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A DEVELOPMENT OF SKILL TESTS BATTERY IN FIELD HOCKEY

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Abstract

The purpose of this study was to develop a skill tests battery in Field Hockey on astro turf surfaces. To achieve the purpose of the study initially, twenty three skill test items were designed by the investigators and a pilot study was conducted. After analyzing the various factors, nine test items were finalized by establishing validity, reliability and objectivity. Four hundred and fifty four male college level Hockey players excluding goal keepers were randomly selected from various colleges of Kerala state, India their age ranging between 17 and 20 years. The above said nine skill test items were administered and subjected to various statistical analysis namely correlation and factor analysis. The result reveals that there was an inter-relationship between the performances of selected test items. The factor analysis yielded two factors which were named as 'stick work ability' and 'accuracy in ball playing ability. Six test items from the two factors which had high loading namely speed dribbling, shooting from 16 yards, straight flick, slap hit, multi target push and straight drive hit were selected to constitute the 'Skill Tests Battery in Field Hockey'.

Key Words: Field Hockey, Skill Tests Battery, Factor Analysis

Introduction

In sports and games, performance of players is judged by competition results. Apart from competition, the assessment of a player in any sports discipline can be done either by subjective or objective means. Generally the subjective assessment is done by the experts, which has certain limitations. The objective assessment can be done by the skill tests of the relevant sports discipline. Sports skill tests are designed to measure the basic skills used in the playing of a specific sport. The nature of the game should be analysed in steps in order to determine the skills that are to be measured. Dureha & Mehrotra (2003) opines that because of the wide range of skills in most sports, a selection of the most important skill is invariably necessary. The skill tests batteries have been used in physical education and sport to assess the skills of the players. The degree of perfection of sport skills obviously varies significantly with the level and sex of the players. High level performance in any game depends upon the mastery of the fundamental skills.

Field Hockey is a fast outdoor game played in more than 132 countries. Field Hockey is otherwise called as 'Hockey' in most of the countries. Hockey is basically a team game, in which each team attempts to place a ball into their opponent's goal using sticks. To perform well at any level in Field Hockey, a player has to learn and use a wide range of skills (Majumdar, 2008). In Field Hockey, most of the skill test measures more than one skill at a time. The combination of various skills in a test fails to give the exact level in each skill. Lemmink, et al. (2004) opines that recent developments in Field Hockey, such as the playing surface, new stick material, and rolling substitution rule, have increased the number of

technical demands made on Field Hockey players at all levels. The skill tests constructed by various experts in the field of Hockey are outdated and day by day the nature of the game changes its structure. Coaches, trainers and players are continually searching for effective methods of identifying and developing those characteristics in a player that may enhance performance.

The batteries of tests for measuring skills in Field Hockey are very few. Moreover very few studies have been done on the astro turf surfaces. One of the investigators being a Hockey player, qualified coach and umpire is keen in designing the skill tests in almost all the vital skills in Hockey. Lack of test in certain skills in Field Hockey motivated the investigators to take up this study. The purpose of this study was to construct a skill test battery in Field Hockey.

Methodology

For the purpose of the study initially, twenty three skill test items were designed by the investigator and a pilot study was conducted. All skill tests were conducted only on the astro turf surface. The data were collected during the competition period. After analyzing the various factors, nine test items were finalized by establishing validity, reliability and objectivity. Four hundred and fifty four male college level Hockey players excluding goal keepers were randomly selected from various colleges of Kerala state, India their age ranging between 17 and 20 years. The subject had past experience of at least three years in the Field Hockey and those who represented their respective college teams were only taken as subjects. Keeping in mind the literature available and the opinion of the experts, the following vital skills in Field Hockey namely dribbling, hit, push, flick, scoop and shooting were taken for investigation.

The following nine skill test items namely speed dribbling, slap hit, straight flick, scoop for distance, shooting from 16 yards, zig-zag dribbling, straight drive hit, multi target push and shooting from three different spots were administered to all the subjects selected. The data collected were subjected to various statistical analysis namely correlation and factor analysis. The first statistical analysis was Pearson's Product Moment Correlation which was used to find out the inter-relationship among all the skill test items. Field (2005) explains in Factor Analysis the significant factors responsible for variance and dominant were extracted through Principal Component Analysis (Un rotated Factor Loadings and Varimax Rotation). The final solution so obtained was used to identify the different factors. These factors were given an appropriate name depending upon the characteristics of variables contained in it. A skill test battery was constructed by picking up the variables having higher loading from each factor.

Administration of the Test Items

Speed Dribbling

Purpose

To assess the speed dribbling ability of the players.

Facilities & Equipment Required

Hockey sticks, balls, cones (used as an obstacle) stop watch and whistle.

Testing personnel

A timer and scorer.

Markings

The area needed was 25 metres by 5 metres. The distance between the two ends was 20 metres.

Diagram

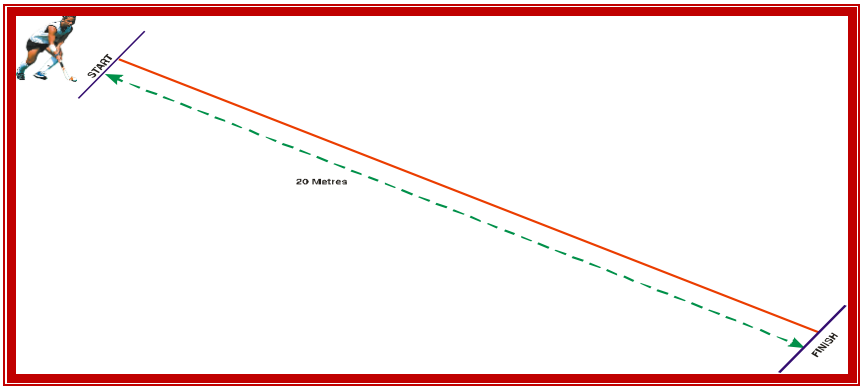

Illustration 1: Speed Dribbling

Procedure

On the whistle, the player dribbles the ball from starting line to the finish line. The player can use any type of dribble.

Scoring

The time for a trial was the elapsed time in seconds from the whistle until the player finishes the third ball. Three trials were recorded and best one was taken as score.

Straight Drive Hit

Purpose

To measure the hitting ability of the subject.

Facilities & Equipment Required

Hockey field with required markings, Hockey sticks, balls, whistle, cones were used.

Testing personnel

A scorer and helpers.

Diagram

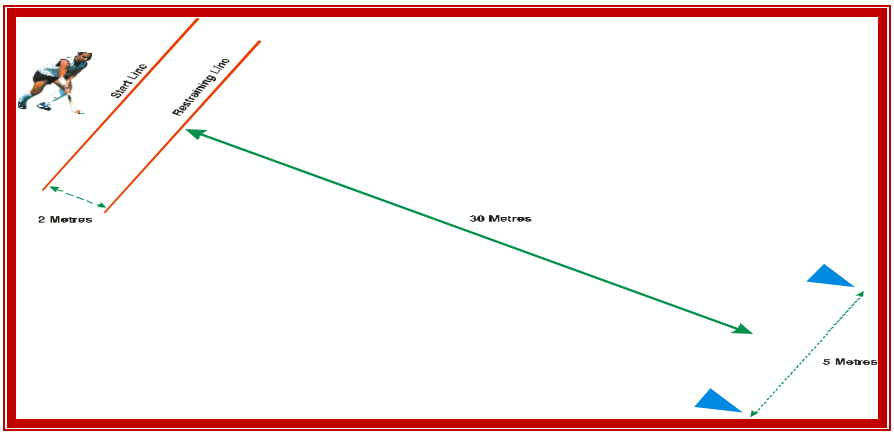

Illustration 2: Straight Drive Hit

Markings

The area needed was 30 metres by 10 metres. The target was fixed with a width of 5 metres at a distance of 30 metres from the restraining line. The area between the starting and restraining line was 2 metres.

Procedure

On the whistle, from the starting line the players dribble and move within the given area and hit the ball before crossing the restraining line.

Scoring

5 points were awarded when the ball goes inside the target. There were no points when the ball goes outside the target. Totally five chances were given to each player and the total score was taken as score.

Slap Hit

Purpose

To measure the slap hit ability of the players.

Facilities & Equipment Required

Hockey field with required markings, Hockey sticks, balls, whistle, cones were used.

Testing personnel

A scorer and helpers.

Diagram

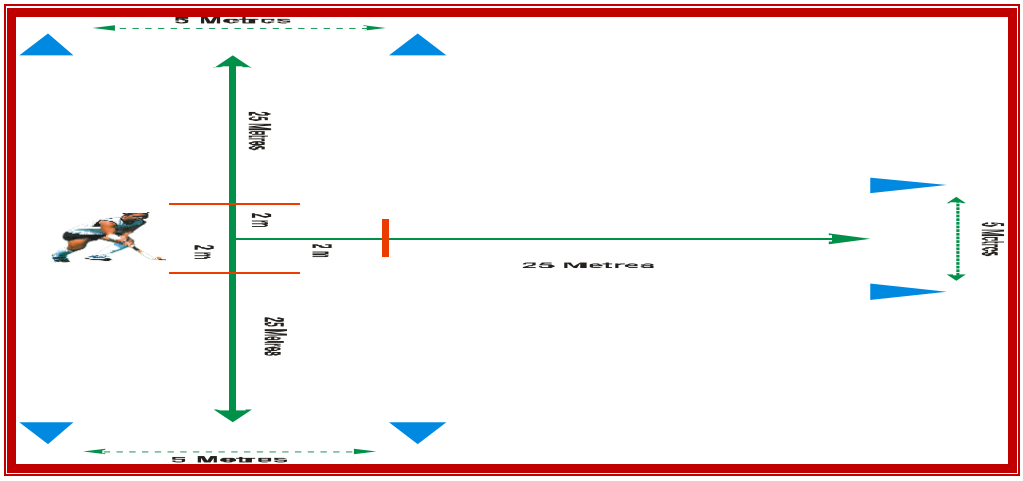

Illustration 3: Slap Hit

Markings

The area needed was 30 metres by 60 metres. The target was fixed at a distance of 25 metres from the centre towards three directions which was left, front and right of the player. The area between the starting and restraining line was 2 metres.

Procedure

On the whistle, from the starting line the player dribble and moves with the ball in a given area and hit the ball continuously before crossing the restraining line towards the target starting from the left, front and right side respectively. Two hits from one direction, only slap hit is permitted along the ground level. Each target width was measured 5 metres. Totally six chances were given, from that two chances were performed on each target.

Scoring

5 points were awarded when the ball goes inside the target. There were no points when the ball goes outside the target. Total score of six chances were taken as score.

Multi Target Push

Purpose

To measure the pushing ability of the players.

Facilities & Equipment Required

Hockey field with required markings, Hockey sticks, balls, whistle, cones were used.

Testing personnel

A scorer and helpers.

Diagram

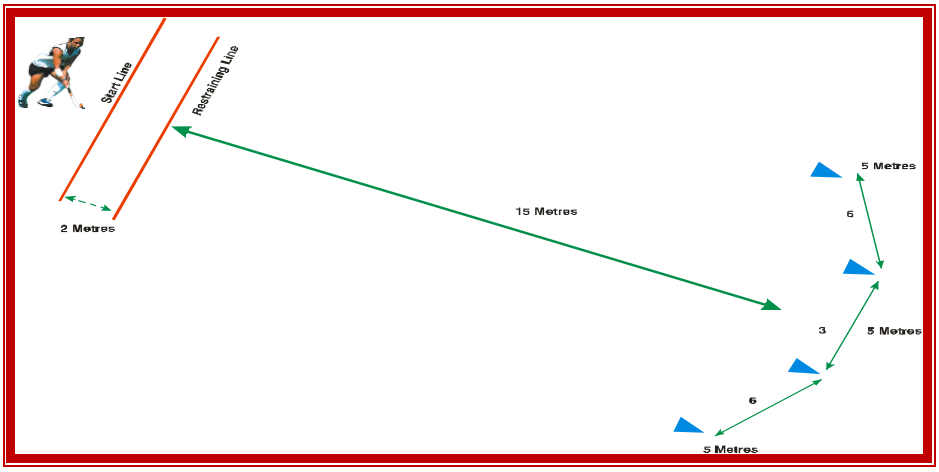

Illustration 4: Multi Target Push

Markings

The area needed was 20 metres by 20 metres. The target was fixed at a distance of 15 metres from the restraining line and divided into three equal areas of 5 metres each. The area between the starting and restraining line was 2 metres.

Procedure

On the whistle, from the starting line the players dribble and move within the given area and push the ball with stick before crossing the restraining line.

Scoring

The target was divided into three equal areas and the points were given as 6, 3 and 6 respectively. If the ball goes inside the target the relevant points were given. If the ball hits the cone which was at center, highest point was awarded. Totally five chances were given to each player and total score was taken as individual score.

Straight Flick

Purpose

To measure the flicking accuracy of the player.

Facilities & Equipment Required

Hockey sticks, balls, flags, whistle, cones, 1 feet board were used.

Testing personnel

A scorer and helpers.

Diagram

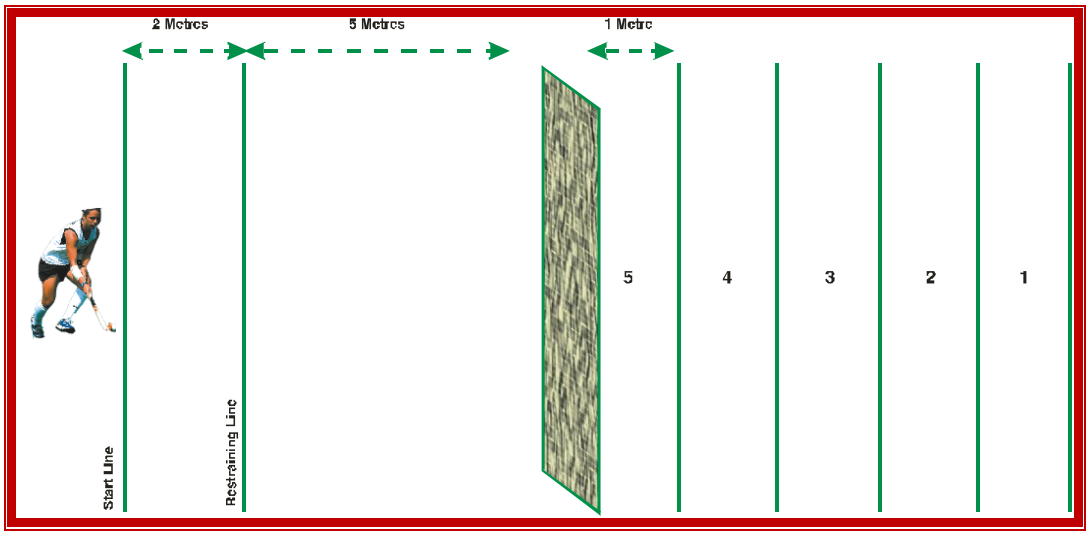

Illustration 6: Straight Flick

Markings

The area needed was 15 metres by 5 metres. From the starting line a board was fixed at 5 meters. The height of the board was 1 feet. From the board five areas of 1 metre each were marked and the points were given as 5,4,3,2 and 1 respectively. The area between the starting and restraining line was 2 metres.

Procedure

On the whistle, from the starting line the player dribble and moves within the given area and flick the ball above the board before crossing the restraining line.

Scoring

The place where the ball bounced first was counted. If the ball bounced on the line the nearest highest points was given. Totally five chances were given to each player and total score was taken as score.

Shooting from 16 Yards

Purpose

To measure the shooting accuracy of the players.

Facilities & Equipment Required

Hockey field with required markings, Hockey sticks, balls, whistle, cones were used.

Testing personnel

A timer, scorer and helpers.

Diagram

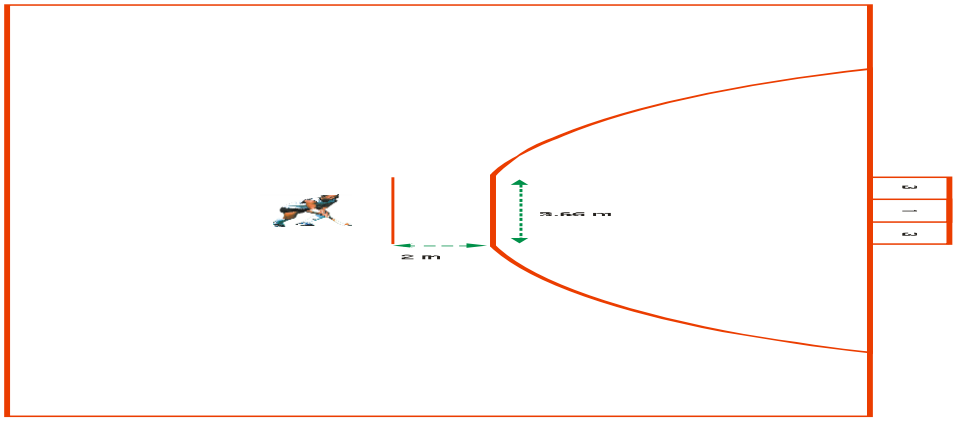

Illustration 6: Shooting from 16 Yards

Markings

The area needed was 25 metres by 10 metres. A line was marked 2 metres from the top of the shooting circle with 3.66 metres width. The goal area was divided into three equal areas and points were given 3, 1 and 3 respectively. The area between the starting and restraining line was 2 metres.

Procedure

On the whistle, from the starting line the player dribble and moves in the given area and shoot the ball at goal just from inside the shooting circle.

Scoring

The place where the ball hits was counted. If the ball hits on the line the nearest highest points were awarded. Totally five chances were given to each player and total score was taken as score.

The objectivity and reliability coefficients of the test items are presented in Table-I.

Table – I

Correlation Coefficients of Skill Tests

S. No.	Test items	Objectivity	Reliability
1	Speed Dribbling	0.90*	0.85*
2	Slap Hit	0.81*	0.88*
3	Straight Flick	0.91*	0.89*
4	Scoop for Distance	0.85*	0.92*
5	Shooting from 16 Yards	0.94*	0.90*
6	Zig Zag Dribbling	0.89*	0.91*
7	Straight Drive Hit	0.82*	0.80*
8	Multi Target Push	0.92*	0.93*
9	Shooting from Three Different Spots	0.94*	0.90*

* Significant at the 0.01 level.

According to Barrow & McGee (1979) arbitrary standard for acceptable objectivity & reliability was 0.80. The above said nine test items were found acceptable according to arbitrary standards for the evaluation of physical performance tests. The descriptive analysis of all the skill test items is shown in the table II.

Table - II

Descriptive Analysis of Skill Tests

Skill tests	Range	Minimum	Maximum	Mean	Std. Deviation (±)
Speed Dribbling (Seconds)	4.89	4	8.89	5.27	0.67
Slap Hit (Points)	20	5	25	15.01	4.55
Straight Flick (Points)	14	10	24	16.69	2.82
Scoop for Distance (Points)	16	5	21	11.73	2.85
Shooting from 16 Yards (Points)	10	5	15	11.22	1.87
Zig Zag Dribbling (Seconds)	6.35	6.54	12.89	9.00	1.27
Straight Drive Hit (Points)	15	10	25	16.63	4.38
Multi Target Push (Points)	14	9	23	17.14	3.45
Shooting from Three Different Spots (Points)	15	10	25	18.93	2.94

Factor Analysis Of Skill Test

Factor analysis is used to uncover the latent structure of a set of variables. It reduces attribute space from a larger number of variables to a smaller number of factors and as such is a "non-dependent" procedure. The data collected from 454 inter-collegiate Field Hockey players on the nine test items that significantly correlated were subjected to Factor Analysis. Factor analysis helped in determining the minimum number of basic sources of variance, which could economically account for the obtained variance among variables. Using Pearson's Product Moment Correlation, a matrix of inter-correlations among the nine test items was obtained. The Correlation Matrix is shown in table III.

Table-III

Correlation Matrix for Skill Test

	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8
ST1								
ST2	0.41*							
ST3	0.31*	0.19**						
ST4	0.18*	0.07	0.38**					
ST5	0.53*	0.26**	0.19**	0.11*				
ST6	-0.00	0.07	-0.04	0.06	0.00			
ST7	-0.01	0.94*	0.06	-0.02	-0.02	0.02		
ST8	0.02	0.08	0.04	0.06	0.02	0.03	0.37*	
ST9	0.17*	-0.05	0.08	-0.01	0.02	-0.07	0.94*	0.20**

** Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

ST1 = Speed Dribbling ST4 = Scoop for Distance ST7 = Straight Drive Hit
ST2 = Slap hit ST5 = Shooting from 16 Yard ST8 = Multi Target Push

ST3 = Straight Flick ST6 = Zig Zag Dribbling ST9 = Shooting from Three Different Spots

The correlation matrix obtained for the nine test items was used in the Principal Component Analysis. With the help of Principal Component Analysis, all the nine test items were divided into two factors. The unloaded factors obtained were then rotated by Varimax Method to find the final solutions. Rotations of the factors were considered important in order to avoid the overlapping of variables in different factors. Most of the statisticians agree that the un-rotated factors do not generally represent useful scientific constructs, and that rotation is necessary if useful and meaningful constructs were to be identified. In the light of statisticians opinion the un-rotated factor matrix was subjected to two rotations since the number of test items were only nine.

The matrix of un-rotated loadings (Principle Component Analysis) and rotated factor loading (Varimax Method) is given in table IV.

Table - IV
Principal Component Analysis (Un rotated Factor loading) & Rotated Factor Loading (Varimax solution)

	PCA (Un rotated Factor loading)		**RFL (Varimax solution)**	
Item no	**1**	**2**	**1**	**2**
Eigen value	2.13	1.44	2.10	1.5
Percentage variance	23.63	16.08	23.30	16.36
Cumulative variance	23.69	39.77	23.30	39.66
Speed Dribbling	0.80	-0.16	**0.82**	0.01
Shooting from 16 Yards	0.66	-0.22	**0.69**	-0.07
Straight Flick	0.61	-0.01	**0.60**	0.11
Slap Hit	0.60	-0.05	**0.59**	0.07
Scoop for Distance	0.45	-0.06	0.45	0.02
Zig Zag Dribbling	0.03	0.01	0.03	-0.02
Multi Target Push	0.20	0.78	0.03	**0.80**
Straight Drive Hit	0.13	0.74	-0.02	**0.75**
Shooting from Three Different Spots	0.19	0.44	0.09	0.47

PCA: Principal Component Analysis RFL: Rotated Factor Loading

The table IV shows the two significant factors that were extracted. The eigen value of the extracted factors were greater than 1.0. The eigen values (latent roots), percentage variance and cumulative percentage of variance pertaining to un rotated and rotated factor matrix are given in the table. There are various indicators, which are used by researchers to decide on the number of factors that need to be extracted. Thus, it is imperative to decide on the indicator and the level of indicator, which should be considered the cut-off to decide on the number of factors to be extracted. Kaiser's measure of statistical adequacy is one such measure, which signifies the extent to which every variable can be predicted by all other variables and it is widely believed that an overall measure of 0.80 or higher is very good, though a measure of under 0.50 is considered poor. From table IV the variable which has the

loading higher than 0.50 are taken as the extracted factors and those factors were interpreted and given an appropriate name. The graphical representation of percentage variance is shown in Illustration 1.

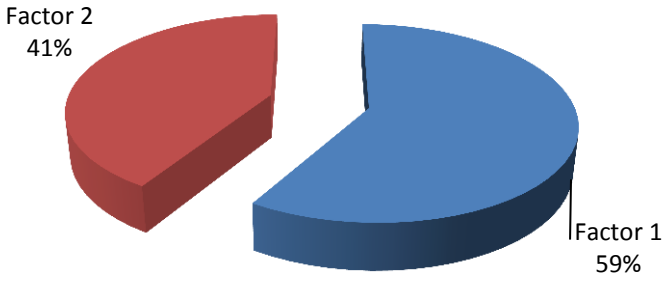

Illustration 1. Percentage Variance of Rotated Factor Loadings

Development of Final Test Battery

The test items to be included in the skill test battery of Field Hockey were selected on the basis of Product Moment Correlation among all the nine test items that have been developed and by applying factor analysis to extract the factors. From the two factors which had been extracted, only the test items which had higher loading from both the factors were selected to constitute the test battery. The test items that constituted the test battery are shown in table V.

Table - V

Skill Test Battery in Field Hockey

S. No.	Name of the Test Item	Name of the Factor
1	Speed Dribbling	Stick Work Ability
2	Slap Hit	
3	Straight Flick	
4	Shooting from 16 Yards	
5	Straight Drive Hit	Accuracy in Ball Playing Ability
6	Multi Target Push	

Conclusions

The prime intention of the researcher was to construct a comprehensive module with limited number of test items and greater level of dependability.

1. The result reveals that there was an inter-relationship between the performances of selected test items.

2. The factor analysis yielded two factors which were named as ‘stick work ability’ and ‘accuracy in ball playing ability.

3. Six test items from the two factors which had high loading were selected to constitute the ‘Skill Tests Battery of Field Hockey’ for the inter-collegiate Field Hockey men players in the age group of 17 to 20 years. The tests were speed dribbling, shooting from 16 yards, straight flick, slap hit, multi target push and straight drive hit.

The high objectivity, reliability and validity scores for the six test items in the final test battery module also affirm the fact that the administration of these six tests have been good, thereby assuring the administrative feasibility of the tests. The tests were constructed involving all the fundamental skills of the game which are imperative to play the game. Final test battery is believed, will be a significant contribution for the promotion of the game. The battery, when employed by the coaches, is expected to help them to come up with useful and reliable data that may be processed for monitoring, talent identification and improving the playing ability of the subjects.

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