Original Article

Statistical study on bodily communication skills in volleyball to improve teaching methods

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ABSTRACT

Raiola G, Di Tore AP. Statistical study on bodily communication skills in volleyball to improve teaching methods. *J. Hum. Sport Exerc.* Vol. 7, No. 2, pp. 468-488, 2012. Focus of the study is to verify the incidence of performance analysis data of bodily communication in volleyball. The sample was chosen to represent the scores obtained in three technical skills strongly influenced by bodily communication: the second ball goes to the opposite court instead of setting for attacking; the attack as fast as possible in the middle of the net and the off speed hit instead of power spike over the block. The purpose of this study is to measure the amount of the three technical skills points for each set, the total of them, the points awarded to the attack and the total points of each set, and so to read the relations between the different categories of scoring. The method used is the recruitment of the data with the use of video software Data Project by a team of operators made by the team's official analyst, by the coach and by the single athlete, only for measurements concerning him. The assignment of the data is attributed by the team's official analyst after sharing with the coach and the athlete. The datum recruited must necessarily accepted by the coach, otherwise is not considered. The data recruited were compared with data on total points in the set and with the overall results of the attack, first individually and then together, in order to determine the relationship among points attributable to bodily communication and the final score. The dependency relationship, analyzed through a simple regression model, was statistically significant. The results show as this study can help the coach to train the team for improving the analyzed technical skills in different mode, creating a methodological system training to enhance the performance. **Key words**: PERFORMANCE ANALYSIS, TECHNICAL SKILL, CATEGORIZATION POINT, REGRESSION ANALYSIS, MULTIPLE REGRESSION, TRAINING, DIDACTICS

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INTRODUCTION

"Volleyball is a sport where the use of bodily language is very frequent, it is a sport with very narrow game space (81 square meters per team) and actions extremely rapid and dynamic, whose technical characteristics, tactics and logistics constantly allows nonverbal communication among the players on the court" (Raiola, 2010a).

Focus of the study is the application of bodily communication to volleyball. The analysis of the results of sporting performance can highlight relationships between scores and some skills attributable to bodily communication. Currently, the process of training, its organization, and teaching methodology need more knowledge on the qualitative aspects of sports performance (Schmidt & Wrisberg, 2008), including bodily communication.

Volleyball is particularly suited to the study of bodily communication for the peculiarity of very limited time available in the neuropsychological processes in the mandatory mode of ball rejecting. The tactical and technical aspects assume greater importance than quantity in volleyball.

According to Lobietti (2009), "volleyball is an open skill sport and for this reason the variability of the movement is very high. Therefore, the biomechanical studies have to follow notational analyses and qualitative descriptions of the skills".

In their study about "Volleyball coaches behavior assessment through systematic observation", Zetou et al. (2011), considered "remarkable the fact that "Tactical instructions» were the most frequently occurring behaviors".

Bodily communication has its own epistemological framework in which the message follows a process of encoding, transmission and decoding (Raiola et al., 2011a; Raiola et al., 2011b). It establishes contacts and relationships that are developed first by data processing and after by message content evaluating.

It has, within it, an ethnic-social substrate that changes in different cultures and contexts (Meharabian, 1972). It is a dynamic flow consisting of five basic elements: context, sender, recipient, channel, code (Jakobson & Halle, 1956) and follows a logical and analogical process.

The arguments of bodily communication affect the feint, manifest intention of achieving a goal through the initial implementation of a plan with specific motor signs, postures, attitudes, which are later implemented in totally different pursuance. In this paper, we refer to the "tactics" decoding of body communication. In particular, the decoding of signs or of bodily communication is "functional" when it refers to the same team and when communication act among players is involved or that one between the trainer and the athletes on the tactical intentions, strategies and problems of game. Decoding can be "diagnostic" when it is possible to recognize the different kind of nonverbal communications of the opposing team, through signs and elements that characterize the communication styles (Argyle, 1988; Hall, 1966) of athletes and coaches. The third form of decoding is "tactics" when the gesture or the action simulates a game intention to solicit a reaction of the adversary who helps their own team. In this case, the neurophysiological and psychological basis of the movement, associated with the perception, influence the performance of each technical skill. According to the principles of bodily communication (Argyle, 1988), the aspects of perceptive senses (Berthoz, 1997) and the neurobiological implications (Rizzolatti & Sinigaglia, 2006) and to give a general plan for training that includes knowledge about the function of gestures, signs and mimicking, the structure

and the mean of non-verbal messages and the effects of bodily communication on behaviour in order to build expressive and communicative skills of volleyball coach of the signs and the gesticulation in communication processes and in particular the "pragmatic" side of communication and the effects that it has on behaviour (Watzlawick et al., 1967).

"It is apparent that sport performance researchers should take great care in matching the particular aims of a study with the correct choice of dependent variable. Unlike clinical researchers, who need to predict the effects of interventions on the construct of `health' by examining specific symptoms of disease (e.g. blood lipids for risk of heart disease), performance researchers may sometimes forget that they can measure final outcomes (performance) directly, rather than relying solely on `symptoms' (predictors) of good performance. This advantage brings with it many important considerations, including the external validity of the sample and test, the delimitation of a worthwhile performance enhancement, the choice of descriptive or intervention research, and adequate research design and analysis" (Atkinson & Nevill, 2001).

The scientific aims of this research work is to analyze three specific skills relating the attacker role and the setter one in relationship to defenders following the last study on it in a specific statistical version:

- The second ball goes to the opposite court instead of setting for attacking.
- The attack as fast as possible in the middle of the net.
- The off speed hit instead of power spike over the block.

The survey of data is entrusted to performance analysis methodology, carried out gradually with the help of experts, coaches and analysts.

"It is vital that the reliability of a data gathering system is demonstrated clearly and in a way that is compatible with the intended analyses of the data. The data must be tested in the same way and to the same depth in which they will be processed in the subsequent analyses" (Hughes, 2004).

The coach of the selected team trains the performance analyst how to analyze three fast skills and to whom exactly to attribute the outcomes between the attacker of his own team and defender of the opposite team applying the different performance indicators. The analysis was carried out:

- In real time, that is the recruitment of data is directly by hand notation when the analyst observes the match.
- In differed time, through the use of match analysis dedicated video- software (Data Project, Dartfish, Elite Focus).

The data recruited were compared with data on total points in the set and with the overall results of the attack, first individually and then together, in order to determine, with correlational procedures, the relationship between points attributable to body communication and the final score.

"Correlational procedures are used to determine the relationship between and among variables. Indeed, predictions and estimations of one variable from one or more other variables are common in kinesiology, human performance and sport and exercise science" (Morrow et al., 2010).

MATERIAL AND METHODS

The method of study combines the theoretical-argumentative approach with experimental approach of performance analysis. It is an integrated approach to aim the ecological aspect of the performance phenomenon in some step of sports game of volleyball.

"Basic research is designed to corroborate or discount theories of the underlying mechanisms of a particular phenomenon. Basic researchers may ask binary-type questions, such as `Does variable x explain variable y, when all other variables are controlled?' Such questions are usually part of the process involved in modelling physiological or psychological mechanisms. Theory-driven research questions like these can be addressed by classical hypothetical-deductive methods, the null hypothesis testing procedure and a sound experimental design, as Chow (1996) has discussed at length. In principle, these procedures should allow the researcher to be reasonably certain that, if all variables other than x have been controlled in an experiment, and the observed changes in y cannot be attributed to chance influences, then x must be the cause of y (Atkinson & Nevill, 2001).The survey of data is entrusted to performance analysis methodology, carried out gradually with the help of experts, coaches and analysts.

Technical skills identified are:

- The second ball goes to the opposite court instead of setting for attacking.
- The attack as fast as possible in the middle of the net.
- The off speed hit instead of power spike over the block.

The analysis is carried out during the match, always in contrast to the opponent wall, according to notational analysis techniques. Hughes (2004) and Franks (1983) suggest that notational analysis is primarily concerned with the analysis of movement, technical and tactical evaluation and statistical compilation. Therefore, the notational analysis is a technique to analyze different aspects of performance through a process which involves a permanent registration of the events. The performance analysis tools are: annotations in real time and also deferred through the use of video-software by experts, coaches and analysts specifically trained. The evaluation of the data is provided by a team of analyst, by the coach, and in some cases by the performer.

The activities were carried out by a research group formed within the trainers, breeders and performance analysts of the volleyball centre of the Campania Regional Qualifying Committee of the Italian Volleyball Federation since 2008.

RESULTS

This study was made on the basis of the results and discussion of an earlier pilot study. The type of decoding "tactics" refers to three technical skills already identified and investigated in the pilot study:

- The second ball goes to the opposite court instead of setting for attacking.
- The attack as fast as possible in the middle of the net.
- The off speed hit instead of power spike over the block.

This study was conducted on league-division women's team Ester Centre of Naples in 2009-10; the team was promoted to the next set for the second consecutive year. The results of the previous study were collected by considering the points added per game of each set played as an indicator of the final result. In fact the final outcome of the match is given in relation to the number of sets won and lost: 3 points for matches won 3 - 0 or 3 - 1 and 2 or 3 points for matches won 3 - 2 , and 1 point for matches lost 3 - 2.

Therefore the sum of the scores of each set for each match does not analyze the data relates to the real points of the sets won and lost. The sample used in the preceding analysis does not guarantee the relationship between the data and the final result in terms of points in chart, so it is consistent to measure the incidence attributable to bodily communication points for each set. The sample sets was chosen to represent the same three categories of scoring described above. The purpose of this study is to measure the amount of the three technical skills points for each set, the total of them, the points awarded to the attack and the total points of each set, and so to read the relations between the different categories of scoring.

The method used is the recruitment of the data with the use of video software Data Project by a team of operators made by the team's official analyst, by the coach and by the single athlete only for measurements that concern him. The assignment of the data is attributed by the team's official analyst after sharing with the coach and the athlete. The datum also recruited must necessarily accepted by the coach, otherwise is not considered. The recruited data were compared with data on total points in the set and with the overall results of the attack, first individually and then together.

The dependency relationships, analyzed through a simple regression model and a multiple regression model, were statistically significant.
Here it reports:

- Simple regression analysis of each single skill on total points in the set.
- Simple regression analysis of aggregate skills data overall results of points attributable to the attack.
- Multiple regression analysis of single skills on total points in the set.

Table 1. *Technical skills data table (49 / 96 set).*

SET	ATTACK AS FAST AS POSSIBLE IN THE MIDDLE OF THE NET	SECOND BALL GOES TO THE OPPOSITE COURT INSTEAD OF SETTING FOR ATTACKING	OFF SPEED HIT INSTEAD OF POWER SPIKE OVER THE BLOCK	SKILLS POINTS (TOTAL)	ATTACK	TOTAL SCORE (SET)
1°	3	1	5	9	15	25
2°	4	2	3	9	13	25
3°	5	1	4	10	15	25

SET	ATTACK AS FAST AS POSSIBLE IN THE MIDDLE OF THE NET	SECOND BALL GOES TO THE OPPOSITE COURT INSTEAD OF SETTING FOR ATTACKING	OFF SPEED HIT INSTEAD OF POWER SPIKE OVER THE BLOCK	SKILLS POINTS (TOTAL)	ATTACK	TOTAL SCORE (SET)
4°	2	0	3	5	11	24
5°	5	0	5	10	17	26
6°	4	3	0	7	13	25
7°	6	2	2	10	16	28
8°	0	1	3	4	8	22
9°	3	0	1	4	7	19
10°	2	2	2	6	13	22
11°	1	1	1	3	12	25
12°	5	0	1	6	15	25
13°	3	0	4	7	13	25
14°	2	1	3	6	15	25
15°	4	2	2	8	11	24
16°	5	3	2	10	17	26
17°	3	1	4	8	13	25
18°	2	1	5	8	16	28
19°	4	0	3	7	11	22
20°	4	0	6	10	16	22
21°	3	2	3	8	13	22
22°	6	3	4	13	18	29
23°	1	2	3	6	15	25
24°	1	1	6	8	13	25
25°	0	1	2	3	15	25
26°	2	0	4	6	11	24
27°	3	0	3	9	17	26
28°	4	0	2	6	13	25
29°	6	2	3	11	16	28
30°	5	2	1	8	12	22
31°	4	1	2	7	17	23
32°	4	1	3	8	13	22
33°	3	1	2	6	12	25
34°	4	0	1	5	15	25
35°	2	0	1	3	13	25
36°	3	2	4	9	15	25

SET	ATTACK AS FAST AS POSSIBLE IN THE MIDDLE OF THE NET	SECOND BALL GOES TO THE OPPOSITE COURT INSTEAD OF SETTING FOR ATTACKING	OFF SPEED HIT INSTEAD OF POWER SPIKE OVER THE BLOCK	SKILLS POINTS (TOTAL)	ATTACK	TOTAL SCORE (SET)
37°	5	2	4	11	14	24
38°	6	1	3	10	17	26
39°	2	1	2	5	13	25
40°	5	2	4	11	16	28
41°	6	1	3	10	15	22
42°	2	1	2	5	7	18
43°	5	2	4	11	13	22
44°	6	1	3	10	15	25
45°	5	2	4	11	15	25
46°	6	1	3	10	11	25
47°	2	1	2	5	11	20
48°	6	1	3	10	13	26
49°	2	1	2	5	16	25

Total score (set) vs. attack as fast as possible skill

The dependency relationship analyzed through a simple regression model was statistically significant. It can be argued that the dependent variable is affected (dependent) from the independent, as evidenced by the p-value (probability value that indicates the degree of significance of the relationship, the more it is close to 0 the more the dependency relationship is hypothesized considered true. in general, a value of p-values indicating a statistically significant relationship of dependency must be less than 5% or less than 0.05).

Simple linear regression model does not seem to be indicated because the index is very low R^2 (R^2 the index varies between 0 and 100 percent, the closer it gets to 100 the more the linear model is justified. In general, an acceptable value is greater than 70%).

In the graph the points are not distributed around the line, this shows that the relationship between Y and X, as well as statistically significant, does not seem to be a linear relationship.

Table 2. *Regression analysis.*

Parameter	Estimate	Standard Error	T Statistic	P-Value
Intercept	23.058	0.723	31.862	0.000
Slope	0.370	0.182	2.029	0.048

*Regression Analysis – Linear model: Y = a + b*X. Dependent variable: total score set. Independent variable:* ***Skill Primo tempo.*** *Correlation Coefficient = 0.283. R-squared = 8.060*

Table 3. *Regression analysis output.*

Statistical regression	
Multiple R	0.283915742
R^2	0.080608149
Adjusted R^2	0.06104662
Standard error	2.156028287
Observations	49

VARIANCE ANALYSIS

	DF	SS	MS	F	Sig. F
Regression	1	19.155	19.155	4.120	0.048
Error	47	218.477	4.648		
Total	48	237.632			

	Coefficients	Standard error	Stat t	Significance value	< 95%	> 95%
Intercepts	23.058	0.724	31.862	1.784	21.602	24.514
Attack Skill	0.370	0.182	2.029	0.048	0.003	0.736

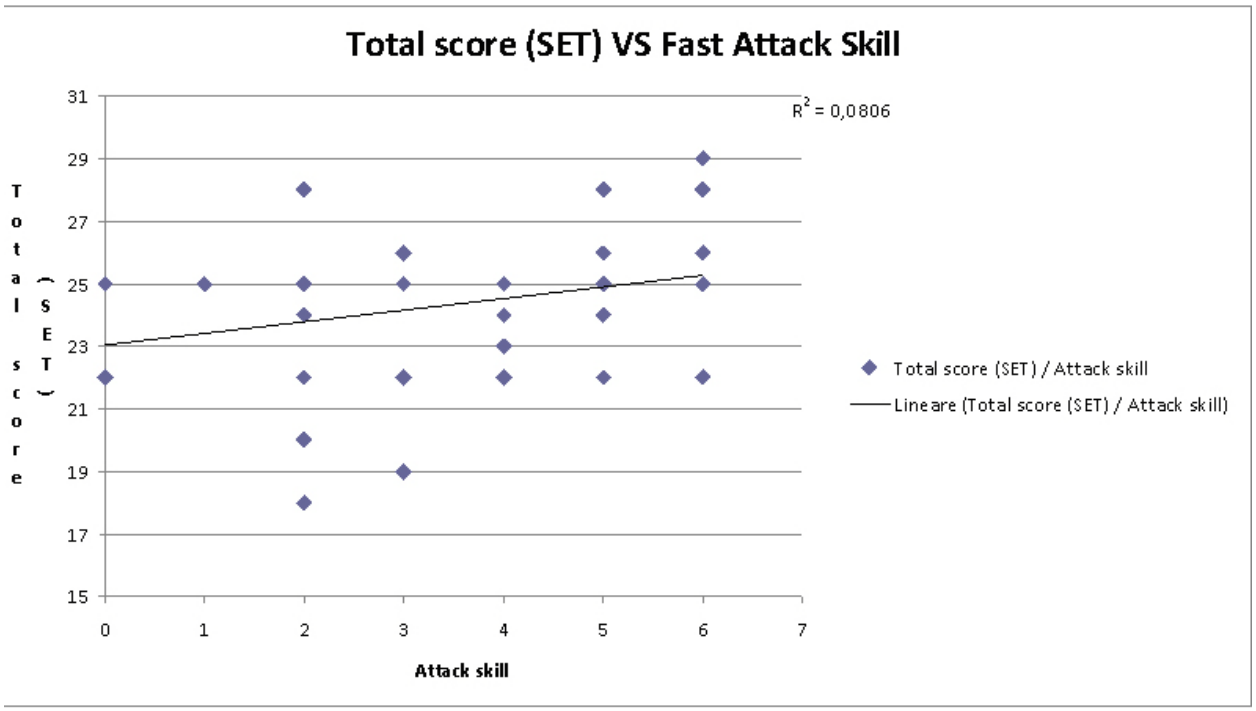

Figure 1. *Total score vs. fast attack skill.*

Total score (set) vs. off speed hit skill

The dependency relationship, analyzed through a simple regression model, was statistically significant: it can be argued that the dependent variable is affected (dependent) from the independent, as evidenced by the p-value (probability value that indicates the level of significance of the relationship, the more it is close to 0 the more the dependency relationship is hypothesized to be considered true. In general, a p-value indicating a statistically significant relationship of dependency must be less than 5% or less than 0.05).

Simple linear regression model does not seem to be indicated because the index is very low R^2 (R^2 the index varies between 0 and 100 percent, the closer it gets to 100 the more the linear model is justified. In general, an acceptable value is greater than 70%).

In the graph the points are not distributed around the line, this shows that the relationship between Y and X, as well as statistically significant, does not seem to be a linear relationship.

Table 4. *Regression analysis.*

Parameter	Estimate	Standard Error	T Statistic	P-Value
Intercept	23.712	0.521	45.512	0.000
Slope	0.591	0.364	1.621	0.112

*Regression Analysis – Linear model: Y = a + b*X. Dependent variable: total score set. Independent variable:* ***off speed kit Skill.*** *Correlation Coefficient = 0.230. R-squared = 5.296.*

Table 5. *Regression analysis output.*

Statistical regression	
Multiple R	0.230
R^2	0.052
Adjusted R^2	0.032
Standard error	2.188
Observations	49

VARIANCE ANALYSIS

	DF	SS	MS	F	Sig. F
Regression	1	12.586	12.586	2.628	0.112
Error	47	225.047	4.788		
Total	48	237.633			

	Coefficients	Standard error	Stat t	Significance value	< 95%	> 95%
Intercept	23.712	0.521	45.512	1.590	22.664	24.760
off speed hit Skill	0.591	0.365	1.621	0.112	-0.142	1.325

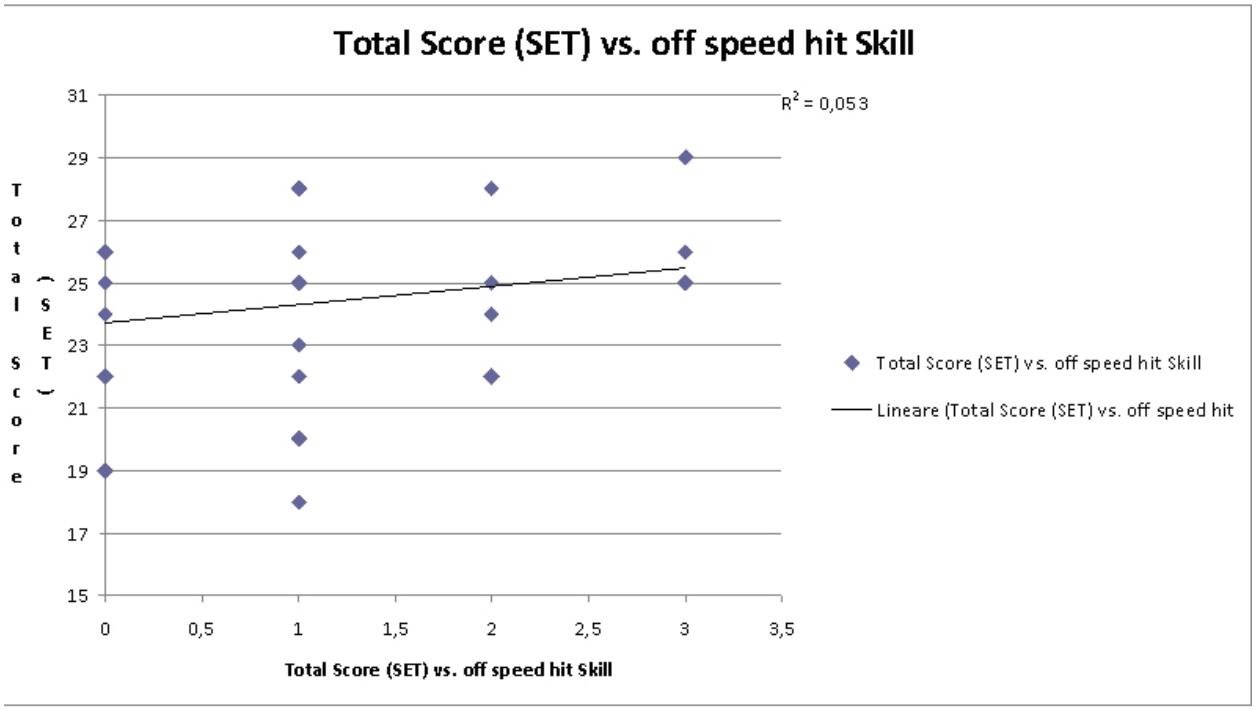

Figure 2. *Total score (set) vs. off speed hit skill.*

Total score (set) vs. second ball skill

The dependency relationship, analyzed through a simple regression model, was statistically significant: it can be argued that the dependent variable is affected (dependent) from the independent, as evidenced by the p-value (probability value that indicates the level of significance of the relationship, the more it is close to 0 the more the dependency relationship is hypothesized to be considered true. in general, a p-value indicating a statistically significant relationship of dependency must be less than 5% or less than 0.05).

Simple linear regression model does not seem to be indicated because the index is very low R^2 (R^2 the index varies between 0 and 100 percent, the closer it gets to 100 the more the linear model is justified. In general, an acceptable value is greater than 70%).

In the graph the points are not distributed around the line, this shows that the relationship between Y and X, as well as statistically significant, does not seem to be a linear relationship.

Table 6. *Regression analysis.*

Parameter	Estimate	Standard Error	T Statistic	P-Value
Intercept	23.361	0.761	30.709	0.000
Slope	0.354	0.239	1.482	0.145

*Regression Analysis – Linear model: Y = a + b*X. Dependent variable: total score set. Independent variable:* ***second ball Skill.*** *Correlation Coefficient = 0.211. R-squared = 4.464.*

Table 7. *Regression analysis output.*

Statistical regression	
Multiple R	0.211
R^2	0.045
Adjusted R^2	0.024
Standard error	2.197
Observations	49

VARIANCE ANALYSIS

	DF	SS	MS	F	Sig. F
Regression	1	10.609	10.609	2.196	0.145
Error	47	227.024	4.830		
Total	48	237.633			

	Coefficients	Standard error	Stat t	Significance value	< 95%	> 95%
Intercept	23.361	0.761	30.709	9.339	21.830	24.891
SKILL Second Ball	0.354	0.239	1.482	0.145	-0.127	0.835

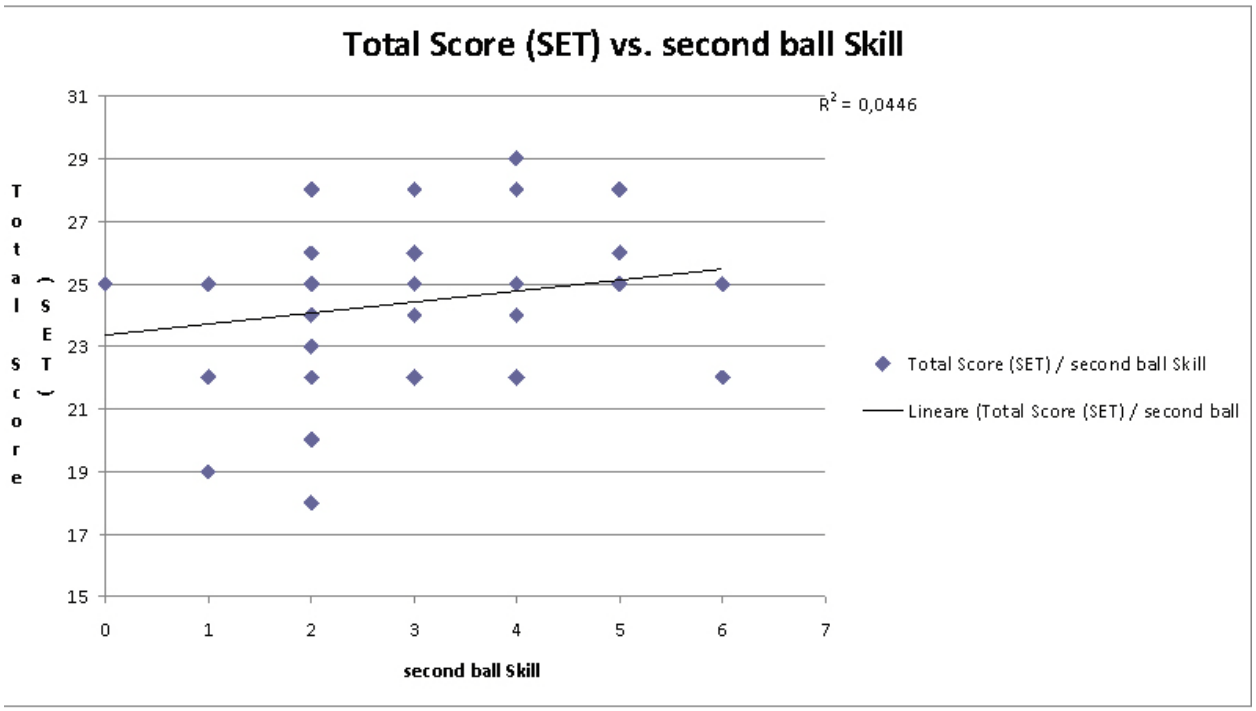

Figure 3. *Total score (SET) vs. second ball skill.*

Total score (set) vs. skills points

The dependency relationship, analyzed through a simple regression model, was statistically significant: it can be argued that the dependent variable is affected (dependent) from the independent, as evidenced by the p-value (probability value that indicates the level of significance of the relationship, the more it is close to 0 the more the dependency relationship is hypothesized to be considered true. in general, a p-value indicating a statistically significant relationship of dependency must be less than 5% or less than 0.05).

Simple linear regression model does not seem to be indicated because the index is very low R^2 (R^2 the index varies between 0 and 100 percent, the closer it gets to 100 the more the linear model is justified. In general, an acceptable value is greater than 70%).

In the graph the points are not distributed around the line, this shows that the relationship between Y and X, as well as statistically significant, does not seem to be a linear relationship.

Table 8. *Regression analysis.*

Parameter	Estimate	Standard Error	T Statistic	P-Value
Intercept	21.645	0.957	22.614	0.000
Slope	0.357	0.118	3.012	0.004

*Regression Analysis – Linear model: Y = a + b*X. Dependent variable: total score set. Independent variable:* ***Skill points.*** *Correlation Coefficient = 0.402. R-squared = 16.176.*

Table 9. *Statistical regression skills points / total score (set).*

Statistical regression	
Multiple R	0.402
R^2	0.162
Adjusted R^2	0.144
Standard error	2.059
Observations	49

VARIANCE ANALYSIS

	DF	SS	MS	F	Sig. F
Regression	1	38.439	38.439	9.069	0.004
Error	47	199.193	4.238		
Total	48	237.633			

	Coefficients	Standard error	Stat t	Significance value	< 95%	> 95%
Intercepts	21.645	0.957	22.614	6.65E-27	19.719	23.570
Total Skills	0.357	0.118	3.012	0.004	0.118	0.595

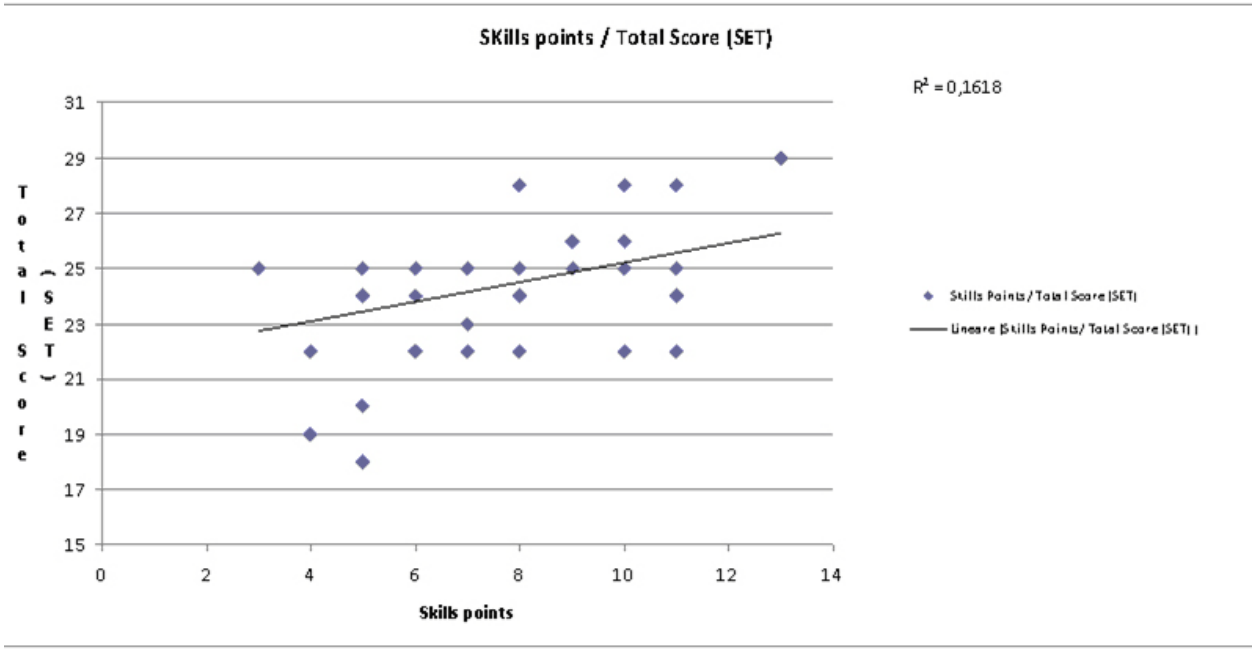

Figure 4. *Skills points / total score (set).*

Attack vs. skills points

The dependency relationship, analyzed through a simple regression model, was statistically significant: it can be argued that the dependent variable is affected (dependent) from the independent, as evidenced by the p-value (probability value that indicates the level of significance of the relationship, the more it is close to 0 the more the dependency relationship is hypothesized to be considered true. in general, a p-value indicating a statistically significant relationship of dependency must be less than 5% or less than 0.05).

Simple linear regression model does not seem to be indicated because the index is very low R^2 (R^2 the index varies between 0 and 100 percent, the closer it gets to 100 the more the linear model is justified. In general, an acceptable value is greater than 70%).

In the graph the points are not distributed around the line, this shows that the relationship between Y and X, as well as statistically significant, does not seem to be a linear relationship.

Table 10. *Regression analysis.*

Parameter	Estimate	Standard Error	T Statistic	P-Value
Intercept	9.613	1.004	9.571	0.000
Slope	0.530	0.124	4.270	0.000

*Regression Analysis – Linear model: Y = a + b*X. Dependent variable: total score (Attack). Independent variable:* ***Total Skill.*** *Correlation Coefficient = 0.529.*

Table 11. *Statistical regression skills points / attack.*

OUTPUT

Statistical regression	
Multiple R	0.528
R^2	0.279
Adjusted R^2	0.264
Standard error	2.160
Observations	49

VARIANCE ANALYSIS

	DF	SS	MS	F	Sig. F
Regression	1	85.086	85.086	18.234	9.42E-05
Error	47	219.322	4.666		
Total	48	304.408			

	Coefficients	Standard error	Stat t	Significance value	< 95%	> 95%
Intercept	9.613	1.004	9.571	1.29E-12	7.592	11.633
Skill Total	0.530	0.124	4.270	9.42E-05	0.280	0.780

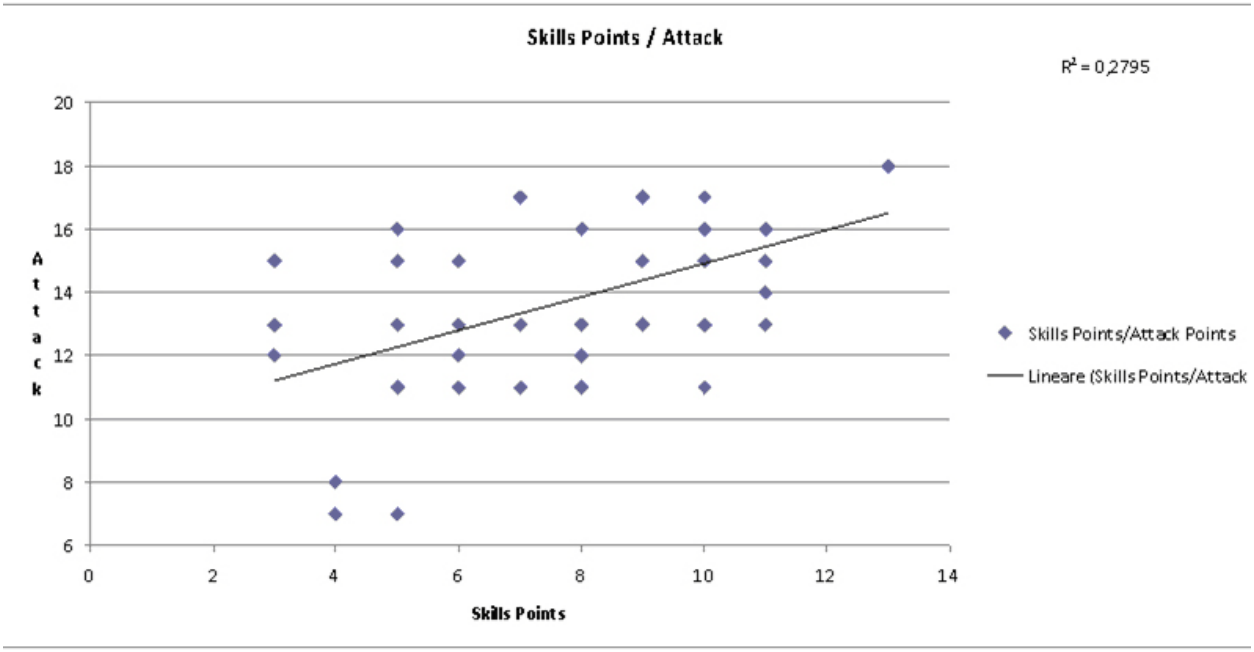

Figure 5. *Skills points / attack.*

Multiple regression–total points of the three skill / total points (attack).

The dependency relationship analyzed through a multiple regression model was statistically significant it can be argued that the dependent variable is affected (dependent) from the independent variables, as evidenced by the p-value (probability value that indicates the degree of significance of the relationship, the more it is close to 0 the more the dependency relationship is hypothesized considered true. in general, a value of p-values indicating a statistically significant relationship of dependency must be less than 5% or less than 0.05).

The multiple regression model does not seem to be effective because the index is very low R^2 (R^2 the index varies between 0 and 100 percent, the closer it gets to 100 the more the linear model is justified. In general it is an acceptable value greater than 70%).

Table 12. *Regression analysis.*

Parameter	Estimate	Standard Error	T Statistic	P-Value
CONSTANT	9.880	1.060	9.314	0.000
Skill second ball	0.526	0.247	2.131	0.038
Skill fast attack	0.495	0.198	2.501	0.016
Skill off speed hit	0.445	0.390	1.141	0.259

Dependent variable: total points (Attack).

Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
Model	74.830	3	24.943	4.89	0.005
Residual	229.578	45	5.102		
Total (Corr.)	304.408	48			

R-squared = 24.582 percent; R-squared (adjusted for d.f.) = 19.554.

Table 13. *Regression analysis output.*

Statistical regression	
Multiple R	0.529
R^2	0.279
Adjusted R^2	0.264
Standard error	2.160
Observations	49

VARIANCE ANALYSIS

	DF	SS	MS	F	Sig. F
Regression	1	85.086	85.086	18.234	9.42E-05
Error	47	219.322	4.666		
Total	48	304.408			

	Coefficients	Standard error	Stat t	Significance value	< 95%	> 95%
Intercept	9.613	1.004	9.571	1.29E-12	7.592	11.633
Total Skills	0.530	0.124	4.270	9.42E-05	0.281	0.780

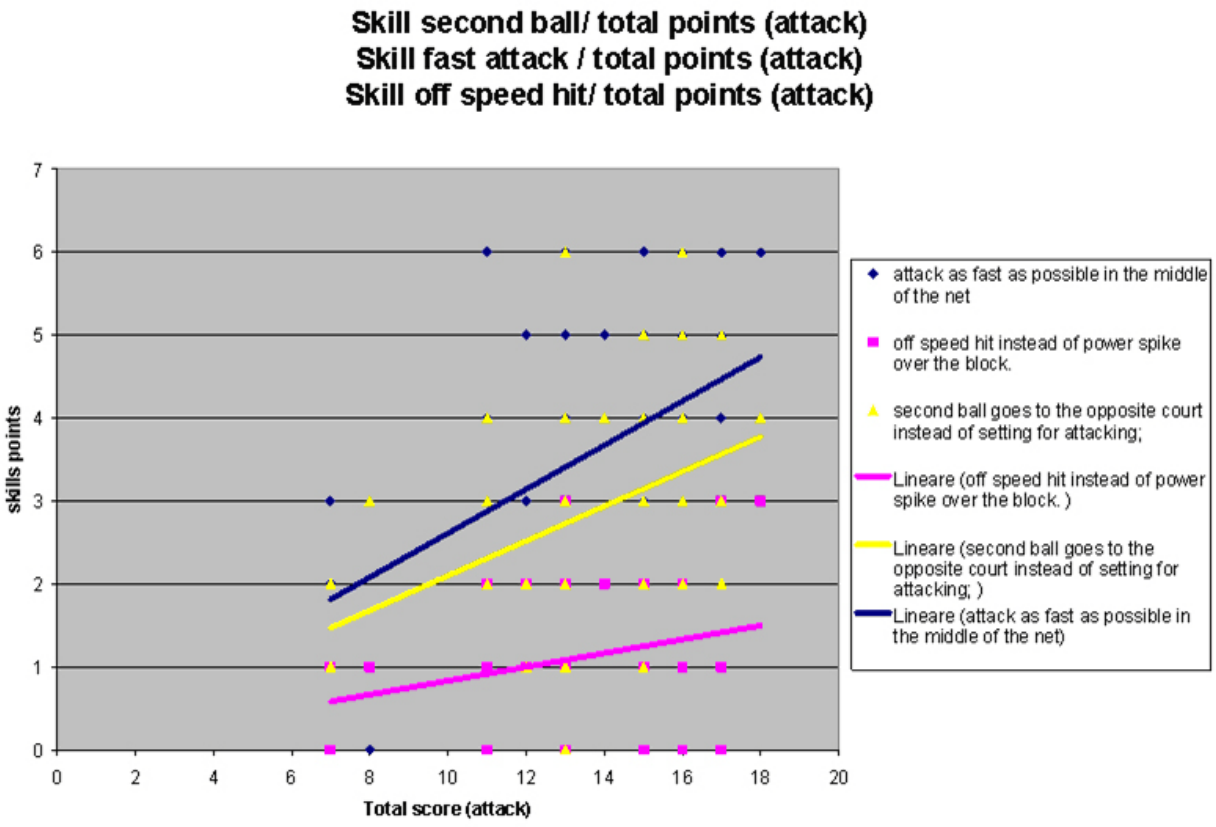

Figure 6. *Overview of the three skill variables.*

The chart below should be considered guidance. It is not possible to graphically represent the four dimensions of the regression, so we considered to provide an overview of the three skill variables considered individually compared to the total score of attack.

DISCUSSION AND CONCLUSIONS

The overall study has highlighted that the results attributed to the Body Communication have a evident weight on the final score and have similar patterns during the competitions. Results attributed to it can be inserted, then, in a class by itself as the points assigned to each key. While being a sum of 3 belonging to the fundamental skills of the attack, they have their own characteristics and accidents. The data of the 3 skills can be approved for a new categorization of data points. This study shows significant relationships with the individual skills and the final score and the aggregate of body communication with the final score.

Table below presents a summary list of tests carried out during the study.

Table 14. *List of tests carried out during the study.*

	Correlation coefficient	R^2	Adjusted R^2	P-value
Total score (set) vs. skills points	0.402	0.162	0.144	0.004
Attack vs. skills points	0.529	0.28	0.264	0
Multiple regression – total score (set)	0.388	0.15	0.094	0.06
Multiple regression – attack	0.496	0.246	0.196	0.005

For each test performed shall be considered:

- The correlation coefficient.
- The coefficient of determination.
- The P-value level of significance.

In order to immediately read the table, we summarize briefly the meaning and function of the reported values.

"The coefficient of correlation is a quantitative value of the relationship between two or more variables. The correlation coefficient can range from 0.00 to 1.00 in either a positive or negative direction. Thus, perfect correlation is 1.00 (either +1.00 or -1.00), and no relationship at all is 0.00" (Thomas, Nelson, Silverman, & Silverman, 2010).

By defining the correlation as linear association between 2 or more variables, the correlation coefficient R of the sample allows us to:

- Summarize the significance of the linear relationship between the variables.
- Test the hypothesis that R is zero (null hypothesis), that is, whether the apparent association between the variables may be casual.

The R-squared value (R^2) indicates the proportion of variation of a variable that is "explained" by other variable, as the following example:

$R=0.9$; $R^2=0.81$; $\Rightarrow$ about 80% of the variation of a variable A is explained by variable B.

Observed scatter diagrams, it was decided to clear the field by the possibility that the observed correlations may be spurious. For this purpose, have been carried out tests of significance (P-value). The level of significance was defined as the probability of accepting or rejecting the null hypothesis (no correlation between the data sets).

The P-value not only provides a rule for acceptance or rejection of the null hypothesis, but expresses significance of evidence for or against this hypothesis. In fact, small values, close to 0, providing strong evidence (low to high) against the null hypothesis, while large values provide evidence in favor of this. More specifically, it is common interpret the P-value (P) based on thresholds set by convention, as follows:

Table 15. *Conventional thresholds for P-value interpretation.*

Conventional thresholds for P-value interpretation	
P ≥ 0.1	Absence of evidence against the null hypothesis: data consistent with the null hypothesis
0.05 ≤ P < 0.1	Low evidence against the null hypothesis in favour of the alternative
0.01 ≤ P < 0.05	Moderate evidence against the null hypothesis in favour of the alternative
0.001 ≤ P < 0.01	Strong evidence against the null hypothesis in favour of the alternative
P < 0.001	Very strong evidence against the null hypothesis in favour of the alternative

In Table 15 thus appears that according to that Convention, the fundamental value to accept or reject the null hypothesis is the value of 0.05. So when P is less than 0.05 will be said that the result obtained from the study is statistically significant.

The number and variety of tests allows us to say, first, that with all the evidence, there is a significant dependence (ρ equal to 0 at a significance level of 0.05) between the individual skills and the final score and between the aggregate of bodily communication and the final score. This dependence, however, does not seem to be satisfactorily explained by simple linear regression model. In this regard, it should be noted that, heuristically, the R^2 measures the fraction of the variability of the observations that we can explain by the linear model. A nonlinear model, for example, may better represent the relationship between the dependent variable and regressors, and present a good explanatory power, even in the presence of an R^2 close to zero. The significance of the reports related to the attack suggests an external dynamic rather than a dynamic belonging to the fundamental. In other words, it believes it is justified in an extrapolation of the three individual technical skills, compared to the fundamental of attack. The conclusions refer to a very small sample, only 2 teams belonging to a specific segment of volleyball: Women and the BC series. It would be useful to investigate the phenomenon in other segments of competitive volleyball.

The overall study has highlighted that the results attributed to bodily communication have an evident weight on the final score and have similar patterns during the matches. These results can be considered, therefore, in a class by itself as the points assigned to each skill. They have their own characteristics and accidents. The data of the 3 skills can be approved for a new categorization of data points.

The bodily communication in the analysis of qualitative performance in volleyball is dedicated to all aspects of individual tactics, when it is extemporaneous, or tactics of team if it is analyzed, designed, programmed and then trained in its development. Studies on the tactical aspects of individual and team are still rare.

"Not surprisingly, the majority of published notational analysis work in sports derives from academics with an interest in soccer, basketball, volleyball etc. and they are not necessarily involved in the coaching process. Many volleyball coaches do not agree how to attribute the outcome points to the single volleyball fundamentals for all action. That happens when the decision of the attacker attribution and the opposite defender is borderline. Often, the inference of the outcomes in these actions is due to the feint and, generally, by the use of bodily communication in fast motor skills" (Raiola 2010a; Raiola 2010b).

It may be useful for the analysis of the performance of the athlete to identify, explain, argue and ultimately justify the specific contribution of bodily communication on the determination of the result.

The exact evaluation of these outcomes, as such as the attribution of the point, could help the coach to analyze the performance of his own athletes and so to train them in the better way.

To systematize organically the whole training plan is needed the technical data over a full period of observation with a rationale design of survey. So it can useful to improve the motor learning and decision making skills by adequate teaching methods according to a new orientation of didactics. In this way, it has to enable greater efficiency in the gaming action in a perspective of optimization of attacking actions.

It may be useful to provide an educational course for technicians and coaches about the following subjects:

- Neurobiological knowledge on the mechanisms of regulation of the various types and ways of imitation, learning, and gestural communication according to the research on mirror neurons (Rizzolatti & Sinigaglia, 2006; Iacoboni, 2008).

- Knowledge of the mechanisms of perception and on the sense of movement or kinaesthesia which makes possible of simulations and anticipations of motor actions (Berthoz, 1997; Latash, 2008).

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