to 0.80, Knox Basketball Test with reliability coefficient from 0.58 to 0.90 and Harrison’s Basketball Test with reliability coefficient from 0.72 to 0.96.
The objectivity of the HRP test items was frame by computing the Intra class coefficient with Two-Way Repeated Measures ANOVA Model. The objectivity coefficient (ICC) R value ranged from 0.966 to 0.997, indicating that all the test items were highly objective.

The Concurrent Validity of the HRP test items was calculated by Pearson Product Moment (PPM) inter-correlation between the criterion scores and HRP test scores. The calculated value of all the test items of HRP were found to have high reliability and low correlation with one another, indicating that each of the factors measured different components of playing ability; hence all the factors had to be considered together.

Face Validity and Construct Validity were accepted as the validity of the final test battery. Reliability of the Final Test Battery was 0.92. A significant difference in the Mean Performance Scores of Successful and Unsuccessful basketball players on the Final Test Battery showed that the constructed test was valid as well as specific. Inter correlation among the test variables was also established.

The data obtained on the administration of all the ten HRP test items were subjected to Factor Analysis using Principal Component Analysis and Varimax Rotation Method. Since the number of test items was only ten, all the ten test items were divided into three factors. The unloaded factors obtained were then rotated by Varimax Rotation Method to develop the Final Test Battery (FTB). From all these tests, only the highest factor
loading from Factor-1, Factor-2 and Factor-3 was taken into the Final Test Battery.

- In Factor-1 of rotated factor loading, four test items – Up and Down Dribble Test (T9) with a loading of 0.863, Up and Down Defensive Movement Test (T10) with a loading of 0.835, Zig-Zag Defensive Movement Test (T5) with a loading of 0.829 and Zig-Zag Dribble Test (T4) with a loading of 0.822 have emerged. This factor indicates the importance of speed and coordination in playing ability and hence it was named as “Playing Ability by Speed and Co-ordination”. From all these tests, only the highest loading was taken into the Final Test Battery.

- In Factor-2 of the rotated factor loadings, two test items – Ball Handling and Passing Accuracy Test (T2) with a loading of 0.814 and Passing Accuracy Test (T7) with a loading of 0.808 have emerged. This factor indicates the importance of Speed and Passing Accuracy in playing the ball and hence it was named as “Playing Ability by Speed and Passing Accuracy”.

- In Factor-3 of the Rotated Factor Loadings, two test items – 45 Degree Shooting Accuracy Test (T3) with a loading of 0.871 and Zero Degree Shooting Accuracy Test (T8) with a loading of 0.838 have emerged. This factor indicates the importance of speed shooting accuracy in playing the ball and hence it was named “Playing Ability by Speed and Shooting Accuracy”.

Even though all those eight test items have factor loading above 0.80, and were found to have high Reliability, Objectivity and Factorial Validity, the only highest factor loading value of Factor-1, Up and Down Dribble Test (T9), Factor-2, Ball Handling and Passing Accuracy Test (T2) and Factor-3, 45 Degree Shooting Accuracy Test (T3) were taken as the Test Items for the Final Test Battery (FTB).

**FINAL TEST BATTERY**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of the Test Items</th>
<th>Reliability</th>
<th>Objectivity</th>
<th>Factorial Validity</th>
<th>Identified Playing Ability Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Up and Down Dribble Test (T9).</td>
<td>0.997*</td>
<td>0.997*</td>
<td>0.868*</td>
<td>Speed &amp; Co-ordination</td>
</tr>
<tr>
<td>2.</td>
<td>Ball Handling and Passing Accuracy Test (T2).</td>
<td>0.971*</td>
<td>0.974*</td>
<td>0.814*</td>
<td>Speed &amp; Passing Accuracy</td>
</tr>
<tr>
<td>3.</td>
<td>45 Degree Shooting Accuracy Test (T3).</td>
<td>0.968*</td>
<td>0.966*</td>
<td>0.871*</td>
<td>Speed &amp; Shooting Accuracy</td>
</tr>
</tbody>
</table>

The entire three test items of the developed skill test battery were standardized on 300 basketball players of Kerala and Tamil Nadu states and Hull scale norms for each test items in the final test battery was developed. Based on the Hull Scale norms, a Six-Sigma Scale was developed to calculate the playing ability scores.
Finally, based on the Six-Sigma Scale for playing ability scores, a ‘Grading Scale’ with five dimensions in both alphabetical and interpretive grade was developed. The developed ‘Grading Scale’ with five dimensions in both alphabetical and interpretive grades is shown below.

**GRADING SCALE**

<table>
<thead>
<tr>
<th>PLAYING ABILITY SCORES</th>
<th>ALPHABETICAL GRADE</th>
<th>INTERPRETATIVE GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>208 and Above</td>
<td>A</td>
<td>Excellent</td>
</tr>
<tr>
<td>179 – 207</td>
<td>B</td>
<td>Good</td>
</tr>
<tr>
<td>121 – 178</td>
<td>C</td>
<td>Average</td>
</tr>
<tr>
<td>93 – 120</td>
<td>D</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Below 92</td>
<td>E</td>
<td>Poor</td>
</tr>
</tbody>
</table>

The frequency distribution of players based on their alphabetical and interpretative grade with respect to their playing ability was shown and it was clear that 5 players comes under Grade “A”, 52 comes under Grade “B”, 194 comes under Grade “C”, 43 comes under Grade “D”, and 6 comes under Grade “E”.
The frequency distribution and percentage of basketball players based on their alphabetical and interpretative grade with respect to their playing ability is also shown.

**THE FREQUENCY DISTRIBUTION AND PERCENTAGE OF PLAYERS BASED ON THEIR GRADE**

<table>
<thead>
<tr>
<th>GRADE</th>
<th>FREQUENCY</th>
<th>PERCENTAGE</th>
<th>CUMULATIVE %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>B</td>
<td>52</td>
<td>17.3</td>
<td>19</td>
</tr>
<tr>
<td>C</td>
<td>194</td>
<td>64.7</td>
<td>83.7</td>
</tr>
<tr>
<td>D</td>
<td>43</td>
<td>14.3</td>
<td>98</td>
</tr>
<tr>
<td>E</td>
<td>6</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

It was believed that, the Final Test Battery (FTB) will be a significant contribution for the promotion of the game basketball among the university and state players. The developed skill test battery, when employed, was expected to help the coaches and physical educators to monitor and improve the playing
ability of the players by identifying their level of proficiency in executing the identified basic skills.

5.6 TENABILITY OF HYPOTHESES

The tenability of hypotheses of the present study was examined on the basis of the major findings.

It was found that the constructed test has scientific authenticity, administrative feasibility and educational application. Further it was observed from the inter-correlations that all the test items measure different skill related playing ability components, hence the hypothesis was accepted.

➢ The first hypothesis was that the newly constructed test battery of basketball skills may be reliable.

In the present study the obtained reliability coefficients of all the three test items of the Final Test Battery (FTB) ranged from 0.968-0.997, which was high above the acceptable margin. This shows that all the test items of the Final Test Battery (FTB) were highly reliable. Hence the first hypothesis of the researcher was fully accepted.

➢ The second hypothesis was that the newly constructed test battery of basketball skills may be objective.

In the present study the obtained objectivity coefficients of all the three test items of the Final Test Battery (FTB) ranged from 0.966-0.997, which was higher than the required margin of 0.90. This shows that all the test items Final
Test Battery (FTB) were highly objective. Hence the second hypothesis of the researcher was fully accepted.

➢ The third hypothesis was that the newly constructed test battery of basketball skills may be valid.

In the present study the obtained value of all the test items of HRP were found to have high reliability and low correlation with one another, indicating that each of the factors measured different components of playing ability; hence all the factors had to be considered together.

Face Validity and Construct Validity were accepted as the validity of the final test battery. A significant difference in the Mean Performance Scores was found to exit between Successful and Unsuccessful basketball players on the Final Test Battery showed that the constructed test was valid as well as specific. Hence the third hypothesis of the researcher was fully accepted.

5.7 CONCLUSIONS

Within the constraints and limitations of this study, the conclusions deduced were as follows:

➢ Factor Analysis yielded three Skill Related Playing Ability factors from the 10 Highly Reliable Package Test Items.

➢ The identified Skill Related Playing Ability Components of Factor-1 are Speed and Co-ordination, whereas of Factor-2 are Speed and Passing Accuracy and of Factor-3 are Speed and Shooting Accuracy.
All the three factors, namely, Factor-1, Speed and Coordination, Factor-2, Speed and Passing Accuracy and Factor-3, Speed and Shooting Accuracy were identified and the test items were Up and Down Dribble Test (T9), Ball Handling and Passing Accuracy Test (T2) and 45 Degree Shooting Accuracy Test (T3) respectively to represent the skill related test battery of women basketball players.

A significant difference in the mean performance score was found to exist between the test variables when applied to the successful and unsuccessful basketball players. This proved beyond any doubt that the test items are highly specific in measuring the playing ability of women basketball players.

Reliability of the Final Test Battery was 0.92.

Hull Scale norms for the Final Skill Test Battery have been developed by administering the test items on women basketball players of the states of Kerala and Tamil Nadu.

Six- Sigma Scale was used to calculate the Playing Ability Scores (PAS) and with this Composite Score, an Alphabetical and an Interpretative ‘Grading Scale’ were developed for interpreting the Basketball Playing Ability (BPA).

In the present study the frequency distribution of basketball players based on their grade with respect to their playing ability was also shown.
5.8 RECOMMENDATIONS

Based on the findings and conclusions made in the present study the following recommendations for further research were given:

- The Final Test Battery (FTB), a three test module evolved by the researcher may be used by physical education teachers, coaches, selectors and trainers.
- The Basketball coaches may use this skill test battery liberally and periodically to ascertain the effectiveness of the playing ability and in evaluating the progress made by the trainees.
- Similar studies may be conducted at the national level for men and women, so that the basketball players of the nation are benefited.
- The norms provided by this study may be used by the physical education teachers, coaches and trainers to systematize and modify their training programmes for better performance and to know the level of playing ability.
- Centralized Sports Hostels and Sports Schools run by the Government agencies and private sector units may use the basketball skill test battery constructed in the present study for selecting potential basketball players and also for evaluating their performance in the game.
- Similar study may be taken up to develop basketball skill test battery and norms may be evolved for men players.
- Keeping in view the latest trends in specificity of training, similar studies may be attempted in other sports disciplines also.
• Similar studies may be developed for the state level school girls and norms may be evolved.

• The present study may be conducted for the national level school boys also and norms may be evolved.