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Anomalías de la efectividad: un modelo matemático utilizado en el voleibol internacional

Anomalies in effectiveness: A mathematical model used in international volleyball

*Santiago Calero Morales, *Angie Fernández Lorenzo, **Pedro Antonio García López, * Enrique Chávez Cevallos
*Universidad de las Fuerzas Armadas ESPE (Ecuador), **Universidad Técnica de Machala (Ecuador)

Abstract. Based on the analysis of the mathematical statistical model «Effectiveness», internationally used to process technical-tactical performance in Volleyball, and also to determine its target under the concept «Effectiveness», including its basic characteristics, the paper demonstrates the existence of three mathematical anomalies in the formula. These anomalies are described through examples, including a population-based study that determined that the technical-tactical action Service, Dig and Block have more negative than positive actions, closely related to a fundamental anomaly that causes inaccurate interpretations of reality.
Key words: Effectiveness Model, Volleyball, Technical Tactical Performance, Anomaly

Resumen. Partiendo del análisis del modelo matemático de «Efectividad», utilizado internacionalmente para procesar el rendimiento técnico-táctico del Voleibol, y luego de determinar su objetivo atendiendo al concepto «Efectividad», así como sus características básicas, en el artículo se demuestra la existencia de tres anomalías en la fórmula. Dichas anomalías son expuestas a través de ejemplos, donde se incluye un estudio poblacional que determina que los fundamentos técnico-tácticos Saque, Defensa de Campo y Bloqueo presentan más acciones negativas que positivas, aspecto estrechamente relacionado con una anomalía fundamental que provoca interpretaciones inexactas de la realidad.
Palabras clave: Modelo Efectividad, Voleibol, Rendimiento Técnico-Táctico, Anomalía

Introduction

A model is considered as an abstract representation of some aspects of reality (Gallagher & Watson 2005; Encarta 2009; González & Guillén, 2013; Thalheim, 2013). The modelling in sport is usually employed, commonly manifested in the design of exercises that simulate reality game, exercises that make theoretical and practical situations that have happened in the competition, as is the case of technico-tactical complexes or K-1 and K-2 (Fiedler et al 1974; Morales & Taboada, 2012; Suárez, Rabaz, Fernández, Gil, & Arroyo, 2017), the typical phases (Fröhner 2004, Martinez 2012) or the simplified situation of the Game (Andux, 2012).

However, the models through exercise are not the only used in the process of management of sports training. The statistics by making physical representations of symbols, simply summarizes phenomena and equations, concepts and theories for studying complex systems (Tormos & Lova, 2003; Gallagher & Watson, 2005; Hong, 2013). Therefore, mathematical models are formed by elements that characterize one or more aspects of the reality modelled (Aracil 1983), in order to extract properties and characteristics of the relationships among the elements, which otherwise would remain hidden and illogical.

In the specific case of statistical models to estimate the charge of technical and tactical performance of volleyball, these actions make the technical and tactical variables that evaluate (according to an objective and a specific function), the technical and tactical performance individually and collectively in order to obtain information related to the process of attracting talent, the exploration of opposites, the evaluation of competitive performance, and delivering specialized information to media, researchers, managers, among others (Coleman, 2002; Velasco quoted by Alonso, 2003; Hohmann, Lames & Letzeier, 2005; Poyato, 2007; Calero, 2009; Silva, Domínguez, Echeverría, Rabaz, & Arroyo, 2016). Therefore, applied statistics is considered as one of the most important aspects for a coach (Coleman, 2002; Thiess, Tschiene & Níkel, 2005; Clarke & Skiba, 2013), both in competitions and in training.

The construction of a mathematical model requires the full employment of concepts, since they classify reality, recalling the objective of the model as a mean to aid in the analysis and understanding of the reality to be measured (Dror, 1986; Tormos & Lova, 2003; Arsham, 2015).

According to the concept, each processed variable is given a numeric value, making up the design of the formula, a value that must represent the real quality of the variable. For that reason, since there are several variables that have significant influence in the performance (according to the technical-tactical actions studied), ones would positively impact in scoring and others would have a negative impact, and also each variable will diverge form the other according to the existing significant differences in relation to the final performance (Calero, 2009-2011). Some mathematic models obtain an approximate description of the phenomenon and in that case it is necessary to check precision if the results are not satisfactory the model should be formulated again using mathematic language (Tang, 2005; Tanner y Gore, 2013; Hatano, Hirata, Suzuki y Aihara, 2015).

In Mesquita, Marques & Maia (2001); Salas, Palou & Schelling (2004); Oliveira, Mesquita & Oliveira (2005); Calero (2007-2009); Gil, Del Villar, Moreno, García & Moreno, (2011); FIVB, (2003-2005), the data of the technical-tactical performance of several techniques and training categories have been tabulated, recording different actions that are usually modelled with Effectiveness and although each paper has its own objective, there are common patterns that undoubtedly typify a technical-tactical action, as the prevalence of negative actions over the positive ones in techniques such as Block, Serve and Dig.

Effectiveness is, according to its definition, «the ability to reach the effect wanted or desired» (RAE, 2015). Effectiveness as a concept is equivalent to reality, certainty, security, validity, warranty (Compact Ocean 2006; Cervantes 2008, Encarta 2009), thus, the primary objective of the model «Effectiveness» is to determine the level of security that has a player or computer when executing technical-tactical actions in the game, this means that if a player gets more points than what he loses, a player is safe, accurate, effective, otherwise it will be a player insecure, not certain, ineffective[1]. Therefore, the variables that represent that concept should symbolize this reality from the mathematical point of view, hence their assessment is in line with that quality.

Effectiveness as a mathematic model uses three significantly influential variables in the final performance (Calero, 2009-2010), it is internationally used by different authors and softwares specialized in applied statistics. In StatTrak for Volleyball, v6.01 (1998); VBSTATS32 V3.2.0E (2002); FIVB (2003-2005); VolleySoft MultiPasport (2005); Mesquita, Marques & Maia (2001); Sydex Volleyball Stats, (2002); Oliveira, Mesquita & Oliveira (2005); League Analyzer for Volleyball v3.2.0 (2005); Volleyball Statware v6, (2006) and Quality Stats Volleyball V10.1.0, (2010)[2] is shown a wide use of that mathematic formula.

The content analysis of the model anticipates statistic anomalies, understanding by anomaly the discrepancy of the model in regard to certain rule or use, in other words, an irregularity. These rules are enumerated in the material and methods epigraph described in Calero (2009); an aspect that causes alterations in the estimation of the technical-

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Santiago Calero Morales
sscalero@espe.edu.ec

tactical performance and therefore in the eventual decision-making.

For that reason, the central objective of the paper consists on demonstrating which are those irregularities or anomalies, and how they impact negatively on the process of technical-tactical control of Volleyball, a key factor in the process of sports training management.

Material and Methods

This concept is conceptualized through the formula or statistical model, available in the following structure:

Model «Effectiveness»

$$\underset{(j;e;c)}{\overset{A\neq 0}{Ef}} = \frac{(Ap - An)}{\frac{T(n)}{N}} * 100$$

Where *i* is the player and *t* the technique selected AP^t_i and AN^t_i the number of positive and negative technical-tactical actions in the technique *t* of the player *i*, respectively, and N^t the total of actions in the technique *t* of the player *i*. Likewise, the total effectiveness of a team or a tournament is defined as the sum of each of the individual effectiveness of every player in the team or the tournament.

In order to show the above mentioned anomalies, some real scoring groups have been analyzed. The first one the Block performance of the RSA[3] player in three games of the qualifiers of the IV National Volleyball League (Table 1), obtained by the Effectiveness model.

However, to know the level of incidence equal to or less than zero, obtained by mathematical calculation in the numerator of the formula were analyzed the scores of two national high level championships, in both genders (Tables 4 and 5). For both cases, was processed the population of executed actions (9413 in males and 8 683 in females) in the finals of the National Volleyball League IV. Havana 2007, recording 14 games of 14 possible, held on 08.03.2007 to 15.03.2007.

Content Analysis as theoretical methods, values the model «Effectiveness» in accordance with five rules formed to evaluate the process of technico-tactical performance, set by (Calero 2009).

There are:

1. You must determine the proposed function and objective.

2. You should include all variables that influence positively depending on its function and objective.

3. You should have a correct mathematical modelation relating to its function and objective.

4. The measure unity should be the most adequate to the social enviroment it is applied.

5. The numeric value assigned to each variable must correspond to real quality.

Therefore, indicators of contending analysis are in correspondence with those rules, emphasizing, for this study case, rules One and Three.

To register and process the volleyball actions was used the ControlVolei Competencia v1 software, and to tabulate the data Microsoft Excel 2010.

Study Variables

The statistical model «Effectiveness» uses three variables significantly influencing the technico- tactical performance of volleyball. These are:

1. The values of evaluative maximum performance range (positive, Ap)

2. The values of evaluative lower-ranking performance (Negative; An)

3. All other values different from previous issues (causing no losses of these points in absolute terms, AS) joined to all the categories of registered actions.

The first two values can be seen in the numerator, which are computed by a subtraction, or are antagonistic, mathematically creating two variables. The third variable is represented by the sum of all the actions or variables registered in the denominator.

The variables registered (for all the examples will be used the Block actions, except for Tables 4 & 5) are represented by the following methodology:

- Positive values (Ap): The Block gets the point

- Negative values (An): The block commits a technical foul penalized by the referee, or the lock throws the ball beyond the reach of other players.

- Slash actions (AS): They belong to the rest of the variables that make up the above categories. Example: The ball bounces behind the lock, obtain or not the offensive initiative. For that matter, this variable is creating opportunities for the opponent.

Results

The statistical model «Effectiveness» presents three anomalies that alter the outcome. These are:

1. Their results show negative rating scale

2. The equivalence between the variables the numerator, creates zero values, not representative of performance in terms of individual comparison.

3. When generating a negative scale, the result is not congruent

Anomaly Number One, «the negative scales» (shown in the example of Table 1), with locking action made by a player in the first game, provides a result of -13,33%. This way of presenting quantitative information tends to have drawbacks, for it provides a negative datum, an aspect that infers decreases and contributes to the third and more important anomaly.

Table 1:
Analysis of three results obtained with the model "Effectiveness" in three different games.

ACTION	GAME 1	GAME 2	GAME 3
AP		2	2
AN	2	2	2
AS	13	15	17
TOTAL	**15**	**19**	**21**
Calculation:	*-13.33%*	*0%*	*0%*

Table 2:
Analysis of four results with the model "Effectiveness" in four different games. Congruent values

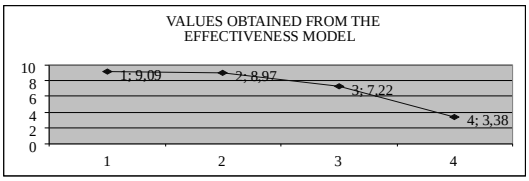
KIND OF ACTIONS	GAME 1	GAME 2	GAME 3	GAME 4
AP	32	32	32	32
AN	25	25	25	25
AS	**20**	**21**	**40**	**150**
TOTAL	77	78	97	207
Calculations:	9.09%	8.97%	7.22%	3.38%

In game number two and three in the table above, you can represent the second anomaly Mathematics, «The equivalence between the variables in the numerator. Here, although the player is regular[4], the formula shows a figure that would be zero for games two and three. The problem occurs when the amount of opposite variables of the numerator are equal (AP y AN).

The Third Mathematic Anomaly «Non-congruent values» are represented in Table 2, using a hypothetical example for better understanding.

After performing the calculation in the numerator (for all cases equals seven games), and having processed values at each step, the model obtains results that match the athletic performance. In all cases the result expressed numerically decreases progressively.

It corresponds to the real value of a player that will generate the above actions, which is determined based on the concept that the more opportunities you provide to the contrary in its mid-game, the greater the chance of successful adversary, therefore, the effectiveness decreases with increasing the opportunities of the opponent. In every game, the volleyball player gives more opportunities to the rival (20, 21, 40 and 150, respectively; Actions Slash: As) under the same value of the numerator (7), therefore the result will decrease in each game (9.09%, 8.97%, 7.22%, 3.38%, respectively). This behavior is seen as consistent or logical, since the model acts positively as expected; prompting him in every game there is a decrease in effectiveness, as it is shown in graphic I.

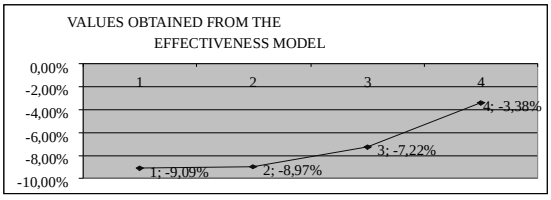


Graphic 1: Values obtained consistent with the calculation of the effectiveness model.

Table 3:
Analysis of four results with the model "Effectiveness" in four different games. Incongruent values

KIND OF ACTIONS	GAME 1	GAME 2	GAME 3	GAME 4
AP	25	25	25	25
AN	32	32	32	32
AS	**20**	**21**	**40**	**150**
TOTAL	77	78	97	207
Calculations:	-9.09%	-8.97%	-7.22%	-3.38%

Table 3 uses the same numeric values that Table 2, although the values of the Effectiveness model numerator (AP and AN) have been inverted to favour understanding, obtaining in all cases the value of -7 (25-32 = -7). By completing the calculations in the formula the values obtained with the model grow as opportunities increase the contrary (20, 21, 40 and 150; Calculation: -9.09% -8.97% -7.22%; -3.38% respectively). This phenomenon is established where the value of the numerator is in the negative scales, since under this condition, the larger the divisor, will approach zero over the result, and therefore the smaller the numerical value of a negative scale, the higher their mathematical value. Graphic 2 represents graphically the above.



Graphic 2: Non-consistent values obtained with the calculation of the effective model.

Table 4:
Derivation of mathematical values of numerators less than or equal to zero (CN = 0). Final Phase of the IV National Volleyball League. Gender Male.

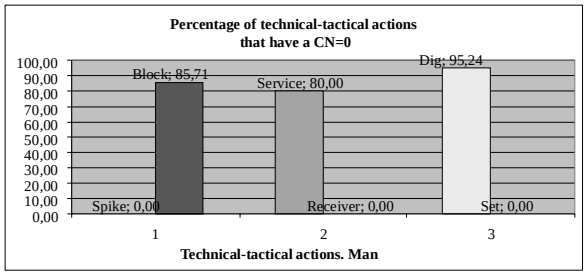
SPIKE					BLOCK					SERVE				
AP	AN	AS	TOTAL	CN	AP	AN	AS	TOTAL	CN	AP	AN	AS	TOTAL	CN
43	8	30	81	35	14	9	18	41	5	9	3	92	104	6
68	25	34	127	43	15	13	15	43	2	9	5	87	101	4
80	24	73	177	56	14	13	42	69	1	13	9	80	102	4
47	19	27	93	28	10	12	18	40	-2	9	6	104	119	3
37	14	28	79	23	26	29	48	103	-3	3	3	51	57	0
27	9	26	62	18	10	14	19	43	-4	1	3	72	76	-2
6	24	58	147	41	10	15	37	62	-5	6	8	75	89	-2
72	33	43	148	39	10	16	17	43	-6	3	6	54	63	-3
62	24	60	146	38	6	15	30	51	-9	3	6	55	64	-3
75	34	53	162	41	11	21	16	48	-10	2	7	50	59	-5
40	1	30	88	22	26	36	49	111	-10	5	10	77	92	-5
71	4	66	171	37	15	26	40	81	-11	12	18	55	85	-6
66	37	45	148	29	7	19	14	40	-12	9	15	64	88	-6
30	17	38	85	13	6	18	22	46	-12	2	9	49	60	-7
20	17	22	59	3	12	24	30	66	-12	8	15	65	88	-7
					8	22	17	47	-14	19	26	82	127	-7
					7	22	21	50	-15	8	16	55	79	-8
					27	42	69	138	-15	6	14	87	107	-8
					14	31	35	80	-17	5	19	61	85	-14
					6	25	18	49	-19	5	20	39	64	-15
					4	24	31	59	-20					
RECEIVER					DIG					SET				
AP	AN	AS	TOTAL	CN	AP	AN	AS	TOTAL	CN	AP	AN	AS	TOTAL	CN
57	6	34	97	51	26	25	22	73	1	149	4	348	501	145
103	14	54	171	89	9	13	11	33	-4	122	3	395	520	119
95	13	53	161	82	10	14	15	39	-4	59	6	428	493	53
113	9	84	206	104	12	17	15	44	-5	39	10	337	386	29
37	5	24	66	32	13	20	19	52	-7					
54	5	44	103	49	2	12	16	30	-10					
49	7	46	102	42	8	20	24	52	-12					
55	8	53	116	47	7	20	25	52	-13					
63	13	57	133	50	2	16	13	31	-14					
63	14	56	133	49	4	19	9	32	-15					
30	8	22	60	22	6	22	21	49	-16					
47	13	41	101	34	3	20	14	37	-17					
26	6	34	66	20	4	23	13	40	-19					
56	20	66	142	36	6	27	16	49	-21					
20	13	28	61	7	3	24	33	60	-21					
					18	40	11	69	-22					
						23	12	35	-23					
					1	25	13	39	-24					
					11	35	21	67	-24					
					3	28	13	44	-25					
					9	43	24	76	-34					

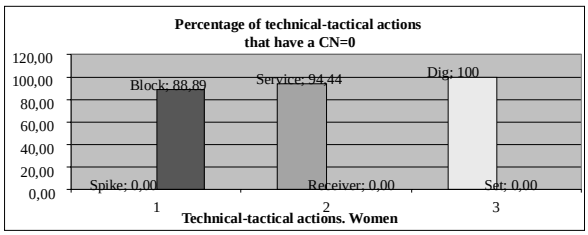
In Table 4, the negative values obtained with the calculation of the numerator are common to the technical-tactical actions Serve, Dig and Block, and non-existent for the rest of the techniques, an aspect that is described in details in Graphic 3.

Table 5:
Acquisition of mathematical values of the numerator less than or equal to zero (CN = 0). Final Phase of the IV National Volleyball League . Gender Female.

SPIKE					BLOCK					SERVE				
AP	AN	AS	TOTAL	CN	AP	AN	AS	TOTAL	CN	AP	AN	AS	TOTAL	CN
38	6	11	55	32	20	18	30	68	2	11	5	46	62	6
62	12	13	87	50	11	10	26	47	1	6	8	69	83	-2
81	11	46	138	70	11	13	21	45	-2	3	6	52	61	-3
3	9	16	58	24	9	12	22	43	-3	7	10	52	69	-3
67	21	37	125	46	8	13	26	47	-5	8	11	79	98	-3
33	11	17	61	22	9	16	14	39	-7	3	6	94	103	-3
49	16	37	102	33	9	17	18	44	-8	14	18	48	80	-4
66	27	35	128	39	12	24	18	54	-12	1	5	64	70	-4
53	22	38	113	31	10	22	45	77	-12	12	16	90	118	-4
67	35	32	134	32	6	19	13	38	-13	11	16	51	78	-5
51	24	41	116	27	6	24	17	47	-18	23	29	65	117	-6
48	28	18	94	20	12	31	15	58	-19	6	14	58	78	-8
21	9	27	57	12	4	25	11	40	-21	3	12	72	87	-9
43	23	45	111	20	9	30	37	76	-21	6	16	35	57	-10
43	28	51	122	15	12	33	38	83	-21	7	17	49	73	-10
43	33	45	121	10	13	44	26	83	-31	9	20	89	118	-11
					25	60	66	151	-35	10	25	77	112	-15
					9	56	34	99	-47	9	28	41	78	-19
RECEIVER					DIG					SET				
AP	AN	AS	TOTAL	CN	AP	AN	AS	TOTAL	CN	AP	AN	AS	TOTAL	CN
93	6	44	143	87	6	10	10	26	-4	70	13	452	535	57
75	11	26	112	64	9	13	11	33	-4	42	6	403	451	36
72	10	37	119	62	7	12	8	27	-5	42	6	438	486	36
58	8	30	96	50	9	14	11	34	-5	33	10	457	500	23
85	10	56	151	75	7	14	11	32	-7					
78	14	39	131	64	11	19	14	44	-8					
59	7	41	107	52	7	15	17	39	-8					
91	21	40	152	70	25	34	23	82	-9					
81	13	54	148	68	6	16	10	32	-10					
30	5	25	60	25	7	18	8	33	-11					
21	4	21	46	17	6	17	14	37	-11					
57	15	43	115	42	8	20	21	49	-12					
30	7	32	69	23	12	24	20	56	-12					
58	19	41	118	39	15	29	20	64	-14					
51	23	40	114	28	8	23	10	41	-15					
					4	20	19	43	-16					
					11	30	14	55	-19					

As in table 4 referring to the male gender, Table 5 shows that in the case of female gender, the technical-tactical actions Serve, Defense and Block present a high coincidence of negative values inside the numerator's calculation.





Graphic 3: For hundreds of calculations obtained from the numerator less than or equal to zero CN = 0 for each technical-tactical action of volleyball. both genders.

Graphic 3 show the percent incidence of values less and equal to zero, obtained after the calculation of the numerator: CN d»0, for both genders. That shows that the values have a high percent incidence in the Block, Serve and Dig action (Block: 85.71% and 88.89%; Serve: 80.00% and 94.44%; Dig: 95.24% and 100%, male and female respectively), while such value are not presented in the technical-tactical actions Spike, Receive and Set, respectively (Spike: 0.00%; Receive: 0.00%; Set: 0.00%, male and female5), according to the individual evaluation of all the regular players that participate in the Finals of the Fourth National

Volleyball League. The aforementioned shows that the result in the numerator (CN < 0) is common in high performance volleyball.

Discussion

Since the Effectiveness statistic model is internationally and functional in several research papers and softwares of applied statistics to Volleyball such as StatTrak for Volleyball, v6.01 (1998); Mesquita et als, (2001); Sydex Volleyball Stats (2002); VBSTATS32 V3.2.0E, (2002); FIVB, (2003-2005); VolleySoft MultiPasport (2005); Oliveira et als., (2005); League Analyzer for Volleyball v3.2.0 (2005); Volleyball Statware v6, (2006) y Quality Stats Volleyball V10.1.0, (2010), among others, the reliability of the mathematic instrument should positively respond under any condition.

However, when the result of the numerator equals zero, the numerical values processed, regardless of the amount and importance, cause equal results (Table 1: game 2 and 3: 0 percent respectively). Another real example is available in Table 4: in the Serve action, whichis colored in blue, and in the ranking best block, best serve and best dig of the World Championship 2011(FIVB, 2011a,b,c), which demonstrates that it happens regularly.

In Calero (2009) was studied the Finals of the Volleyball World League held in Moscow, Russia, and it was defined that the probability to lose one point after an AS action in Block is 47,78 percent, and the probability to score a point 25,06 percent (Difference: 22,72 percentage points more in favour of losing a point); for which the AS Blocking actions give the opponent more advantages. Therefore, the AS action should be statistically interpreted as a variable that reduces the final value obtained by the Effectiveness model. The Table 1 predicts estimation errors of the technical-tactical performance of the Block, concerning the RSA player, who in games 2 and 3 has the same result (0 percent) even performing different actions AS (15 and 17 respectively) under the same numerator value. That indicates that the model equals performance when actually had substantial variations in the actions. Each significantly influential action will have more or less probabilities of losing or winning a point, as it is the case of the setter demonstrated in Calero (2009, 2011), and the rest of the technical-tactical action. Therefore, as there are differences in then Slash (AS) actions, there must be numerical differences in the final result of the equation.

This player, if compared to one that has never played, seemed to have the same numeric value (0). Then, reality affirms that not playing equals doing nothing in practice, and having two positive actions (AP), two negative (AN) and 15 Slash (AS) (Table 1) equals influential values in higher or lesser numbers for the technical-tactical performance. That causes two problems for the coach, the first situation would be the impossibility of comparing a regular player and a bench one (both would have a numeric value of zero); the second situation will be related to the competitive ranking, since an A player with a numeric value of 0 will mathematically overcome every player with more negative than positive actions, although the A player as an excessively higher amount of Slash (SA) actions; therefore, the coach will make a mistaken analysis of the individual performances, which would cause taking wrong decisions.

The previous anomaly derives from the possibility that the technical-tactical variables have equal negative and positive actions, since the Effectiveness model is able to generate negative values (anomaly 1).

The error of the Effectiveness model negatively increases the estimation of the technical-tactical performance by presenting more negative actions than positive ones (Serve, Dig, Block), an common aspect demonstrated in tables 4 and 5 and represented in graphic 3. That characteristic in the action of the technical-tactical actions previously described have been widely corroborated by other sources, such as Mesquita, Marques & Maia (2001); Salas, Palou & Schelling (2004); Oliveira, Mesquita & Oliveira (2005); Calero, (2009); Gil *et als* (2011); FIVB (2003, 2011a,b,c), an inconvenient increased in younger categories (Calero, 2007), for which the research carried out from the model analyzed, as the one made in Block by Oliveira *et als*. (2005), distort the result expected and therefore the data is wrongly interpreted, taking into account that the more the technical-tactical opportunities given to the rival, the more probabilities of losing a point, and therefore the final value should decrease in the final Effectiveness equation.

However, Effectiveness under the condition CN < 0 raises the final value as the AS actions increase, or increases the value as the technical-tactical opportunities given to the rival increase. This contradiction causes uncertainty in the estimation of the technical-tactical performance, coinciding with the affirmation made by Tang (2005) that models with similar imprecision should be reformulated. Therefore, if the Effectiveness model is used, the rankings of the Block, Serve and Dig actions will distort reality, since ever AS action will wrongly increase the numeric performance of a player, when if should reduce it.

The Effectiveness statistic model as it generates equal or lesser values than zero after the calculation of the numerator (Anomaly 1 and 2), creates inconsistent values (Anomaly 3). The three anomalies previously noted do not fulfil the third rule for processing the technical-tactical performance; since it has a wrong mathematical modelling in relation with the objective pursued (determine effectiveness). That implies that the model does not determines correctly the goal of the authors (Rule number 1) when the CN < 0 condition is present, having a negative influence in the estimation of the individual and collective performance of the technical-tactical actions of volleyball, with emphasis in Serve, Dig and Block.

That allows affirming that the Effectiveness statistic model, after calculating the numerator and presenting the condition CN < 0, shows a false fulfilment of the goal, causing three mathematic anomalies that imply false interpretations of the reality.

Conclusions

The above can generally conclude that: Effectiveness in the statistical model is identified under the condition CN < 0, obtained in the processing of the variables in the numerator of the formula referenced, three anomalies that adversely affect the performance estimation of technical-tactical Volleyball, causing certain false conditions and interpretations of the final performance. For that reason, the use of the Effectiveness statistical model should be applied on those technical-tactical actions with more positive actions than negative ones (Spike, Receive and Set), while its application must be excluded from those fundamentals that regularly obtain more negative actions than positive ones (Block, Dig, Serve).

Autor Notes

1. In the paper the word Ineffective is considered an antonym of Effective.
2. Not all authors have the same organization for the previously described model, although the structure is similar.
3. By ethical reasons, the name of the player is omitted.
4. A regular player is that who plays and participates in several actions of the game, meaning that the team depends on his performance.
5. Although in the competitions analyzed the regular players had no negative values higher than the positive ones (CNd»0), in the case of Spike, Receive and Set, other national competitions have had them, especially in younger categories, according to studies made in other competitions available in Calero (2007-2009).

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