CHAPTER III
PROCEDURE

The procedures adopted for the selection of subjects, preliminary selection of test items, pilot study, criterion variable, reliability of judges rating of basketball playing ability, tester competency, instrument reliability, subject reliability, administration of skill test items and collection of data, for establishing reliability, objectivity and validity, and construction of norms have been described in this chapter.

Selection of Subjects

The data were collected into two phases. The first phase related to the construction of the tests and the second phase to the development of the norms. In drawing the samples, the table of random numbers was followed at both the stages.

In the first phase, a sample of one hundred and two male basketball players, between 16 to 18 years old, from Tamil Nadu representing eight teams from both categories who had participated and reached semi-final stage in the Inter-District Basketball championship for High Schools and Higher Secondary Schools during 1991-92 was
selected as subjects for this study. Six state-level players were also included in the study even though their teams lost in the preliminary rounds.

The table below shows the subjects selected from various educational districts of Tamil Nadu.

**TABLE 1**

SUBJECTS SELECTED FROM VARIOUS EDUCATIONAL DISTRICTS OF TAMIL NADU

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of Institution</th>
<th>Name of Educational District</th>
<th>No. of Subjects Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sarvajana HSS, Coimbatore</td>
<td>Coimbatore</td>
<td>12</td>
</tr>
<tr>
<td>2.</td>
<td>Campian HSS, Trichy</td>
<td>Trichy</td>
<td>12</td>
</tr>
<tr>
<td>3.</td>
<td>Caldwell HSS, Tuticorin</td>
<td>Tirunelveli</td>
<td>12</td>
</tr>
<tr>
<td>4.</td>
<td>St. Joseph HSS, Chengalpet</td>
<td>Madras</td>
<td>12</td>
</tr>
<tr>
<td>5.</td>
<td>Maruthi Sports H. School, CBE</td>
<td>Coimbatore</td>
<td>12</td>
</tr>
<tr>
<td>6.</td>
<td>T. Nagar H. School, Madras</td>
<td>Madras</td>
<td>12</td>
</tr>
<tr>
<td>7.</td>
<td>M.D.T. Hindu College H. School, Tirunelveli</td>
<td>Tirunelveli</td>
<td>12</td>
</tr>
<tr>
<td>8.</td>
<td>Sowrashtra HSS, Madurai</td>
<td>Madurai</td>
<td>12</td>
</tr>
<tr>
<td>9.</td>
<td>Bishop Heber HSS, Trichy</td>
<td>Trichy</td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>Sethupathy HSS, Madurai</td>
<td>Madurai</td>
<td>2</td>
</tr>
<tr>
<td>11.</td>
<td>Govt. HSS, Bathalagundu</td>
<td>Madurai</td>
<td>1</td>
</tr>
<tr>
<td>12.</td>
<td>M.V. Raja HSS, Rajapalayam</td>
<td>Kamarajar</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>102</td>
</tr>
</tbody>
</table>
In the second phase, a sample of one thousand and five hundred male basketball players, between 16 to 18 years old from Tamil Nadu who participated in the Inter-School Basketball Tournament during 1991-92 was selected as subjects to construct norms for the skill test items finally selected. The list of subjects selected from various districts of Tamil Nadu for construction of norms is given in Appendix A.

**Selection of Test Items**

Care was taken to select tentative test items which most closely approximated to the fundamental skills of basketball game. Apart from personal observation, the researcher went through the literature related to the game, and books on tests, measurement and evaluation to acquaint himself with the procedures of test construction and suitability of skill tests items selected. Besides, during the Tamil Nadu State Inter-District Junior Basketball Championship in September 1991, the researcher watched the matches very closely. During this period, a meeting of the experts and coaches attending the championship was convened and the problem was discussed at length. After a long discussion, the following fundamental skills were identified: passing and receiving, dribbling, shooting,
footwork, and rebound. Thereafter, methods of evaluation were devised. A list of test-items was framed which could measure the playing ability of basketball players in relation to the fundamental skills described above. The face value of each item was discussed to establish the face validity of each test item.

Most of the test items decided by the experts were believed to be commonly used by coaches for evaluating the players' performance, but these tests were not standardised by establishing validity, reliability, objectivity, and norms.

**Pilot Study**

A pilot study was conducted with thirty boys of 16 -18 years, who had participated in the Inter-District Basketball Tournament for High Schools and Higher Secondary Schools of Tamil Nadu in order to determine the administrative feasibility of the test items and to provide estimates of their reliability and validity. Reliability was computed by using the intra-class correlation method\(^1\) for all the twenty test items selected. The reliability

### TABLE 2

**RELIABILITY COEFFICIENTS OF CORRELATION OF BASKETBALL FUNDAMENTAL SKILL TEST ITEMS**

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Name of Skill Test</th>
<th>Source of Variance</th>
<th>'R' Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Between Subjects</td>
<td>Within Subjects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SS</td>
<td>DF</td>
</tr>
<tr>
<td>1.</td>
<td>Wall Passing</td>
<td>417.961</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Target Accuracy Passing</td>
<td>835.434</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>One-Hand Pass For Accuracy</td>
<td>105.656</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Zig-Zag Dribbling</td>
<td>233.961</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Alternate Hand Straight Dribbling</td>
<td>156.305</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Zig-Zag Dribbling &amp; Lay-up Shooting</td>
<td>25.105</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>Free Throw Shooting</td>
<td>214.233</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>Dribble, Stop &amp; Shooting</td>
<td>61.655</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>Three Points Shooting</td>
<td>239.121</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>Speed Spot Shooting</td>
<td>151.567</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>Alternate Under-Basket Shooting</td>
<td>109.123</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>Figure-of-Eight Lay-up Shooting</td>
<td>34.399</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>Rebounding Ability</td>
<td>134.233</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>Defensive Movement in Circle</td>
<td>52.222</td>
<td>3</td>
</tr>
<tr>
<td>Test No.</td>
<td>Name of Skill Test</td>
<td>Source of Variance</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>--------------------------------------------------------</td>
<td>--------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Between Subjects</td>
<td>Within Subjects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SS</td>
<td>DF</td>
</tr>
<tr>
<td>15.</td>
<td>Defensive Movement in Restricted Area</td>
<td>19.507</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>Field Goal Shooting</td>
<td>382.455</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>Speed, Dribble and Lay-up Shooting</td>
<td>53.433</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>Bounce and Shooting</td>
<td>466.888</td>
<td>3</td>
</tr>
<tr>
<td>19.</td>
<td>Rebound and Shooting</td>
<td>76.888</td>
<td>3</td>
</tr>
<tr>
<td>20.</td>
<td>Tip in Shooting</td>
<td>56.500</td>
<td>3</td>
</tr>
</tbody>
</table>
coefficients of correlation are given in Table 2. The pilot study of skill test scores is presented in Appendix B.

On the basis of the reliability coefficient of correlation, administrative convenience in terms of cost, time and materials, fifteen out of the twenty experimental fundamental skill test items were selected for the final study.

Criterion Variable

The criterion variable was the playing ability of the basketball players who had participated in the Inter-District Basketball Championship for High Schools and Higher Secondary Schools. The playing ability of each player was determined by subjective ratings during the competition in the following fundamental skills, viz., passing and receiving, dribbling, shooting, footwork, individual defence, offensive rebounding, and defensive rebounding, tactics, cooperation with the team players and overall understanding of the game including general behaviour like respecting the rules and the officials. Subjective rating was done on a ten-point rating scale for each of the above factors by three experts. The rating scale had ten categories, each category scoring from a minimum of one point to a maximum of ten points. The total score was the
sum of the scores of all the ten categories. The total score was divided by ten to get each judge's individual score on the ten-point rating scale. The average score of three experts was the final score of the playing ability. The detailed instructional chart for grading the playing ability given to the judges is presented in Appendix C.

The purpose of dividing the playing ability into ten categories was to make the expert rating of basketball playing ability reliable and accurate.

Reliability of Judges' Rating of Playing Ability

A panel of three experts in basketball, comprising three basketball coaches with outstanding experience in the game, acted as judges and rated the playing ability of basketball players during the Inter-District Basketball Championship for High Schools and Higher Secondary Schools of Tamil Nadu.

The mean scores of the experts were considered to be a reliable and true indicator of playing ability, which has been selected as a criterion measure (dependent variable) for validating the test items. The judges were oriented on guidelines to assess the playing ability in order to ensure greater approximation in rating among them.
Further, to find out the consistency of the scores awarded by the three experts, the scores given by them were compared using the first-order partial correlation method\(^2\) and are presented in Table 3. The scores of the three judges' rating on playing ability are presented in Appendix D.

**TABLE 3**

**RELIABILITY OF JUDGES' RATING ON BASKETBALL PLAYING ABILITY**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Judge's Name</th>
<th>Coefficient of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Simple</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Correlation</td>
</tr>
<tr>
<td>1.</td>
<td>Judge 1 &amp; Judge 2</td>
<td>0.3870**</td>
</tr>
<tr>
<td>2.</td>
<td>Judge 1 &amp; Judge 3</td>
<td>0.4145**</td>
</tr>
<tr>
<td>3.</td>
<td>Judge 2 &amp; Judge 3</td>
<td>0.4835**</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level  
** Significant at 0.01 level

The correlation values obtained were higher than the table value at 0.05 level \(r = 0.195\) and 0.01 level \(r = 0.254\).

The above table clearly shows that the judges were consistent in rating the players' playing ability.

Tester Competency

Eventhough the investigator was well versed in the techniques of conducting these tests, the able assistance of other trained physical education teachers and basketball coaches was also sought. Each tester was made to get himself acquainted well with the procedure of conducting and scoring the fundamental basketball skill test items selected. Competency was demonstrated in the form of objectivity coefficients based on test-retest correlations with the tests given to the same subjects by different testers. The Tester Competency was computed by using the Pearson's Product-Moment Correlation Coefficient Method as described by Bosco³, which is presented in the Table 4. The reliability coefficients for tester competency ranged between 0.9055 and 0.9748 for various skill test items, which were considered to be high for the purpose of this study. Tester competency in various skill test item scores is presented in Appendix E.

The Table 4 shows that the correlation obtained in different fundamental skill test items was found to be very high.

³Ibid.
<table>
<thead>
<tr>
<th>Test No.</th>
<th>Name of Skill Test</th>
<th>Coefficient of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wall passing</td>
<td>0.9634</td>
</tr>
<tr>
<td>2</td>
<td>Target accuracy passing</td>
<td>0.9125</td>
</tr>
<tr>
<td>3</td>
<td>One-hand pass for accuracy</td>
<td>0.9689</td>
</tr>
<tr>
<td>4</td>
<td>Zig-Zag dribbling</td>
<td>0.9718</td>
</tr>
<tr>
<td>5</td>
<td>Alternate hand straight dribbling</td>
<td>0.9707</td>
</tr>
<tr>
<td>6</td>
<td>Zig-Zag dribbling and lay-up shooting</td>
<td>0.9653</td>
</tr>
<tr>
<td>7</td>
<td>Free throw shooting</td>
<td>0.9237</td>
</tr>
<tr>
<td>8</td>
<td>Dribble, stop and shooting</td>
<td>0.9055</td>
</tr>
<tr>
<td>9</td>
<td>Three point shooting</td>
<td>0.9137</td>
</tr>
<tr>
<td>10</td>
<td>Speed spot shooting</td>
<td>0.9644</td>
</tr>
<tr>
<td>11</td>
<td>Under-basket shooting</td>
<td>0.9439</td>
</tr>
<tr>
<td>12</td>
<td>Figure-of-eight lay-up shooting</td>
<td>0.9725</td>
</tr>
<tr>
<td>13</td>
<td>Rebounding ability</td>
<td>0.9748</td>
</tr>
<tr>
<td>14</td>
<td>Defensive movement in circle</td>
<td>0.9569</td>
</tr>
<tr>
<td>15</td>
<td>Defensive movement in restricted area</td>
<td>0.9721</td>
</tr>
</tbody>
</table>
Instrument Reliability

The stop watches and measuring tapes used for the basketball skill tests were considered reliable as they were procured from reputed firms and were being used for research purposes. Further, these instruments were calibrated in standard units. To determine the reliability of the instrument, measurements on each of the (variables) tests were recorded five times under similar conditions using the same instrument. The scores obtained were the same and the scores were also compared with other scores recorded by the instruments from other reputed firms. Hence they were accepted as reliable and precise for purpose of this study.

Subject Reliability

To determine the subject reliability, thirty subjects were selected at random. The basketball fundamental skill tests were conducted and recorded twice under similar conditions by the investigator. These tests were administered in four days. On the first day, three skill tests were conducted in the morning and four in the evening. On the second day, four skill tests were conducted in the morning and four in the evening. These tests were repeated on subsequent days in the same order.
The fundamental skill tests were conducted in the following order for two days:

**First Day**

**Morning Session**
1. Wall passing
2. Alternate Under-basket shooting
3. Free throw shooting.

**Evening Session**
1. Target accuracy passing
2. Dribble, stop and shooting
3. Zig-zag dribbling
4. Three points shooting

**Second Day**

**Morning Session**
1. Alternate hand straight dribbling
2. Speed spot shooting
3. Defensive movement in circle
4. Rebounding ability.

**Evening Session**
1. One hand pass for accuracy
2. Zig-zag dribbling and lay-up shooting
3. Figure of eight lay-up shooting
4. Defensive movement in restricted area.
### TABLE 5

**RELIABILITY CO-EFFICIENTS OF CORRELATION OF TEST-RETEST**

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Name of Skill Test</th>
<th>Coefficient of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Wall passing</td>
<td>0.9225</td>
</tr>
<tr>
<td>2.</td>
<td>Target accuracy passing</td>
<td>0.9630</td>
</tr>
<tr>
<td>3.</td>
<td>One-hand pass for accuracy</td>
<td>0.8562</td>
</tr>
<tr>
<td>4.</td>
<td>Zig-Zag dribbling</td>
<td>0.8735</td>
</tr>
<tr>
<td>5.</td>
<td>Alternate hand straight dribbling</td>
<td>0.9251</td>
</tr>
<tr>
<td>6.</td>
<td>Zig-Zag dribbling and lay-up shooting</td>
<td>0.8531</td>
</tr>
<tr>
<td>7.</td>
<td>Free throw shooting</td>
<td>0.8691</td>
</tr>
<tr>
<td>8.</td>
<td>Dribble, stop and shooting</td>
<td>0.8806</td>
</tr>
<tr>
<td>9.</td>
<td>Three point shooting</td>
<td>0.8599</td>
</tr>
<tr>
<td>10.</td>
<td>Speed spot shooting</td>
<td>0.8686</td>
</tr>
<tr>
<td>11.</td>
<td>Alternate Under-basket shooting</td>
<td>0.8540</td>
</tr>
<tr>
<td>12.</td>
<td>Figure-of-eight lay-up shooting</td>
<td>0.8726</td>
</tr>
<tr>
<td>13.</td>
<td>Rebounding ability</td>
<td>0.8762</td>
</tr>
<tr>
<td>14.</td>
<td>Defensive movement in circle</td>
<td>0.8929</td>
</tr>
<tr>
<td>15.</td>
<td>Defensive movement in restricted area</td>
<td>0.8561</td>
</tr>
</tbody>
</table>

The scores obtained for all the fifteen fundamental skill tests were correlated using the Pearson's
product-Moment Correlation Method as described by Bosco. The coefficients of correlation are presented in Table 5.

An examination of the correlations shows that the correlation obtained in different test items was found to be very high.

The scores of the fifteen fundamental skill test items are presented in Appendix F.

Administration of Skill Test Items and Collection of Data

The administration of skill test items and collection of data were done in two phases. In the first phase, data on fifteen fundamental skill test items were collected in two days. In the second phase, data were collected to establish percentile norms and 'T' scores of the five fundamental skill test items finally selected. A systematic sampling device was used to select the subjects and the selected skill test items were administered and the data collected the data for the second phase of the study.

The basketball fundamental skill test items selected were administered on basketball players of 16-18 years. All these players represented their educational districts of Tamil Nadu in the Inter-District Basketball Championships for High Schools and Higher Secondary Schools for 1991-1992.

The investigator selected appropriate measurement techniques for administering the fundamental skill test items. All the necessary equipment was collected, and court markings and special markings were done on the wall. The Individual score sheets were proposed for recording the scores of the fifteen fundamental skill test items. The individual score sheet is presented in Appendix G. All the test stations were clearly indicated. The skill tests were conducted for each team separately. The trained basketball coaches were assisted in administering these selected fundamental skill tests. These coaches were trained in administering the test items, techniques and methods of scoring. All the test items were explained and demonstrated to the testers. The method of scoring was explained prior to the actual administration of test items.

The data were collected during November - December 1991. This period was considered to be the best period for the collection of data because the basketball
players had acquired good performance skill on account of the state level basketball tournament. The influence of their training in basketball was considered to be at the peak level. The response of the subjects to the test items was fairly good. The dates for administering the skill tests selected has been decided well in advance in consultation with the coaches and respective Physical Directors of schools and Physical Education Teachers. To avoid fatigue and monotony, the tests were administered on two consecutive days.

The tests were administered between 6.30 and 8.30 a.m and from 4.30 to 6.30 p.m. The purpose and significance of the study were explained to the subjects to ensure their maximum cooperation. Before administering the tests, the subjects were asked to do a proper warm-up. A demonstration of each skill test item was done with adequate explanation. The subjects were allowed to practise once in each test item. The students were motivated while they were performing each skill test item. Safety precautions were taken into consideration during the testing period.

In the second phase, tests were administered and data were collected on the battery of five fundamental skill test items finally selected. These tests were administered
for boys of 16-18 years in different districts of Tamil Nadu in high schools and higher secondary schools. The schools were randomly selected. The score sheet prepared for recording the fundamental skill test scores is presented in Appendix H. The consolidated scores of the fundamental skill test items finally selected for 16, 17 and 18 years are presented in Appendix I. The details and the procedure for test administration of all the fundamental skill test items were as follows:

Wall Passing Test

Objective

To measure the speed with which the subject can continue to pass and catch the ball against the wall.

Equipment

A smooth solid wall, a stop-watch and a standard inflated basketball.

Floor Markings

In front of a smooth wall, a restraining line was marked eight feet away and parallel to the wall. Two vertical
WALL PASSING TEST FLOOR MARKINGS

FIG. 1
lines were worked on the wall twelve feet apart. The vertical lines were extended upward 10 feet from the floor.

Test Procedure

The player stood with a basketball behind the restraining line on the floor. At the signal "GO", the player passed the ball against the wall, using two hand chest pass, caught the rebound, and continued passing against the wall as rapidly as possible for 30 seconds. A practice trial was given. Three trials were allowed for the test.

Rules

All passes must be made from behind the restraining line. The ball must be caught and passed, not batted. The ball can hit the wall at any height. If the ball was dropped, the subject must recover it and continue to pass from behind the restraining line.

Scoring

Each hit against the wall counted one point. The number of ball hits on the wall was recorded. Three complete trials were recorded, using the better score of the three trials. The best score of the three trials made in 30 seconds was the final score.
Target - Accuracy Passing Test

Objective

To measure the ability to pass to the target and recover the ball accurately while moving.

Equipment

A standard inflated basketball, a stop-watch, a smooth wall surface, and a measuring tape.

Floor and Wall Markings

On a smooth wall, two vertical lines, 18 feet apart, were marked. Then six one-foot square targets were marked in such a way that the first target was one-foot from the left vertical line and its bottom 4 feet 6 inches from the floor level; the second target was two feet to the right of the first target and its bottom line was 3 feet 6 inches from the floor; the third and fifth targets were level with the first target intervening the fourth and sixth targets at the height of the second target. All the targets were 2 feet away from each other. Besides, there was a one-foot gap between the sixth target and the right vertical line.
TARGET ACCURACY PASSING TEST FLOOR AND WALL MARKINGS

FIG. 2
Test Procedure

The subject stood with the ball behind the restraining line facing the first target on the left. On the signal "GO", he passed the ball to the first target, recovered the rebound, and moved to the second target and repeated the same procedure for all the targets. After hitting the sixth target, he started moving towards his left, repeating the same act, and continued moving left to right and right to left for 30 seconds.

Rules

- A subject should not step on or cut the restraining line while passing.

- He should not hit any target twice except the right and left extremes.

Scoring

The score was equal to the number of legal hits on the targets. Even if the ball touched the line of the target it carried a point. The best score of the three trials was the final score.
One-Hand Pass for Accuracy Test

**Objective**

The purpose of this test was to measure the ability of one-hand pass to hit the target accurately and score more points.

**Equipment**

A smooth solid wall, a stop-watch, and a standard inflated basketball.

**Floor and Wall Markings**

On a smooth wall, two parallel vertical lines were marked 8 feet apart. A restraining line was marked 20 feet away from the wall. At the height of three, four, five and six feet from the floor, horizontal lines were marked on the wall. These lines were parallel to the floor and the width of each lines was 5 cms. Points were written as 1 above the three-feet line, 2 above the four-feet line, and one above the five-feet line.

**Test Procedure**

The subject stood with the ball behind the restraining line and was asked to hit the wall by using one hand over the
ONE-HAND PASS FOR ACCURACY TEST FLOOR AND WALL MARKINGS

FIG. 3
shoulder pass. The aim was to hit between the lines so as to earn 2 points. If the ball hit on the line the subject got greater score. If the ball hit either the bottom line or top line, the subject would get one point. Three sets of ten trials were allowed and these trial scores were recorded.

Rules

a) The subject should not step on or over the restraining line while throwing.

b) Only the over-the-shoulder pass should be used.

Scoring

The best aggregate score of ten trials of the three sets was the final score.

Zig-Zag Dribbling Test

Objective

The purpose of the test was to measure the speed and control over the ball by both hands with which a subject can dribble a ball around obstacles.
ZIG-ZAG DRIBBLING TEST FLOOR MARKINGS

FIG. 4
**Equipment**

A stop watch, a standard inflated basketball and five folding chairs.

**Floor Markings**

A starting line five metre in length was marked. Perpendicular to the middle of this line, 5 chairs were placed. The first chair was placed at ten feet from the starting line and the other chairs five feet apart from each other.

**Test Procedure**

The subject stood behind the middle of the starting line with a ball facing the first chair. On the signal "GO", he started dribbling to the right of the first chair. He continued his dribble in a Zig-Zag manner upto fifth chair and returns in the same manner to the starting line, and continued the same procedure for thirty seconds. Three complete trials were allowed. When the subject passed each obstacle, the tester counted the number of obstacles crossed.
Rules

Only legal dribble is permitted. The subject must dribble at least once as each chair is passed. If the ball goes far away by mistake, then the dribbler himself should run and pick up the ball. He should start dribbling again from the spot where he made the mistake.

Scoring

For crossing each chair, the subject scored one point. The score was the total number of (obstacles) chairs crossed by the subject in 30 seconds. Three trials were given. The final score was the best score of three trials.

Alternate Hand Straight Dribble Test

Objective

The purpose of the test was to measure the speed and control over the ball by both hands with which a subject can dribble straight in full length of the court.

Equipment

Stop watches and standard inflated basketballs.
ALTERNATE HAND STRAIGHT DRIBBLE TEST FLOOR MARKINGS

FIG. 5
Floor Markings

In a standard basketball court (28 x 15 mts) both the free throw lines were extended upto the side lines.

Test Procedure

The subject stood behind the end line with the ball facing the court. The tester gave the signal "GO" and started the stop watch. The subject dribbled the ball with the right hand upto the free throw line and touched the line by one foot. He returned from the free throw line to the end line with left hand dribble. From the end line he dribbled with the right hand upto the centre line and touched the line. Then he returned from the centre line to the end line with a left hand dribble. He dribbled from the end line with the right hand upto the next free throw line and touched the line. Then he returned to the end line (where he started the dribble) with the left hand and touched the line (end line) with one foot. He dribbled from the end line with the right hand upto the opposite end line diagonally and touched the end line. Then he returned from the end line to end line with the left hand and finished the test. The tester stopped the watch when the subject crossed the end line. Three complete trials were given.
Rules

- Only legal dribble is permitted.
- The subject must have a contact for each dribble.
- He should not push the ball ahead and run forward to contact the ball.
- If the ball control is lost, the subject himself should gain control over the ball and start dribbling again from the point where he lost the control.

Scoring

The stop watch started when the signal "GO" was given and stopped when the course was completed. Three trials were given and the time was recorded to the nearest one-tenth of a second. The best time of the three trials was the final score.

Zig-Zag Dribbling and Lay-up Shooting Test

Objective

The purpose of the test was to measure the speed and control over the ball by both hands with which a subject can dribble a ball around obstacles and to measure the speed in making lay-up shooting.
ZIG-ZAG Dribbling and Lay-up Shooting Test Floor Markings

FIG. 6
Equipment

A stop watch, two standard inflated basketballs and four folding chairs.

Floor Markings

A two-feet starting line was marked 39 feet away from the imaginary vertical point of the centre of the basket at 45 degrees. The first chair was placed 10 feet from the starting line. The remaining chairs were placed in a straight line at 7 feet distance in between, leaving 8 feet between the last chair and the centre of the basket.

Test Procedure

The subject stood behind the starting line with a basketball in his hands. The tester gave the signal 'Ready, GO', and started the stop watch. The subject dribbled around the chairs in a Zig-Zag manner and made a lay-up shooting by the right hand. If the basket was missed, he had to try again from under the basket itself. After the basket was scored, he collected the rebound and dribbled back around the chairs in a zig-zag manner to the starting line and completed the test. The tester stopped the watch when the subject crossed the starting line (finishing line). Three complete trials were given.
Rules

- Illegal dribble is not permitted.

- While dribbling, the subject must use both the hands alternately.

- If the ball went out of the subject's control by mistake, he himself should run and get the ball. He should start dribbling again on the spot where he made the mistake.

- Only after a successful basket, a subject should come back by dribbling in a zig-zag manner.

Scoring

The stop watch started when the signal "GO" was given and stopped when a subject crossed the finishing line. Three trials were given and the time was recorded to the nearest one-tenth of a second. The score was the time taken by a subject to complete a course. The best timing of the three trials was the final score.

Free throw Shooting Test

Objective

To measure the ability to shoot behind the free throw line.
Equipment

Standard inflated basketballs and score sheets.

Test Procedure

The subject stood behind the free throw line with the ball. He attempted twenty free throws in a series of two free throws at a time. He had to leave the spot after attempting two free throws. Any method of shooting was permitted, i.e., either set shooting or jump shooting. Three sets of twenty trials were provided.

Rules

The subject should attempt the free throws within five seconds. He should not cross or touch the free throw line while attempting the free throws.

Scoring

One point was given for each successful basket regardless of how the ball went inside the basket. Twenty points were possible. The best score of the three sets of trials was recorded as the final score.
Dribble, Stop and Shooting Test

Objective

The purpose of the test was to measure the fundamental skills of dribbling, stopping, and shooting from behind the free throw line.

Equipment

Four standard inflated basketballs, a standard basketball court, standard goals, and two hurdles.

Floor Markings

Two hurdles were placed on the free throw line parallel to the end line. The height of the hurdles was 3 feet 6 inches.

Test Procedure

The subject stood with a basketball immediately behind the centre line facing the basket. This was the starting line. At the signal "GO", the subject dribbled the ball towards the hurdle. He stopped the dribble by scoot stop in front of the obstacle (hurdle). Then he attempted either jump shot or set shot. A successful basket counted 2 points. After each attempt, he went back to the starting line. Each
DRIBBLE, STOP AND SHOOTING TEST FLOOR MARKINGS

FIG. 7
time the ball was passed to the subject, the subject continued the same action. In total, he would attempt 10 baskets. Three sets of trials were given.

**Rules**

- Illegal dribble is not permitted.

- Legal stop is to be performed by the subject as per the basketball rules.

- A basket is invalid if violations occur before attempting the basket.

- If the ball goes out of his control while dribbling, then that attempt is counted as a missed basket.

**Scoring**

Each successful basket counted 2 points. The number of baskets made in 10 attempts was recorded. The best score of the three sets of trials was the final score.

**Three Point Shooting Test**

**Objective**

The purpose of the test is to measure the shooting ability from the three-point shooting circle.
THREE POINTS SHOOTING TEST FLOOR MARKINGS

FIG. 8
Equipment

Four standard inflated basketballs and score sheets.

Floor Markings

A three-point shooting circle was marked.

Test Procedure

The subject stood with the ball in his hands just behind the three-point shooting circle, wherever he wanted to. The tester gave the signal "Go", and the subject started shooting from outside the three-point shooting circle either from the right or the left side of the board. Ten attempts were given in all.

Rules

- At the time of releasing the ball, the subject should not cross or step on the three-point shooting circle.
- The subject should not attempt two or more shots consecutively from one spot.

Scoring

Each successful basket counted three points. If the ball touched the rim of the ring one point was given. The score
was the number of baskets made in ten attempts and the number of times the ball touched the rim. The best score in three trials was recorded as his score.

**Speed Spot Shooting Test**

**Objectives**

The purpose of the test is to measure the speed in shooting ability of a subject behind the fifteen-feet line in one minute.

**Equipment**

Four standard inflated basketballs, a stop watch, a measuring tape, and chunnam.

**Floor Markings**

Just below the ring, vertically on the floor, a centre point was marked. Keeping this point as the centre, a semi-circle with a radius of fifteen feet was marked. Ten spots with equal distance on the semi-circle were marked and given numbers from 1 to 10.

**Test Procedure**

The subject stood at No. 1 spot with the basketball in his hands. The tester gave the signal "GO" and started the stop
SPEED SPOT SHOOTING TEST FLOOR MARKINGS

FIG. 9
watch. The subject started jump shooting from No.1 spot. If the basket was made, he would get 2 points. He ran towards the ball and collected it. After collecting the ball, the subject went to any one of the spots by running with the ball and made the jump shot. The test continued like this. If the basket was missed, the subject went for a rebound and collected the ball before it bounced on the floor. Then he made a basket without bouncing the ball on the floor. If the basket was made after rebound, one point was awarded. The tester counted the points for each attempt. This shooting procedure continued for 60 seconds.

**Rules**

- Stepping on or cutting the semi-circle line is not permitted while attempting jump shots.

- After a rebound, only one attempt is allowed whether the ball goes inside the basket or not.

- After a rebound, no dribble is to be made before taking the jump shot.

- Jump shots can be made from any one of the spots but not continuously from the same spot.
Scoring

For a successful basket, two points were awarded. After the collection of rebound, if the basket was made, one point was awarded. Three trials were given. The score was the number of points obtained in 60 seconds. The best score in three trials was recorded as the final score.

Alternate Under-Basket Shooting Test

Objective

The purpose of the test is to measure the shooting ability of a subject by alternate hand from under the basket (right and left hand).

Equipment

A stop watch and two standard inflated basketballs.

Test Procedure

The subject stood with the ball under the right side of the basket, when he was facing the board. The tester gave the signal "Ready Go" and started the stop watch. The subject started shooting under the basket by the right hand. After
a successful basket, he had to go to the left side of the basket and shoot with the left hand. He should shoot from alternate sides by alternate hands. If the basket was missed he had to convert the basket only from that side and move to the other side. The tester stopped the stop watch after 30 seconds and asked the subject to stop shooting. Each successful basket scored one point. The tester counted each successful basket. Three trials were given.

Rules

- From the right hand side one has to shoot with the right hand and from the left side with the left hand.

- If the basket is missed one, has to convert the basket in that side and move to the other side.

- By chance if the ball goes out of his control, he has to bring the ball where he lost the control of the ball and should shoot from that side.

Scoring

The score was the number of baskets made in 30 seconds. The best score in three trials was recorded as his final score.
Figure-of-Eight Lay-up Shooting Test

Objective

The purpose of the test is to measure the speed in dribbling in which the subject can continue to make lay-up shots in a stipulated time.

Equipment

Two standard inflated basketballs, two folding chairs, a stop watch, and a basketball board with basket.

Floor Markings

Just below the ring, vertically on the floor, a centre point was marked. Keeping this point as the centre, a starting line was marked fifteen feet away at an angle of 45 degrees on both sides of the ring. Two folding chairs were kept on these two points. These spots were known as 'A' and 'B' - 'A' on the right side and 'B' on the left side of the backboard.

Test Procedure

The subject stood with the ball at the spot 'A', behind the chair, facing the board. The tester gave the signal 'Ready
FIGURE—OF—EIGHT LAY-UP SHOOTING TEST FLOOR MARKINGS

FIG. 10
Go' and started the stop watch. The subject made one or two dribbles forward with the right hand moving towards the board and made lay-up shot with the right hand. If it was a successful basket, the subject collected the rebound and dribbled the ball with the left hand towards 'B'. If the basket was missed he had to try again with the right hand from the right side. After a successful basket, the subject went behind the chair at 'B' and dribbled forward with the left hand moving towards the board. He tried a lay-up shot with the left hand. If it was a successful basket, he collected the rebound and dribbled the ball with the right hand towards 'A'. Like this, the subject continued to make lay-up shots for 30 seconds. The tester stopped the watch after 30 seconds and asked the subject to stop dribbling. Each successful basket counted one point. Three trials were given.

Rules

- One has to dribble with the right hand from the right side and with the left hand from the left side.

- While making lay-up shooting, the subject must use the right hand from the right side and the left hand from the left side.
If a basket is missed, the subject must convert the basket from the same side and must use only the respective hand.

- After each basket, the subject must change hand for dribbling.

- Double dribble and carrying the ball are not permitted before making a basket. If there is any violation, the basket is invalid.

- The subject should go to the other side, i.e., right to left, and vice versa, after each successful basket.

Scoring

For each successful basket one point was awarded. Three trials of 30 seconds each were given. The score was the number of points scored in 30 seconds. All three trial scores were recorded. The best score of the three trials was recorded as the final score.

Rebounding Test

Objective

To measure the ability to jump and collect the ball over the head in the air during its downward flight.
Equipment

Standard inflated basketballs, an old net to cover the basket, a measuring tape, a stop watch, and a score sheet.

Test Procedure

The subject stood with the ball just behind the free throw line facing the board. The tester gave the signal 'Ready Go' and started the stop watch. The subject shot or tossed the ball against the board in such a way that the ball rebounded. He then ran forward and jumped in the air, collected the ball over his head while he was in the air. After collecting the rebound he lands on the floor. He ran back to the free throw line with the ball, without making a dribble. Then he repeated the same procedure for 30 seconds. Each successful rebound counted one point. Three trials were given.

Rules

- The subject should not bang the board instead of tossing or shooting.

- The rebounding ball should be collected over the head while the subject is in the air.
The rebounding ball should not be bounced on the floor before it is collected.

Scoring

The tester counted each successful rebound collected. For each successful rebound one point was awarded. The score was, the total number of successful rebounds collected in 30 seconds.

Defensive Movement in Circle Test

Objective

The purpose of the test is to measure the performance of the basic defensive movement.

Equipment

A stop watch, and a measuring tape.

Floor Markings

For this test, the restricted area circle or centre circle was used. The circle's diameter was 3.60 metres including the thickness of the lines. The width of the line was 5 centimetres.
DEFENSIVE MOVEMENT IN CIRCLE TEST FLOOR MARKINGS

FIG. 11

3.60 m
Test Procedure

The subject stood without the ball on the circumference of the restricted area circle. His right leg was just outside the circle and his left leg was on the circle where the free throw line met the circle. On the command "GO", he shuffled his feet towards his left side by bending his knees and extending his hands sideways at the shoulder level. He crossed the left side free throw line, kept the left leg outside the circle, and moved to the right side. The same procedure was followed for 30 seconds. Three complete trials were conducted.

Rules

Foot faults (crossing feet during sliding or shuffling or running) should be avoided. If he crosses the feet or runs, that particular movement is not taken into account for counting.

Scoring

The watch was started when the signal 'GO' was given and stopped after 30 seconds. When the subject slide or shuffled full length of the free throw line and came back, it counted one point. The number of slides or shuffles made
during the 30 seconds was recorded. Three trials were given using the better score of the three as the final score.

Defensive Movement in Restricted Area Test

Objective

The purpose of the test is to measure the performance of basic defensive movements in different directions.

Equipment

A stop watch, a standard basketball court with free throw lane, a marking and measuring tape.

Floor Markings

On the base line or end line where free throw lines met, two spots are marked. The distance was 6 metres. The centre point was also marked on the base line. Two points were marked where the free throw line joined the restricted area circle. The distance was 3.60 metres. The centre point was also marked on the free throw line. On the free throw lane the centre point was found out which was 3 metres from the base line. Eight spots were marked in all on the free throw lane and each spot was numbered 1-8. These numbers were in
FIG. 12
diagonal and continuous. Numbers 7 and 8 were at centre of the free throw line and the centre of the base line respectively.

Test Procedure

The subject stood on the spot No.1 without the ball with his back facing the backboard and his right leg outside the lane. The tester gave the signal "Ready Go" and started the stop watch. The subject slide sideward to the spots 2, 3, 4, 5 & 6 and touched the spot by one leg. Then he slide sidewards from spot 6 to spot 7. From there he shuffled backwards to the spot 8. From here he shuffled forwards to the spot 7. Again, he shuffled backwards from spot 7 to spot 8 and shuffled forwards to spot 7 where he completed the test. As soon as the subject crossed the free throw line, the tester stopped the watch. The time was recorded to the nearest one-tenth of second. Three trials were given.

Rules

Foot faults (crossing feet during sliding or shuffling or running) should be avoided. If a fault occurs, the trial is stopped and started again.
Scoring

The score for each trial was the time lapse required to complete the course legally. Scores were recorded to the nearest tenth of a second for each trial. The best score of the three trials was recorded as the final score.

Field Goal Shooting Test

Objective

The purpose of the test is to measure skills in shooting and rebounding from specific positions.

Equipment

Four standard inflated basketballs, a measuring tape, and chunnam.

Floor Markings

At the end line, the centre point was marked and keeping this point as the centre, an arc was drawn with a radius of 5.80 metres. This arc passed along the free throw line. On the arc 10 spots were marked. There was no mark on the free throw line. Each spot was 1.46 metres apart and numbered from 1 to 10.
FIELD GOAL SHOOTING TEST FLOOR MARKINGS

FIG. 13
Test Procedure

The subject stood behind the spot marked on the floor. He started from spot 1. On the signal "Ready Go", the subject shot from spot 1. If the ball went inside the basket, two points were given. If the ball missed the basket, and the subject collected the rebound and made the basket, it counted only one point. After rebound, no dribble was made. The ball was supplied to the subject at all ten spots. Ten attempts were given for each subject.

Rules

- The subject must attempt only jump shot.

- Before shooting, the subject should not dribble on the spot.

- After rebound, the subject should not dribble.

- Before the rebound is collected, the ball should not bounce or drop on the ground.

Scoring

If the ball went inside the basket after an attempt, it counted 2 points. After the rebound, if the subject made
the basket, it counted one point. A subject could score a maximum of thirty points.

**Speed Dribble and Lay-up Shooting Test**

**Objective**

The purpose of the test is to measure the skill in speed dribble and lay-up shooting.

**Equipment**

A stop watch, standard inflated basketballs, a standard basketball court, and standard goals.

**Test Procedure**

The subject stood with a basketball at the mid-point of the side line where the centre line joined on his left side. At the signal "GO", the subject dribbled the ball towards the right side basket and tried a lay-up shot. After making a successful basket, he collected the ball and dribbled fast towards the other end of the basket. Again he tried a lay-up shot and collected the ball. He continued the same procedure for sixty seconds. Each successful basket counted one point.
SPEED DRIBBLE AND LAY-UP SHOOTING TEST FLOOR MARKINGS

FIG. 14
Rules

- The subject must attempt lay-up shooting at each basket.

- If the subject misses the basket, he should collect the rebound and must make a basket.

- Illegal dribble, double dribble, and running with the ball are not permitted. A basket is invalid if these violations occur before making the basket.

- If the ball goes out of his control, he must bring the ball to the same spot and dribble forward.

Scoring

The watch was started when the signal "GO" was given and stopped after sixty seconds. Each successful basket counted one point, and the number of baskets made was recorded. Three complete trials were given. The best score of the three trials was recorded as the final score of the test.
Bounce and Shooting Test

Objective

The purpose of the test is to measure the shooting ability after one bounce.

Equipment

Four standard inflated basket balls, score sheets, and a measuring tape.

Floor Marking

Just below the ring, vertically on the floor, a centre point was marked. Keeping this point as centre, a semi-circle with 18 feet radius was marked.

Test Procedure

The subject stood with the ball outside the semi-circle marked to the right side of the ring. When the tester gave the signal to start, the subject bounced only one time and shot. If the basket was made or missed, he had to go to the left side of the ring and receive the ball from the tester for the next shot. He could shoot from any place. Likewise, he had to shoot ten times from the right side and from the left side alternately. Three trials were given.
BOUNCE AND SHOOTING TEST FLOOR MARKINGS

FIG. 15
Rules

- The subject should not bounce more than once before shooting.

- After one bounce, he should not step on the semi-circle or take one step inside the semi-circle.

- The subject should shoot from the right and left sides of the ring alternately.

- The subject is not allowed to shoot twice from one side consecutively.

Scoring

Each successful basket counted two points. The score was the number of baskets made in ten attempts. The best score of the three trials was recorded as the final score of the test.

Rebound and Shooting Test

Objective

The purpose of the test was to measure the ability to jump and collect the ball over the head and shoot the ball into the basket.
Equipment

Standard inflated basketballs, a basketball backboard, and a score sheet.

Test Procedure

The subject stood with the ball just behind the free throw line, facing the board. The tester gave the signal "Ready Go". The subject tossed the ball against the board in such a way that the ball rebounded. He ran forward, jumped in the air, and collected the ball in its downward flight over his head. After collecting the rebound, he landed on the floor and made a basket without taking a further step or dribble towards the board. If the basket was missed, he could not attempt to shoot again. Then he came back to the free throw line by running. At the free throw line, the ball was supplied by the tester. The subject collected the ball and tossed against the board for rebound. He repeated the same procedure. Ten chances were given in all. Each successful basket counted one point. Three trials were given.

Rules

The subject should not bang the board instead of tossing the ball.
The rebounding ball should be collected over his head while the subject is in the air.

The rebounding ball should not be bounced on the floor before being caught by the subject.

After collecting the rebound, no dribble or further step is made towards the board.

After attempting the basket, the subject should not collect the rebound whether the basket is made or missed.

Scoring

The tester counted each successful basket made. Each successful basket counted one point. Ten chances and three trials were given in all. The score was the total number of points or baskets scored in each trial. All trial scores were recorded. The best score of the three trials was taken as the final score of the test.

Tip in Shooting Test

Objective

The purpose of the test is to measure the ability of tipping the ball into the basket which caroms from the board.
Equipment

A standard inflated basketball, a basketball backboard, and a score sheet.

Test Procedure

The subject stood by the right of the basket facing the board. The tester stood by the left side of the basket with the ball. The scorer stood near the free throw line facing the board. The tester tossed the ball against the board over the basket. The subject jumped up and collected the ball over his head by one hand or two hands while he was in the air and tipped the ball into the basket. The same procedure continued. If the ball went inside the basket, the subject got one point. If it missed the basket, no point was awarded. The tester tossed the ball five times from the right side and five times from the left. Ten chances were given for each trial and three trials were given in all.

Rules

Tipping should be done before landing.
Scoring

A successful basket counted one point. The recorder counted each successful basket and recorded the total number of baskets in each trial. The score was the total number of baskets scored in each trial. All trial scores were recorded. The best score of the three trials was taken as the final score of the test.

Procedure for Establishing the Validity of Test Items

Statistical validity was established by the investigator for this study by computing a correlation matrix among the fifteen basketball fundamental skill tests and the criterion of playing ability by using the Pearson's Product-Moment Correlation Method.

The investigator also used the composite scores method for establishing validity. The raw scores of each skill test item was converted into standard scores ('Z' scores). The standard scores for each subject for the five test items finally selected were added to obtain a composite score. The composite scores obtained on basketball

---

fundamental skill test items were correlated with the playing ability.

Selection of Test Battery

The investigator computed multiple correlations to express the degree of relationship between the criterion measure (playing ability) and two or more skill test items. The Wherry-Doolittle Multiple Correlation of Test Selection Method was employed in order to select the minimum number of experimental skill tests with the highest multiple correlation with criterion and to select them in the order of their contribution to the correlation.

Construction of Norms

The five test items finally selected were administered on one thousand five hundred subjects in order to establish norms. This was the second phase of the data collection. The data collected on 102 subjects in the first phase and those on 1398 subjects in the second phase of the study were pooled together and then organised into three different age groups from 16 to 18 years. Percentile norms and 'T' scales were prepared for the age groups of 16, 17 and 18 years separately.