Chapter - III
PROCEDURE

In this chapter the selection of subjects, criterion measures, reliability of data, filming protocol, analysis of film, administration of test and collection of data and its analysis have been described.

Selection of Subject

Twenty male basketball players who had qualified for Inter Zonal University Competition in the North Zone Inter-University Basketball Tournament held at CSJM University, Kanpur in November 2011 were selected as subjects for this study. Since the players had been trained for a considerable period of time, they were considered skilled and their technique was treated as stabilized. All the subjects were explained the purpose of the study and were requested to put in their best during each attempt.

Selection of Variables

Based on literary evidence, correspondence with the expert and scholar's own understanding and keeping the feasibility criterion in mind, the research scholar selected the following kinematic variables for the study.

A. Angular Kinematic
   i. Angle of Right Ankle Joint
   ii. Angle of Right Knee Joint
   iii. Angle of Right Hip Joint
   iv. Angle of Right Shoulder Joint
   v. Angle of Right Elbow Joint
   vi. Angle of Right Wrist Joint

Figure 1: Angular Kinematics
B. Linear Kinematic Variables

i. Height of Centre of gravity of the body at propulsion phase- 4
ii. Height of ball release at propulsion phase- 4
iii. Distance of Ball travelling
iv. Velocity of Ball travelling
v. Time of Ball travelling

C. Fundamental Skills

i. Baseball pass
ii. Chest pass
iii. High dribble
iv. Low dribble
v. Hook shot
vi. Jump shot

Criterion Measure

The performance of subjects in selected fundamental skills was taken as the criterion measure for the purpose of the present study. The subject’s performance was recorded on the basis of three judge’s evaluation. The performance for each trial was judged by three experts and their scores were recorded. From each trial the score was converted into numerical form (details are given in Table 1) and out of the two trials, the best was used for analysis of data.

Table -1

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Five Point Scale</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Poor</td>
<td>1 – 2</td>
</tr>
<tr>
<td>2</td>
<td>Below average</td>
<td>3 – 4</td>
</tr>
<tr>
<td>3</td>
<td>Good</td>
<td>5 – 6</td>
</tr>
<tr>
<td>4</td>
<td>Very good</td>
<td>7 – 8</td>
</tr>
<tr>
<td>5</td>
<td>Excellent</td>
<td>9 – 10</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>
On the basis of the below mentioned parameters the performance of subjects were assessed by three judges by using the above listed 5 point scale for each of the fundamental skills, sum of scores of all judges was taken as the criterion measure for this study.

1. Stance
2. Execution
3. Movement coordination
4. Ball placement
5. Follow through

Collection of Data

The procedure of filming protocol and analysis of the film has been described as follows:

Filming Protocol & Analysis of Film:

The video camera (Casio Exilim EX-F1) was adjusted on a tripod at a height of 1.50 mts. from the ground, it was placed perpendicular to the execution line and parallel to horizontal plane at a displacement of 7.70 mts. from the midpoint of the execution line. The subjects were made to take two trials.

The 300 frames per second as obtained by the use of high velocity videography were analysed (the best trial) by Siliconcoach Pro-7 software. Only one selected frame was obtained and the Research Scholar developed the stick figures from which various kinematic variables were obtained. The stick figures were developed by using joint point method in which the body projections at the joints facing the camera were considered for the study.

The videos of different skills of subjects were captured at the basketball court of Chhatrapati Shahu Ji Mahraj University, Kanpur. The videos were captured under controlled conditions. Seven moments was analysed simultaneously,
Figure 2: Baseball Pass Execution

Figure 3: Chest Pass Execution
Figure 4: High Dribble Execution

Figure 5: Low dribble Execution
Figure 6: Hook Shot Execution

Figure 7: Jump Shot Execution
The center of gravity of each subject, at selected moment i.e. propulsion phase- 4 was located by using segmentation method.

Procedure for Location of Center of Gravity:

The following steps were followed for locating the center of gravity of each subject at the time of performing selected fundamental skills:

1. On the photograph the reference points associated with each segment were marked.

2. A stick figure representation of the subject by ruling straight lines between appropriate reference points was prepared. Trunk line was obtained by joining the midpoint of the line between right and left hip joints to the midpoint of the trunk at the level of the supra-sternal notch.

3. The length of each segment lines was measured and divided into appropriate ratio as indicated in Table 2. At the point of division the marks were made (i.e. the center of gravity of the segments) on their respective lines.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Segments</th>
<th>Center of Gravity Location expressed as percentage of Total Displacement between reference points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Head</td>
<td>46.4% to vertex, 53.6% to chin neck intersect</td>
</tr>
<tr>
<td>2.</td>
<td>Trunk</td>
<td>43.8% to supra-sternal notch; 56.2% to hip axis</td>
</tr>
<tr>
<td>3.</td>
<td>Upper Arm</td>
<td>49.1% shoulder axis; 50.9% to elbow axis</td>
</tr>
<tr>
<td>4.</td>
<td>Forearm</td>
<td>41.8% to elbow axis; 58.2% to wrist axis</td>
</tr>
<tr>
<td>5.</td>
<td>Hand</td>
<td>82% to wrist axis; 18% to knuckle III</td>
</tr>
<tr>
<td>6.</td>
<td>Thigh</td>
<td>40% to hip axis; 60% to knee axis</td>
</tr>
<tr>
<td>7.</td>
<td>Calf</td>
<td>41.8% to knee axis; 58.2% ankle axis</td>
</tr>
<tr>
<td>8.</td>
<td>Foot</td>
<td>44.9% to heel, 55.1% to tip of longest toe.</td>
</tr>
</tbody>
</table>

4. Two arbitrary axes (OY and OX), one to the left and one below the stick figure were ruled out.

5. A form was prepared (Appendix- H) and in Column 1 the weight of the segments was entered. The weights of the body segments are given in Table 3.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Segments</th>
<th>Relative Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Head</td>
<td>0.073</td>
</tr>
<tr>
<td>2.</td>
<td>Trunk</td>
<td>0.507</td>
</tr>
<tr>
<td>3.</td>
<td>Upper Arm</td>
<td>0.026</td>
</tr>
<tr>
<td>4.</td>
<td>Forearm</td>
<td>0.016</td>
</tr>
<tr>
<td>5.</td>
<td>Hand</td>
<td>0.007</td>
</tr>
<tr>
<td>6.</td>
<td>Thigh</td>
<td>0.103</td>
</tr>
<tr>
<td>7.</td>
<td>Calf</td>
<td>0.043</td>
</tr>
<tr>
<td>8.</td>
<td>Foot</td>
<td>0.015</td>
</tr>
</tbody>
</table>

6. For each segment, the perpendicular displacement from its center of gravity to the line OY was measured and entered in the appropriate place on the form in Column 2.

7. To find the moment about OY, the weight of each segment was multiplied by the displacement of its center of gravity from the line OY and these values were entered at appropriate places on the form in column 3.

8. The sum of the moments about OY was found out by adding the contents of column 3 on the form.

9. An imaginary line O'Y' parallel to OY was ruled at a displacement x from it (x = sum of moments about OY), the center of gravity of the subject lies on this line.

10. The steps from 5 to 9 were repeated, taking moments OX instead of OY, which brought out another imaginary line O"X" parallel to OX at a displacement from OX (y = sum of moments about OX), the center of gravity of the subject lies on this line.
Since the C.G lies on both O'Y' and O"X" and these two lines have only one point in common (the point where they intersect), it is here that the center of gravity of the subject is situated.

The height of center of gravity was obtained by calculating the displacement from the court and the center of gravity of the body of the players. (Appendix)

**Angular Kinematic Variables:**

The selected kinematic variables such as angles at ankle joint, knee joint, hip joint, shoulder joint elbow joint and wrist joint were obtained by measuring with the help of Siliconcoach pro-7 software from the stick figures.

**Analysis of Data**

To analyze data, descriptive statistics was used. Further to examine the relationship of selected kinematic variables with performance of basic fundamental skill execution in basketball, Pearson's Product Correlation Moment was used. To test the hypothesis the level of significance was set at 0.05. The above statistical technique was analyzed by using SPSS version 15.