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Designing New Groups of Tests for Measuring the Technical Performance of the Basketball Players

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ABSTRACT

It is difficult to measure the skills of basketball players and their technical level carefully and objectively. Therefore, the present study aimed to design some tests for measuring the most important skills of basketball, which commensurate with the growing sophistication of the game. The descriptive approach was used because of its suitability with the nature of the study. A sample of sixty-three players, at 16 of age, was selected from Zamalek Club and Eastern Company Club. Based on the proposed procedures, it is possible to draw the following conclusions; the technical level of basketball players could be measured using specific tests, which were turnover, jump shot, free throw, rebound defense, dribbling, rebound offensive, the accuracy and speed of passing, fast break, assist, block shot, lay-up shot and steal. Finally, the skill tests designed for basketball in this study are recommended to evaluate objectively the technical level of basketball players.

Key words: Performance level, measurement, basketball players, technical level

INTRODUCTION

Playing basketball requires especial skills. The intense, fast-paced action of a typical basketball game simultaneously develops speed, hand-eye coordination and cardiovascular endurance more than any other game, for example, moving quickly back and forth across the court needs specific skills for the lower-body part, while shooting, defending and passing needs specific skills for the upper-body part. Therefore, it is of especial importance to measure the skills and technical performance of basketball players. The laws of the game that are approved and recommended by the Technical Committee of the Federation of International Basketball (FIBA, 2000) urged the specialists and researchers towards the development of the skills and improving the performance of basketball players. This can be achieved by developing the procedures of skills measurement. Therefore, it is essential to use the effective measurements that reflect the real skills of the players. In order to evaluate exactly the level the players, subsequently the level of the whole team.

Besides, Hassanein (2001) confirmed that basketball game requires a great deal of changes in offensive and defensive skills. Accurate measuring of such skills is the appropriate way to compare players with each other's (Ambler, 1979; Krause, 1991). The existence of standard tests makes it easier to objectively make these comparisons more accurate. Converting the raw scores derived from these standardized tests, will help in grading and leveling of the players. These tests may include distance, time and/or any other tests. Without the existence of standards for these tests, it will be difficult to determine the degree of the overall performance of the players (Hassanein, 2001).

There is a continuous evolution in the training course and measurements of the level of the players and teams. The continuous modifications of the course of training are to increase the players level, in order to achieve the highest ranks in the tournaments. Such modifications in the

course of training also increases and upgrades the level of the individual players, as a result, enriching the players' personal skills, the matter which is strongly required in basketball games. There are several players' personal skills, e.g., the offensive, jump shooting, rebounds defensive, blocked shots and high jumping. The improvement in the aforementioned skills leads to achieve the best results (Wooden, 1986; Krause, 1991; Mohammed, 1998).

The analytical studies of the World and Olympic basketball championships revealed that the most important changes in basketball player include offensive variables (goal field, 3 points region, free throw, offensive rebounds, 2 points region and assists) and defensive variables (rebounds defensive, turnovers, steal and blocked shots) as well as passing, dribbling and the fast-break. All experts agreed that all basketball players should learn these essential skills (Al-Gendy, 2005; Mohammed, 1998). The most important skills of basketball are the offensive skills; including all types of shooting such as shooting from inside the 2-points region (6.25 m), jump shooting or lay-up shoots and dribbling near the basket, then hand shooting on the basketball while running (using one of the legs followed by lifting the other leg). However, the hand to be shooting should be close to the basket from the right or left (Amin and Abdel-Aziz, 1986; Helal, 1990). All the experts of basketball are in accordance that, shooting the 3-points from outside the arc of 6.25 m, is on the top of skills of basketball in general and offensive in particular. This skill is the most effective in determining the result of basketball games (Kamel, 1990).

The old basketball experts (Moawad, 1986; Wooden, 1986), referred to the importance of shooting skill from places at different distances and angles. This skill avoids the offender from being fooled by the defenders. While shooting, the offender may be exposed to violence from the defender to preventing him from hitting the target. This in turn declares the importance of developing the other offensive skills such as free throw that is implemented because of personal or technical mistake by the defender. The free throw is intended to shoot the ball (from stability) from the free throw line to account one point. Therefore, many championships resolved on the free throw line, i.e., it is possible to beat the other team depending on how the performance of free throw is. It is possible that the offender fails in the performance of the free throw and this shows the great importance of the other offensive skills, i.e., rebounds offensive, which the players should be characterized (Moawad, 1986; Wooden, 1986).

The problem lies in the low level of skill-evaluation of sports in general and basketball in especial. Additionally, it is difficult to measure the technical level of basketball players carefully and objectively. Moreover, the tests of basic skills are not faithfully reflecting the true level of the players. So, the present work was carried out to solve this equation, by finding an objective precision way to measure the real level of basketball players, in which, a group of tests were designed to measure the skills and technical performance of the basketball players, taking in the account the commensuration of the tests with the growing sophistication of the game.

MATERIALS AND METHODS

The research used descriptive approach because of its relevance to the nature of the study.

Sample: Out of sixty-three basketball players (Table 1), two groups of players were selected. The first group from Zamalek Club (at the age of 16 years) as indistinctive group and the second one from Eastern Company Club (the first team for the club) as distinctive group. For different circumstances, some players were ruled out and the final sample was 16 players from each team.

Table 1: Characteristics of the test sample (N = 63)

Variable	Mean	SD	Median	Sequence
Age (year)	17.65	5.96	15	1.495
Height (cm)	170.63	6.92	170	0.084
Weight (kg)	71.77	6.68	75	0.789
Training age (year)	8.55	5.15	7	1.245

The tested variables: The variables included some tests of skill for basketball as follows; Rebounds defensive, blocked shots, fast break, assistance, free throws, lay-up shooting, 3 points, 2 points, dabbling, rebounds offensive, turnovers, passing and steal.

Experimental procedure: The 2 groups of players were subjected to 39 tests. The two groups are distinct (16 players) and indistinctive (16 players under 16 of age) the statistical significance between the two groups was differentiated using t- test. The stability of the results of the proposed skill tests was examined by the application of the 39 skill tests twice with one-week interval. The first and second application were carried out on the 16 players, the statistical analysis was calculated using the Pearson correlation coefficient.

Since the factor analysis is the most powerful way to know the sincerity of the results, the factorial analysis was performed in order to extract the combination of skill testes that effectively and objectively measure the level of basketball players. Factorial analysis able to detect the most common factors that affect the technical performance of basketball players and also able to summarize and reduce the number factors.

Statistical analysis: All the statistical analyses were performed using the statistical package SPSS. The analysis includes; mean, the standard deviation, T test for significant differences between the groups, correlation coefficient of the proposed skill tests at the first and second and application and finally the factorial analysis. The statistical analysis was done at probability (P) level of $p \leq 0.05$.

RESULTS AND DISCUSSION

It is clear from Table 2 the existence of significant differences between the tests applied on distinctive and indistinctive groups. This was confirmed by the value of calculated T that came higher than the tabulated t value (1.697), at the probability level of $p \leq 0.05$, which confirms the sincerity of the results of these tests in the measurement of the different variables.

As shown in Table 3, there was significant correlation coefficient (R) between the two the first application and the second application, in all the variables of different tests, which was confirmed by the calculated value of T that came higher than the tabulated value (0.542) at 30 degree of freedom ($p \leq 0.05$). These results support the suitability of the results of those tests in the measurement of the test variables. Table 4 shows the value of correlation coefficient between each factor and the other variables of the different tests for the different groups. The data demonstrated the existence of varying degrees of correlation.

Orthogonal rotation: Rotation of the hubs leads to simpler and more systematic of the extracted factors, which facilitates the interpreting of the tested factors and finding the best solutions for the problem (Said, 1986). From this point of view, simple rotation of factors have been done by

Table 2: Statistical differences between the two tested groups of players using t-test (N = 16 for each group)

		Indistinctive group		Distinctive group			
Variable	Factors (tests)	Mean	SD	Mean	SD	Calculated t	Significance($p \leq 0.05$)
Rebounds	1	4.500	0.516	2.313	0.479	12.426	*
defensive	2	4.063	0.929	2.063	0.680	6.950	*
	3	19.313	0.947	14.875	1.148	11.933	*
Blocked shots	4	8.750	0.775	4.250	0.577	18.632	*
	5	4.563	0.629	2.188	0.403	12.714	*
	6	18.813	0.911	12.625	0.957	18.732	*
Fast break	7	5.563	0.629	7.563	0.512	9.860	*
	8	5.250	0.683	7.688	0.479	11.688	*
	9	5.313	0.704	7.438	0.892	7.479	*
Assists	10	5.750	0.931	3.313	0.479	9.314	*
	11	8.875	0.719	5.625	0.500	14.847	*
	12	6.938	0.772	4.375	0.500	11.145	*
Free throw	13	15.125	0.719	8.063	0.854	25.310	*
	14	10.063	1.237	4.750	0.683	15.042	*
	15	10.188	1.276	4.500	0.516	16.523	*
Lay-up shooting	16	7.063	0.998	4.500	0.516	9.122	*
	17	12.938	0.772	18.813	0.750	21.835	*
	18	9.813	0.655	4.563	0.512	25.251	*
3 points	19	11.750	1.390	6.563	0.629	13.596	*
	20	7.125	0.957	4.313	0.704	9.466	*
	21	8.313	0.793	4.500	0.817	13.397	*
2 points	22	15.063	0.772	9.500	1.713	11.844	*
	23	8.250	0.931	4.625	0.500	13.722	*
	24	16.000	0.730	9.125	1.708	14.806	*
Dabbling	25	15.125	0.719	31.625	1.668	36.332	*
	26	10.063	1.237	13.250	1.000	8.017	*
	27	10.188	1.276	13.000	0.966	7.028	*
Rebounds	28	18.563	1.031	12.438	1.315	14.663	*
offensive	29	16.938	1.289	11.500	1.265	12.042	*
	30	7.000	0.894	3.688	0.602	12.289	*
Turnovers	31	5.625	0.619	7.313	0.704	7.199	*
	32	5.063	0.854	7.375	0.806	7.877	*
	33	7.000	0.817	8.125	0.957	3.576	*
Passing	34	4.163	0.585	5.875	0.681	7.631	*
	35	7.050	0.750	7.625	0.806	2.089	*
	36	79.250	2.910	50.000	3.204	27.032	*
Steal	37	1.938	0.772	0.938	0.772	3.664	*
	38	2.188	0.403	0.750	0.775	6.585	*
	39	5.500	0.516	2.375	0.500	17.390	*

*Value of tabulated t is equal to 1.697, indexed at a degree of freedom of 30

orthogonal rotation using the Varimax rotation, which supports this method of rotation to maintain an angle of 90 degrees between the axes, so that the cosine of angle equal to zero, so there is no any relationship between the variables except the perpendicular relationship (non-zero) which mean avoiding the overlapping of the independent factors and the taxonomic groups.

Table 3: Stability of the proposed skill tests in basketball using correlation coefficient (N = 16 for each application)

		First application		Second application			
Variable	Factors (tests)	Mean	SD	Mean	SD	Correlation (R)	Significance (p≤0.05)
Rebounds defensive	1	4.500	0.516	4.375	0.500	0.774	*
	2	4.063	0.929	3.938	0.854	0.929	*
	3	19.313	0.947	19.188	0.834	0.934	*
Blocked shots	4	8.750	0.775	8.625	0.719	0.898	*
	5	4.563	0.629	4.438	0.512	0.840	*
	6	18.813	0.911	18.688	0.873	0.927	*
Fast break	7	5.563	0.629	5.563	0.727	0.864	*
	8	5.250	0.683	5.133	0.640	0.867	*
	9	5.313	0.704	5.188	0.655	0.876	*
Assistance	10	5.750	0.931	5.625	0.885	0.930	*
	11	8.563	1.153	8.688	0.602	0.366	*
	12	6.938	0.772	6.813	0.750	0.899	*
Free throws	13	15.125	0.719	15.000	0.633	0.879	*
	14	10.063	1.237	9.938	1.124	0.962	*
	15	10.188	1.276	10.000	1.155	0.904	*
Lay-up shooting	16	7.063	0.998	6.938	0.929	0.939	*
	17	12.938	0.772	12.750	1.000	0.842	*
	18	9.813	0.655	10.000	0.633	0.643	*
3 points	19	11.750	1.390	11.563	1.504	0.932	*
	20	7.125	0.957	7.125	0.885	0.924	*
	21	8.313	0.793	8.188	0.750	0.903	*
2 points	22	15.063	0.772	15.188	0.750	0.899	*
	23	8.250	0.931	8.125	0.719	0.946	*
	24	16.000	0.730	15.813	0.750	0.730	*
Dabbling	25	15.125	0.719	15.000	0.633	0.879	*
	26	10.063	1.237	9.875	1.258	0.905	*
	27	10.188	1.276	10.063	1.237	0.963	*
Rebounds offensive	28	18.563	1.031	18.438	1.031	0.945	*
	29	16.938	1.289	16.813	1.328	0.966	*
	30	7.000	0.894	7.063	0.772	0.869	*
Turnovers	31	5.625	0.619	5.500	0.516	0.834	*
	32	5.063	0.854	4.938	0.854	0.920	*
	33	7.000	0.817	7.125	0.885	0.922	*
Passing	34	4.163	0.585	4.081	0.560	0.913	*
	35	7.050	0.750	6.894	0.775	0.843	*
	36	79.250	2.910	78.500	2.366	0.793	*
Steal	37	1.938	0.772	1.813	0.655	0.898	*
	38	2.188	0.403	2.063	0.250	0.537	ns
	39	5.500	0.516	5.375	0.500	0.774	*

*Value of R is equal to 0.542, indexed at a degree of freedom of 30, ns: not significant

The aim of orthogonal rotation is; (1) approximation of the values of variance for the factors so, saturation of the factors distributed on the rest of the factors, leading to convergence of the relative importance of the factors and the first factor is liberated from its generalization, moreover, the most of the saturation is positive, (2) reducing of zero saturations and negative effect on factors, which would lead to the exclusion of some variables as saturation factor down to zero and (3) transforms of saturation pattern to the simple structure, to ensure the consistent and uniform of the result (El-Bahi, 1996).

Table 4: Correlation matrix of factors before orthogonal rotation of the tests

		Group			
Variable	Factors (tests)	1	2	3	4
Rebounds defensive	1	0.042	0.061	0.141	0.136
	2	0.207	0.349	0.232	0.085
	3	0.534	0.082	0.306	0.113
Blocked shots	4	0.282	0.606	0.022	0.187
	5	0.329	0.143	0.387	0.158
	6	0.320	0.290	0.009	0.274
Fast break	7	0.134	0.758	0.108	0.010
	8	0.369	0.59	0.245	0.133
	9	0.245	0.348	0.096	0.615
Assists	10	0.425	0.215	0.462	0.193
	11	0.241	0.275	0.324	0.082
	12	0.227	0.272	0.288	0.342
Dribbling	13	0.074	0.359	0.459	0.117
	14	0.708	0.082	0.539	0.061
	15	0.397	0.628	0.230	0.415
Rebounds offensive	16	0.436	0.101	0.274	0.489
	17	0.616	0.380	0.453	0.144
	18	0.285	0.243	0.394	0.193
Free throws	19	0.523	0.280	0.380	0.212
	20	0.116	0.217	0.138	0.448
	21	0.365	0.374	0.460	0.043
Lay-up shooting	22	0.386	0.084	0.254	0.075
	23	0.116	0.216	0.088	0.468
	24	0.084	0.337	0.374	0.247
3 point shooting	25	0.680	0.128	0.188	0.146
	26	0.467	0.108	0.370	0.172
	27	0.092	0.323	0.309	0.034
Jump shooting	28	0.046	0.294	0.390	0.363
	29	0.537	0.170	0.427	0.162
	30	0.421	0.406	0.129	0.346
Turnovers	31	0.547	0.065	0.130	0.165
	32	0.197	0.505	0.608	0.242
	33	0.734	0.451	0.255	0.193
Passing	34	0.307	0.409	0.369	0.116
	35	0.144	0.085	0.032	0.187
	36	0.077	0.068	0.261	0.393
Steal	37	0.114	0.075	0.168	0.501
	38	0.221	0.472	0.067	0.545
	39	0.575	0.215	0.054	0.224

Table 5 is the correlation matrix of factors after orthogonal rotation (Varimax rotation), in which, it is clear that the values of saturation tests on the tested factors changed and varied in comparison to those of the Table 4. This shows the redistribution of the numeric values of the saturation. The factorial analysis was used to find out the test that measures the technical performance of basketball players. Factorial analysis has the ability to reveal the very common factors that affect the technical performance of basketball players, where the analysis of factors is able to analyze

Table 5: Correlation matrix of factors after orthogonal rotation of the test variables (factors)

		Groups			
Variable	Factors (tests)	1	2	3	4
Rebounds defensive	1				
	2			0.317	0.323
	3		0.562		
Blocked shots	4			0.306	5.86
	5	0.484			
	6	0.388		0.327	
Fast break	7		0.351	0.549	0.419
	8		0.342	0.584	
	9		0.488	0.469	0.304
Assists	10		0.485	0.316	0.371
	11		0.491		
	12			0.514	
Dribbling	13		0.400		0.345
	14		0.802		
	15	0.301	0.574		0.596
Rebounds offensive	16	0.676			
	17		0.847		
	18			0.485	
Free throws	19	0.639			
	20	0.359			
	21	0.439		0.530	
Lay-up shooting	22	0.399			
	23				0.507
	24		0.396		0.382
3 point shooting	25	0.401	0.478		0.362
	26	0.479			0.334
	27		0.306		
Jump shooting	28			0.597	
	29	0.702			
	30				0.624
Turnovers	31	0.547			
	32			0.800	
	33	0.820			0.341
Passing	34		0.626		
	35				
	36			0.393	
Steal	37				0.441
	38				0.756
	39	0.539			
Hidden root		5.574	4.348	3.689	3.006
Variance		14.294	11.150	9.458	7.707

many of basketball skills and minimize them to obtain few skills that accurately measure the tested skills. Therefore, the analysis of factors is a rigorous scientific brief to reveal the main components of phenomenon. In the present case, the technical performance in basketball was measured

accurately and the factors were analyzed to determine the validity of the findings. This is so-called honesty factors (Hassanein, 2001).

By classifying the results of the study, it would be easy to answer the question of the research, which was about the possibility of designing a test to measure the skills in basketball. Through the course of the study, all of the available tests were added and other new tests were designed to develop new measurement of the skills, taking in the account the continuous development in basketball that do not have tests available to measure them. Based on that new design and application of these tests together with the available tests that already used to measure the common variables in basketball skills, the previous question could be answered. The results of factorial analysis concluded that, only twelve tests could be extracted from the twenty-one tests used in the beginning of the study. These 12 tests can objectively measure the technical level of basketball players using the rule on of the used tests.

The results pointed out that, the level of technical performance of the basketball players can be measured through the application of the proposed tests, which categorized under four groups or categories Table 6, which are, (1) the offensive and turnover, (2) the rebound defense and offense, (3) effective assistance and the fast break and (4) stealing the ball and shooting.

The offensive and turnovers: Concerning the tests of the first category (the offensive and turnovers), it is clear from Table 6 that the number of saturated tests of this group is five tests representing 12.82% of the total tests. These testes belonging to the tests that measure the performance of skills, number 33, 29, 16, 19 and 39 (Simpson, 1996).

The rebounds defense and offense: Regarding the second category of tests i.e., rebounds defense and offensive, it was found that the number of saturated tests on this factor was five tests being

Table 6: Orthogonal of test on four groups of the tests for high level basketball player

Group	Group name	Test code	Test name	Orthogonal	No. of tests
1	The offensive and turnovers	33	Turnovers	0.820	5
		29	Jump shooting	0.702	
		16	Rebounds offensive	0.676	
		19	Free throws	0.639	
		39	Steal	0.539	
2	The rebounds defense and offense	3	Rebounds defense	0.562	5
		14	Dribbling	0.802	
		15	Dribbling	0.574	
		17	Rebounds offensive	0.847	
		34	Accuracy and speed of passing	0.626	
3	Effective assistance and the fast break	7	Fast break	0.549	6
		8	Fast break	0.584	
		12	effective assistance (assists)	0.514	
		21	Free throws	0.530	
		28	Jump shooting	0.597	
		32	Turnovers	0.800	
4	Stealing the ball and shooting	4	Blocked shots	0.586	5
		15	Dribbling	0.596	
		23	Lay-up shot	0.507	
		30	Jump shooting	0.624	
		38	Steal	0.756	

12.82% of the total tests. This group is designed to tests the performance skills of rebounds defensive and offensive it was saturated with the five tests; 3, 14, 15, 17 and 34 (Ismail, 1995, 1999).

Effective assistance and the fast break: It is clear from the tests of the third category (effective assistance and the fast break) that the numbers of saturated tests is six, which amounted to 15.38% of the total tests and this group (category) is linked to tests that measure the performance skills of assistance and fast break, they occupied the tests number 7, 8, 12, 21, 28 and 32.

Stealing the ball and shooting: Finally, the numbers of saturated tests of the fourth category (stealing the ball and shooting) were five tests (number 4, 15, 23, 30 and 38); representing 12.82% of the total tests and this group is testing the skills of stealing the ball and shooting.

Considering to the four groups that composed the tests of skill in basketball and through the use of factorial analysis, it was found that the tests were in accordance (in their way and direction) with that happen in the basketball game (Mohamed, 1994). So, these combination of testes could be grouped; in binary factors e.g., turnover (the most saturated test), mono-factors such as the free throws or special factors like free throws, rebounds defensive, passing and the fast-Break (Wooten, 1999; Martens, 1990).

CONCLUSION

Following the procedures described above, it is possible to design some skill tests in order to, objectively, measure the technical level of basketball players. These tested were classified into four group i.e., the offensive and turnovers (turnovers, jump shooting, rebounds offensive free throw and steal), the rebounds defense and offense (rebounds defense, dribbling, dribbling, rebounds offensive and accuracy and speed of passing), effective assistance and the fast break (fast break, fast break, effective assistance, free throws, jump shooting and turnovers), finally, stealing the ball and shooting (blocked shots, dribbling, lay-up shooting, jump shooting and steal).

RECOMMENDATION

Using the skill tests designed in the present study is recommended to evaluate, objectively, the technical level of basketball players, as well as, to compare the technical level of local basketball players with international level, as well as to determine the differences in the technical level of the basketball players. Applying these tests periodically on the basketball teams will help in prediction of how the technical level in the future would be. Additionally, to determine the technical level at different ages, as well as to modify the criteria suitable for measuring the technical level of each age. Finally, these tests would help in follow up all new developments of the global variables in the skills techniques and the rules of the game, that are needed to design new tests aligned with the new requirement, which expected to update the basketball in the future.

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