

AN UPDATE ON SPARRING TAEKWONDO'S INTERNAL LOGIC

*UMA ATUALIZAÇÃO DA LÓGICA INTERNA DE COMPETIÇÃO DO
COMBATE NO TAEKWONDO*

*UNA ACTUALIZACIÓN DE LA LÓGICA INTERNA DE LA COMPETICIÓN
DEL COMBATE EN EL TAEKWONDO*

Cristina Menescardi*, **Laura Ruiz Sanchis****, **Isaac Estevan***,
Coral Falco***

Keywords:
Structural analysis.
Functional analysis.
Sports.
Techniques.
Martial arts.

Abstract: This manuscript addresses the internal logic of sparring taekwondo, regulated by the World Taekwondo Federation, to explain motor actions used in competitions. A narrative review was conducted on Google Scholar, Scopus, Web of Science, Ebsco, PubMed, ProQuest, and Dialnet databases, guided by structural and functional taekwondo parameters with no limits as to year of publication or language used. The authors describe the various elements that make up the sport's internal logic such as regulation, space, time, motor communication, roles and sub-roles in addition to the techniques or execution models that explain their special characteristics. This could assist in further examining the characteristics of that sport, defining combat actions, and contextualizing the real competitive situation by adapting tactical taekwondo sequences. Being aware of this sport's unique characteristics will enable creating the necessary framework to continue research on Olympic-level taekwondo.

Palavras chave:
Análise estrutural.
Análise funcional.
Esportes.
Técnicas.
Artes marciais.

Resumo: O objetivo do manuscrito é abordar a lógica interna do taekwondo competição regulamentada pela Federação Mundial do Taekwondo para explicar a ação motora na competição. Uma revisão narrativa foi realizada com base nos parâmetros estruturais e funcionais do taekwondo nos bancos de dados do Google Scholar, Scopus, Web of Science, Ebsco, PubMed, ProQuest e Dialnet, sem limitar o ano de publicação nem o idioma utilizado. Os autores se referem aos diversos elementos que compõem a lógica interna mencionada, como regulação, espaço, tempo, comunicação motora, papéis e subfunções, além dos modelos de técnica ou execução, explicando suas particularidades. Isso poderia nos ajudar a aprofundar as características desse esporte, definir a ação de combate e contextualizar a situação real da competição, adaptando as sequências táticas do taekwondo. O conhecimento das particularidades desse esporte permite criar uma estrutura necessária para continuar o trabalho da pesquisa no taekwondo olímpico.

Palabras clave:
Análisis estructural.
Análisis funcional.
Deportes.
Técnicas.
Artes marciales.

Resumen: El objetivo de este manuscrito es abordar la lógica interna del taekwondo de competición regulado por la Federación Mundial de Taekwondo para explicar la acción motriz en la competición. Se realizó una revisión narrativa basada en los parámetros estructurales y funcionales del taekwondo en las bases de datos del Google Scholar, Scopus, Web of Science, Ebsco, PubMed, ProQuest y Dialnet sin limitar el año de publicación ni el idioma. Los autores se refieren a los diversos elementos que componen la lógica interna mencionada, como reglamento, espacio, tiempo, comunicación motriz, roles y subroles, además de la técnica y modelos de ejecución, explicando sus particularidades. Esto podría ayudarnos a profundizar en las características del taekwondo, a definir la acción de combate y a contextualizar la situación real de la competición, adaptando las secuencias tácticas del taekwondo. El conocimiento de las particularidades de este deporte permite crear un marco necesario para continuar el trabajo de investigación en el taekwondo olímpico.

*Universidad de Valencia. Valencia, España.
E-mail:
cristina.menescardi@uv.es;
isaac.estevan@uv.es

**Universidad Católica de Valencia "San Vicente Mártir". Valencia, España.
E-mail:
laura.ruiz@ucv.es

***Western Norway University of Applied Sciences. Bergen, Norway.
E-mail:
coral.falco@hvl.no

Recebido em: 12-01-2020
Aprovado em: 20-04-2020
Publicado em: 25-05-2020



1 INTRODUCTION

Taekwondo (TKD) is a martial art of Korean origin (BRIDGE; JONES; DRUST, 2011), regarded as both techniques of offence and defense for the survival of a country and individuals (AHN; HONG; PARK, 2009). As all martial arts, it evolved over time, and in 1988 it became an exhibition sport in the Olympic Games in Seoul and in 2000 an Olympic combat sport in Sydney (see AHN; HONG; PARK, 2009; MOENIG; CHO; SONG, 2012 for further information of the historical evolution of TKD). As a result, TKD became more popular and practiced around the world (GUTIÉRREZ; PÉREZ, 2009).

Currently, two taekwondo competition systems are recognized (the World Taekwondo Federation [WTF] and the International Taekwondo Federation [ITF]), which can be differentiated by the competition rules, techniques and equipment used. The WTF competition system allows full contact in addition to punches to the trunk and kicks to both trunk and head, making it necessary for competitors to wear the prescribed protection equipment. On the contrary, as the ITF competitors do not wear trunk protectors (instead they have hand and feet safety equipment), punches are performed through light contact (CULAR; KRSTULOVIC; TOMLJANOVIC, 2011). ITF taekwondo is a more traditional form, following philosophic and ancestral percepts, which include formal patterns, sparring, special techniques, power test and traditional sparring (MOENIG, 2015; POLISZCZUK *et al.*, 2016). The competition taekwondo style practiced by the WTF is the only of the two recognized as an Olympic sport (CULAR; KRSTULOVIC; TOMLJANOVIC, 2011; MOENIG, 2015) and is the one addressed in the present manuscript.

As in every Olympic sport, its internal logic determines the way it is taught and practiced and describes the functional and structural elements that drive the practitioners' performance, such as the actions involved. In this regard, structural elements determine the sport's spatial-temporal parameters (i.e., space and time) and the functional elements determine the interaction between the participants (i.e. communication, roles and subroles) (JIMÉNEZ, 2011; NAVARRO; JIMÉNEZ, 1998). Internal logic thus refers to the features of a motor situation that influence the practitioners' motor behavior and are manifested according to their regulation. This conceptual framework determines the interaction of structural constants that appear in the presence or absence of the participants' uncertainty as regards the physical environment or their opponents (PARLEBAS, 2011). As the motor interactions involve uncertainty due to the adversary's tactics, it is thus considered as an adversary sport or combat sport (HERNÁNDEZ, 1994a; KNAPP, 1979), due to the confrontation between two opponents whose interests are opposed, i.e., the success of one practitioner is equivalent to the loss of the other (PARLEBAS, 2011). The analysis of competitive motor interaction requires a clear definition of the structure and internal logic of the sport to clarify the operationalization and interpretation of the results and help coaches to devise winning strategies.

In the analysis of the TKD's structural and functional elements, the actions or series of parameters that help to describe the functional structure (space, time, technique, motor communication, motor strategy and rules) are considered to be

the minimum practitioners' behavior involved in the sport (HERNÁNDEZ, 1994a). Among these parameters, the regulation (i.e., space, time, type of communication) influences the interactions between the practitioners (technique, tactics, and strategy) and the adequate and detailed description of this action (JIMÉNEZ, 2011; NAVARRO; JIMÉNEZ, 1998). The importance of the internal logic elements lies in the fact that they serve to situate and define the play action. In this way the play action is developed under the different functional constants of each sport, i.e., it assumes certain strategic attacking and defensive roles, considers some of the intentions (i.e., to attack to score or defend to avoid being scored against) involved in certain technical actions (i.e., attacks and counterattacks and defensive actions such as blocks, dodges or cuts), and whether or not to interact with the opponent. As to date no study has described in depth TKD's internal logic, the aim of this work was to identify, describe and address the different structural and functional elements that explain TKD actions, starting with the regulations as elements that make up the structure of the sport and influence the interaction between the participants.

2 MATERIAL AND METHODS

A narrative review (SOBRIDO; RUMBO-PRIETO, 2018) was conducted on the structural and functional analysis of TKD in the previous literature (HERNÁNDEZ-MORENO *et al.*, 2015). A narrative review is a critical analysis or synthesis of the scientific literature within subject area, using informal methods to select and interpret scientific information (SOBRIDO; RUMBO-PRIETO, 2018). Such reviews provide readers with up-to-date knowledge about a specific topic or theme, thereby playing an important role in continuing education of a wider audience (GREEN; JOHSON; ADAMS, 2006). With such an analysis in place, missing links or gaps in the literature can be identified and provide basis for new research development. To do this, the structural (space and time) and functional parameters (motor communication, roles, and subroles) and regulations were used as a reference (HERNÁNDEZ-MORENO, 1994a, 1994b), in accordance with Parlebas' theoretical motor praxeology framework (PARLEBAS, 2003, 2011). The literature analysis was conducted in both electronic and manual searches of published papers in Google Scholar, Scopus, Ebsco, PubMed, ProQuest, and Dialnet, with no restrictions as to year of publication while language used was restricted to English and Spanish. In line with previous studies, keywords were used (GARCÍA *et al.*, 2018; PLOTNIKOW *et al.*, 2018) such as "taekwondo", "praxeology", "internal logic", "structure", "techniques" and "tactics", separately or in combination. A total of 32 documents (25 articles, 4 books, and 3 doctoral thesis) were used to develop the topics according to the parameters of the internal logic of TKD mentioned. The authors reviewed every document and selected those related to the present topic.

3 ANALYSIS OF TKD INTERNAL LOGIC

The internal logic of the sport is the result of the dynamic of the relations of the structural (i.e., space and time) and functional elements (e.g., the relationships between athletes), which are explained by the regulations of the sport (ARIAS;

ARGUDO; ALONSO, 2011). Determining the internal logic of a sport can facilitate the possibility of structuring and characterizing the motor practice (HERNÁNDEZ-MORENO, 1994a, 1994b) of taekwondo. An important objective when studying the internal logic of a sport is to identify the consequences for the notions of strategy and tactics, and consequently for teaching and training. Sport's internal logic analysis can be used, in combination with observational methodology, to plan a study design. In the next paragraphs, we provide the necessary and updated information for teachers or coaches to carry out an analysis of each of the six aspects of the TKD's internal logic.

3.1 REGULATIONS

A combat sport is primarily defined by its rules (RUIZ-SANCHIS; ROS; BASTIDA, 2016). Rules regulate and clarify the incidence of the structural elements involved in the sport and specify the context that gives meaning to the play actions that occur (HERNÁNDEZ, 1994a). The elements that constitute the formal aspects and the development of the play action are: a) the competition area (characteristics and dimensions), b) the material used, c) the total and partial times of the bout (e.g., quarters, rounds), d) the scoring method, and e) the relationship of participants and adversaries (HERNÁNDEZ, 1994a). In addition, as a particular feature of combat sports, we find the protections or clothes used, without which they would not be possible (RUIZ-SANCHIS; ROS; BASTIDA, 2016).

3.1.1 Body protection system

As in most martial arts (MOENIG, 2011; MOENIG; CHO; SONG, 2012), body protection is one of the particular features of this sport. The official TKD protective elements are the trunk protector, helmet, gloves and socks for electronic scoring system (PSS), as well as forearm, groin, shin guards and gum shields, which are compulsory to compete (WORLD TAEKWONDO FEDERATION, 2018). They protect vulnerable areas of the body as well as valid score areas such as the head and trunk, which brings us to the last feature: the scoring system.

3.1.2 Scoring system

The scoring system in TKD is based on attacking actions (CASTARLENAS, 1993), as well as infractions of the regulation by performing defensive actions (e.g., passivity during the bout and leaving the competition area), while the opponent may be awarded penalty points for prohibited or dangerous actions (e.g., attacking the opponent after "Kal-yeo") (RUIZ-SANCHIS; ROS; BASTIDA, 2016; TORRES, 1997).

Regarding the offensive actions or those that lead to a score (SAMPEDRO, 1999), the regulations determine two valid zones: (a) the head and (b) the trunk, in the area covered by the trunk protector (WORLD TAEKWONDO FEDERATION, 2018). In attacking actions, points are obtained by punching or kicking. Punches are only allowed to the trunk area, while kicks are allowed to both trunk and head. Punches to the trunk score one point, while kicks to the same area score two points (e.g., *bandal chagui* or *miro chagui*), while a kick to the head scores three points (e.g., *neryo chagui* or *dollyo chagui*).

Actions to the trunk with a previous spin score four points (e.g., *tuit chagui*) and five points to the head (e.g., *mondollyo chagui*) (WORLD TAEKWONDO FEDERATION, 2018). As can be seen, scoring depends on objective and subjective criteria (CASTARLENAS, 1993). The objective criteria are in the points obtained through the PSS (2 and 3 points), while subjective criteria are used when it is necessary to identify the actions as kicks with a previous spin, which add an additional point to the score and also punches to the trunk protector (WORLD TAEKWONDO FEDERATION, 2018).

In TKD it is possible to score without performing offensive actions, i.e., penalties (*Gam-jeon*) add one point (1 point) to the opponent's score (WORLD TAEKWONDO FEDERATION, 2018). For instance, a practitioner can be penalized for delaying or avoiding the combat (passivity), when he/she does not perform actions or stays in a defensive attitude for more than 5 seconds, dodging the opponent or leaving the competition area to avoid combat (WORLD TAEKWONDO FEDERATION, 2018). These actions are penalized (by giving a point to the opponent), even when this is committed as a consequence of the opponent's strategy. While forbidden and penalized actions include pushing or kicking the opponent to prevent him/her from kicking, kicking below the waist, continuing the attack after the referee has stopped the combat, attacking a fallen opponent, punching to the head, acts of violence or extreme misbehavior, as well as interfering with the scoring system (WORLD TAEKWONDO FEDERATION, 2018).

The scoring system has changed over time, for example, TKD rules and regulations have changed several times in the last two decades. Initially, actions to the head and trunk scored equally, but when TKD was included in the Olympics (in 2000) a variety of rule changes were implemented (MOENIG; CHO; SONG, 2012). The most important was in 2004 when actions to the head scored triple (3 points) and spin actions to the trunk scored double (2 points) (GONZÁLEZ, 2011). In 2009, actions to the head with linear or circular techniques scored 3 points, while an additional point was obtained when spin-actions were performed to the head, achieving 4 points (MOENIG; CHO; SONG, 2012). In 2016, the scoring system changed once again (as described above) to make taekwondo more dynamic and attractive for spectators. This means the internal logic of this sport must be adapted and updated to these changes. As coaching, training and tactics are influenced by the scoring system, they should adapt to the new rules.

3.2 STRUCTURAL ELEMENTS OF TAEKWONDO

Structural elements can be seen as part of the rules and regulations and are considered extremely important for the development of play actions (HERNÁNDEZ, 1994a).

3.2.1 Space: competition area

In competitions, all the actions take place within a clearly defined space. This space is also subdivided into different subspaces and diverse forms that could influence the practitioner's behavior (HERNÁNDEZ, 1994a). The sum of both the contest area and subspaces is called the competition area.

In TKD, the contest area is common to both competitors (SAMPEDRO, 1999) and is clearly marked (PARLEBAS, 2003, 2011). Both the shape and size of the

space influence the techniques used by taekwondo practitioners (MOENIG; CHO; SONG, 2012). The contest area is an 8 x 8 m square (subspace 1). In addition, there is a safety 1-2 m safety area on each side (subspace 2). The competition area, including the two subspaces and must be no smaller than 10 x10m and no larger than 12x12m (WORLD TAEKWONDO FEDERATION, 2018, Article 3). It seems that TKD practitioners tend to use the central space as the main area for their actions, since the closer they get to the outer limit, the closer they are to being penalized for leaving the competition area (GONZÁLEZ, 2011).

The interaction space, understood as the space occupied by practitioners when interacting, is variable and depends on the decisions made by the practitioners about where to attack or avoid the attacks (TORRES, 1997). In TKD, the practitioners are required to be familiar with the combat distance from the opponent, as well as the space they need for an action. The confrontation distance is considered as the distance that separates both adversaries in a direct confrontation, i.e., the guard distance before the attack (PARLEBAS, 2011). In this sport the distance that separates the opponents is between 1 and 3 m, or the distance that can be covered by the movement of the lower limbs when kicking (FALCO *et al.*, 2009; SAMPEDRO, 1999).

3.2.2 Time

Every sport action is framed in a time specified in the regulations (PARLEBAS, 2011): a) total duration of the match (considered as a synonymous of bout), b) the division into parts or periods, and c) the stops, pauses or downtime. The regulations include the obligation to: d) carry out certain actions in a specified time and act at a specific speed to avoid being penalized for passivity (HERNÁNDEZ, 1994a). Regarding the total duration of the bout and the periods into which it is divided, a bout normally has three rounds of one minute, a minute and a half or two minutes each, depending on the category, which may be either cadet, junior or adult/senior, respectively. However, the bout may end before the third round due to technical superiority (i.e., by point difference), an injury or knockout (KO). The bout may also go into an extra fourth round if the third round finishes in a draw, in which case the first to score wins the match (golden point). If at the end of the fourth round the combat is still a draw, the referees will designate the winner on superiority (WORLD TAEKWONDO FEDERATION, 2018, Article 7).

There is a one-minute rest between rounds in which the players may retire to their area, have a drink or talk to their coach. On the other hand, the referee will stop the match when they are in a clinch to separate them and restart the bout. Also, it is possible to stop the bout for injury or to fix deficient equipment and it will not be restarted when: a) a practitioner has been knocked down, b) after 1 minute of medical treatment, c) for an injury that prevents returning to combat or d) when one's physical integrity is at risk (WORLD TAEKWONDO FEDERATION, 2018, Articles 18 and 19). Previous research shows that bout time can be split up into fight time (synonymous of effort time) or non-fight time (synonymous of pause) (SANTOS; FRANCHINI; LIMA-SILVA, 2011). The fight time lasts between 1.5-3 s whereas the non-fight time can vary between 3 – 6 s in cadets (MENESCARDI *et al.*, 2016), while in Olympic and World championship

combats it is around 8 and 10 s, respectively (SANTOS; FRANCHINI; LIMA-SILVA, 2011). Thus, the fight: non-fight ratio used to analyze effort (pause ratio, E: P) in these studies ranges from 1: 2 to 1: 4 (SANTOS; FRANCHINI; LIMA-SILVA, 2011). Time is a key element in the practitioner's strategy, since it determines the speed of the actions (LASIERRA, 2017). For example, the ratio varies at the end of the bout because the competitors tend to speed up in the last round due to its decisive nature for a victory (GONZÁLEZ, 2011, IGLESIAS *et al.*, 2010, MENESCARDI *et al.*, 2015).

3.3 FUNCTIONAL ELEMENTS OF TAEKWONDO

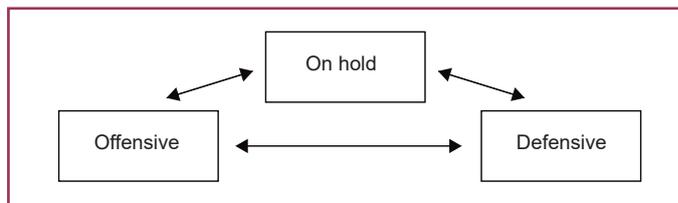
3.3.1 Motor communication or relationship between participants

The relationship between the participants is established through motor communication or counter-communication, which refers to the exchange of information by means of the actions carried out during the bout (competitor's interaction) and clearly influences the opponent's actions (communication or counter-communication) (PARLEBAS, 1981), which is allowed by the regulations. In TKD, since communication tends to maximize uncertainty with the opponent, it could be seen mainly as motor counter-communication (opposing interaction between adversaries or antagonistic communication network) (PARLEBAS, 2011) to gain an advantage and score (RUIZ-SANCHIS; ROS; BASTIDA, 2016; TORRES, 1997). This counter-communication is exclusive, since they are always rivals, and stable, since it is constant throughout the competition (PARLEBAS, 2011), which means a continuous change of roles (offensive and defensive) during the round (RUIZ-SANCHIS; ROS; BASTIDA, 2016). Other aspects can also contribute to communication, such as praxial indirect communication through gestemic and proxemic codes (PARLEBAS, 2011). Proxemic code is observable motor action with a symbolic value that provides evidence for a tactical project and is a unit of behavior, while a gestemic code is nonverbal communication that conveys information (GONZÁLEZ-GONZÁLEZ; NAVARRO-ADELANTADO, 2015). It can be seen in actions with tactical meanings such as feints or gestures to invite the opponent to attack (MENESCARDI, 2017).

3.3.2 Tactics (roles)

The play action is assumed by a practitioner with a strategic role (JIMÉNEZ, 2011). This role could be either offensive or defensive, as the aim of the action is to score or avoid the opponent's kick or punch, respectively (GONZÁLEZ *et al.*, 2011; PARLEBAS, 2011). The fundamental structure of the dynamics between both roles is called "athlete on hold" and is the transition between offensive and defensive roles, when the practitioner is deciding whether to defend or attack (CASTARLENAS, 1993; FIGUEIREDO, 2003; RUIZ-SANCHIS; ROS; BASTIDA, 2016) (Figure 1). The practitioner on hold will determine the combat distance and the decision to act. It should be noted that the fluidity between the roles of attack and defense could mean that the situation of fighter on hold may not actually occur (e.g., a combination of uninterrupted attacks) (AVELAR; FIGUEIREDO, 2009).

Figure 1 - Different roles that can be assumed by practitioners in combat sports.

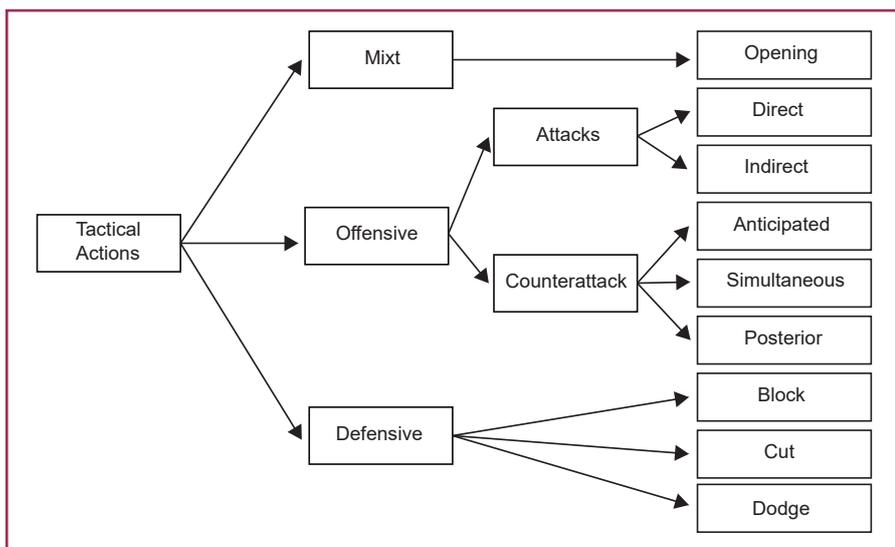


Source: Ruiz-Sanchis; Ros; Bastida (2016, p.30).

Offensive tactics can be divided into attacks and counterattacks (FALCO *et al.*, 2012; GONZÁLEZ, 2011; MENESCARDI *et al.*, 2012, MENESCARDI *et al.*, 2015; PYCIARZ, 2011). An attack is an offensive action that initiates the tactical sequence (MYONG, 2001), taking the initiative with the intention of scoring (SAMPEDRO, 1999). The practitioner performs a counterattack when he responds to the adversary’s attack (MYONG, 2001; SAMPEDRO, 1999). The ways of scoring have changed over time; in the 2000 and 2004 Olympic Games, taekwondo practitioners used more attacking actions to score (KAZEMI; CASELLA; PERRI, 2009, KAZEMI *et al.*, 2006), while in 2008 and 2012 there were more counterattacks (KAZEMI; PERRI; SOAVE, 2010; MENESCARDI, 2017).

It is thus important when training to consider the competitor’s tactics. In TKD, attacks can be direct or indirect, depending on the technical resource involved (e.g., feints, displacements, change of guard) before the kick (GONZÁLEZ, 2011; MENESCARDI *et al.*, 2017). Openings arise as a consequence of the evolution of this sport (MENESCARDI, 2017). Openings are actions aimed at provoking a certain reaction as well as keeping a safe distance (defensive action) and so can be considered as mixed actions (MENESCARDI *et al.*, 2017). On the other hand, counterattacks can be initiated before, during or after the opponent’s action (GONZÁLEZ, 2011; MENESCARDI *et al.*, 2017) (Figure 2).

Figure 2 - Mixt, offensive and defensive tactical actions in TKD.



Source: Modified from González (2011, p. 36).

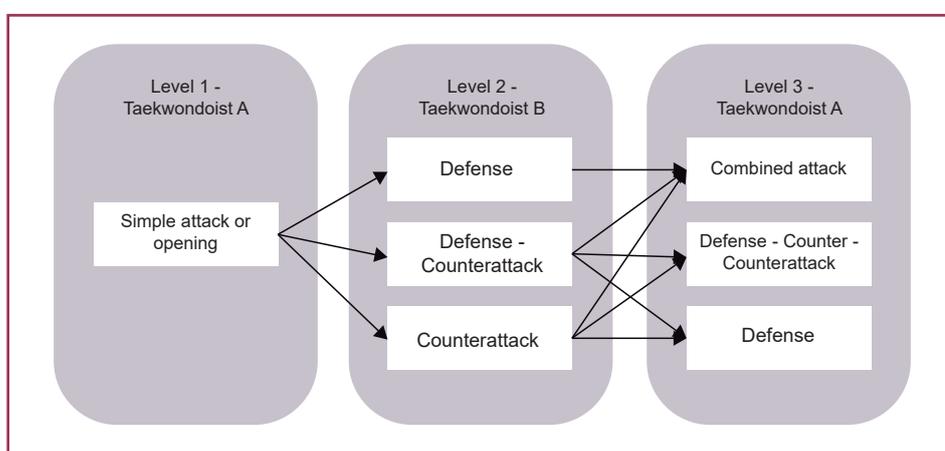
Defensive actions repel an attack and do not aim to score (SAMPEDRO, 1999). They include dodging, blocking and cutting (GONZÁLEZ *et al.*, 2011; MENESCARDI

et al., 2017) the opponent's action. Dodging is used to avoid physical contact with the opponent (GONZÁLEZ *et al.*, 2011; MENESCARDI *et al.*, 2017) and can be performed in any direction (FARGAS, 1990), while blocking and cutting use arms or the body to avoid contact (GONZÁLEZ *et al.*, 2011; MENESCARDI *et al.*, 2017). The present regulations do not allow blockages with the legs (WORLD TAEKWONDO FEDERATION, 2018) as only hands can be used at head or body height (LOSITO, 2001). These actions represent 21.19% of the total actions, with 41.58% dodges, 42.83% blockages and 57.17% cuts in elite male practitioners (GONZÁLEZ; IGLESIAS; ANGUERA, 2011).

A study carried out on university practitioners showed that they used more dodges than cuts and blocks, while defensive actions were used according to the practitioners' weight category, with fin competitors using fewer dodges than other categories and light categories performed more dodges than the heavier ones. This could be because the lighter categories, except fin, have less body mass and can react quickly to an attack (MENESCARDI, 2016). It should be noted that in combat sports such as TKD each action has an offensive defensive component, which can be combined in a clinch (close combat), where a defense can threaten a future attack or take advantage of the opponent's attack to counterattack him/her (TORRES, 1997).

To contextualize the tactical actions used in real competitions, it is necessary to mention tactical sequences or schemes. This term, coined by Szabó (1977) for fencing, is used to refer to a series of offensive, defensive and counter-offensive actions in the course of the bout (DZIWENKA; JOHNSON, 2015). The tactical sequence for TKD established in previous studies is shown in Figure 3 (MENESCARDI; ESTEVAN, 2017). This sequence begins with an attack or opening (Level 1 - Taekwondo A) where the opponent has three options (Level 2 - Taekwondo B): (a) perform a defensive action, (b) counter-offensive or (c) a combination of both (ALARCIA; ALONSO; SAUCEDO, 2000). In the first case, practitioners can perform a defensive action to distance themselves from the opponent, such as dodges, or a cutting or blocking action to stop the attack (FARGAS, 1990). A second option is to carry out a counterattack, while the third alternative is to perform a combination of both defensive actions (e.g., blocking or cutting) and a counterattack (e.g., posterior).

Figure 3 - Offensive-defensive tactical sequence in TKD.



Source: Own elaboration.

It should be noted that although dodges and simultaneous counterattacks seem to be the most used actions in competition (GONZÁLEZ, 2011, MENESCARDI, 2017; MENESCARDI; ESTEVAN, 2017), a cut followed by a counterattack is revealed as an effective tactic to score points in a clinch (MENESCARDI, 2017). Regardless of the option chosen by a Level 2 practitioner, the attacker may choose to continue with the offensive action (Level 3 - Taekwondo A), through a combined attack (TORRES, 1997) or a defense-counterattack (also called stop-response) (TORRES, 1997).

A recent study (MENESCARDI *et al.*, 2019a) have been shown that Olympic athletes used different sequences when compete. They used openings (level 1) followed by posterior the counterpart's counterattacks and dodges (level 2), highlighting a testing strategy by taekwondoists where one initiate the attack and the other try to avoid being kicked against. In addition, they used attacks (direct and indirect) that were followed by all the types of counterattacks (i.e., anticipatory, simultaneous, and posterior) or defensive actions (e.g., blocks and cuts). These results pointed out that elite athletes master and use all the tactical options included on the prior schema (tactical repertoire). Despite of this domain of the tactical repertoire, athletes used more direct attacks to score one point (to the trunk), simultaneous spinning kicks to score two points and indirect attacks or posterior counterattacks to score three points to the head (MENESCARDI *et al.*, 2019b).

Following authors such as Bayer (1992) or Jiménez (2011), who mention the offensive and defensive principles in collective sports based on the role of the player, we could say that TKD's offensive and defensive principles are those shown in Box 1. Hindering an opponent's defensive action may also be used, for which it is important to vary the type of attack, which leads us to the next point. Movement variations are seen as a functional and intrinsic feature of adaptive movement, as they provide the flexibility required to consistently achieve a movement goal in dynamic sports such as TKD combats (RENSHAW *et al.*, 2010).

Box 1 - Offensive and defensive principles in TKD.

Offensive	Defensive
Progress / advance towards the opponent to shorten the intervening distance and attack	Prevent an opponent's kick or advance (e.g. by cutting an action)
Feint to mislead the opponent and kick/punch with the least opposition	Maintain guard distance (e.g. dodging)
Score (kick/punch in a valid zone with enough force to be detected by the PSS)	Avoid opponent scoring (e.g. blocking)

Source: Own elaboration.

3.3.3 Techniques and execution models (subroles)

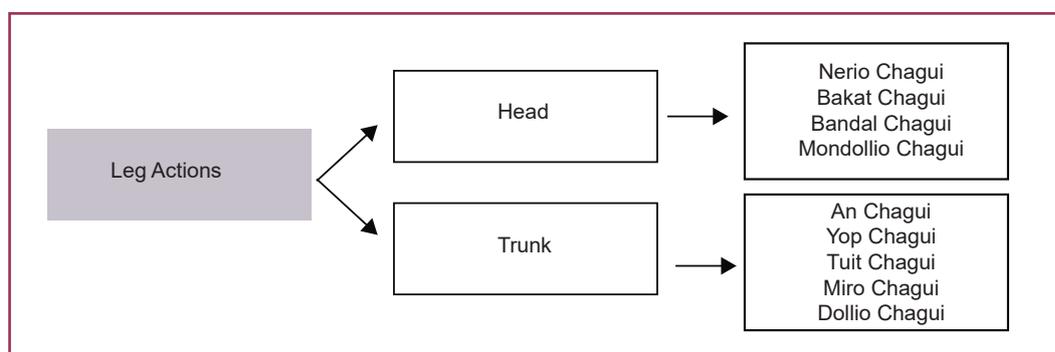
Within any strategic role, subroles can be found that use the techniques that best suit each situation or role (JIMÉNEZ, 2011), in which practitioners evaluate their alternatives and use whichever seems the best to defeat the adversary, bearing in mind that deception is the center of all tactical action (RIERA, 1995).

Techniques are ideal models of specific movements in each sport and are based on the practical or theoretical experience of the practitioner in competition (LEES, 2002). Technique is thus associated with the execution of actions and is usually subject to tactics and can be classified according to the part of the body used (AMADOR, 1995; HERNÁNDEZ-MORENO, 1994a). In TKD, only kicks and punches are allowed.

For punches, the techniques allowed are: a) *Checho jirugui* (from bottom to top), b) *Montong dollio jirugui* (circular), and c) *Montong jirugui* (straight from the center) (GONZÁLEZ *et al.*, 2011). However, these are rarely used in high-level competition (GONZÁLEZ, 2011) and only when the opponent's action is cut in close combat (MENESCARDI, 2017). Leg techniques are the main ways of attacking and counterattacking (KAZEMI; CASELLA; PERRI, 2009), because there are more areas where kicks (i.e., head and trunk) can score than punches (i.e., only on the trunk) and they have a greater impact on the opponent than punches (KIM *et al.* 2009). The most often used scoring techniques (see Figure 4) are: a) *bandal chagui* (circular kick also known as roundhouse kick to the head), b) *miro chagui* (linear kick to the trunk), c) *dollio chagui* (circular technique to the trunk), and d) *neryo chagui* (linear kick to the head) (GONZÁLEZ; IGLESIAS; ANGUERA, 2015). However, the current regulations seem to promote the use of techniques with a previous spin (e.g., *mondollio chagui*), which get additional points (MOENIG, 2011), and circular techniques seem to be the most used to score (FALCO *et al.*, 2012; GONZÁLEZ *et al.*, 2011; GONZÁLEZ; IGLESIAS; ANGUERA, 2015; KWOK, 2012; MATSUSHIGUE; HARTMANN; FRANCHINI, 2009; MENESCARDI *et al.*, 2012; MYONG, 2001).

The greater use of circular techniques is attributed to their high speed and precision (PIETER, 1991), they are difficult to prevent and include the possibility of knocking out the opponent (OLIVÉ, 2005). However, recent articles consider linear actions including a PSS to be more frequent than other types in competition (KRUSZEWSKI *et al.*, 2014; PYCIARZ, 2011) due to their speed and effectiveness (KRUSZEWSKI *et al.*, 2014; PYCIARZ, 2011). Despite this, practitioners will use those techniques that allow them to score easily and give them an advantage.

Figure 4 - Leg actions permitted.



Source: Modified from González (2011, p. 33).

It should be noted that the importance of a technique lies in its degree of automation, since it should free the practitioner's mind for other more complex tasks (SAMPEDRO, 1999). The appropriate use of technical actions should also be considered

in terms of spatio-temporal parameters as well as the relationship with the opponents, all in accordance with the regulations (LÓPEZ, 2008; SAMPEDRO, 1999). Therefore, practitioners should be familiar with the sport and its characteristics and be able to analyze the different situations that can arise (HERNÁNDEZ-MORENO, 1994b).

4 PRACTICAL APPLICATIONS

Due to the nature (internal logic) of TKD as a combat sport, a large repertoire of offensive and defensive actions can help practitioners to adapt themselves to any conditions (e.g., the opponent's strategy). The repertoire depends on multiple factors such as the regulations, as well as structural and functional elements. Coaches and trainers should generate multiple (open and closed) environments and proposals to enhance the practitioner's adaptability to any hypothetical condition (CHOW *et al.*, 2016; ESTEVAN, 2016). It is suggested that coaches base their proposals on a sound theoretical model in terms of selecting appropriate equipment for the practitioner, organizing and structuring learning environments and training tasks, planning practice programs, preventing injuries and understanding the nature of individual differences at various levels of performance (RENSHAW *et al.*, 2010).

The constraint-led approach in skill acquisition addresses multiple conditions, mainly characterized by the constraints related to the environment, tasks and individualities (CHOW *et al.*, 2016; RENSCHAW *et al.*, 2010, 2016). The inherent necessity of adapting performance to the counterpart's tactics highlights the importance of a constraints-based framework. This process involves learning to adapt movement patterns to achieve consistent movement outcomes in the face of unexpected changes in a varying context (RENSHAW *et al.*, 2010). Coaches should implement a variety of appropriate constraints to promote functional variability and help practitioners effectively search for successful movement solutions (e.g., effective coordination patterns in kicks). This search process will lead to adaptability, seeking a movement solution that is unique to individual, task and environmental constraints (CHOW *et al.*, 2016; RENSCHAW *et al.*, 2010).

By encouraging free but oriented-based exploration in dynamic training, coaches can lead TKD practitioners to consistently repeat a performance outcome, although the movement pattern may not always be the same (RENSHAW *et al.*, 2010). Unlike free combat, the essence of this practical suggestion is to acquire new movement solutions that will help to perform, adapt and/or respond effectively to an open environment (ESTEVAN, 2016). Good coaches should integrate varying movements into the training process and provide controlled boundaries of exploration in dynamic settings through the provision of relevant task constraints within TKD's internal logic (e.g., onset stance position, height of target, 2x1 combats, limited or controlled combats). This should help practitioners to widen their repertoire and improve their performance in an ecological manner (ESTEVAN *et al.*, 2016).

5 CONCLUSION

This is the first paper to address the TKD's internal logic and contextualize the sport with the latest scientific data. The aim is to allow researchers and coaches

to keep in mind all the constituent elements of motor actions in the competitive field. Specifically, combat sports as TKD, by essence, involve an opposition relationship between two athletes who try to win the bout. Winning implies defeating the opponent, by scoring more points than she/he and with that objective in mind, it is necessary to choose appropriate tactics (with respect to offensive and/or defensive actions) to ensure victory. Coaches, athletes and teachers should consider the structural and functional elements of the sport to teach, train and prepare accordingly their athletes. In addition, knowledge of TKD's special characteristics as well as its contextualization in a competitive situation will act as a guide for coaches and make it possible to establish the bases of future research in this sport.

REFERENCES

AHN, Jeong Deok; HONG, Suk Ho; PARK; Yeong Kil. The Historical and Cultural Identity of Taekwondo as a Traditional Korean Martial Art. **The International Journal of the History of Sport**, v. 26, n. 11, p. 1716-1734, 2009.

ALARCIA, Leoncio; ALONSO, Cruz José; SAUCEDO Francisco. **Esgrima con sables de espuma**. Madrid: Esteban Sanz, 2000.

AMADOR, Fernando. **Estudio praxiológico de los deportes de lucha: análisis de la acción de brega en la lucha canaria**. Tesis (Doctorado en Educación Física) - Las Palmas: Universidad de Las Palmas de Gran Canaria, 1995.

ARIAS, José; ARGUDO, Francisco; ALONSO, José. Review of rule modification in sport. **Journal of Sports Science and Medicine**, v.10, n. 1, p. 1-8, 2011.

AVELAR, Bruno; FIGUEIREDO, Abel. La iniciación a los deportes de combate: Interpretación de la estructura del fenómeno lúdico luctatorio. **Revista de Artes Marciales Asiáticas**, v. 4, n. 3, p. 44-57, 2009.

BAYER, Claude. **La enseñanza de los juegos deportivos colectivos**. Barcelona: Hispano Europea, 1992.

BRIDGE, Craig; JONES, Michelle; DRUST, Barry. The Activity Profile in International Taekwondo Competition Is Modulated by Weight Category. **International Journal of Sports Physiology and Performance**, v.6, n. 3, p. 344-357, 2011.

CASTARLENAS, Josep Lluís. Estudi de les situacions d'oposició i competició. Aplicació dels universals ludomotors als esports de combat: El judo. **Apunts**, n. 32, p. 54-64, 1993.

CHOW, Jia Yi *et al.* **Non-Linear Pedagogy in Skill Acquisition, an introduction**. New York: Routledge, 2016.

CULAR, Drazen; KRSTULOVIC, Sasa; TOMLJANOVIC, M. The differences between medalists and non-medalists at the 2008 Olympic Games taekwondo tournament. **Human Movement**, v. 12, n. 2, p. 165– 170, 2011.

DZIWENKA, Ronald; JOHNSON, John. Philosophical perspectives of practice: Traditional martial arts taekwondo vs. modern sports taekwondo. **The Journal of the International Association for Taekwondo Research**, v. 2, n. 2, p. 1-8, 2015.

- ESTEVAN, Isaac. Ensino do Taekwondo nas Escolas. *In: SANTOS, Sérgio Luiz (org.). Esportes de Combate: ensino na Educação Física Escolar.* Curitiba: CRV, 2016. v. 2, p. 221 – 256.
- ESTEVAN, Isaac *et al.* Segment coupling and coordination variability analyses of the roundhouse kick in taekwondo relative to the initial stance position. **Journal of Sports Sciences**, v. 34, n. 18, 1766–1773, 2016.
- FALCO, Coral *et al.* Influence of the distance in a roundhouse kick's execution time and impact force in Taekwondo. **Journal of Biomechanics**, v. 42, n. 3, p. 242-248, 2009.
- FALCO, Coral *et al.* Match analysis in a university taekwondo championship. **Advances in Physical Education**, v. 2, n. 1, p. 28-31, 2012.
- FARGAS, Ireno. **Taekwondo.** Barcelona: Total Press, 1990.
- FIGUEIREDO, Abel. Os exercícios de treino do Karate: introdução à posição de base fundamental (guarda). **Karate Portugal**, v. 3, p. 17-18, 2003.
- GARCÍA, Ana Maria *et al.* Fecal Incontinence in Older Patients.: a Narrative Review. **Cirugía Española**, v. 96, n. 3, p. 131-137, 2018.
- GONZÁLEZ, Cristina. **Caracterización técnico-táctica de la competición de combate de alto nivel en Taekwondo.** Efectividad de las acciones tácticas. 2011. Tesis (Doctorado en Actividad Física y Deporte) – Instituto Nacional de Educación Física de Cataluña. Barcelona: Universitat de Barcelona, 2011.
- GONZÁLEZ, Cristina; IGLESIAS, Xavier; ANGUERA, María Teresa. Tactical moves in top level competition taekwondo combat. A descriptive study. *In: SCIENTIFIC CONGRESS ON MARTIAL ARTS AND COMBAT SPORTS.* Viseu, Portugal: Associação para o desenvolvimento e investigação de Viseu, p. 48–49, 2011.
- GONZÁLEZ, Cristina *et al.* Sistematización de la acción táctica en el taekwondo de alta competición. **Apunts. Educació física i esports**, v. 103, n. 1, p. 56-67, 2011.
- GONZÁLEZ, Cristina; IGLESIAS, Xavier; ANGUERA, María Teresa. Detección de regularidades en taekwondo de alto nivel. **Cuadernos de Psicología del Deporte**, v. 15, n. 1, p. 99–110, 2015.
- GONZÁLEZ-GONZÁLEZ, Carina Soledad; NAVARRO-ADELANTADO, Vicente. A Structural Theoretical Framework Based on Motor Play to Categorize and Analyze Active Video Games. **Games and Culture**, p. 1-30, 2015. <https://doi.org/10.1177/1555412015576613>.
- GREEN, Bart; JOHNSON, Claire; ADAMS, Alam. Writing narrative literature reviews for peer-reviewed journals: secrets of the trade. **Journal of Chiropractic Medicine**, v. 5, n. 3, p. 101–117, 2006.
- GUTIÉRREZ, Carlos; PÉREZ, Mikel. Study on scientific production in martial arts in Spain from 1990 to present. *In: CYNARSKI, Wojciech Jan. Martial Arts and Combat Sports: Humanistic Outlook.* Rzeszow: Wydawnictwo Uniwersytetu Rzeszowskiego, 2009. p. 90-115.
- HERNÁNDEZ-MORENO, José. **Fundamentos del deporte.** Análisis de las estructuras del juego deportivo. Barcelona: Inde, 1994a.
- HERNÁNDEZ-MORENO, José. Hacia un análisis praxiológico del deporte. **Revista de Entrenamiento Deportivo**, v. 8, n. 2, p. 5-10, 1994b.

HERNÁNDEZ-MORENO, José *et al.* Diachronic analysis of motor communication in traditional games and sports of the canary island. **Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte**, v. 15, n. 57, p.123-137, 2015.

IGLESIAS, Xavier *et al.* Interacción competitiva y presión ambiental en deportes de combate: Aplicación de la metodología observacional. **Revista Iberoamericana de Psicología del Ejercicio y el Deporte**, v. 5, n. 2, p. 267-282, 2010.

JIMÉNEZ, Francisco. Análisis estructural de las situaciones de enseñanza en los deportes colectivos. **Acción Motriz**, v. 6, p. 39-57, 2011.

KAZEMI, Mohsen; CASELLA, Claudia; PERRI, Giovanni. 2004 Olympic Tae Kwon Do Practitioner Profile. **The Journal of the Canadian Chiropractic Association**, v. 53, n. 2, p. 144-152, 2009.

KAZEMI, Mohsen; PERRI, Giovanni; SOAVE, David. A profile of 2008 Olympic taekwondo competitors. **The Journal of the Canadian Chiropractic Association**, v. 54, n. 4, p. 243-249, 2010.

KAZEMI, Mohsen *et al.* A profile of Olympic taekwondo competitors. **Journal of Sports Science & Medicine**, v. 5, p.114–121, 2006.

KIM, Jae-Wong *et al.* The effects of target distance on pivot hip, trunk, pelvis, and kicking leg kinematics in Taekwondo roundhouse kicks. **Sports Biomechanics**, v. 9, n. 2, p. 98–114, 2009.

KNAPP, Barbara. **La habilidad en el deporte**. Valladolid: Miñón, 1979.

KRUSZEWSKI, Artur *et al.* Effect of changes in the sports regulations on the fight of taekwondo female players on the example of Beijing Olympic Tournaments 2008 and London 2012. **Journal of Combat Sports and Martial Arts**, v. 5, n. 2, p. 97-100, 2014.

KWOK, Heather Hei Man. Discrepancies in fighting strategies between Taekwondo medalists and non-medalists. **Journal of Human Sport & Exercise**, v.7, n. 4, p. 806-814, 2012.

LASIERRA, Gerard. **Balonmano: la relación entre los sistemas de juego, los procedimientos colectivos y su eficacia**. Lleida: Universidad de Lleida, 2017.

LEES, Adrian. Technique analysis in sports: a critical review. **Journal of Sports Sciences**, v. 20, n. 10, p. 813-828, 2002.

LÓPEZ, Enrique. **El tocado con fondo en la esgrima de alto nivel: estudio biomecánico del fondo en competición. El golpe recto clásico**. Madrid: Universidad Politécnica de Madrid, 2008.

LOSITO, Guisepe. **Lecciones de tae kwon do**. Barcelona: De Vecchi, 2001.

MATSUSHIGUE, Karin; HARTMANN, Katia; FRANCHINI, Emerson. Taekwondo: Physiological responses and match analysis. **Journal of Strength and Conditioning Research**, v. 23, n. 4, p. 1112–1117, 2009.

MENESCARDI, Cristina. **Análisis técnico-táctico en taekwondo femenino: Un estudio de los Juegos Olímpicos de Londres 2012**. 2017. Tesis (Doctorado en Ciencias de la Actividad Física y el Deporte) - Facultad de Ciencias de la Actividad Física y el Deporte. Valencia: Universidad Católica de Valencia, 2017.

MENESCARDI, Cristina. Defensive actions in Taekwondo. **Revista de Artes Marciales Asiáticas**, v. 11, n. 2s, p. 60-61, 2016.

MENESCARDI, Cristina *et al.* Diferencias técnico-tácticas en taekwondistas universitarios según sexo y categoría de competición. **Revista de Artes Marciales Asiáticas**, v. 7, n. 2, p. 1–11, 2012.

MENESCARDI, Cristina *et al.* Análisis del tiempo de lucha y no lucha en taekwondistas cadetes. **Sportis**, v. 2, n. 2, p. 164-176, 2016.

MENESCARDI, Cristina; ESTEVAN, Isaac. Detection of behavioural patterns in Olympic male taekwondo athletes. **Journal of Human Sport and Exercise**, v. 12, n. 2, p. 435-445, 2017.

MENESCARDI, Cristina *et al.* Generalizability Theory applied to Olympic male taekwondo combats. **European Journal of Human Movement**, v. 39, p. 65-81, 2017.

MENESCARDI, Cristina *et al.* Tactical aspects of a National university Taekwondo championship in relation to round and match outcome. **Journal of Strength and Conditioning Research**, v. 29, n. 2, p. 466–471, 2015.

MENESCARDI, Cristina *et al.* Development of a Taekwondo Combat Model Based on Markov Analysis. **Frontiers in Psychology**, v. 10, art. 2188, p.1-12, 2019a.

MENESCARDI, Cristina *et al.* Technical-Tactical Actions Used to Score in Taekwondo: An Analysis of Two Medalists in Two Olympic Championships. **Frontiers in Psychology**, v. 10, art. 2708, p.1-13, dec. 2019b. doi: 10.3389/fpsyg.2019.02708

MOENIG, Udo. The evolution of kicking techniques in taekwondo. **Journal of Asian Martial Arts**, v. 6, n. 1, p. 117–140, 2011.

MOENIG, Udo. **Taekwondo: from a Martial Art to a Martial Sport**. New York: Routledge, 2015.

MOENIG, Udo; CHO, Sungkyun; SONG, Hyeongseok. The Modifications of Protective Gear, Rules and Regulations During Taekwondo's Evolution—From its Obscure Origins to the Olympics. **The International Journal of the History of Sport**, v. 29, n. 9, p. 1363–1381, 2012.

MYONG, Kyong. **Taekwondo Kyorugi: la competición**. Barcelona: Hispano Europea, 2001.

NAVARRO, Vicente; JIMÉNEZ, Francisco. Un modelo estructural-funcional para el estudio del comportamiento estratégico en los juegos deportivos. **Educación Física: renovar la teoría y la práctica**, n. 71, p. 5-14, 1998.

OLIVÉ, Ramón. **Estudio de la cadera del practicante de taekwondo**. 2005. Tesis (Doctorado en Medicina)- Facultad de Medicina. Barcelona: Universidad Autónoma de Barcelona, 2005.

PARLEBAS, Pierre. **Contribution a un léxique commenté en science de la action motrice**. Paris: INSEP, 1981.

PARLEBAS, Pierre. **Juegos, deporte y sociedad**. Léxico de praxiología motriz. Barcelona: Paidotribo, 2011.

PARLEBAS, Pierre. **Elementos de sociología del deporte**. Málaga: Unisport, 2003.

PIETER, Willy. Performance characteristics of elite taekwondo athletes. **Korean Journal of Sport Science**, v. 3, n.1, 94–117, 1991.

PLOTNIKOW, Gustavo Adrián *et al.* Acondicionamiento del gas inhalado en pacientes con vía aérea artificial. Revisión narrativa. **Revista Brasileira de Terapia Intensiva**, v. 30, n. 1, p. 86-97, Mar. 2018.

POLISZCZUK, Tatiana *et al.* Somatic profile of elite polish female taekwon-do (ITF) athletes and their relationships to performance. *In*: NIŻNIKOWSKI, Tomasz *et al.* (Ed.). **Coordination Abilities in Physical Education, Sports and Rehabilitation**. Poland: International Association of Sport Kinetics, 2016. p. 202-217.

PYCIARZ, Tomasz. Analysis of sport fight structure in Taekwondo during the Olympics in Beijing in 2008 and Senior World Championships in 2009 in terms of technical skills after regulation and implementation of the electronic system of score recording. **Journal of Combat Sports and Martial Arts**, v. 2, n. 2, p. 109-115, 2011.

RENSHAW, Ian *et al.* Why the Constraints-Led Approach is not Teaching Games for Understanding: A clarification. **Physical Education and Sport Pedagogy**, v. 21, n. 5, p. 459–480, 2016.

RENSHAW, Ian *et al.* 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**, v. 15, n. 2, p. 117–137, 2010.

RIERA, Joan. Estrategia, táctica y técnica deportivas. **Apunts**, v. 39, p. 45–56, 1995.

RUIZ-SANCHIS, Laura; ROS, Concepción; BASTIDA, Anabel. **Iniciación a la esgrima escolar**: secundaria. Barcelona: Inde, 2016.

SAMPEDRO, Javier. **Fundamentos de táctica deportiva**: análisis de la estrategia de los deportes. Madrid: Gymnos, 1999.

SANTOS, Víctor; FRANCHINI, Emerson; LIMA-SILVA, Adriano. Relationship between attack and skipping in taekwondo contests. **Journal of Strength and Conditioning Research**, v. 25, n. 6, p. 1743–1751, 2011.

SOBRIDO, María; RUMBO-PRIETO, José María. The systematic review: Plurality of approaches and Methodologies. **Enfermería Clínica**, v. 28, n. 6, p. 387-393, 2018.

SZABÓ, Laszlo. **Fencing and the Master**. Budapest: Ed. Corvina, 1977.

TORRES, Fernando. **El karate deportivo, estudio praxiológico**; análisis del kumite deportivo en la modalidad de shiai-kumite:(estudio histórico y kinantropométrico). 1997. Tesis (Doctorado en Educación Física) - Las Palmas: Universidad de Las Palmas de Gran Canaria, 1997.

WORLD TAEKWONDO FEDERATION (WTF). **Competition rules**, 2018. Available at: http://www.wtf.org/wtf_eng/site/rules/competition.html. Accessed on: 20 dec. 2018.