

European Journal of Human Movement, 2014: 32, 104-124

IMPLICATIONS OF INSTRUCTIONAL STRATEGIES IN SPORT TEACHING: A NONLINEAR PEDAGOGY-BASED APPROACH

Alexander Gil ¹; Duarte Araújo ²; Luis García-González ³;
Maria Perla Moreno ⁴; Fernando del Villar ⁴

1. Faculty of Physical Activity and Sport Sciences. Saint Antonio Catholic University of Murcia.
2. Faculty of Human Kinetics, Technical University of Lisbon.
3. Faculty of Health and Sport Sciences, University of Zaragoza.
4. Faculty of Sport Sciences, University of Extremadura.

ABSTRACT

In this article, we have tried to establish the practical implications of instructional strategies in sport teaching. Firstly, we have highlighted the importance of the Teaching Game for Understanding as a teaching model that is fundamentally based on the use of modified games, whose purpose is for students to learn the tactical aspects of a certain sport, by way of modified versions of the real game. Later on, we have gone further into depth into a new way of understanding the teaching-learning process in sport, non-Linear Pedagogy, which is based on manipulating the relevant determining factors (task, environment and individual) to increase information sources and thus be able to guide students towards obtaining their objectives. Within non-linear pedagogy, verbal instruction (e.g., questioning) is considered to be a determining factor that attempts to channel the search for tactical solutions within a learning environment. Finally, we end the article with a section that refers to practical applications, where we purport to give a series of guidelines on how to implement questioning as a didactical resource whose aim is to improve students' tactical action capacity.

Key Words: teaching game for understanding, nonlinear pedagogy, constraints, questioning

RESUMEN

En este artículo hemos tratado de establecer cuáles son las implicaciones prácticas que tienen las estrategias instruccionales en la enseñanza del deporte. En primer lugar, hemos destacado la importancia del Teaching Game for Understanding como modelo de enseñanza que se basa fundamentalmente en la utilización de los juegos modificados, con el fin de que los alumnos aprendan los aspectos tácticos de un deporte determinado a partir de versiones modificadas del juego real. Posteriormente, nos hemos adentrado en una nueva forma de entender el proceso de enseñanza-aprendizaje en el deporte, la Pedagogía no Lineal, que se basa en la manipulación de condicionantes relevante (tarea, entorno y sujeto) para ampliar fuentes de información y poder así guiar a los alumnos hacia la consecución de sus objetivos. Dentro de la pedagogía no lineal, la instrucción verbal (e.g. cuestionamiento) es considerado como un condicionante que trata de canalizar la búsqueda de soluciones tácticas dentro de un entorno de aprendizaje. Por último, finalizamos el artículo con un apartado de aplicaciones prácticas, en el que pretendemos dar una serie de orientaciones de cómo implementar el cuestionamiento como un recurso didáctico que pretende mejorar la capacidad de actuación táctica por parte de los alumnos.

Palabras clave: enseñanza para la comprensión, pedagogía no lineal, constreñimientos, cuestionamiento

Correspondence:

Alexander Gil Arias

Departamento de Ciencias de la Actividad Física y del Deporte.

Facultad de Ciencias de la Actividad Física y del Deporte.

Universidad Católica San Antonio de Murcia (UCAM).

Avda. de los Jerónimos, 135, 30107 Guadalupe, Murcia.

agilarias@ucam.edu

Submitted: 15/06/2014

Accepted: 30/06/2014

INTRODUCTION

Over the last few years, there has been constant concern in the field of motor and sport learning in terms of identifying which sport teaching model is the most effective (Blomqvist, Luhtanen, and Laakso, 2001; Clemente, 2012). In this sense, a large number of studies have been conducted, focused on comparing teaching models aimed at technical acquisition, with teaching models that favour tactical competence (Conte, Moreno-Murcia, Pérez, and Iglesias, 2013; García-Herrero and Ruiz-Pérez, 2003, 2007; Tallir, Musch, Valcke, and Lenoir, 2003), but the most effective model for teaching sport has still not been resolved.

The first empirical studies on this topic favoured the use of behaviourism-derived teaching models, based on the comprehensive learning of sporting skills (Batting, 1979). With this methodology, repeated practice blocks were used to instruct students, where technical skills were trained via a linear progression of exercises aimed exclusively at acquiring execution patterns. This traditional approach decontextualises the teaching of the sport skill, given that the technical execution is carried out in an isolated manner from the real game situation. But, this model does not promote the development of skills related to decision making (Gray and Sproule, 2011). In this teaching model, teachers give priority to prescriptive feedback, aimed at improving technical execution, and not cognitively involving students in the development of the motor task.

From the 1980s onwards, studies began to emerge that questioned the technical teaching model, as researchers started to observe that those individuals who were taught via methods derived from behavioural currents, were not able to retain the new skills learned in the long run, but rather, those skills were only effective for a short period of time (Vickers, 2007).

Thus, and in order to satisfy the deficiencies of the technical model, new models emerged that focused the teaching-learning process on the students, placing emphasis on the need to contextualise the practice and highlighting the participation of the pupils in constructing their own learning (Gréhaigne, Wallian, and Goodbout, 2005; Griffin, Brooker, and Patton, 2005; Hopper, 2002). Thus, models emerge such as Teaching Game for Understanding (from hereinafter TGfU) (Bunker and Thorpe, 1982) and Non-linear Pedagogy (Chow et al., 2006) in opposition to the technique-based teaching technique (Clemente, 2012; Hopper, 2002).

Comprehensive Teaching Model. Teaching Games for Understanding

The TGfU model was created by Bunker and Thorpe (1982), who argued that analytical and traditional approaches focused on teaching technical skills in an isolated manner from the game reality. Therefore, the TGfU was

developed to permit students to learn tactical aspects of the game via modified versions of the real game. It is viewed as an approach that placed emphasis on understanding tactical aspects before developing technical skills, which were applied by the students when they were familiar with a specific response strategy. The key component of this approach is the use of modified games, which are mainly characterised because they present adaptations of the sport in its original version in terms of the dimensions of the game area, the number of players, change of rules, adaptation of the equipment, etc, always taking into consideration, the learning level and the evolving characteristics of the students (Harvey, Cushion, and Massa-González, 2010; Hopper, 2002; Vilar, Duarte, Silva, Chow, and Davids, 2014).

The exposure of students to a game situation where they have to cope with the real conditions of the environment, although in modified and adapted situations, makes pupils appreciate the game concept, develop their tactical awareness, analyse the relevance of technical skills in the different game situations, and obtain an understanding on how to play and act in a certain sport (Díaz-Cueto and Castejón, 2011; Gray and Sproule, 2011; Kirk and MacPhail, 2002). Based on this idea, the technical skills are effectively integrated into contextualised situations, at the same time as students have more fun, because they are engaging in the sport in similar conditions to the real game (Light, 2003; Van Acker, Carreriro da Costa, De Bourdeaudhuij, Cardon, and Haerens, 2010).

Teaching based on the application of modified games must satisfy four pedagogical principles (Griffin and Patton, 2005): (1) expose the individuals to variable game play in which the game conditions are not always going to be the same; (2) manipulate the complexity of the sport so that it starts off simple and easy for students to understand; (3) get the individual to cope with similar tactical problems to those that the sport offers in its original version; and (4) expose individuals to game situations that include the structural elements of the sport. In this sense, learning in sport is determined by the relationship between the athlete and his or her game environment, in such a way that the integrated practice of the perceptive and decisional components are going to make it easier to functionally adapt to the actual characteristics of the sport modality. Thus, providing contextual variability to the sport teaching process is beneficial for pupils, as it provides them with a perceptive experience and it can thus increase the alternatives to certain game problems (Clemente, 2012). On the other hand, Light (2003) considered that teaching approaches focused on understanding the game foster the joint development of physical skills, cognitive and emotional techniques, all of which provide students with comprehensive training (Dyson, Griffin, and Hastie, 2004).

In agreement with this idea, motivation increases when the individual perceives that his or her learning experiences are significant, as they occur in real game situations (Kirk and McPhail, 2002). Learning under the TGfU model is mainly carried out explicitly, because, as indicated by Turner and Martinek (1995), teaching the tactic at the start of the process favours understanding the game, as well as the acquisition of explicit knowledge (Raab, 2003).

Some defenders of the TGfU model have highlighted above all else the importance of teaching sport based on an approach that focuses on the tactic (Alison and Thorpe, 1997; Light and Fawns, 2003). However, other researchers who have compared the application of TGfU with traditional teaching, have found contradictory results (Butler, Griffin, Lombardo, and Nastasi, 2003; García and Ruiz, 2003, 2007; Velázquez, 2011). These contradictory results found in the specific bibliography may be explained partly by the difference in the research designs, the different sports that the studies have been based on, the differences in time and nature of the intervention and the selection of different variables for the research (Rink, Frech, and Tjeerdsma, 1996). This has made it clear that there is a need to find new research channels and methods that can increase knowledge about sport teaching processes that take place in the educational context. It also reveals the need to review the actual comprehensive model and its theoretic-conceptual bases in order to convert it into a really valuable tool for Physical Education teachers.

However, and although the application of TGfU at schools has increased students' motivation to engage in sport, and researchers defend its effectiveness for sport teaching in Physical Education sessions, the actual comprehensive model and its theoretical-conceptual basis must be revised in order to convert it into a really valuable tool for Physical Education teachers (Strean and Bengoechea, 2003). As a result, a series of questions have emerged around the relative effectiveness of TGfU as a sport teaching method in the context of Physical Education. Some of the most outstanding questions are: (1) Is TGfU adequate for students who are in different learning stages?; (2) Is there a theoretical reference framework that is able to verify the hypotheses posed in empirical research studies related to TGfU? (3) Is the development of technical skills from a tactical approach valid to assess the effectiveness of TGfU compared with the traditional technique-focused approach? (Chow et al., 2006).

These questions still go unanswered in the scientific community, probably because, although this type of research has provided valid information about the actual teaching-learning process, considering the interactions between the student and the environment (game environment), there is still a lack of knowledge about how sport learning is the consequence of these interactions.

The new sport teaching currents based on Non-linear Pedagogy come from the conceptual principles of TGfU, respecting its rationality, but placing all the emphasis on the interaction maintained between athletes and the environment (Chow et al., 2006; Renshaw, Chow, Davids, and Hammond 2010; Rovegno, Nevett, and Babiarz, 2001).

A new way of understanding the teaching-learning process: Nonlinear Pedagogy

Non-linear pedagogy is based on concepts, ideas and declarations from the Ecological Psychology and Dynamical Systems Theory, and it can be defined as the application of concepts and tools of non-linear dynamics in the context of Physical Education (Chow et al., 2006; Davids Araújo, Vilar, Renshaw, and Pinder, 2013). Basic concepts, such as the interaction between students and the environment, the perception-action binomial and the non-linear nature of the systems (e.g., students in practice situation), are applied in the design of the practice from the perspective of non-linear pedagogy (Renshaw, Davids, Chow, and Shuttleworth, 2009). In this regard, teaching sport from the non-linear pedagogy perspective is a process that focuses on manipulating relevant determining factors that try to increase information sources in order to guide students towards their goals (Araújo, 2009; Araújo and Davids, 2009; Carvalho, Araújo, García-González, and Iglesias, 2011; Passos, Araújo, Davids, and Shuttleworth, 2008). Therefore, the determining factors are demands imposed on the sporting action, which give rise to the appearance of motor behaviours based on a movement system (e.g., student) that tries to find organisational stability (Newell, 1986). In this sense, the motor learning model of Newell (1996) describes how movement systems emerge based on the relative impact of the determining factors on the coordination pattern, in agreement with the different specific situations (Araújo, Davids, and Serpa, 2003).

In agreement with Newell (1996, p. 398), and in order to coherently address the understanding of how the coordination patterns emerge during intentional behaviour, the determining factors can be categorised into three different classes: task, environment and performer (figure 1).

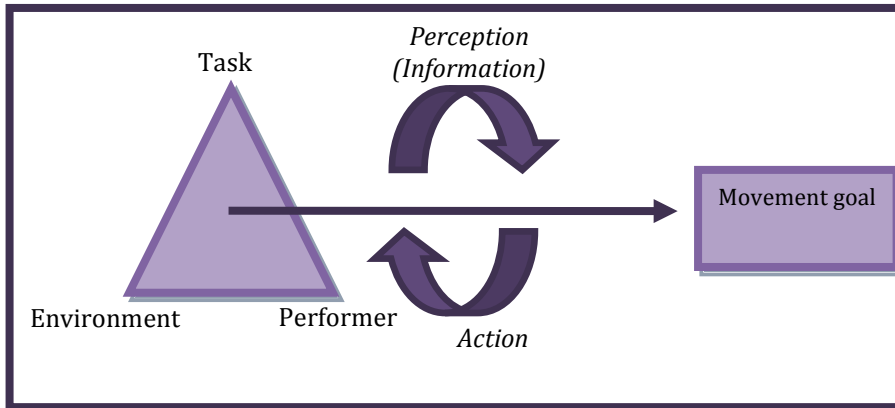


FIGURE 1: Coordination based on the interactions of determining factors (Newell and McDonald, 1994).

As illustrated in the figure, the determining factors of an action may be orientated towards the student, towards the environment, or towards the task. The student-related determining factors refer to the personal characteristics of the individual, which may be physical, technical or psychological, etc., which determine his or her individual response (Newell, 1996). For example, the student's physical condition, the level of technical skill, or his or her personality are factors that the teacher must take into account to provoke individual adaptations in the tasks.

The environmental determining factors refer basically to physical factors, such as visual and auditory information sources (amount of light or level of noise in the learning environment, atmospheric temperature, or surfaces where the sport is carried out). Another environmental determining factor refers to social influences such as, groups of friends, social and cultural expectations in the community, family support, etc. In this type of determining factor, it is important to consider the influence of the classroom climate on the acquisition of skills. Thus, the Physical Education teacher may create two types of atmospheres: ego-oriented atmosphere or atmosphere oriented towards the student's mastery (Ames, 1992; Nicholls, 1989). The first of the two is more oriented towards praising competitiveness, getting students to evaluate their level of skill compared with other students. This type of atmosphere invites players to be more cautious and to use the solutions they master best to avoid the risk of failing. On the other hand, an atmosphere oriented towards mastery focuses more on students' intrinsic motivation and encourages them to work in agreement with their specific needs and objectives (Roberts, Treasure, and Conroy, 2007).

Finally, task-related determining factors are probably the most important to be manipulated in the teaching-learning process of an open sport. This determining factor is comprised of three types of components:

- The objectives, which are normally established in one or two dimensions (space or time).
- The rules of a specific sport and the specific conditions of a given sport.
- The utensils used during the activity, the courts or fields, and the respective marks.

In the education context, one of the greatest challenges faced by Physical Education Teachers is how to structure the teaching-learning process in order to provide a response to the large number of students in the classrooms. The students all have different individual needs as they do not all possess the same learning capacity and although the motor situation is exactly the same, the solution they provide is not always the same (Chow, Davids, Hiristavski, Araújo, and Passos, 2011). Therefore, it is the teacher's job to adapt the complexity of the task so that each student can be successful. Thus, if the task is simplified or if its level is reduced, this allows each student to be successful and potentially make a better adjustment between intrinsic dynamics and the dynamics of the task (Tan, Chow, and Davids, 2011). Thus, and in order to satisfy the students' individual needs, the Physical Education teacher may use the following strategies: (1) Design tasks that are representative of the real game, including the actual structural elements of the sport. (2) Propose tasks, dividing students into groups depending on their level of skill, in order to favour individualised teaching. (3) Modify the rules to adapt the complexity of the tactical situation to the students' learning level, guiding them towards the desired learning lines. (4) Use utensils and equipment that adapt to the athletes' physical and technical characteristics. (Chow, Renshaw, Button, Davids, and Tan, 2012).

In this regard, the Physical Education teacher must create a dynamic and unpredictable learning environment where students are encouraged to reach the desired movement patterns, based on self-exploration or problem-solving process (Williams and Hodges, 2005). Therefore, teachers must have an in-depth knowledge of the sport as well as a high degree of mastery to identify the task-related determining factors, as their manipulation may lead to the appearance of functional and individualised movement patterns (Araújo, Davids, Bennett, Button, and Chapman, 2004; Chow et al., 2006). For example, a pass exercise in a 2x2 situation, in order to maintain ball possession in football in a defined space, enables students to explore different pass alternatives as well as improve their execution technique in an open situation (Araújo et al., 2004).

The teaching methodology based on manipulating the determining factors is clearly in line with the principles of TGfU, given that when the teacher designs modified games, he or she has to adapt the determining factors of the task to the students' characteristics. This must be done progressively and in agreement with their complexity, favouring an adequate tactical development of the pupils (Beaudet and Grube, 2005). For example, if, instead of playing basketball in its original version, the rules are manipulated, this will help create situations of 2x2 and 3x2. The objective of this is to favour ball possession, to advance towards the goal and throw with the least level of opposition. On the other hand, the use of modified equipment is extensively used in order to make skill acquisition easier for students. For example, when students start to learn tennis, it is very common to use shorter rackets, and larger but lighter balls (Carvalho, Correia, and Araújo, 2013). The same occurs in basketball, as if the height of the basket is reduced, this increases the effectiveness of the throw, and if the size and weight of the ball is reduced, this improves the throw technique (Arias, Argudo, and Alonso, 2011).

The determining factors of the task, of the environment and of the athlete are not independent from each other, as the movement patterns arise within a context where all the elements play a significant role in the acquisition of motor skills (Chow et al., 2007). More specifically, the interaction dynamics between the different types of determining factors in a learning situation favours the appearance of functional and adaptative skills based on the demand of the planned motor task. For example, in a situation of 1 on 1 in basketball, the player decides to throw or pass depending on the position of the nearest defender (task-related determining factor), on the level of physical fatigue or on his or her throwing assurance (personal determining factors), on the actual result of the game and the regulation throw time (environment-related determining factors), etc.

In this sense, the cognitive factors related to the intelligence of the game, such as anticipation, decision-making, and creativity determine the students' intentions, so the teacher must plan to present motor situations where the interaction of the determining factors of the task, the environment and the individual are present, thus favouring students' adaptative response (Araújo, Davids, and Hristovski, 2006). Based on all of this, the three types of determining factors are always present in any learning context, although if any one of them is modified, the results may be different.

Within non-linear pedagogy, we have seen how important it is to plan and design motor tasks, but the teacher's intervention during the session is equally important, as he or she must adapt the task to the students' characteristics, as

well as manage the determining factors of the environment in order to create a variable and dynamic learning environment.

Within this learning context, one of the most decisive teaching skills is the skill that focuses on the interaction with the student, and more specifically communication during the presentation of the task and during the application of the teaching feedback. The purpose of this communication is to establish the limits of the task, trying to guide the students' search process, as well as talk to them about whether the action was carried out in agreement with the objectives pursued and discover the intention of the action carried out. Therefore, in the motor skill acquisition process, the instructional strategies do not operate in an isolated manner, but rather in coordination with the other types of determining factors (Newell and Ranganathan, 2010).

Instructional strategies as determining factors of motor behaviour

The role played by instructional strategies in physical-sport activities has been a considerable source of studies in the field of motor learning (Chow, Koh, Davids, Button, and Rein, 2013; Williams and Hodge, 2005). The aim of teacher-student communication is to inform about what to do, but this must be done openly and favouring the understanding of the task to be carried out. In this sense, the information transmitted by the teacher must favour the students' cognitive engagement, related to "what to do" (Iglesias, Cárdenas, and Alarcón, 2007). From this perspective, instructional strategies are interventions carried out by the teacher that aim to facilitate the acquisition process of a motor skill in a group of students.

The information provided in the instruction process aims to direct the students' attention towards the most relevant aspects of the task before they execute it, and it is a basic category of teaching intervention, which leads to an increase in efficiency in the teaching-learning process (Herbert, Landin, and Solmon, 2000).

The verbal instruction that occurs at the start of the sporting activity may be considered as a determining factor that aims to favour the search for solutions within a learning environment (Newell and Ranganathan, 2010). In this regard, more than imposing a movement pattern on the student, the Physical Education teacher, through his teaching verbalisation behaviour, purports to foster motor learning based on investigation and on extending the contextual information, thus creating practice opportunities for students to be able to learn by themselves. The teacher's job goes beyond explaining the task, and his or her teaching function is redefined as a student counselling and guidance process (Hodges and Franks, 2003; Newell and Ranganathan, 2010; Williams and Hodges, 2005).

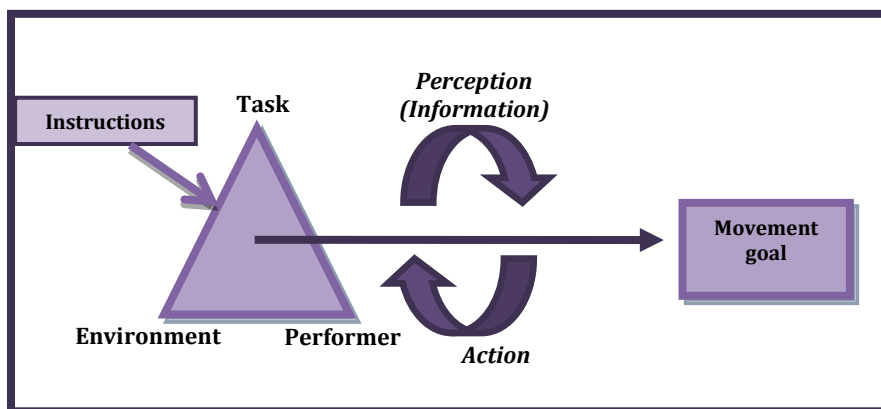


FIGURE 2: Adaptation of the diagram of the determining factors of the action (Newell & Ranganathan, 2010) with the introduction of the role of instructional strategies

In figure 2, the external arrow highlights the specific determining factor of the instruction, which may influence the three types of determining factors. This means that instructional strategies do not operate in an isolated way when acquiring a motor skill, but rather in line with all the determining factors. Thus, the aim of the instructional strategies is to change the interaction dynamics between the individual and the environment in order for the student to respond to the purpose of the task and be able to execute it without the teacher being present. Therefore, the teacher's role is to limit and condition the degrees of freedom that favour the appearance of a movement pattern, whether this is technical or tactical (Cordovil et al., 2009; Davids, Button, and Bennett, 2008; Lopes, Araújo, Duarte, Davids, and Fernandes, 2012; Newell and Ranganathan, 2010).

There are several information categories within the instructional process that the teacher can transmit to his or her students (Ford, Yates, and Williams, 2010). In any case, the main challenge of the Physical Education teacher is, depending on the pupils' level and on the type of motor skill, to identify which information must be transmitted and how it must be transmitted. When transmitting the information, the teacher may use a demonstration method to give students a global image of the movement pattern they have to learn (Hodges and Franks, 2003); and the explanation (verbal instruction) for students to have relevant information about the task or for the pupils to be able to direct their attention at the effect of the movement or on the movement of certain parts of the body (Rink, 1994; Wulf, Töllner, and Shea, 2007). In this communication process, the teacher can explicitly transmit the task to be carried out to his or her students, including the objective, conditions of the task,

key elements, spatial, human and material organisation, and the challenge of the activity, in order for the students to have enough information to carry out the task.

Questioning as an instructional strategy that favours the teaching-learning process

In the previous section, we have pointed out that the information transmitted by the teacher during the learning process of a motor task must favour the student's cognitive engagement in "what to do" (Iglesias et al., 2007). It has also been highlighted that the instructional process that occurs at the start of the motor skill can be considered as a determining factor that purports to channel the search for solutions within a learning environment (Newell and Ranganathan, 2010). But, however, whilst the students are carrying out the different motor tasks, the teacher's feedback can be integrated into the practice conditions so that the students can adapt better to the motor task proposed. In this sense, of all the strategies that the teacher can use to transmit feedback, in this article, we will focus on the use of questioning (interrogative feedback), which, based on the theoretical framework of non-linear pedagogy, is a teaching tool that permits creating a perception of competence in the student, by improving knowledge related to the task, as well as developing greater autonomy and increasing the student's learning capacity (Tan et al., 2012).

Questioning or interrogative feedback does not have much of a tradition in Physical Education classes. It is also a difficult tool to implement in the educational context due mainly to 3 reasons: (1) it requires a high level of knowledge of the sport to be taught; (2) teachers do not feel prepared to cope with a methodology change in their way of teaching; and (3) it is necessary to develop listening skills which, the majority of times, are new for the teachers. The main aim of this tool is to ask students a series of questions that will enable them to explore new ways of interaction with the environment and thus be able to efficiently execute a technical-tactical skill (Díaz del Cueto, Hernández-Álvarez, and Castejón, 2012). Therefore, this is a process whereby teachers, instead of telling the students the movement pattern that they have to execute and providing direct feedback about what they have to correct, launch questions at the students so it is they who, understanding the objective of the task, find out how to solve the motor problem proposed, in relation to the selected technical-tactical tasks (Vickers, 2007).

In the questioning implementation process in Physical Education, the teacher must help develop the students' knowledge. Thus, the teacher must prepare a series of questions that provides them with guidance in solving motor problems. In this case, the teacher must bear in mind two basic aspects:

remember what the students know to be able to prepare the series of questions and also remember the students' normal behaviour when faced with the problem proposed (Díaz-Cueto and Castejón, 2011). In this sense, when Physical Education teachers use this tool, they must consider the following aspects: 1) have a clear purpose in mind when they ask the questions; 2) ask questions that are easy for students to understand; 3) ask questions with a high level of individualisation; and 4) ask questions aimed at seeking novel solutions (Good and Brophy, 2000). Apart from all of this, it is essential to ask questions that have a high tactical component, as these are the ones that give rise to greater cognitive engagement and a greater range of improvement. For example, if we are teaching a Didactic Volleyball Unit and we want students to be aware of and explore the tactical aspects of this sport in the attack action, we can ask questions such as the following: what is your position on the court before making the attack? What other attack options were available? What part of the court was covered by the block? What tendencies do the companions from the other team have in defence? etc.

With these high tactical content questions, the teacher's aim is for the students to be more effective in real play (Ismail and Alexander, 2005). In previous studies, King (1994) had already found that, when questions with a high tactical content were asked, the athletes' answers were more novel and constructive, whilst questions that had little tactical content reiterate and reinforce already existing knowledge. In short, questioning may be one of the most effective tools when teaching open sports skills because it favours the development of sport expertise and improves tactical knowledge.

Final considerations and practical applications

The aim of this study was to review the different sport teaching models, highlighting the role played by instructional strategies as a determining factor of the task established by the teacher in order to guide the search for motor solutions within a learning environment. As a result of this review, and in agreement with the findings of different research studies that have been framed within motor learning, the teaching-learning process must not only focus on executing a series of motor skills, but also on acquiring perspective-cognitive skills, such as advance information based on the postural orientation of an opponent, develop predictions with respect to what type of actions companions or opponents can carry out and take appropriate decisions (Williams and Ward, 2007).

In this regard, and in order to guide students towards integral training in the sport, the use of a comprehensive teaching model, called Teaching Games for Understanding, is important. The key component of this model is based on

the use of modified games that are basically characterised by adaptations made to the original version of the sport. Based on this methodology, and in agreement with the principles of non-linear pedagogy, the objective of sport teaching focuses on seeking a balance between the demands for attention and the students' level of skill, in order to establish adequate progression within the pupil's tactical development (Davids, Araújo, Correia, and Vilar, 2013).

Likewise, teaching the sport from the perspective of non-linear pedagogy focuses on the motor learning model of Newell (1996). This is a relevant theoretical framework to explain how a student acquires a series of technical-tactical skills. According to this model, the movement systems emerge due to the relative impact of the different types of determining factors, which are oriented towards the task, the environment and the individual. In this case the teacher's work is based on manipulating this type of determining factor to increase information sources and thus be able to channel the search for solutions within a learning context (Araújo, 2009; Newell and Ranganathan, 2010).

In this sense, the Physical Education teacher, by manipulating the task-related determining factors, must create a dynamic and unpredictable learning environment, where students will be encouraged to reach the desired movement patterns. Thus, teachers must have an in-depth knowledge of the sport to be taught, in order to identify and manipulate the determining factors of the most relevant task that will lead to the appearance of functional and individualised movement patterns. According to this theoretical framework, and more specifically in the sport of volleyball, the teacher's work focuses mainly on manipulating the different structural elements that exist in this sport modality, as is the case of the net, motive, space, companions, opponents and rules. The main objective pursued by the Physical Education teacher is always to search for adaptive responses from the students.

Consequently, and focusing on the sport mentioned above, the teacher can manipulate the height of the net in order to hamper students' perception. Thus, tasks with a high net represent less perceptive difficulty, as students have more time to perceive the trajectory of the ball, whilst with a lower net, the perceptive difficulty is greater, as the ball defines a more tense trajectory. With respect to space, the evolution would be from a smaller space, where the area to be covered is smaller, to a larger space where the area to be covered is greater. Another way of manipulating space would be its shape, as if what we want is to favour the appearance of lateral movements, a possible alternative would be to create short and wide spaces, whilst if we want to favour the appearance of forward movements, the spaces would be narrower and longer. Another very important structural element in volleyball would be the number

of companions and opponents. In the first learning phases, the tasks would be carried out with fewer companions and opponents, whilst after passing through the different learning stages, the space dimensions would be increased as well as the number of companions and opponents. With respect to the rules, which are established by the teacher to determine the achievement of the objectives proposed, the following type of rules could be set: point won by a feint is worth double, points in zone four are only achieved by an attack down the line and a loss of a point if the same attack zone is repeated in two consecutive attacks.

The manipulation of the different task-related determining factors is not only put forward to design a progression from simpler to more complicated exercises insofar as the environment demands are concerned, but it also permits placing emphasis on a certain information source and for the action or a combination of actions to arise, which will make it possible to achieve the defined objective (Araújo and Davids, 2009). Let us assume that the student finds it rather difficult to decide which is the most adequate direction for the attack in volleyball, depending on the characteristics of the block of the opposite team, despite the fact that the student, in terms of technical skills, masters the different types of attack in terms of direction (attack down the line, long cross-court attack, and short cross-court attack). In this case, and in agreement with a theoretical framework of non-linear pedagogy, the teacher's task would be to create a learning context based on the manipulation of the determining factors of this task, so that the student can decide to guide the attack in one direction or another depending on the block conditions. Modifying the number of blockers (from fewer to more blockers), the area covered by the block (line or cross-court), or the cohesion of the block (more open or more closed block) may be factors that will lead to an increase in the possibility of success when deciding on the direction of the attack, depending on the characteristics of the first defensive line. These modifications in the block conditions must be established in agreement with the characteristics of each student, so that manipulating these determining factors will favour the appearance of an attack in one direction or another, based on the opposite team's block.

With respect to the determining factors in a learning environment, the aim of instructional strategies is to change the interaction dynamics between the students and the environment, and limit the degrees of freedom that favour the appearance of a certain movement pattern, whether this is technical or tactical. Therefore, this is a process where teachers, instead of telling the students what movements they have to execute and providing direct feedback about what they have to correct, launch questions to the pupils for them to understand the objective of the task themselves and try to find a solution to the motor problem

posed. In this way active, critical and independent students are formed in terms of their teaching-learning process. Let us assume that we are teaching a Didactic Unit of volleyball and our aim is for the students to be aware of the tactical aspects of this sport in the attack action. To do this, we propose reduced play situations of 4 vs. 4 where every time an attack is made by a student who has certain tactical deficiencies, he or she is asked a series of high tactical content questions. The purpose of all of this is to analyse the possible solutions that could have been applied (e.g., what other attack actions are available? What effect could each of those attack actions that you have verbalised have? What could be a better result? Why?) And for them to conduct an exhaustive analysis of the answer selected (e.g., what have you based yourself on to carry out this type of attack? What are the consequences of the decision taken? Do you believe that the decision you have taken has been effective? Why?).

By formulating this type of open questions, students have to reflect on all those elements that can, in some way or another, determine the attack action in volleyball. Therefore, the teacher's job does not just focus on correcting errors that have been observed directly, but on trying to get the actual student to find different alternatives, understanding the questions not as a tool that favours the optimisation of declarative or procedural knowledge, but as a didactic resource that permits developing greater autonomy and better capacity of action by students.

REFERENCES

- Allison, S. & Thorpe, R. (1997). A comparison of the effectiveness of two approaches to teaching games within physical education. A skills approach versus a games for understanding approach. *The British Journal of Education*, 28 (3), 9-13.
- Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, 84, 261-271.
- Araújo, D. (2009). O desenvolvimento da competência tática no desporto: o papel dos constrangimentos no comportamento decisional. *Motriz*, 15(3), 537-570.
- Araújo, D. & Davids, K. (2009). Ecological approaches to cognition and action in sport and exercise: Ask not only what you do, but where you do it. *International Journal of Sport Psychology*, 40(1), 5-37.
- Araújo, D., Davids, K., Bennett, S., Button, C., & Chapman, G. (2004). Emergence of Sport Skills under Constraints. In A. M. Williams & N. J. Hodges (Eds.), *Skill acquisition in sport: Research, theory and practice* (pp. 409-434). London: Routledge, Taylor & Francis.

- Araujo, D., Davids, K., & Hristovski, R. (2006). The ecological dynamics of decision making in sport. *Psychology of Sport and Exercise*, 7, 653-676.
- Araújo, D., Davids, K., & Serpa, S. (2003). Decision dynamics and intentional behaviour in one-on-one situations. *Abstract Book Science and Football V*. (p. 234-235). Madrid: Editorial Gymnos.
- Arias, J. L., Argudo, F. M., & Alonso, J.I. (2011). Rules as didactical variables. an example in formative basketball. *International Journal of Medicine and Science of Physical Activity and Sport*, 43(11), 491-512
- Batting, W. F. (1979). The flexibility of human memory. In L.S. Cermak and F.I.M. Craik (Eds.) *Levels of processing in human memory* (pp. 23-44) Hillsdale, NJ: Erlbaum.
- Beaudet, B. & Grube, D. (2005). Simplifying volleying through modified game play. *Teaching Elementary Physical Education*, 16(4), 32-33
- Blomqvist, M., Luhtanen, P., & Laakso, L. (2001). Comparison of two types of instruction in badminton. *European Journal of Physical Education*, 6, 139-155.
- Bunker, D. & Thorpe, R. (1982) A model for the teaching of games in the secondary school. *Bulletin of Physical Education*, 10, 9-16.
- Butler, J., Griffin, L., Lombardo, B., Nastasi, R., & Robson, C. (2003). Reflections and projections. In J. Butler, L. Griffin, B. Lombardo & R. Nastasi (Eds.), *Teaching games for understanding in physical education and sport* (pp. 213-221). Redmond, VA: NASPE Publications.
- Carvalho, J., Araújo, D., García-González, L., & Iglesias, D. (2011). Decision-making training in tennis: what scientific principles can be applied to training programmes? *Revista de Psicología del Deporte*, 20(2), 767-783.
- Carvalho, J., Correia, V., & Araújo, D., (2013). A constraints-led approach to skill enhancement in tennis. *ITF Coaching and Sport Science Review*, 60(21), 10-11.
- Chow, J. Y., Davids, K. Button, C., Shuttleworth, R., Renshaw, I., & Araújo, D. (2006). Nonlinear pedagogy: A constraints-led framework for understanding emergence of game play and movement skills. *Nonlinear Dynamics, Psychology, and Life Science*, 10(1), 71-103.
- Chow, J.Y., Davids, K., Hristovski, R., Araújo, D., & Passos, P. (2011). Nonlinear Pedagogy: Learning design for self-organizing neurobiological systems. *New Ideas in Psychology*, 29(2), 189-200.
- Chow, J.Y., Davids, K, Button, C, Shuttleworth, R, Renshaw, I., & Araújo, D. (2007). The role of nonlinear pedagogy in physical education. *Review of Educational Research*, 77,251-78.
- Chow, J.Y., Koh,M., Davids, K., Button, C., & Rein, R. (2013). Effects of different instructional constraints on task performance and emergence of

- coordination in children. *European Journal of Sport Science*, DOI: 10.1080/17461391.2013.780097
- 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.
- Conte, L., Moreno-Murcia, J. A., Pérez, G., & Iglesias, D. (2013). Traditional and comprehensive comparison methodology in practice basketball. *International Journal of Medicine and Science of Physical Activity and Sport*, 13(51), 507-523.
- Cordovil, R., Araújo, D., Davids, K., Gouveia, L., Barreiros, J., Fernandes, O., and Serpa, S. (2009). The influence of instructions and body-scaling as constraints on decisionmaking processes in team sports. *European Journal of Sport Science*, 9(3), 169-179.
- Davids, K., Araújo, D., Correia, V., & Vilar, L. (2013). How small-sided and conditioned games enhance acquisition of movement and decision-making skills. *Exercise and Sport Sciences Reviews*, 41(3), 154-161.
- Davids, K., Araújo, D., Vilar, L., Renshaw, I., & Pinder, R. (2013). An Ecological Dynamics Approach to Skill Acquisition: Implications for Development of Talent in Sport. *Talent Development & Excellence*, 5(1), 21-34.
- Davids, K., Button, C., & Bennett, S. J. (2008) *Dynamics of skill acquisition : a constraints-led approach*. Human Kinetics, Champaign, Illinois.
- Díaz-Cueto, M. & Castejón, F. J. (2011). La enseñanza comprensiva del deporte: dificultades del profesorado en el diseño de tareas y en la estrategia de pregunta-respuesta. *Tándem. Didáctica de la Educación Física*, 37, 31-41.
- Díaz-Cueto, M., Hernández-Álvarez, J. L., & Castejón, F. J. (2012). Question-answer strategy as key change of sports comprehensive teaching in Physical Education: Case studies. *Cultura y Educación*, 24(3), 279-288.
- Dyson, B., Griffin, L.L., & Hastie, P. (2004). Sport Education, tactical game and cooperative learning: theoretical and pedagogical considerations. *Quest*, 56, 226-240.
- Ford, P. R., Yates, I., & Williams, A. M. (2011). An analysis of practice activities and instructional behaviours used by youth soccer coaches during practice: Exploring the link between science and application. *Journal of Sport Science*, 28(5), 483-495.
- García-Herrero, J. A. & Ruiz, L. M. (2003). Análisis comparativo de dos modelos de intervención en el aprendizaje del balonmano. *Revista de Psicología del Deporte*, 12(1), 55-66.
- García-Herrero, J. A. & Ruiz, L. M. (2007). Knowledge and action in the first stages of learning of the handball. *Apunts. Educación Física y Deportes*, 89, 48-55.

- Good, T. L. & Brophy, J. E. (200). *Looking in classrooms*. New York: Longman.
- Gray, S. & Sproule, J. (2011). Developing Pupils' Performance in Team Invasion Games: a comparative study within a Scottish context. *Physical Education and Sport Pedagogy*, 16 (1), 15-32.
- Gréhaigne, J. F., Wallian, N., & Godbout, P. (2005). Tactical-decision learning model and students' practices. *Physical Education and Sport Pedagogy*, 10, 255-269.
- Griffin, L. L., Brooker, R., & Patton, K. (2005). Working towards legitimacy: Two decades of Teaching Games for Understanding. *Physical Education and Sport Pedagogy*, 10, 213-223.
- Griffin, L. L. & Patton, K. (2005). Two decades of Teaching Games for Understanding: Looking at the past, present, and future. In L. L. Griffin & J. Butler (Eds.). *Teaching Games for Understanding: Theory, research, and practice* (pp. 1-17). Champaign, IL:Human Kinetics.
- Harvey, S., Cushion, C. J., & Mass-Gonzalez, M. (2010). Learning a new method: Teaching Games for Understanding in the coaches' eyes. *Physical Education and Sport Pedagogy*, 15(4), 361-382.
- Herbert, E., Landin D., & Solmon, M. (2000). The Impact of Task Progressions on Students' Practice, Quality and Task-Related Thoughts. *Journal of Teaching in Physical Education*, 19, 338-354.
- Hodges, N. J. & Franks, I. M. (2003). Modelling coaching practice: the role of instruction and demonstration. *Journal of Sports Sciences*, 20, 793- 811.
- Holt, N. L. Strean, W. B., & García, E. (2002). Expanding the teaching games for understanding model: New avenues for future research and practice. *Journal of Teaching in Physical Education* 21, 162-76.
- Hopper, T. (2002). Teaching games for understanding: The importance of student emphasis over content emphasis. *Journal of Physical Education Recreation and Dance*, 73, 44-48.
- Iglesias, D., Cárdenas, D., & Alarcón, F. (2007). Communication during the didactic intervention of the coach considerations for the development of tactical knowledge and the improvement in decision making in basketball. *Culture, Science and Sport*, 7(3), 43-50.
- Ismail, H. & Alexander, J. M. (2005). Learning within scripted and non-scripted peer tutoring sessions: The Malaysian context. *Journal of Educational Research*, 99, 67-77.
- King, A. (1994). Guiding knowledge construction in the classroom: effects of teaching children how to question and how to explain. *American Educational Research Journal*, 31(2), 338-368.

- Kirk, D. & MacPhail, A. (2002). Teaching Games for Understanding and situated learning: Rethinking the Bunker-Thorpe model. *Journal of Teaching in Physical Education*, 21, 177-192.
- Light, R. (2003). The joy of learning: Emotion and learning in games through TGfU. *Journal of Physical Education New Zealand*, 36 (1), 93-99.
- Light, R. & Fawns, R. (2003). Knowing the game: Integrating speech and action through TGfU. *Quest*, 55, 161-177.
- Lopes, J. E., Araújo, D., Duarte, R., Davids, K., and Fernandes, O. (2012). Instructional constraints on movement and performance of players in the penalty kick. *International Journal of Performance Analysis in Sport*, 12, 311-345.
- Mitchell, S. A., Griffin, L. L., & Oslin, J. L. (1995). An analysis of two instructional approaches to teaching invasion games. *Research Quarterly for Exercise and Sport*, March Supplement: A-65-66.
- Mitchell, S. A., Oslin, J. L., & Griffin, L. L. (2003). *Sport Foundations for Elementary Physical Education: A Tactical Games Approach*. Champaign, IL: Human Kinetics.
- Mitchell, S. A., Oslin, J. L., & Griffin, L. L. (2006). *Teaching sport concepts and skill. A tactical games approach* (2nd ed.). Champaign: Human Kinetics.
- Newell KM (1986). Constraints on the development of coordination. In M. Wade, H.T.A. Whiting (Eds): *Motor Development in Children: Aspects of Coordination and Control* (pages 341-360). Dordrecht, Germany: Martinus Nijhoff.
- Newell, K. M. (1996). Change in movement and skill: learning, retention and transfer. In M, Latash, & M. Turvey (Eds.). *Dexterity and its development* (pp. 393-429). Mahwah, NJ: LEA.
- Newell, K. M. & McDonald, P. V. (1994). Learning to coordinate redundant biomechanical degrees of freedom. In S. Winne, H. Heuer, J. Massion, Casaer, P. (Eds.). *Interlimb coordination: neural, dynamical, and cognitive constraints* (pp. 515-536). New York: Academic Press.
- Newell, K. M., & Ranganathan, R. (2010). Instructions as constraints in motor skill acquisition. In I. Renshaw, K. Davids, & G. J. P. Savelsbergh (Eds.), *Motor Learning in Practice: A constraints-led approach* (pp. 17-32). London: Routledge.
- Nicholls, J. G. (1989). *The competitive ethos and democratic education*. Cambridge, MA, US: Harvard University Press.
- Passos, P., Araújo, D., Davids, K., & Shuttleworth, R. (2008). Manipulating constraints to train decision making in Rugby Union. *International Journal of Sport Science and Coaching*, 3(1), 125-140.

- Raab, M. (2003). Implicit and explicit learning of decision making in sports is affected by complexity of situation. *International Journal of Sport Psychology*, 34, 273-288.
- Renshaw, I. J. Y. Chow, K. Davids, & 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 and Sport Pedagogy* 15, 117-37.
- Renshaw, I., K. Davids, R. Shuttleworth, & Chow, J. (2009). Insights from ecological psychology and dynamical systems theory can underpin a philosophy of coaching. *International Journal of Sport Psychology* 40, 540-602.
- Rink, J. (1993). *Teaching physical education for learning*. St. Louis: Mosby
- Rink, J. E., French, K. E., & Tjeerdsma (1996). Foundations for the learning and instruction of sport and games. *Journal of Teaching in Physical Education*, 15, 399-417.
- Roberts, G., Treasure, D. & Conroy, D. (2007). Understanding the dynamics of motivation in sport and physical activity: an achievement goal interpretation. En G. Tenenbaum y R. Eklund (Eds.), *Handbook of Sport Psychology* (3rd ed., pp. 3-30). Hoboken, NJ: John Wiley.
- Rovegno, I., M. Nevett, M. & Babiarz, M. (2001). Learning and teaching invasion-game tactics in 4th grade: Introduction and theoretical perspective. *Journal of Teaching in Physical Education* 20, 341-351.
- Strean, W. B. & Bengoechea, E. G. (2003). Beyond technical vs tactical: Extending the games-teaching debate. In J. Butler, L. Griffin, B. Lombardo & R. Nastasi (Eds.), *Teaching games for understanding in physical education and sport* (pp. 181-188). Redmond, VA: NASPE Publications.
- Tan, C. W. K. , Chow, J. , & Davids, K. (2011) 'How does TGfU work?': examining the relationship between learning design in TGfU and a nonlinear pedagogy. *Physical Education and Sport Pedagogy*, DOI: 10.1080/17408989.2011.582486
- Tallir, I., Musch, E., Valcke, M., & Lenoir, M. (2005). Effects of two instructional approaches for basketball on decision-making and recognition ability. *International Journal of Sport Psychology*, 36, 107-126.
- Thorpe, R., Bunker, D., & Almond, L. (1986). *Rethinking games teaching*. Loughborough: University of Technology.
- Turner, A. P. & Martinek, T. J. (1995). Teaching for understanding: a model for improving decision making during game play. *Quest*, 47(1), 44-63.
- Van Acker, R., Carreiro da Costa, F., De Bourdeaudhuij, I., Cardon, G. & Haerens, L. (2010). Sex equity and physical activity levels in coeducational Physical

- Education: exploring the potential of modified game forms. *Physical Education and Sport Pedagogy*, 15, 159-173.
- Vilar, L., Duarte, R., Silva, P., Chow, J.Y., & Davids, K. (2014). The influence of pitch dimensions on performance during small-sided and conditioned soccer games. *Journal of Sports Sciences*, DOI: 10.1080/02640414.2014.918640.
- Vickers, J. N. (2007). *Perception, Cognition, and Decision Training. The Quiet Eye in Action*. Human Kinetics.
- Williams, A. M. & Hodges, N. J. (2005). Practice, instruction and skill acquisition in soccer: challenging tradition. *Journal of Sport Science*, 23(6), 637-650.
- Williams, A. M. & Ward, P. (2007). Anticipation and decision making: exploring new horizons. In G. Tenenbaum, y H. C. Eklund (Eds). *Handbook of Sport Psychology* (pp. 203-223). Wiley.
- Wulf G., Töllner T., & Shea H. (2007) Attentional focus effects as a function of task complexity. *Research Quartely Exercise Sport*, 78, 257–64.