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HOW COACHES USE THEIR KNOWLEDGE TO DEVELOP SMALL-SIDED SOCCER GAMES: A CASE STUDY

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ABSTRACT

The method employed by coaches when designing small-sided soccer games has had limited attention from the scientific community. Therefore, the aim of this study was to undertake a case study where one expert coach was interviewed and tasked with designing and justifying four different small-sided games (SSG) for different physiological effects. Using these games, players were tested and the real-time heart rate responses of the players were compared with the coach's estimation. Both qualitative methodology and quantitative methodology were developed to differentiate the games in terms of the effort produced. The coach's estimation was compared with the actual real-time effects produced by the players' efforts. It was possible to identify that, as predicted by the coach during the design of the games, the management of task constraints such as goals/targets and specific zones of action had statistical effects on the players' efforts as measured by heart rate monitors. The case study revealed how the soccer-specific coach organises his knowledge and experience to develop small-sided games. Possibilities for future study that would identify the fundamental decisions that differentiate novice and experienced coaches were revealed.

Key words: Coach knowledge; Small-sided games; Soccer; Qualitative and quantitative methods.

INTRODUCTION

Knowledge and a deeper understanding of a specific subject matter are essential to any professional activity. Knowledge of a specific issue can result from a range and depth of understanding different concepts and conceptions (Abraham *et al*., 2006). The concepts can be defined by their formality on categorisation boards and by procedural and declarative knowledge (Abraham & Collins, 1998). On the other hand, the conceptions represent a personal interpretation of the concepts applied in a given context that means something to the coach (Abraham *et al*., 2006). Therefore, the knowledge of coaches not only depends on their concepts, but also on integration between the concepts and the experience gained in the field through the application of these concepts.

In the area of sport, previous studies suggest that a large part of training knowledge and its associated practice are based on the coaches' experience and personal interpretations of those experiences (Cushion *et al*., 2003). Nevertheless, this does not mean that all experienced

coaches are competent (Bell, 1997), but to become one it is important to have a high level of experience (Lyle, 2002). The quality practise time promoted by experience and the evolution of training methods is a deciding factor for success in this profession (Cushion *et al*., 2003). In this sense, it is very important to have a flexible body of knowledge that produces mental schemes based on what coaches perceive, perform and evaluate from their own practice (Ritzer, 1996).

One variable of the most important ones that needs to be taken into account by team sports coaches is the development of ecological tasks (drills). How does this process happen? Few studies have developed a cross-methodological process to understand how this process occurs (Light & Robert, 2010). An understanding of how coaches think, project and prescribe their drills are essential for the success of the intervention, requires investigation.

There are several variables that soccer coaches can use to develop a drill (Hill-Haas *et al*., 2011). When the main goal is to develop physical, technical and tactical performance indicators simultaneously, it is important to have a deeper understanding of how these variables interact with one another to achieve the fundamental objectives (Clemente *et al*., 2012). In small-sided games (SSG), the variables used regularly include the number of players, field dimensions, specific rules, touch limitations, and type of targets or encouragements provided to induce different responses in players' performance (Aguiar *et al*., 2012). These variables have been studied in recent years; however, the process of how coaches use them to achieve their goals has not been investigated, despite its importance. The way in which coaches project the drills for specific goals is very important for the improvement of training courses or curricular programmes.

RESEARCH AIM

This study aims to analyse how a specific coach organises his drills to achieve the specific goals set by the research team. As a case study, it was proposed that an expert coach develop four different tasks (SSG) to achieve specific physiological and kinematical responses from the players. During the design of the drills, the coaches were interviewed to identify their thoughts about their personal criteria when organising drills to achieve specific goals. Afterwards the coaches were asked to anticipate the efforts experienced by players during their SSG. This study used a methodological approach. It is expected that a relation between the coaches' estimation and the actual heart rate (HR) responses of the players during the SSG will be found.

METHODOLOGY

Participants

Six soccer players (13±1.1 years old) with a minimum of 3 years of soccer experience participated in this study. After an initial phase of coach selection, which was defined by the criteria of a minimum of 5 years of experience, using SSG in his training process, possession of a minimum academic qualification of a master's degree in Sports Science or Physical Education, one coach was selected from the 10 analysed. One soccer coach with 6 years of experience was selected to have his planning soccer drills analysed. All data collected

complies with the American Psychology Association (APA) ethical standards for treatment of human or animal subjects.

Research design

This case study used a series of interviews conducted over a 2-week period in August 2013. The study was then organised into 2 data-collecting phases.

During the first phase, the coach was interviewed with regard to his own perspective of small-sided soccer games. Data was generated through a series of one-to-one, semi-structured interviews guided by the following core research questions: How can you use SSG to develop your players and how do you think such games can be developed? The interviews were conducted by the authors with an initial interview of 30 minutes, followed by 3 subsequent interviews of approximately 20 minutes each.

During the last 3 interviews, the coach was asked to develop a set of 4 different small-sided soccer games that would gradually increase the HR responses of the soccer players (measured by heart rate monitors). A maximum of 15 players participated and were asked to begin at 80% HRmax and attempt to finish closer to 90% HRmax. The coach designed all games during interviews and no further instructions were provided. The coach selected his own task constraints to achieve the main goal. After the SSG had been designed, the coach was asked to define the mean of effort (in %-HRmax) for each game.

At the completion of the first study phase, the coach developed his SSG for soccer training. He was asked not to develop such games before the analysis phase in order to avoid the previous knowledge retention by the players. The four SSG as designed by the coach were applied to 6 players. Four games of 3 minutes each were performed, followed by 3 minutes of passive recovery. The coach also defined those orientations. Six heart rate monitors (Polar RC3 GPS with Heart Rate Sensor) were used to measure the players' level of activity.

Data analysis

The quantitative analysis was used to compare the anticipation of players' physiological responses as predicted by the coach compared to the specific physiological responses of players in a practice context. The qualitative analysis (interview) was used to establish how the coaches organised their drills based on the specific objectives set by the researchers.

Interview analysis

The method of qualitative analysis involved systematically gathering enough information about a person, social setting, event or group to allow the researcher to understand effectively how the person operates or functions (Berg, 2007). The themes were coded manually from the transcribed interviews. The main concepts from all interviews were selected in order to compare the consistency of thinking. Three overall themes were identified: (1) the coach's perception of using SSG; (2) the most pertinent task constraints to develop SSG; (3) the knowledge and experience of the HR effects of such task constraints.

Statistical analysis

The quantitative analysis entailed the following. To determine statistical differences between the four SSG a one-way ANOVA was applied. In order to analyse the differences between the variables, the Games-Howell test was used as a post hoc test. Generally, this test is more effective than the other alternatives for case studies similar to this one. The estimation of the effect size (the proportion of the variance in the dependent variables that can be explained by the independent variables), was established according to Pallant (2011). Apart from the effect size, the power of the corresponding test was also presented. The analysis of the power of the test is a fundamental procedure to validate the conclusions reached in the inferential analysis (Pallant, 2011). This analysis was performed using IBM SPSS Statistics for a significance level of 5%. In order to determine the relationship between the coach's estimation of effort with the real effort of the players, the Pearson r-test was applied with both of these values. This analysis was also performed using IBM SPSS Statistics for a significance level of 5%.

RESULTS

How the coach used his knowledge

The following section presents and discusses the ways the coach thinks about and organises SSG. The first analysis provided information about how the coach viewed an opportunity to use SSG in training.

> *Well, from my first contact with small-sided games, I have never stopped thinking about their importance. Actually, the importance of such games is very high. All games are always valuable for players and for us (coaches). We can develop many things at the same time, from physical responses to technical and tactical actions – we can develop everything in a single moment. Moreover, it is also possible to develop the social elements such as co-working and team spirit.*

It was also possible to explore the reasons why the coach regarded SSG in a particular way. Previous experiences and some cultural influences were determinants for his thinking on SSG.

> *From very early on, I had some coaches that developed my thinking about the importance of practising the game 'in' the game. I mean, if you are a soccer player, you need to have soccer training and not athletic training or other sports not related to the unique dynamics of soccer. When I started my coaching, I read many books about different methods to achieve the same goal. Thus, if I can use the game to achieve the main goal, why can't I develop that? Moreover, through their results, our national coaches showed me that it is possible to be successful using these kinds of games at a professional level.*

Following the interview with regard to the personal importance of SSG, the coach introduced some important topics. These topics concerned the reactions and feelings about the importance of such games for the players.

> *When I come to a new team with players who have never experienced a training methodology based on small-sided games, I sensed an initial distrust of the real benefits of such games and their ability to develop mainly the players' physical capabilities. Nevertheless, after the pre-season training and during the initial games of the season, it is possible for them to compare their fitness with that of their opponents. It is at this point that my players realise that small-sided games have effects similar to traditional training based on running activities and other physical activities without game play and many times without the ball. Moreover, players increase their commitment to training sessions because these are always different and always have what the players love - a game of soccer! They enjoy all the training sessions!*

After the first interview concerning the importance of SSG to the coach, during the following sessions the coach was asked to develop 4 different games in which, while ensuring the same shape of the game and field dimensions he had selected initially, the games should induce different HR responses. To achieve the target of 80% HRmax up until 90% HRmax using a maximum number of 6 players, the coach selected the game shape 1v1 plus 1 in a field dimension of 15x15m. His reasons were as follows:

> *Well, for such efforts I need to organise a game with a small number of players. When I develop a task with a great number of players, the possibility of all players working at the same time decreases. In games with a small number of players, the individual participation will increase for sure. I will select a game shape with only 1v1 and 1 neutral player. Why I use a neutral player? I do it to increase the success for the attacker and to increase the effort during the defensive phase. Regarding the playfield dimensions, I think 15x15m should be enough to ensure an interesting running activity and not push my players too much. When they experience higher values of fatigue, their soccer contribution will decrease.*

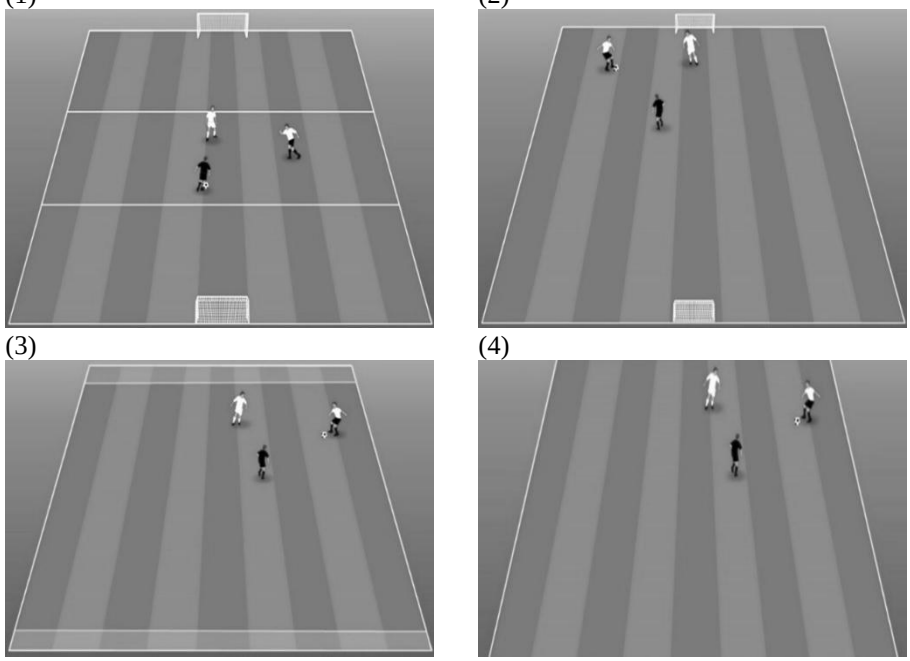
After the shape of the game and the field dimensions had been selected, the coach was asked to organise 4 games using the task constraints he wanted. He was provided with a computer containing specific software to develop the drills. The coach created the design in the presence of the researchers. The coach selected the following games (Figure 1).

For each game, the coach was asked to comment on his options and to describe each small-sided game and his reasoning and decision-making process:

> *For the first task [(1)] I will choose to use the goals and one spatial limitation for the neutral player. In this game, the neutral player can just use the middle zone, reducing his intervention in the game. Thus, his physiological responses will be reduced. The goals are used to impose a small space to shoot at. However, with a target, the players do not need to run too much because they have the opportunity to shoot from far away, thus reducing their activity and the effort of the task. They will work at an effort of 80% HRmax or less.*
>
> *In order to increase the effort a little, I will remove the middle area [in game (2)]. Now the neutral player can use all the space, increasing his participation and increasing the task's complexity. The defender should now have to worry*

about the man with the ball and the man without it. As for the effort, I think that will increase to something around 85% HRmax.

(1) (2)



(3) (4)

FIGURE 1. **FOUR DIFFERENT SMALL-SIDED SOCCER GAMES DESIGNED BY THE COACH DURING INTERVIEWS**

For the 2 initial games, the coach used the goals. He then opted to remove the goals and reorganise the game. He explained his choice:

I chose to remove the goals because I needed to increase the effort. Thus, if players have a target, they will protect the target in the middle of the field. Without a central target, it is harder to protect their defensive zone because it is bigger than a single goal, thus this will increase their activity on the field and increase the effort.

The last 2 games were developed to achieve higher efforts. The explanations were as follows:

I will replace the goal with a defensive line that will be the target in this task [game (3)]. I believe players will achieve efforts of around 85-88% HRmax. I bet on 87% HRmax! This effort increases the opportunity to explore the whole goal line of the field, thus increasing the running activities. For example, the player with the ball should get through the defensive line using ball control. The neutral player cannot score. Thus, the constraint to get over the finishing line will increase the effort because they need to run more to reach the end of the field.

> *Well, I need to achieve 90% HRmax, right? Therefore, it is simple! I will remove any kind of target [game (4)]. Usually, the games without a target increase the effort because you can play in any part of the field, thus increasing the running activities and the efforts. For this game, the players should keep possession of the ball for the maximum time possible. The neutral player can only play with the player with the ball. When one player loses the ball, the other player should try to keep the ball by playing with the neutral player. I believe they will achieve values closer to 90% HRmax. I can bet on this!*

After the coach described the main categories of thinking, it was possible to compare his theoretical notions with the actual effects on the players. The quantitative analysis had 2 kinds of tests: an analysis of variance to differentiate the heart rate responses for different games; and a comparison between the heart rate estimated by the coach and the real efforts revealed by the players.

Heart rate experienced by players in different SSG

After the SSG had been defined by the coach they were applied on the field. The descriptive results from those games are given in Table 1.

TABLE 1. **DESCRIPTIVE STATISTICS FOR %-HRMAX OF PLAYERS DURING FOUR DIFFERENT SMALL-SIDED GAMES**

%-HRmax	Mean	Std. Dev.	% Coefficient of Variation
Task 1	81.924	14.271	17.420
Task 2	81.785	12.806	15.658
Task 3	85.811	10.332	12.040
Task 4	86.106	9.966	11.574
Total	83.906	12.147	14.477

Task 4 shows the highest %-HRmax (86% HRmax). Task 2 shows the lowest %-HRmax and generally the heart rate responses increased gradually until the last task. The only exception is between Task 1 and 2, where Task 2 had a lower effort than the first. This can be seen in the mean differences shown in Table 2.

The analysis of the %-HRmax between the different SSG showed statistically significant differences with small effect ($F_{(3,431679)}$= 42.398; p-value= 0.001; η^2= 0.029; Power= 1.00). More specifically, the post hoc tests showed that Task 1 was statistically different from Tasks 2 (p-value= 0.001) and 3 (p-value= 0.001), showing significantly lower values for %-HRmax. The efforts achieved in Task 2 were also statistically lower compared to Tasks 3 (p-value= 0.001) and 4 (p-value= 0.001). No significant differences were observed between either Tasks 1 and 2 or between Tasks 3 and 4.

TABLE 2. **MEAN DIFFERENCE BETWEEN %-HRMAX VALUES ACHIEVED IN SMALL-SIDED GAMES**

Task	Task 1	Task 2	Task 3	Task 4
Task 1	–	0.13873	−3.88690*	−4.18151*
Task 2	–	–	−4.02563*	−4.32025*
Task 3	–	–	–	−0.29461

* Mean differences are significant at the p<0.001 level.

The relation between the coach's anticipation and the real heart rate responses experienced by players was investigated using the Pearson r-test. The mean values can be seen in Figure 2.

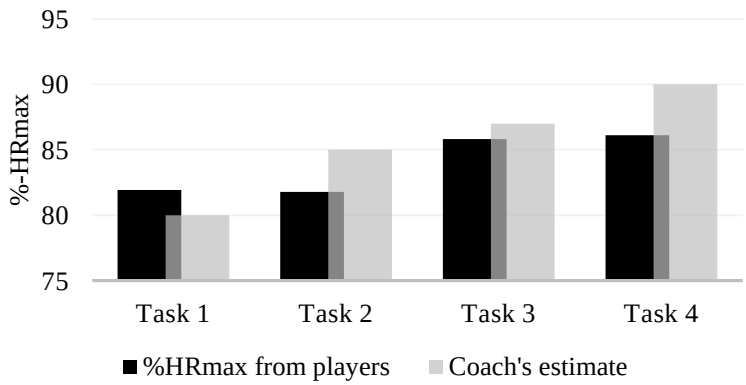


FIGURE 2. **MEAN OF %-HRMAX OF PLAYERS AND ESTIMATE FOR EACH TASK BY THE COACH**

Generally, the coach's estimates are an over estimation, except in Task 1. The Pearson r-test that established the relationship between the actual %-HRmax of the players with the coach's estimate, showed a very large and positive correlation between both factors (r= 0.827). The values were not linear, based on the significance value of p-value= 0.173.

DISCUSSION

This study aimed to analyse how a coach plans and develops SSG and the criteria he uses to define them. Moreover, it was intended to identify whether the coach's perception is in line with players' HR responses during soccer sessions. Both goals are extremely important to identify how coaches organise their planning sessions and to understand the mechanisms that support the options provided by SSG in a soccer-training context.

During the interview, it was possible to compare the coach's comments with existing literature. One of the main themes that the coach highlighted was the players' motivation for training when SSG are developed. This proved to be in agreement with previous studies developed in sessions using ecological methods (Ryan & Deci, 2000). Some studies on SSG have shown that, despite great psychological flow levels, the effort is not stressful for players due to the games' dynamics, and players report that SSG are rewarding and enjoyable activities (Krustrup *et al*., 2010).

It is not only the psychological and social effects of SSG that can be reported as benefits. During the interview, the coach also reported SSG as being holistic games that develop physical, technical, tactical and social variables at the same time. This kind of analysis can be corroborated by previous research that looked at the effects of SSG regarding HR responses and technical/tactical actions (Hill-Haas *et al*., 2011; Aguiar *et al*., 2012; Clemente *et al*., 2012). In a more general way, it is possible to confirm that no statistical differences were found between SSG and traditional training based on running regimes on the HR effects in a training programme (Sassi *et al*., 2004; Dellal *et al*., 2008). Moreover, SSG allow technical and tactical actions to develop, thus contributing more to soccer training (Clemente *et al*., 2012).

Based on specific initial instructions to develop SSG requiring efforts between 80% HRmax and 90% HRmax, the soccer coach opted to develop drills for a specific game shape of 1v1 plus 1. This option seems in line with existing guidelines defined for SSG (Little, 2009), with the shape of the game being the first decision to make.

The fundamental task constraints the coach opted to use were the different goals/targets, specific zones of action and different rules. He argued that to increase the effort it was necessary to remove the goals, until a situation without any target was reached. These options, as expected by the coach, resulted in increasing the %-HRmax closer to 90%. He surmised that, without targets, players could explore the entire field's space, thus increasing the running activities and variability of actions. Moreover, he was sure that SSG with goals decreased the effort experienced by players. This expectation was confirmed by the results of the practice.

The analysis of variance showed statistical differences between Tasks 1 and 2 (using goals) and Tasks 3 and 4 (using the line and without the line or target). During activities with goals, it was possible to observe values closer to 82% HRmax in both Tasks 1 and 2. For their part, Tasks 3 and 4 showed values around 86% HRmax. Such results are in line with previous studies that compared tasks with goals and without goals (Duarte *et al*., 2010; Casamichana *et al*., 2011). In actuality, the activities without goals increase the variability of the heartbeat, thus increasing the effort and reducing the opportunities for recovery in the game. In the presence of goals, the movements are more standardised in direction to one central point, and therefore, the movements performed by both players (attacker and defender) are more predictable.

The coach was also asked to predict the effort for each game developed. By using this information and the values achieved in the game by the players, it was possible to identify a very large and positive correlation value. The coach was able to anticipate the players'

responses with relative accuracy during the games. It was also observed that in 3 of the 4 games the coach overestimated the players' heart rate responses. This could be due to the fact that there was no specific regular measurement of the players' fitness, and therefore, their responses varied over different seasons' moments, mainly reducing HR rest and increasing the VO_{2max} (McMillan *et al*., 2005). Thus, specific methods to measure the players' fitness (such as heart rate monitors), are very important to ensure a quality of stimulation and to regulate the training process, thereby helping the coach to be more efficient with regard to the players' stimulation (Impellizzeri *et al*., 2004).

CONCLUSION

In this case study, it was possible to assess how a coach organises his thoughts with regard to the development of SSG. The coach's experience with SSG seems to be essential in order to develop this kind of training regime. However, these results cannot be generalised for other coaches without further research. It would be interesting to compare different expert coaches with different kinds of academic backgrounds in future to identify whether such decisions are the same or whether they are indeed different. It would also be interesting to compare expert and novice coaches regarding their designing of SSG and the estimation of the effort. It can be assumed that the criteria employed by each to develop games would certainly be different, thus providing pertinent information for the potential reorganisation of the academic curriculum and coaching programmes. It could prove to be beneficial to both academic qualification and coaching programmes to increase the time spent in practice, thereby promoting the attainment of real-time experiences that could potentially define the most important variables (task constraints) when designing and promoting SSG.

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