Filipe Manuel Clemente*
Rúben Filipe Rocha

THE EFFECTS OF TASK CONSTRAINTS ON THE HEART RATE RESPONSES OF STUDENTS DURING SMALL-SIDED HANDBALL GAMES

UČINKI OMEJITEV NALOG NA ODZIVE V SRČNI FREKVENCI ŠTUDENTOV PRI ROKOMETNIH IGRAH NA OMEJENEM PROSTORU

ABSTRACT

Task constraints used by the teacher to guide students during small-sided games in a physical education context can be a factor to improve the quality of the students' practice. One of these task constraints is the number of players present in small-sided games. Therefore, this study aims to analyse the influence of the number of players on the students' heart rate intensity. Thus, eight male students (18.25 ± 1.04 years old) voluntarily participated in this study. The mean heart rate results were obtained in three sub-phases of the game (2 v 2, 3 v 3 and 4 v 4). ANOVA test showed statistically significant differences ($F_{(2,\ 1077)}$ = 25.661; *p-value* 0.001) between them. The results confirm the importance of task constraints in the management of practice intensity so as to simultaneously promote the opportunity to develop the game's technical and tactical contents as well as the students' fitness. Therefore, the teacher needs to carefully consider the number of players per task in order to develop the main goals of the lesson correctly.

Key words: physical education; small-sided games; heart rate; handball

RoboCorp; Faculty of Sport Sciences and Physical Education – University of Coimbra, Portugal

**Corresponding author:*
Filipe Manuel Clemente
RoboCorp,
Faculty of Sport Sciences and Physical Education,
University of Coimbra, Portugal
E-mail: Filipe.clemente5@gmail.com

IZVLEČEK

Omejitve nalog, ki jih učitelj postavi študentom pri igrah na omejenem prostoru v okviru športne vzgoje, je lahko dejavnik izboljšanja kakovosti vadbe za študente. Ena od takšnih omejitev je število igralcev v igri na omejenem prostoru. Namen te študije je analizirati vpliv števila igralcev na srčno frekvenco študentov. V raziskavi je prostovoljno sodelovalo osem študentov moškega spola (18,25 ± 1,04 let). Povprečne vrednosti srčne frekvence so bile zabeležene v treh podfazah igre (2 na 2, 3 na 3 in 4 na 4). Analiza variance s pomočjo testa ANOVA je pokazala statistično značilne razlike ($F_{(2,\ 1077)}$ = 25,661; *vrednost-p* 0,001) med njimi. Rezultati potrjujejo, da so pri obvladovanju intenzivnosti vadbe pomembne omejitve nalog, saj sočasno ponujajo možnost razvijanja tehničnih in taktičnih prvin igre in izboljšanja telesne pripravljenosti študentov. Zato mora učitelj skrbno razmisliti o številu igralcev pri vsaki nalogi, da lahko na pravilen način doseže glavne cilje vadbe.

Ključne besede: športna vzgoja, igre na omejenem prostoru, srčna frekvenca, rokomet

INTRODUCTION

Recent models of ecological teaching (e.g., Teaching Games for Understanding, Non-linear Pedagogy) aim to achieve different factors at the same time in order to fully develop the student (Clemente, 2012). These models advocate that each task needs to maintain the ecological dynamics of the game (e.g., Chow, Davids, Button, Suttleworth, Renshaw, & Araújo, 2006; Renshaw, Davids, Shuttleworth, & Chow, 2009). Therefore, inversely to the decomposition of the game commonly adopted until now, the new tasks must simplify the game while seeking to maintain the game's main constituents (Davids, Button, & Bennett, 2008). In fact, the traditional decomposition of the game into tasks can be strongly prejudicial to a student because it can increase the possibilities of disintegrating the information-movement coupling (Handford, 2006), thereby decreasing the didactical effects of the task on students (Clemente & Mendes, 2011). Actually, the simplification process can be richer for the student, maintaining the ecological dynamics of the game and simultaneously giving the student an opportunity to learn the specific contents of the game (Tan, Chow, & Davids, 2012). Therefore, the teacher's main role is to consider the different task constraints that can improve the didactic potential of the game (Chow et al., 2006).

The task organisation must be correctly considered by the teacher so as to adequately integrate physiological, psychological, technical and tactical factors (Bangsbo, 1994). In effect, the teaching session seeks to integrate a multitude of factors in order to achieve different objectives while improving the quality and range of the didactic intervention (Clemente, Couceiro, Martins, & Mendes, 2012). Therefore, the selection process of the task constraints is a key factor determining the quality and efficiency of the teacher's intervention (Chow et al., 2006). The teacher must accordingly be an important connoisseur of the game in order to integrate the pertinent constraints that will guide the students during the task to achieve the main goals (Renshaw, Chow, Davids, & Hammond, 2010).

Recent literature reports the consensual importance of small-sided games as fundamental tasks to integrate multiple factors related with the student (e.g., Bompa, 1983; Helgerud, Engen, Wisloff, & Hoff, 2001; Aroso, Rebelo, & Gomes-Pereira, 2004; Mallo & Navarro, 2008). Using small-sided games, it is possible to maintain the essential principles of the game and, at the same time, to constrain the students to act in line with the task constraints adopted by the teacher (e.g., MacLaren, Davis, Isokawa, Mellor, & Reilly, 1988; Hoff, Wisloff, Engen, Kemi, & Helgerud, 2002; Reilly, & White, 2004; Mallo, & Navarro, 2008). Thus, task constraints (cf. Newell, 1986) are unquestionable factors that determine the quality of the teaching process. In effect, constraints related to the practice space, the numbers of players, the game rules or the duration of the task are fundamental when planning the exercise in order to achieve the main teaching goal (Clemente, & Mendes, 2011).

The option of small-sided games reduces the possibility of inactive practice for each player, improving individual contributions to the common objective and, at the same time, offering opportunities to increase individual technical and tactical behaviours (Bastos, Graça, & Santos, 2008). Therefore, the constraints related to the practice space and number of players can be a predictor of the action intensity during the game (e.g., Tessitore, Meeusen, Piacentini, Demarie, & Capranica, 2006; Rampinini, Impellizzeri, Castagna, Abt, Chamari, Sassicccc, & Marcora, 2007; Hill-Haas, Dawson, Coutts, & Rowsell, 2009; Katis, & Kellis, 2009; Casamichana, & Castellano, 2010; Owen, Twist & Ford, 2004), along with the number and type of technical and tactical actions performed by the students (Clemente et al., 2012).

Hence, it is important to analyse the real influence of small-sided games and their task constraints in the context of PE, trying to observe the potential of these games for the students in order to achieve the main goals set by the teachers. Thus, this work aims to analyse the specific contribution of the space and the number of players in small-sided handball games concerning the physiological responses of the students, verifying potential differences between the selected task constraints.

METHODS

Participants

This study relied on the voluntary participation of eight male students (18.25 ± 1.04 years old; 67.83 ± 0.93 kg) without regular practice outside the school context, thus representing the majority of the everyday community of PE. All individuals signed a Free and Clarified Consent Form respecting the Helsinki Declaration. The participants did not have any kinds of physical or psychological diseases.

Task and Procedures

The task consisted of scoring by having one offensive player catching a ball pass beyond the opponent defensive line, i.e., in the present task there was a regular goal. All other rules respected the regulations of handball. During the study, six practice conditions were analysed and organised into three sub-phases of the game (2 v 2, 3 v 3 and 4 v 4) and two practice spaces (cf. figure 1): i) 2 v 2 in space *a;* ii) 2 v 2 in space *b;* iii) 3 v 3 in space *a;* iv) 3 v 3 in space *b;* v) 4 v 4 in space *a;* and vi) 4 v 4 in space *b.*

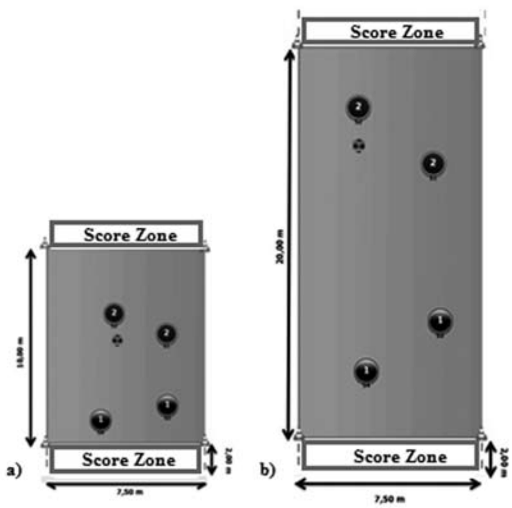

Figure 1. Practice Space: a) 1/8 of the regular field (10 x 7.5 metres); and b) 2/8 of the regular field (20 x 7.5 metres).

Each task lasted five minutes and the main goal was to catch the ball thrown by one teammate beyond the opponents' defensive line. Before each practice, the students had heart rate monitors fitted in and calibrated, periodically recording every five seconds. Simultaneously, one video recorder was placed above the practice field in order to capture the games for the following notational analysis. The variables analysed were the students' absolute heart rate, directly measured by the heart monitors, and the technical events, which were indirectly analysed using the video recorder. Ball contacts are characterised by the number of times each player passes the ball. Dribbling consists of the number of times a player moves the ball causing it to hit the floor. Jinks are the number of times a player tries to overtake the opponent through simulations. The number of interceptions represents the opportunity for the defender to prevent the progression of the opponents' ball, deflecting it off the field or recovering it.

The players' actions were captured using a digital SLR (Canon EOS 500D) with the capacity to process images at 30 Hz (i.e., 30 frames per second). The camera was placed at 4.53 m above the ground to capture the whole task. Official handball balls were used for this specific age group. The two teams wore orange and yellow vests. The notational analysis consisted of viewing and respectively registering the video. The heart rate was captured by eight heart rate monitors (Polar FT4) periodically recording every five seconds.

Statistical Procedures

The aim of this work is to analyse the variance between the sub-phases (i.e., 2 v 2, 3 v 3 and 4 v 4) of the handball game performed during physical education (PE) sessions. To do this, a one-way ANOVA was used to establish statistically significant differences between the sub-phase conditions. The assumption of a normal distribution of the one-way ANOVA in the three sub-phases (i.e., 2 v 2, 3 v 3 and 4 v 4) was studied using the Shapiro-Wilk test. It was found that the distributions were not normal in the dependent variable. Although it was not normal, since $n > 30$, using the Central Limit Theorem (Maroco, & Bispo, 2003; Pedrosa, & Gama, 2004) we made the assumption of normality (Akritas, & Papadatos, 2004). The analysis of homogeneity was carried out using the Levene test. It was found that there is no uniformity of practice in the previously mentioned conditions. However, despite the lack of homogeneity, the F test (ANOVA) is robust to homogeneity violations when the number of observations in each group is equal or approximately equal (Vicent, 1999), which is the case. As with the assumption of normality, a violation of this assumption does not radically change the F value (Vicent, 1999). We used the Scheffé post hoc test (Laureano, 2011) for this type of data. The classification of the size effect (i.e., the measure of the proportion of the total variation in the dependent variable explained by the independent variable) was done according to Maroco (2010) and Pallant (2011). This analysis was performed using the IBM SPSS program (version 19) with a significance level of 5%.

RESULTS

The notational analysis enables the observation that those sub-phases with more students (i.e., 4 v 4) show the highest number of technical events, such as ball contacts, dribbles, jinks or interceptions. Nevertheless, it is important to take into consideration that this number includes every event, i.e., it does not represent the average number per student.

Table 1. Frequency of technical events during small-sided handball games

Sub-Phases	Ball Contacts		Dribble		Jinks		Interceptions		Balls Recovered		Faults		Points Obtained	
	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)
2 v 2	98	86	15	20	1	6	3	2	6	8	1	1	14	12
3 v 3	122	113	10	22	1	3	1	3	11	11	0	0	15	9
3 v 3	117	121	13	27	5	6	6	0	8	7	0	0	11	13

The obtained results demonstrate that the 2 v 2 sub-phase shows a higher average heart rate (Figure 2 and 3) in both practice spaces (171 beats/min and 177 beats/min). Inversely, the lower heart rate average occurs in the 4 v 4 sub-phase (159 beats/min and 167 beats/min).

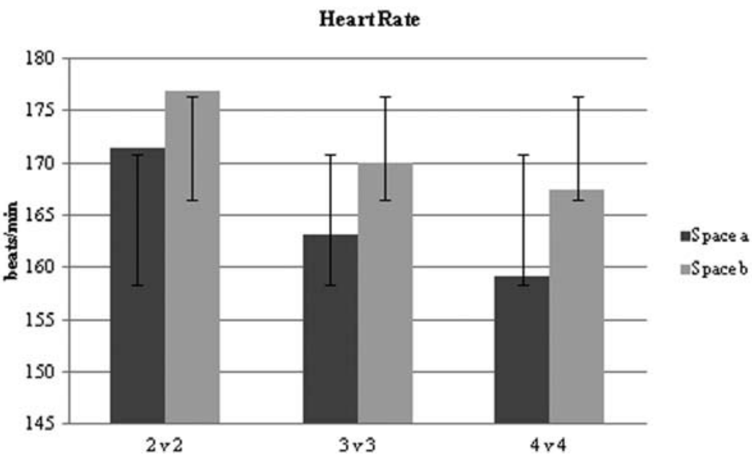

Figure 2. Average heart rate in the two practice conditions.

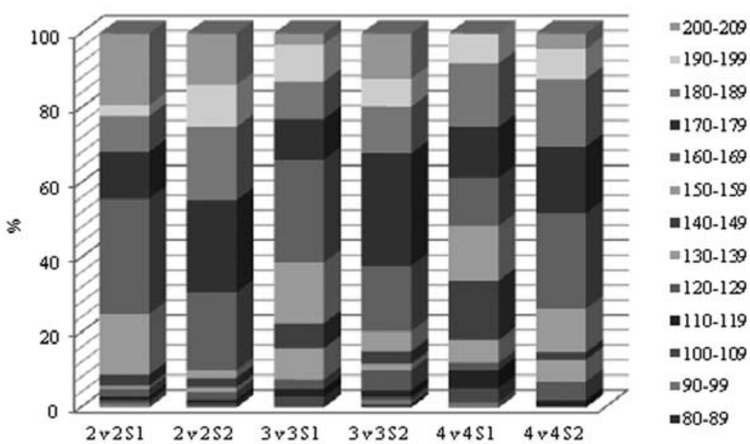

Figure 3. Intensity distributions for each practice condition.

Comparing the mean heart rate obtained in the three sub-phases of the game, it is possible to observe statistically significant differences with a small effect ($F_{(2, 1077)} = 25.661$; *p-value* 0.001; $\eta_p^2 = 0.045$; *Power* = 1.0). More specifically, the post hoc tests show differences among the 2 v 2, 3 v 3 (*p-value* 0.001) and 4 v 4 (*p-value* 0.001) sub-phases, where the highest heart rate occurs in the 2 v 2 sub-phase. Between the 3 v 3 and 4 v 4 sub-phases, one can observe statistically significant differences (*p-value* = .049), with the students' lowest heart rate found in the 4 v 4 sub-phase.

Table 2 shows that in small-sided games with fewer players the number of ball contacts, dribble, and interception are higher.

Table 2. Average frequency of technical events during small-sided handball games per player

Sub-Phases	**Ball contacts**		**Dribble**		**Jinks**		**Interceptions**		**Balls Recovered**		**Faults**		**Points Obtained**	
	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)	Space a)	Space b)
2 v 2	24.5	21.5	3.75	5	0.25	1.5	0.75	0.5	1.5	2	0.25	0.25	3.5	3
3 v 3	20.3	18.8	1.7	3.7	0.2	0.5	0.2	0.5	1.8	1.8	0.0	0.0	2.5	1.5
4 v 4	14.6	15.1	1.6	3.4	0.6	0.8	0.8	0.0	1.0	0.9	0.0	0.0	1.4	1.6

DISCUSSION

The number of students in each task can constrain actions in the field (Clemente et al., 2012). Studies on this matter have tried to analyse the influence of different sub-phases, while maintaining the space ratio per player. Although this methodology does not allow an analysis of the real independent effects of the variance of the sub-phases because it keeps the spatial ratio per player, the discussion will focus on the studies reported that used this methodology.

Jones and Drust (2007) analysed the influence of the number of players in small-sided soccer games on heart rate responses. They (Jones, & Drust, 2007) tested 4 v 4 and 8 v 8 sub-phases. The results demonstrated that the number of players did not change the heart rate responses significantly. Nevertheless, manipulating the number of players seems to have a small impact on the work-rate profiles observed, namely that a sub-phase with fewer players has the highest heart rate average (Clemente et al., 2012). However, those impacts do not differ statistically. Similar results were obtained by Little and Williams (2007) who found significant differences among all training drills except for just three of the fifteen post hoc comparisons (2 v 2 and 5 v 5, 2 v 2 and 8 v 8, 6 v 6 and 8 v 8). Overall, the authors observed an increase in the heart rate responses in small-sided soccer games with fewer players.

Similarly, some studies (e.g., Owen, Twist, & Ford, 2004; Hill-Haas, Dawson, Coutts, & Roussel, 2009; Katis, & Kellis, 2009; Rampinini et al., 2007; Rodríguez-Morroyo, Pernía, & Villa, 2009) confirm that sub-phases with fewer players result in an increment of the heart rate. In the present study, significant statistical differences were found between the sub-phases analysed (i.e., 2 v 2, 3 v 3 and 4 v 4) confirming that the highest heart rate intensity occurs in those sub-phases with fewer participants. These results are in line with the literature (e.g., Hill-Haas et al., 2009; Jones, & Drust, 2007; Owen, Twist, & Ford, 2004).

Effectively, the heart rate increase in small-sided games with fewer players can be related to the increase in the number of tactical and technical actions per player, i.e., there are more ball contacts per player (Balsom, 1999). In addition, it is important to consider that running with the ball increases energy expenditure (Reilly, & Ball, 1984). Table 2 shows that in small-sided games with fewer players the number of technical events per participant is higher. It can also be confirmed that in the 2 v 2 sub-phase the frequency of technical actions by each player is higher compared to the other sub-phases. Thus, these results suggest that an individual's participation in the game increases when there are fewer players in the sub-phases, i.e., the opportunity to recover during the game is lower (Clemente, & Rocha, 2012). Equally, in the 2 v 2 sub-phase, each player's tactical participation is higher and more pertinent to the collective action. Considering that the increase in technical and tactical actions by each participant can be a predictor of a rise in intensity (Reilly, & Ball, 1984), one can suggest that small-sided games with fewer players are synonymous with an activity with higher heart rate intensity. This fact can be justified by the need of each player to actively and determinedly contribute to the success of their team because, in a team of just two players, if one member does not actively participate the opportunities for success decrease drastically (Clemente, & Rocha, 2012).

The present study has one main limitation that needs to be addressed in future works. It involves the fact that the relative heart rate has not been considered, i.e., the absolute heart rate can mask the variability of the results because each student may have a different heart rate average. Nevertheless, all the results were compared individually by taking each student and their variation throughout the practice conditions into consideration and, thus, preserving the individual analysis. Therefore, one may regard the obtained results as valid.

Despite its limitation, the present study confirms the pertinence of small-sided games for developing students' conditional skills during PE classes (Martin, Grissom, Ward & Leenders, 2003). In fact, along with the great opportunity to keep students motivated and engaged with the practice (e.g., Ryan, & Deci, 2000; Smith, 2010), it is possible to develop the students' fitness. Thus, the playing of small-sided games is strongly recommended in the context of PE so as to fully develop (e.g., physically, technically/tactically, cognitively and psychologically) the students (Clemente, & Mendes, 2011).

Therefore, the teacher's main role is to adjust the task constraints (e.g., space of practice, number of players, game rules) to the main goals of the lesson plans (Clemente et al., 2012). Equally, the teacher needs to consider the duration of the task in order to manage the intensity of the practice. In effect, the fatigue induced by the task can be a potential obstacle to the learning process. Lower levels of fatigue are indeed strongly recommended so as to enable the opportunity to increase the students' performance efficiency, improving the chance to learn the contents developed and emphasised in the tasks.

CONCLUSION

The present work studied the effects of different sub-phases in heart rate intensity during the practice of small-sided handball games in a PE context. The results suggest that small-sided games with fewer players can significantly increase the intensity of the practice. This fact can be justified by the students' higher individual participation when there are fewer teammates. Therefore, the study confirms the relevance of small-sided games in the context of PE, highlighting the opportunity to simultaneously develop the learning process of technical and tactical contents, as well as the students' fitness.

REFERENCES

Akritas, M. G., & Papadatos, N. (2004). Heteroscedastioc One-Way ANOVA and Lack-of-Fit tests. *Journal of the American Statistical Association, 99*(466), 368–390.

Aroso, J., Rebelo, A. N., & Gomes-Pereira, J. (2004). Physiological impact of selected game-related exercises. *Journal of Sports Sciences, 22,* 522–530.

Balsom, P. (1999). *Precision football.* Kempele, Finland: Polar Electro Oy.

Bangsbo, J. (1994). The physiology of soccer with special reference to intense intermittent exercise. *Acta Physiologica Scandinavica, 619,* 1–155.

Bastos, M. J., Graça, A., & Santos, P. (2008). Análise da complexidade do jogo formal versus jogo reduzido em jovens do 3º ciclo do ensino básico. *Revista Portuguesa de Ciências do Desporto, 8*(3), 355–364.

Bernstein, N. (1967). *The Coordination and Regulation of Movement.* New York: Pergamon Press.

Bompa, T. (1983). *Theory and Methodology of Training.* Dubusque, Iowa: Kendall/Hunt.

Casamichana, D., & Castellano, J. (2010). Time-motion, heart rate, perceptual and motor behaviour demands in small-sides soccer games: Effects of field size. *Journal of Sports Sciences, 28*(14), 1615–1623.

Chow, J. Y., Davids, K., Button, C., Shuttleworth, R., Renshaw, I., & Araújo, D. (2006). Nonlinear pedagogy: A constraints-led framework to understand emergence of game play and skills. *Nonlinear Dynamics, Psychology and Life Sciences, 10*(1), 71–104.

Clemente, F. M. (2012). Princípios Pedagógicos dos Teaching Games for Understanding e da Pedagogia Não-Linear no Ensino da Educação Física. *Movimento, 18*(2), 315–335.

Clemente, F., Couceiro, M., Martins, F., & Mendes, R. (2012). The usefulness of small-sided games on soccer training. *Journal of Physical Education and Sport, 12*(1), 93–102.

Clemente, F., & Mendes, R. (2011a). Aprender o jogo jogando: uma abordagem transdisciplinar. *Revista Científica Exedra, 5*(1), 27–36.

Clemente, F. M., & Rocha, R. F. (2012). Utilização dos jogos reduzidos no ensino do handebol: A influência nas ações táticas. *Conexões, 10*(2), 66–76.

Davids, K., Button, C., & Bennett, S. (2008). *Dynamics of Skill Acquisition: A Constraints-Led Approach.* Champaign: Human Kinetics.

Handford, C. H. (2006). Serving up variability and stability. In K. Davids, C. Button, & K. Newell (Eds.), *Movement system variability.* Champaign, IL: Human Kinetics.

Helgerud, J., Engen, J. C., WislØff, U., & Hoff, J. (2001). Aerobic endurance training improves soccer performance. *Medicine and Science in Sports and Exercise, 33*(11), 1925–1931.

Hill-Haas, S. V., Dawson, B. T., Coutts, A. J., & Rowsell, G. J. (2009). Physiological responses and time-motion characteristics of various small-sided soccer games in youth players. *Journal of Sports Sciences, 27*(1), 1–8.

Hoff, J., WislØff, U., Engen, L. C., Kemi, O. J., & Helgerud, J. (2002). Soccer specific aerobic endurance training. *British Journal of Sports Medicine, 36*(3), 218–221.

Jones, S., & Drust, B. (2007). Physiological and technical demands of 4 v 4 and 8 v 8 games in elite youth soccer players. *Kinesiology, 39*(2), 150–156.

Katis, A., & Kellis, E. (2009). Effects of small-sided games on physical conditioning and performance in young soccer players. *Journal of Sports Science and Medicine, 8,* 374–380.

Laureano, R. M. (2011). *Teste de Hipóteses com o SPSS. O meu manual de consulta rápida.* Lisboa: Edições Sílabo.

Little, T., & Williams, A. G. (2007). Measures of exercise intensity during soccer training drills with professional soccer players. *Journal of Strength and Conditioning Research, 21*(2), 367–371.

MacLaren, D., Davis, K., Isokawa, M., Mellor, S., & Reilly, T. (1988). Physiological strain in 4-a-side soccer. In T. Reilly, A. Lees, K. Davis, & W. J. Murphy (Eds.), *Science and Football* (pp. 76–80).

Mallo, J., & Navarro, E. (2008). Physical load imposed on soccer players during small-sided training games. *The Journal of Sports Medicine and Physical Fitness, 48*(2), 166–171.

Maroco, J., & Bispo, R. (2003). *Estatística Aplicada às Ciências Sociais e Humanas.* Lisboa: Climepsi Editores.

Martin, B., Grissom, T., Ward, P., & Leenders, N. Y. J. (2003). Effects of wearing heart rate monitors on elementary students' activity levels during a team handball unit. *Research Quarterly for Exercise and Sport, 74*(1), pp. 25–35.

Newell, K. M. (1986). Constraints on the development of coordination. In M. G. Wade & H. T. A. Whiting (Eds.), *Motor Development in Children: Aspects of Coordination and Control* (pp. 341–360). Dordrecht, Netherlands: Martinus Nijhoff.

Owen, A., Twist, C., & Ford, P. (2004). Small-sided games: The physiological and technical effect of altering field size and player numbers. *Insight, 7*(2), 50–53.

Pedrosa, A. C., & Gama, S. M. A. (2004). *Introdução computacional à probabilidade e estatística.* Porto: Porto Editora.

Rampinini, E., Impellizzeri, F. M., Castagna, C., Abt, G., Chamari, K., Sassi, A., & Marcora, S. M. (2007). Factors influencing physiological responses to small-sided soccer games. *Journal of Sports Sciences, 25*(6), 659–666.

Reilly, T., & Ball, D. (1984). The net energetic cost of dribbling a soccer ball. *Research Quarterly for Exercise and Sport, 55,* 267–271.

Reilly, T., & White, C. (2004). Small-sided games as an alternative to interval-training for soccer players. In T. Reilly, J. Cabri, & D. Araújo (Eds.), *Science and Football V* (pp. 355–358). London and New York: Routledge Taylor & Francis Group.

Renshaw, I., Chow, J. Y., Davids, K., & Hammond, J. (2010). A constraints-led perspective to understanding skill acquisition and game play: A basis for integration of motor learning theory and Physical Education praxis? *Physical Education & Sport Pedagogy, 15*(2), 117–137.

Renshaw, I., Davids, K., Shuttleworth, R., & Chow, J. (2009). Insights from ecological psychology and dynamical systems theory can underpin a philosophy of coaching. *International Journal of Sport Psychology, 40*(4), 540–602.

Rodríguez-Marroyo, J. A., Pernía, R., & Villa, J. G. (2009). Intensidad de esfuerzo en Fútbol 7 vs Fútbol 11. *Rendimiento en el Deporte, VIII. 14,* 67–70.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development and well being. *American Psychologist, 55*(1), 68–78.

Smith, L. R. (2010). *The Role of the TGfU Pedagogical Approach in Promoting Physical Activity Levels During Physical Education Lessons and Beyond.* Unpublished doctoral dissertation. University of Bedfordshire.

Tan, C. W. K., Chow, J. Y., & Davids, K. (2012). 'How does TGfU work?': Examining the relationship between learning design in TGfU and a nonlinear pedagogy. *Physical Education & Sport Pedagogy, 17*(4), 331 - 348.

Tessitore, A., Meeusen, R., Piacentini, M. F., Demarie, S., & Capranica, L. (2006). Physiological and technical aspects of '6-a-side' soccer drills. *The Journal of Sports Medicine and Physical Fitness, 46*(1), 36–43.

Vincent, W. J. (1999). *Statistics in Kinesiology* (2nd Edition). Champaign: Human Kinetics.