Original Article

Video analysis evaluation of goal actions using a new tactical analytic approach

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Abstract:

Match analysis is of great importance for the study of performance at an individual or collective level. In this context, the notational analysis represents an element of self-evaluation to verify what is done in the field by the players in a team sport like football. Several studies have dealt with evaluating: goal scoring, influence 1st victory goal, losing teams winning losses, types of offensive actions. This study aims to assess the ways in which a U16 team has scored goals and how these have evolved over the course of a championship (2017/2018). The matches were resumed and subsequently analysed. The elements taken into consideration were: timing of the goal, type of possession, number of passes, duration of the action, and area of commencement of the action. By category of possession, 3 main categories have been identified: Fast Action (AV, maximum 3 passes), Open Action (AM, at least 4 passes), Set-piece Football (CP). For the area where the possession of the ball began, the areas were divided as follows: Zone 1 defensive, Zone 2 pre-defensive, Zone 3 pre-offensive, Zone 4 offensive. The results showed 19 goals from AV, 13 from AM and 4 from CP; 2 goals from Zone 1, 12 from Zone 2, 13 from Zone 3, 5 from Zone 4. The following differences were detected between the outward and return journeys: average passes decreased from 4.69 to 3.21, average duration of the action decreased from 13.14 to 11.37; 7 more goals from AV the round of return; from Zone 3, 3 goals more in the Round of Return and 6 goals from AV against 1 goal from AM; +4 goals scored, -5 goals conceded, +1 point. All these elements combine to highlight the characteristics of the team and the players, the effectiveness of the training course and the evolution of the variables examined.

Keywords: Match analysis, player performance model, goal actions, offensive actions type.

Introduction

In the last decade there was a great increase in research focused on analysing the performance of sports competitions. The first objective of these studies was to look for objective data related with key performance indicators (KPI) that have relevance on the final result. This new approach is of great importance for all sports coaches because they can get relevant information about past performances in order to improve future ones. Identify the strengths of your own team, with the possibility of developing them in the future, and to discover the weak points, thus suggesting and developing methods to improve them, is the basis of the Match Analysis (MA). With the same methodical, the coaching staff will analyse the opponents' performances to identify, strong points and highlight the weaknesses. The MA has therefore become an element used by all the staff of professional teams, to investigate the team performance or a single player.

The analysis of the match is described through KPI that represent a selection, or combination, of variable actions that have the objective of defining some aspects of the performance of a given sport [1]. It is very difficult to accurately identify the factors related to victory and defeat in football, due to its variable nature and unpredictable environmental factors; the notational analysis describes KPI to arrive at conclusions that may be useful for improving the quality and effectiveness of tactics during matches. Within this context, the scientific literature produced a large number of publications; in order to search and define the KPI that could have greater relevance on performance and in the final result. The physical demand (external load) was the most studied topic during the last years [2, 3]. Other important researches investigated the relationship between physical demands and players roles, with the goal to suggest more specific performance models (PM) [4, 5]. Different countries teams presented differences in physical and technical aspects of match play; cultural differences may contribute to a different PM even in professional soccer leagues [6, 7]. Find a connection between parameters of physical

performance (objective and quantitative); technical-tactical indicators were the aim of many studies and more in specific is the goal of modern era of performance analysis. Scientists tried to identify a winning profile, but all of those studies were restricted to observing and comparing single factors. In average winning team performed more interceptions; clearances; aerial challenges; and fewer crosses, passes, and dribbles; and when observing two teams of different skill levels, the weaker ones perform more passes and less dribbling, about ball possession it was detected greater when losing than when winning or drawing [8].

Footballers performed less high-intensity events during winning, in more specific, elite players performed with less high intensity when winning than when losing [9]. A part of the literature has evaluated the minute of goals scored and the influence of the 1st goal scored on the final result, Goral [10] analysing the goals scored in the 2013 U-20 World Cup showed that in 33 games out of 52 (63.46%), the winning teams were the ones that scored first. In addition, 63 goals (41.45%) were scored in the first half (T1), 82 goals (53.94%) in the second half (T2), 7 goals (4.6%) were scored in the extra time (ET). Similar results were found by Sharam et al. [11] analysing the 2010 World Cup in South Africa: 86 goals on 145 (59.31%) were scored in the T2. In agreement with Alberti et al. [12] that studying the 4 major European championships (Serie A, English Premier League, French Ligue 1 and Spanish Liga) showed that out of a total of 10,885 goals scored in 4,560 games analysed, 55.1% were always scored during T2. Armatas et al. [13] analysing the goals scored in T2 of the World Cup found the following results: 60.8% in 1998, 59% in 2002 and 52.5% in 2006. In the following years again Armatas et al. (2009) [14] confirm this trend with 57.4% of goals scored in T2 of the 2004 European Championship. These recurrent data in the aforementioned studies evaluated both in national and international competitions suggest that one of the factors that can have the major impact on performance results is the outcome of fatigue, which can lead to an increase of errors and condition the final result. Another main aspect to consider is the increasing amount of risks, which occur when the game is near the finish line. It seems that the final fifteen minutes of the T2 frequently represent a critical period of the game; Pratas [15] confirm this attitude highlighting that in the 2006 World Cup the highest percentage of goals (32.8%) was scored in the last 15 minutes (75-90). However, Sharam et al. [11] do not confirm the same results regarding the 2010 World Cup matches, there were no significant differences in goals scored.

A study by Lastella et al. [16] compared the characteristics in terms of timing of the goals scored between the 2016 European Championship and the 2016 America's Cup. The results showed significant differences: most goals were marked in T2 as regards the European 2016 but not for the America's Cup 2016 where the result was opposite, particularly in the first 15 minutes of the match with a twice percentage (24% in American Cup vs. 12% in European Cup). This trend could give an idea of the different approach between European and South American teams, especially in the opening minutes of matches. Leontijevic et al. [17] compared two Champions League seasons (2015/2016 and 2016/2017). Analysing the number of shots on goal made in each 15-minutes interval, a significant increase was seen in the 0-15 minutes of the 2016/2017 season compared to the previous one. Both seasons were characterized by a greater number of shots on goal in the T2 but the greatest increase was precisely in the initial phase of the game. Other studies have evaluated the correlation between the marking of the 1st goal of the match and the final victory; Armatas et al. [18] showed that in the 2006 World Cup, the team that scored the first goal for 73.21% turned out as a winner. Results confirmed by Mitrotasios [19] with a victory rate of 85.7%, Leite [20] assessed the 2012 European Championship with the impact of the 1st goal on the final victory of 70.97% and by Goral [10] who estimated the same in the 2013 World Cup for the U-20 teams with an incidence of 61.1%. A part of the literature has focused on the search of KPI between winning and losing teams within an international competition or between teams ranked among the first and last position in a national league. For example, Rumpf et al. [21] examined the 2014 World Cup evaluating different KPI, and the results established that the winning teams scored a greater number of goals, goals on set pieces, goals for shots on goal, shots on goal and more accurate shots on goal. At the same time these teams also receive fewer yellow cards. No differences were found regarding the physical parameters between the winning and losing teams, nor regarding the percentage of ball possession, the total number of passes and the accuracy of them. A further distinction can be made regarding the way in which a goal is scored: the winning teams scored more goals from an open game situation (75.5% vs. 68%), while the losing teams scored more goals from set-pieces and corners (32% vs. 25.5%).

Lago-Ballesteros et al. [22] also showed that in the Spanish Liga the teams that finished first in the standings had a greater number of shots on goal compared to those that ended in mid or late rankings, and that the winning teams performed more shots and shots on goal with better effectiveness than the other teams. Hughes and Franks [23] have shown that the main difference between winning and losing teams is the converting rate between possession and shots on goal that of course is higher in winning teams. Jankovic et al. [24] instead studied the Serbian championship in the 2009/2010 season highlighting the characteristics of the teams divided into 3 groups based on the ranking position: G1—first 4 classified; G2—teams from 7th to 11th place; G3—the last 4 places. The results confirmed that the teams belonging to the G1 group had a higher percentage of accuracy in shots on goal and a greater number of goals with a goal/shot ratio of 1:6, compared to 1:9 of the G2, and 1:8 of the G3. The last element that characterizes this subdivision is the proximity to the door in the conclusion of the offensive action; while the teams of group G1 and G2 manage to finish the action near the penalty spot for 36.1% and 36% of the time, the losing teams do it only for 26%. This shows the different

technical level between the teams that arrive in different ranking positions with the winners who manage to finish the action closest to the goal. A large part of the studies focused on the description of the offensive actions that lead to shooting on goal and the goal by taking into consideration parameters such as number of passes, number of seconds, players involved. Also, in this case they were conducted both on national championships and on international competitions. For the description of the offensive actions the literature agrees on 3 main types:

- Possession play, Organized Attack or Maneuverer Action, when the defence can organize itself to minimize the offensive from the opposing team;
- Direct play, when it is characterized by a series of individual actions or vertical passages, directed towards the goal, and the defence has less time available to organize itself;
- Set pieces, free-kicks, corner kicks as penalties.

Several national championships have been analysed from this point of view; Gonzalez-Rodenas et al.[25]on a study conducted on MLS (Major League Soccer) found goals with 52.8% from possession play, 25.3% direct play and 21.9% with set pieces. Other competitions such as Euro 2004 were evaluated and all found a greater percentage of offensive actions carried through a possession play. A common element of the studies on these international competitions is the percentage of goals from set pieces always greater than the counter-attack, attesting to their importance within relatively short competitions such as a European or world championship. Leontijevic et al. [16]have studied two consecutive seasons of the 2015/2016-2016/2017 Champions League highlighting a growth in percentage of goals through possession play (56%-58%) and direct play (23%-25%) and a decrease in goals through set pieces (21%-17%).

Other studies that have investigated national competitions have highlighted specific characteristics in a specific league, making reference at to the position reached in the standings.Jankovic et al. [23]studying the goals scored in the Serbian championship 2009/2010 saw that most offensive actions are characterized by a duration of 3 seconds or less, with a number of players involved between 2 and 4, with a number of passages including between 2 and 4 without distinction with respect to the ranking position. The element that distinguishes the differently classified teams concerns the relationship between shots on goal and goals in favour of the first classified (1:6 vs. 1:8) which demonstrates a better coefficient of accuracy.Tengaet al. [26] conducted a similar study by subdividing the group of three-season teams of the Norwegian champion—2008,2009,2010—into three categories based on the ranking emphasizing that the last-ranked teams generally score fewer goals with a possession with 0-4 passes, with a duration of 12 seconds or more and with a possession that starts in the midfield area compared to the teams ranked in the upper part, that score more goals from the direct play than the others.Yue et al. [27]confirmed the greater efficiency of direct play compared to possession play by analysing the Bundesliga matches analysing 126 matches. However, it was seen how the conditions in which the shot takes place, referring to the position from which it is performed and the presence of opponents, can have a greater influence on the efficiency of the goal than to the total number of passes made.Lago-Penas and Dellal [9] studying the matches of the Spanish Liga 2008-2009 have found that the top ranked teams maintain a higher percentage of possession than the last classified.

They also studied ball possession based on the varying situations that presented themselves in the game, demonstrating that the possession actions were greater for the team in defeat rather than victory or draw and for the teams playing home. This underlined the fact that the team that was ahead decreased its possession preferring the way of the counterattack, while the team that was underneath tried to control the game to reverse the result. Ball possession was not a determining factor for the teams that were most successful in the 2014 World Cup contrary to what was observed for the 2006 and 2010 editions [3]. The studies analysed showed how the style of playand consequently the PM, change during times, following different “fashions” style because of its nature that is multidisciplinary and dynamic, it is a set of complex interactions, formed, as mentioned, by various components at the same time, and it must be dynamic and adaptable to different match situations, in fact, it varies for instance from the category or from country to country, according to the game styles and the characteristics of the athletes.Because of this the coaching staff must to analyse, study and adapt theory training mythology and tactics to the variation of the PM, in order to build a flexible team able to read and answer to different stimulus.

Our study focuses exclusively on the technical and tactical aspects of the game of football, evaluating variables and elements that can give important information to the coaches. The objective of the analysis is to evaluate the offensive actions that led to the goal and the evolution of the parameters, which characterize them, over the course of a season.It is crucial to analyse the actions that most frequently lead to the marking of a goal not only to fully understand the intrinsic characteristics of the team but also to evaluate the effectiveness of training sessions, and in order to modify the same when it will be necessary,trying to not forget that scoring a goal is also the result of a combination of technical, psychological, physical and tactical factors.

Means and Methods

The aim of the study was to propose a MA method base on the video analysis and the tactical and technical analysis of goal actions. The team examined was the U-16 of the AC. Perugia 1905 participatedin the U-16 Serie A/ B Championship—Round C during the season 2018/2019. The championship was attended by 14 teams; every team performed a total of 26 matches during season, divided in first round and second round; 24

matches were filmed; the remaining 2 were not filmed from technical problems, and consequently were not analysed. Of 38 goals scored in the season, 36 have been studied; the 2 goals missing for the same reasons described above have been omitted. The games of the U-16 category are 40 minutes for half, for a total of 80 minutes, 24 matches were filmed using a Sony Handycam Camcorder (HDR-CX240) Full Hd.

Subsequently each game was reviewed and through video analysis, with the IMovie program, all offensive actions that led to the marking of a goal were taken into consideration and cropped by manually annotating, in the first instance, the elements characterizing the action itself that will be described below. The variables taken into consideration for each goal scored were the following:

- (1)Time of the goal, in which it was signed (T1 or T2);
- (2)Type of possession;
- (3)Number of passes made in the goal action;
- (4)Number of seconds, passed in the goal action, considering the touch of the first player who retrieves the ball until the goal is marked;
- (5)Starting zone of possession, with field divided into 4 zones.

With reference to the time the goal count was made both with a split between T1 and T2 and in 6 intervals each: 0-15, 15-30, 30-40, extra time from first half (ET1); 40-55, 55-70, 70-80 and extra time of second half (ET2). The type of offensive possession that led to the goal was divided:

- (1)Direct Play (DP), considering all the possessions with a maximum of 3 passes, therefore fast actions that do not allow, or at least with difficulty, the possibility of the opposing team organizing their best defensive phase;
- (2)Possession Play (PP), all possessions with at least 4 passes, which allow more time to the opposing team to organize a proper defense;
- (3)Set Pieces (SP), all goals resulting from free kicks, penalties and corners.

Zone of where the possession that lead the goal was starting was divided as follows (Fig. 1): Zone 1 (defensive zone, Z1); Zone 2 (pre-defensive zone, Z2), Zone 3 (pre-offensive zone, Z3) and Zone 4 (offensive zone, Z4).

Data Analysis

Table 1 shows data from the video-analysis regarding the Full Match. On 36 total goals were scored 19 goals (53%) from DP actions with 1.7 average pass (A-P) and 7.3 average seconds (A-S). No one DP goal was scored starting the action from Z1, 5 were scored from Z2, 9 from Z3 and 5 from Z4. From PP actions were scored 13 goals (36%) with 6.8 A-P and 20.2 A-S. No one PP goal was scored from Z4, 2 goals were scored from Z1, 7 from Z2 and 4 from Z3. At least 4 goals (11%) were scored from SP all from Z4. In Full Match in total (Tot) were scored 36 goals with 3.8 A-P and 12.5 A-S.

Fig.1 Zone of football field, used to describe goal action.

Table 1 Data from video-analysis, regarding the Full Match.

Full match				
Type	Zone	Tot goal	Avg pass	Avg seconds
DP	Avg	19	1.7	7.3
	2	5	1.4	10
	3	9	2.2	7
	4	5	1	5
	Avg	13	6.8	20.2
PP	1	2	7	25
	2	7	7	21
	3	4	6	17
	Avg	4	-	-
SP	4	4	-	-
	Tot	36	3.8	12.5

Tables 2 and 3 show data from video-analysis from T1 and T2. Regarding the T1 were scored 6 goals from DP actions with 1.2 A-P and 5.5 A-S. From Z2 was scored 1 goal, 2 from Z3 and 3 from Z4. From PP actions were scored 8 goals with 7.0 A-P and 21.4 A-S. From Z1 was scored 1 goal, 6 from Z2 and 1 from Z3. At least 3 goals were scored from SP all from Z4. In Tot in T1 were scored 17 goals with 4.5 A-P and 14.6 A-S. Regarding the T2 were scored 13 goals with DP actions with 2.0 A-P and 8.1 A-S. From DP actions 4 goals were scored from Z2, 7 from Z3 and 2 from Z4. From PP actions were scored 5 goals with 6.6 A-P and 18.2 A-S. From Z1 was scored 1 goal, 1 from Z2 and 3 from Z3. Only one goal was scored from SP. In Tot in T2 were scored 19 goals with 3.3 A-P and 10.9 A-S.

Fig.2 shows the goal trending during half and quarters, more goals were scored during 0-15 and 55-70 quarters both with 9 marks, 6 goals were scored both for 15-30 and 70-80, 4 were scored in 40-55 and only 2 in 30-40.

Table 2 Data from video-analysis, regarding the T1.

T1				
Type	Zone	Tot goal	Avg pass	Avg seconds
DP	Avg	6	1.2	5.5
	2	1	1.0	10
	3	2	2.0	7
	4	3	1	3
PP	Avg	8	7.0	21.4
	1	1	9	32
	2	6	7	21
	3	1	6	16
SP	Avg	3	-	-
	4	3	-	-
Tot		17	4.5	14.6

Table 3 Data from video-analysis, regarding the T2.

T2				
Type	Zone	Tot goal	Avg pass	Avg seconds
DP	Avg	13	2.0	8.1
	2	4	1.5	10
	3	7	2.3	8
	4	2	2	7
PP	Avg	5	6.6	18.2
	1	1	5	18
	2	1	9	21
	3	3	6	17
SP	Avg	1	-	-
	4	1	-	-
Tot		19	3.3	10.9

Fig. 2 Goal trending during half and quarters.

Fig. 3 Goal scored during first round and second round divided by half.

Fig. 3 shows the trending of goals between first round and second round of championship, same subdivision it is shown in Fig. 4 but goals are divided by type of action

Fig. 4 Goal scored during first round and second round divided by action types.

Discussion

The aim of this study was to analyse, using the MA, one entire football season of a professional young team U-16 from U-16 Serie A/B Championship- Round C during the season 2018/2019, with the main goal to evaluate the goal actions. The intention was to find a tool that can be used by all coaches and, in particular, for all those who train in non-professional categories, or in less structured youth academy, in order to provide important and crucial information to the coaching staff. In the literature there are numerous studies that have analysed competitions of different types and different technical level going from international competitions (World Cup, European Championship) to national competitions. We have seen in general that the winning teams at the senior level of the various competitions tend to score more goals using actions with a large number of passes, mainly thanks to the technical level of the players.

This characteristic was not found in the teams grouped in the lower part of the ranking or those coming out in the first league of international competitions, these tend to verticalize with more speed, to seek in the first moments of recovery of the ball an action directed immediately towards the opponent's goal; they have also shown less ability than others to convert goal shots into goals. In our study were scored 36 goals in total, 19 were from DP (1.7 A-P, 7.3 A-S), 13 from PP (6.8 A-P, 20.2 A-S) and 4 from SP. In T1 were scored 15 goals and 21 in T2, following the data from literature that showed and higher amount of goals during the T2. Considering the zones 2 goals were scored in Z1 (6%), 12 in Z2 (33%), 13 in Z3 (36%) and 9 from Z4 (25%).

Referring to the totality of the goal actions, the team presented an average of 3.8 passes and 12.5 seconds per action. The team had a prevalence of goals (53%) with DP showing an excellent ability to score using actions with a maximum of 3 passes. To better define the study the 36 goals were divided between the T1, T2 and by quarters, 17 goals were scored in T1 (4.5 A-P, 14.6 A-S) and 19 goals were scored in T2 (3.3 A-P, 10.9 A-S). The 0-15 and 55-70 quarters show the high amount of goals 9 for each, 6 were scored in 15-30 and 70-80, 4 in 40-55 and only 2 were marked in 30-40. In the first round of championship were scored 15 goals and 21 in second round, same subdivision was built for type of actions in first round were scored 7 goals from PP, 6 from DP and 2 from SP. In the second round 6 goals were scored for PP, 13 from DP and 2 from SP. This highlights the improvement of the team that in the second part of the season managed to score more goals with

DP actions. Through the work carried out during the week and the best knowledge by the players, the game connections have improved which have consequently made it possible to improve the reading of the times and spaces of the game; while in the first interval of goals there was the need to make more passes to make goals in the second interval, the team showed an improvement in this sense managing to use fewer steps. There has been an improvement in the total data, both in the average of the passages per action, from 4.69 to 3.21, and in terms of duration, from 13.14 to 11.37.

Fig. 5 Goal actions divided by zone and round.

Fig. 5 shows the trending of goals divided by types and championship rounds, no particular differences are showed, except for the growth of DP in zone Z3 from first round and second round from 3 to 6. No DP was performed in Z1 and in the other hand no PP was performed in Z4. The growth of DP from first round to second round suggests that the training protocol during the year, managed to increase the speed of actions, also another determining factor is the knowledge of the team and the players between them, which obviously improves over the course of time and from game to game.

Conclusion

In conclusion, at the end of the season the team showed an improvement between the rounds, producing +1 point, +4 goals scored and -5 goals conceded. Other improvements were showed in goal actions with a 4.69 A-P and 13.4 A-Sin goal actions during first round and with a 3.21 A-P and 11.37 A-S in second round of championship. Another interesting datum deriving from the simultaneous analysis of two elements, the type of goal scored and the area where the action starts, showed an improvement in the team having signed the return round a greater number of goals from Z3, pre-offensive, using DP compared to PP. Considering the results obtained, the correlation between improvement in terms of points obtained and in the technical-tactical elements that led to the marking of goals in the team examined was demonstrated. Evaluating these aspects it is possible to have a general picture of knowledge about a team and, consequently, about its players by directly making an assessment that derives from what was shown during each game, and during the championship subsequently. From these considerations the coach can modify or maintain his own training program based on the targets he sets himself. The final evaluation regarding the evolution of the variables or their maintenance helps to understand the effectiveness of a specific training schedule. The self-assessment of the work-plane has become as important a part as the work itself and this protocol sets itself the goal of improving its quality. This evaluation protocol allows constantly having the numerical data relating to the goals scored match by match. The task of this protocol is not to suggest a specific work that allows the evolution of the variables but to analyze the effectiveness of the work itself thanks to a notational analysis that can be carried out without using excessively expensive tools. This type of analysis is a fundamental element to evaluate the correct transmission of technical-tactical concepts exposed during the weekly training sessions, with the final goal, from the growth of the technical-tactical within the academy to the pure research of result in senior teams.

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