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Prognostication of Handball Performance as a Rationale of Coordinative Abilities by Framing Multiple Regression Models

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Abstract

The objective of research was to prognosticate Handball Performance as a rationale of Coordinative Abilities by framing multiple regression models. On the basis of random sampling method, seventy (N = 70) male Handball Players from different Indian Universities were selected during the Intervarsity Championship. All the subjects were from the age group of 18 to 26 years who participated in the Intervarsity Championship. For the Prognostication of Handball Performance as a Rationale of Coordinative Abilities, Handball Players (HBP) was selected as Dependent Variable (DV) and Coordinative Abilities (Orientation Ability, Differentiation Ability, Reaction Ability, Balance Ability and Rhythmic Ability) were selected as Independent Variables (IV). Multiple Regression Analysis was used to analyse data. Two models are framed for the Prognostication of Handball Performance as a Rationale Coordinative Abilities. In model one, value of R (.79) shows the relationship between dependent variable (Handball Performance) and independent variable (Orientation Ability). Value of R Square (.62) shows that 62 percent of Handball Performance is explained by Orientation Ability. In relation to model two, value of R (.81) shows the relationship between dependent variable (Handball Performance) and independent variables (Orientation Ability and Differentiation Ability). Value of Adjusted R Square (.65) shows that 65 percent of Handball Performance is explained by Orientation Ability and Differentiation Ability. Two framed models for the Prognostication of Handball Performance as a Rationale Coordinative Abilities are: (1) Handball Performance = 59.68 + -5.22 × Orientation Ability, (2) Handball Performance = 44.23 + 44.23 × Orientation Ability + .463 × Differentiation Ability.

Key Words: Handball Performance, Coordinative Abilities, Regression Model.

1. Introduction:

In the modern era, it has been found that up to maximum extent sports performance is dependent on coordinative abilities. Coordinative abilities have been considered as an essential tool for learning sports techniques. It is also important for the refinement & modification of these techniques during long term training process (Singh, H., 1991). Using different parts of the body in an ordered sequence of movement to achieve a desired goal requires a high degree of neuromuscular coordination. Some skilled acts required predominantly eye-foot-hand coordination, such as in punting a football; other skills require mainly eye-hand coordination, such as in the precision task of hitting the ball in a centre jump in basketball; and still others require eye-foot coordination, such as in kicking a soccer ball (Daniel, D. A., & Robert, A. P., 1978). Coordination can be described as precisely integrated muscle group responses to a demand for agile movement. Coordination is also critical to efficient movement in ways that can increase endurance and stamina (Lee, B., 2010). In the field of exercise science, coordination is recognized as the ability of the body to organize two or more patterns to achieve a specific movement goal. Coordination involves an intricate and complex sequence of activities. In Simple words these activities encompass reacting to sensory input (stimulus), choosing and processing the proper motor program from learned skills (motor learning), and finally, executing the action. Information is sent to the brain for prediction, evaluation, and adjustment. The entire process occurs in fractions of milliseconds (Foran, B., 2001). This ability enables the sportsperson to change and analyze body position in time & space in accordance with performance area or an object which is in motion. It is dependent on the functioning of optic sense organ, kinesthetic receptors and vestibular apparatus (Uppal, A. K., 2001). Differentiation ability helps the sportsperson to achieve perfection in body movements. It requires regular practice when one has to acquire mastery in a particular skill. It is dependent on kinesthetic sense organs (Uppal, A. K., 2001). It is an ability to respond quickly against a given stimulus resulting in the execution of well-directed actions. It is dependent on the functional capacity of acoustic, optic and tactile sense organs. Balance ability is the most important trait for any sportsmen. In handball also it has great significance. Author (Lee, B., 2010) described balance

ability as a foundation of all movements. All the movements originate from the balance ability. In any sports, players loose centre of gravity and try to regain it to maintain the balance. During play this is performed several times. Rhythm in the field of sports plays integral role. Which occurs due to constant practice generally athletes of track & field, gymnasts, swimmers; skaters possess high sense of rhythm. A successful athlete should have stamina, quickness, agility, explosive strength & coordination of high quality along with good rhythm & sense of timing. All locomotors movements are rhythmic & repetitive sequence of movements like stride in running or stroke in swimming (Kamlesh, M. L., 2011). It is very different test to frame any regression model for the Prognostication of Handball Performance in any game. Since, first we have to identify the trait and characteristics which are associate with performance of any game. In the present study, on the basis of literature and post investigations as well as on the basis of post experiences of investigators, coordinative abilities are found appropriate for the Prognostication of Handball Performance.

2. Materials and Method:

2.1. Objective of the Study:

The objective of research was to prognosticate Handball Performance as a rationale of Coordinative Abilities by framing multiple regression models.

2.2 Participants:

On the basis of random sampling method, seventy (N = 70) male Handball Players from different Indian Universities were selected during the Intervarsity Championship. All the subjects were from the age group of 18 to 26 years who participated in the Intervarsity Championship as per the Association of Indian Universities (AIU) rules.

2.3 Measures:

For the Prognostication of Handball Performance as a Rationale of Coordinative Abilities, Handball Players (HBP) was selected as Dependent Variable (DV) and Coordinative Abilities (Orientation Ability, Differentiation Ability, Reaction Ability, Balance Ability and Rhythmic Ability) were selected as Independent Variables (IV).

2.4 Design of the Study:

Correlational design was used to conduct the study. All the selected Handball Players were equally divided in to seven groups (Seven Playing Positions).

2.5 Statistical Techniques:

For the Prognostication of Handball Performance as a Rationale of Coordinative Abilities, Multiple Regression Analysis [(Best, J. W., (1963), Landau, S., & Everitt, B. S., (2004), Brown, J., (2001), Chan, Y. H., (2003), Chan, Y. H., (2003), Field, A., (2009), Gay, L. R., (2000) and Foran, B., (2001)] was used.

2.6 Testing of Assumption to frame regression model:

Table- 1 Standardized Residuals (to test the outliers), Value of Durbin Watson (to test the independence) related to framing of regression model for the Prognostication of Handball Performance as a Rational of Coordinative Abilities.

3. Results of the Study:

Table: 1

Table showing value of Standardized Residuals and Durbin Watson Value

Standardized Residuals		
Minimum	Maximum	Durbin Watson Value
-2.83	2.73	1.75

Minimum (-2.83) and maximum (2.73) value of Standardized Residuals were found (table- 1) with in the expected range (-3 to 3). This shows that no outlier is found in relation to residuals.

Durbin Watson value of 1.75 was found as per expectation (near 2 and away from 0 and 4). This shows that independence of residuals was found.

Figure: 1

Normal Curve with Histogram of Regression Standardized Residuals (to test Normality)

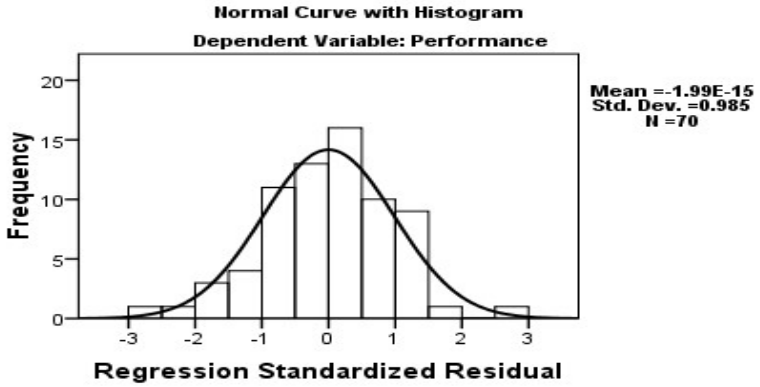

Figure: 2

Normal P-P Plot of Regression Standardized Residual (to test the Normality)

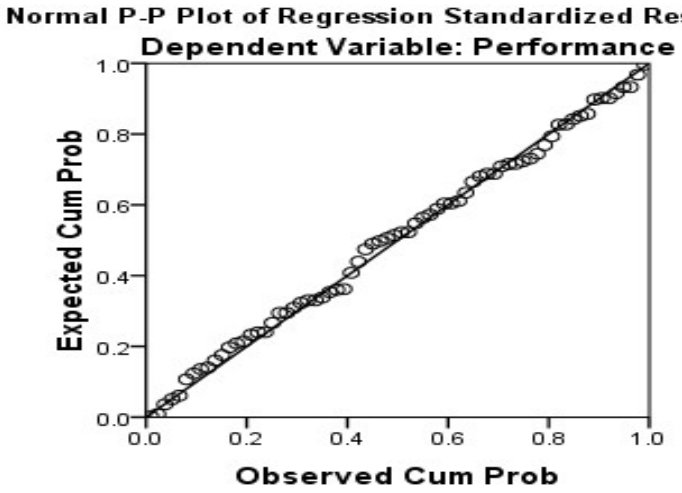

Figure: 3

Scatter Plot showing Regression Standardized Residual versus Regression Standardized Predictive Value (to test constant variance)

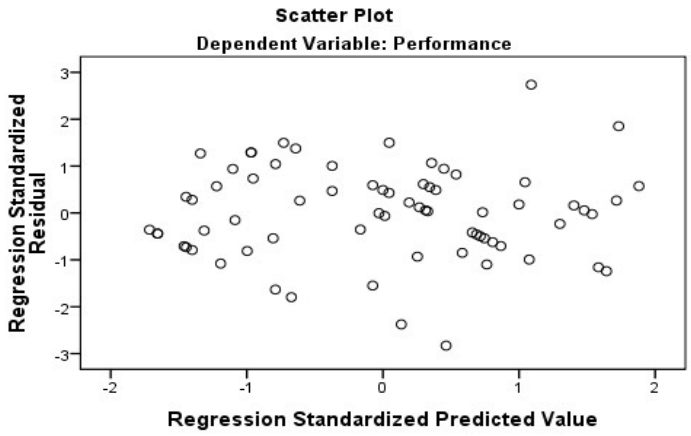

Figure: 1 shows the normality of residuals. Data of normal curve (along with Histogram) was found in a proper shape. In P-P Plot (Figure- 2), all the scores of residuals are found scattered very closely to a standard line. This shows the normality of residuals. Figure: 3 also shows the constant variance, since no pattern was found in case of Residuals.

Figure: 4

Scatter Plot with Regression Line related to First Establish Model (R of Handball Performance as a R of Orientation Ability)

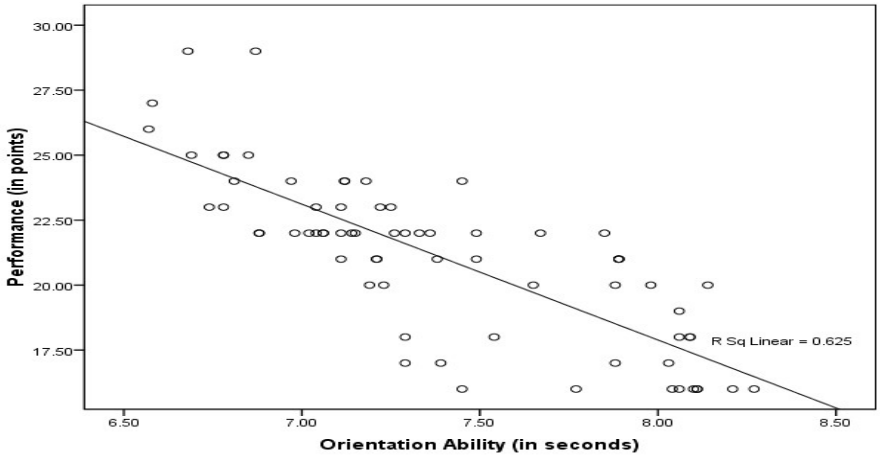

Figure: 4 shows the relationship of Handball Performance and Orientation Ability for the Prognostication of Handball Performance as a Rationale of Coordinative Abilities between the range of 6.50 to 8.50 Orientation Ability of this range the established equation may not be valid.

Framed Models:

(1) Handball Performance = 59.68 + -5.22 × Orientation Ability.

(2) Handball Performance = 44.23 + 44.23 × Orientation Ability + .463 × Differentiation Ability.

Since all the assumptions of Multiple Regression Analysis have been fulfilled, Multiple Regression Analysis was applied for the Prognostication of Handball Performance as a Rationale of Coordinative Abilities.

Table 2

Coefficients of correlation, R Square & Adjusted R Square related to Handball Performance (in points), Orientation Ability (in seconds), Differentiation Ability (in points), Reaction Ability (in centimetres), Balance Ability (in seconds) and Rhythmic Ability (in seconds) and the significance level.

Relationship Between	Coefficients of correlation	Significance level	Model One		Model Two	
			R	R Square	R	Adjusted R Square
P vs OA	-.79	P < .01	.79	.62	.81	.65
P vs DA	.71					
P vs RA	-.52					
P vs BA	-.47					
P vs RHA	-.54					
OA vs DA	-.73					
OA vs RA	.63					
OA vs BA	.70					
OA vs RHA	.76					
DA vs RA	-.55					
DA vs BA	-.53					
DA vs RHA	-.62					
RA vs BA	.64					
RA vs RHA	.65					
BA vs RHA	.79					

(P=Performance, OA=Orientation Ability, DA=Differentiation Ability, RA= Reaction Ability, BA=Balance Ability and RHA=Rhythmic Ability)
Model I (DV = Handball Performance, IV = Orientation Ability)
Model II (DV = Handball Performance, IV = Orientation Ability & Differentiation Ability)

Table- 2 revealed the inter relationship of dependent variable (Handball Performance) and all independent variables (Orientation Ability, Differentiation Ability, Reaction Ability, Balance Ability & Rhythmic Ability). The observed coefficients of correlation were found significant in all the pairs i.e. Performance versus Orientation Ability ($r = -.79$, $p < .01$), Performance versus Differentiation Ability ($r = .71$, $p < .01$), Performance versus Reaction Ability ($r = -.52$, $p < .01$), Performance versus Balance Ability ($r = -.47$, $p < .01$), Performance versus Rhythmic Ability ($r = -.54$, $p < .01$), Orientation Ability versus Differentiation Ability ($r = -.73$, $p < .01$), Orientation Ability versus Reaction Ability ($r = .63$, $p < .01$), Orientation Ability versus Balance Ability ($r = .70$, $p < .01$), Orientation Ability versus Rhythmic Ability ($r = .76$, $p < .01$), Differentiation Ability versus Reaction Ability ($r = -.55$, $p < .01$), Differentiation Ability versus Balance Ability ($r = -.53$, $p < .01$), Differentiation Ability versus Rhythmic Ability ($r = -.62$, $p < .01$), Reaction Ability versus Balance Ability ($r = .64$, $p < .01$), Reaction Ability versus Rhythmic Ability ($r = .65$, $p < .01$) & Balance Ability versus Rhythmic Ability ($r = .79$, $p < .01$). In relation to model one, value of R (.79) shows the relationship between dependent variable (Handball Performance) and independent variable (Orientation Ability). Value of R Square shows this 62% of Handball Performance of Indian Universities Players is explained by Orientation Ability.

In related to model two, value of R (.81) shows the relationship between dependent variable (Handball Performance) and independent variables (Orientation Ability and Differentiation Ability). Value of R Square shows this 66% of Handball Performance of Indian Universities Players are explained by Orientation Ability and Differentiation Ability.

Table 3
ANOVA (Analysis of Variance) table to test the utility of two framed regression models

Models		SS (Sum of Squares)	DF (Degree of Freedom)	MS (Mean Square)	F	Significance
	Regression	432.40	1	432.40		
One	Residual	259.08	68	3.81	113.49	P < .01
	Total	691.48	69			
	Regression	458.13	2	229.06		
Two	Residual	233.35	67	3.48	65.77	P < .01
	Total	691.48	69			

Model I (DV = Handball Performance, IV = Orientation Ability)
Model II (DV = Handball Performance, IV = Orientation Ability & Differentiation Ability)
Results of ANOVA (table 3) shows the usefulness of two established models.

In both the models, F – values (First Model = 113.49, Second Model = 65.77) were found significant at .01 level of significance. Results shows that both the models are found useful to Prognosticate Handball Performance as a Rationale of Coordinative Abilities (In model one as a rationale of Orientation Ability and in model two as a rationale of Orientation Ability and Differentiation Ability).

Table: 4

Unstandardized & Standardized Regression Coefficients along with Collinearity Statistics (Tolerance & VIF) related to two framed regression models

		UC (Unstandardized Coefficients)	SC (Standardized Coefficients)	CS (Collinearity Statistics)	
Model		**Beta**	**Beta**	**Tolerance**	**VIF**
One	(Constant)	59.68			
	Orientation Ability	-5.22	-.79	1.00	1.00
Two	(Constant)	44.23			
	Orientation Ability	-3.83	-.58	.45	2.18
	Differentiation Ability	.463	.28	.45	2.18

Model I (DV = Handball Performance, IV = Orientation Ability)
Model II (DV = Handball Performance, IV = Orientation Ability & Differentiation Ability)
Table- 4 shows the Unstandardized and Standardized Coefficients related to two framed models.

In case of model one, Unstandardized Coefficient (Beta) of constant i.e. 59.68 shows that all Indian Universities Handball Players will possess minimum of 59.68 level of performance when Orientation Ability remains zero. Unstandardized Coefficients (Beta) of Orientation Ability shows that every one unit change in Orientation Ability lead to -5.22 change in the score in Handball Performance. Standardized Coefficients of (Beta) value shows the importance of Independent Variables. In model one, since there is only one Independent Variable (Orientation Ability), so Standardized Coefficients of Beta value has no importance.

In model two, Orientation Ability was found more important than Differentiation Ability in Prognosticate of Handball Performance as a Rationale of Orientation Ability and Differentiation Ability, since value of Orientation Ability (.58) was found higher than value of Differentiation Ability (.28).

Collinearity Statistics was used to test the Muticollinearity among the paired variables. Since, in all cases, this value is found greater than .4, no Multicollinearity was found.

4. Conclusion:

Two framed models for the Prognostication of Handball Performance as a Rationale Coordinative Abilities are:

- Handball Performance = 59.68 + -5.22 × Orientation Ability.
- Handball Performance = 44.23 + 44.23 × Orientation Ability + .463 × Differentiation Ability.

5. Discussions:

Several studies have been conducted in different games/sports to establish relationship between performance and coordinative abilities. In the game Kabaddi (Indian traditional game, played in every part of India), significant relationship was found between (Mishra, M. K., & Choudhary, R., 2015) Kabaddi Performance (specially Raider's Performance i.e. a specific playing position in the game Kabaddi) and selected coordinative abilities (Rhythmic Ability, Balance Ability & Differentiation Ability). By the Multiple Regression Analysis, three Regression Models were framed. First model was on the basis of one Coordinative Ability (Rhythmic Ability), second model was on the basis of two Coordinative Abilities (Balance Ability & Rhythmic Ability) and third model was on the basis of three Coordinative Abilities (Rhythmic Ability, Balance Ability & Differentiation Ability). In present study, only two models have been framed. It is found that Differentiation Ability is common trait that is required to excel in both the games i.e. Kabaddi & Handball Performance. Another study (Chowdhary, B., Borman, A. S., & Barman, S., 2014) from the game Kabaddi investigated the significant relationship between Kabaddi performance (Dependent Variable) and coordinative Abilities (Independent Variables). Two

Coordinative Abilities i.e. Reaction Ability & Rhythmic Ability showed significant relationship with Kabaddi Performance. Orientation Ability, Differentiation Ability & Balance Ability showed insignificant relationship. Study on Handball (Bayraktar, I., 2017) showed significant relationship between Reactive Ability and change of direction (COD) speed; Reactive Ability and Left Leg Balance Ability. Reactive Ability is the same as Reaction Ability as described in present study. Since Reactive Ability showed significant relationship with change of direction and Balance Ability, it is observed that Reactive Ability, change of direction and Balance Ability jointly contributed to it Handball Performance. In the game Kabaddi, movement of foot and leg are more or less same as Handball. Studies (Chowdhary, B., Borman, A. S., & Barman, S., 2014 and Mishra, M. K., & Choudhary, R., 2015) showed the Rhythmic Ability, Reaction Ability and Differentiation Ability significantly contribute to Kabaddi Performance. In the present study, both the models are framed on the basis of Differentiation Ability and Orientation Ability. Differentiation Ability is found common to excel in both sports i.e. Kabaddi & Handball. Emphasis should be given to develop these characteristics.

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