

<https://doi.org/10.5232/ricyde2019.05501>

Estimating motor competence through motor games Estimar la competencia motriz mediante juegos motores

Miguel Pic¹, Pere Lavega-Burgués²

1. University of La Laguna. Spain

2. National Institute of Physical Education of Catalonia (INEFC), University of Lleida. Spain

Abstract

The main objective of the work is to address the estimation of the motor competence of girls and boys from the spontaneity of the motor game. 112 individuals of mixed groups were selected ($M = 14.2$, $SD = 2.2$) for the practice of two motor games. An observational methodology was used through a nomothetic, following and multidimensional design, with the assistance of two expert observers for the registration. The registration tool consisted of 19 categories, grouped into 3 macrocriteria. All the decisions of the protagonists were classified according to their gender, game role, quality of motor behavior and cooperative or antagonistic sense of the decision observed. Chi-square and multivariate analysis were applied (Chaid Model), being variables Cartesian tested in their double function (VD / VI). Among the most relevant results, revealing a differentiated participation according to the gender of the protagonists, girls registered similar values in effective behaviors in both games ($J1 = 186$, $J5 = 183$) unlike the boys ($J1 = 240$, $J5 = 307$). The predictive capacity of motor decisions when playing through the valence ($p < .001$) and role ($p < .001$) among others, were the most determinant variables. Evaluating motor competence through motor games is viable without altering the validity of the curriculum and the spontaneity of the contextualized decision.

Key words: motor competence; context; decision; motor game.

Resumen

El principal objetivo del trabajo es abordar la estimación de la competencia motriz de las niñas y niños desde la espontaneidad del juego motor. Se seleccionaron 112 individuos de grupos mixtos ($M = 14,2$; $SD = 2,2$) para la práctica de dos juegos motores. Se empleó una metodología observacional mediante un diseño nomotético, seguimiento y multidimensional, contándose con la asistencia de dos observadores expertos para el registro. La herramienta de registro constó de 19 categorías, agrupadas en 3 macrocriterios. Todas las decisiones de los protagonistas fueron clasificadas en función del género del protagonista, rol de juego, calidad de la conducta motriz y sentido cooperativo o antagonista de la decisión observada. Se aplicaron análisis Chi-square y multivariantes (Chaid Model), siendo probadas cartesianamente las variables en su doble función (VD/VI). Entre los resultados más relevantes, se revelaba una participación diferenciada según el género de los protagonistas, las chicas registraron valores similares en comportamientos efectivos en ambos juegos ($J1 = 186$, $J5 = 183$) a diferencia de los chicos ($J1 = 240$, $J5 = 307$). La capacidad predictiva de las decisiones motrices cuando se juega mediante la valencia ($p < ,001$) y el rol ($p < ,001$) entre otras, fueron de las variables más determinantes. Estimar la competencia motriz mediante juegos motores es viable sin alterar la vigencia del curriculum y la espontaneidad de la decisión contextualizada.

Palabras clave: competencia motriz; contexto; decisión; juego motor.

Correspondence/correspondencia: Miguel Pic Aguilar
Universidad de la Laguna. España
Email: pic.aguilar.90@ull.edu.es

Introduction

Clumsy children in physical education class represent a challenge for teachers. Motor competence (MC) finds in physical education (PE) an adequate context for its evaluation and development. It is a priority to develop tools which provide teachers with mechanisms to detect the state of motor competence. In order to fulfill this aim, offering appropriate contexts (Chow, Davids, Button & Renshaw, 2016) is prescriptive in formal education. The programming of participatory practices, in compliance with curricula by competences (Gordon et al., 2009) has in the design of tasks a motive for the vindication of the teaching role. The motor game in PE class allows a casual climate, conducive to the education of interpersonal skills (Sáez de Ocáriz, Lavega & March, 2013).

The original concept of MC (Ruiz, 1995) refers to knowledge, procedures, attitudes and feelings involved in the interactions between participants in a given medium. Thus, assessing MC would imply knowing the effectiveness of students in complex motor tasks in a given medium (Ruiz, 2014, Ruiz-Pérez, Rioja-Collado, Graupera-Sanz, Palomo-Nieto & García-Coll, 2015). The harmony of the actions would be related to the motor coordination (Meinel & Schnabel, 2004), implying for it the adaptation of motor practice in relation to objectives. Both concepts share, this way, a certain conceptual equivalence. Due to this reason, test batteries based on coordinative aspects of motor competence are known, applied with 3 to 6-year-old children in pre-school education (Ayán, 2013). Also, there are favorable correlations between competence and motor coordination with 3 to 18-year-old young people (Barnett., et al 2016).

When a PE teacher participates in research tasks, there are often difficulties to be overcome, such as the existence of rigid research protocols or the overcrowding of the number of students. This issue usually originates the scarcity of initiatives or, at best, the undertaking of isolated actions, devoid of scientific validations. Hence, it is relatively common to find a certain shortage in the validation of protocols (Ruiz-Pérez, Barriopedro-Moro, Ramón-Otero, Palomo-Nieto, Rioja-Collado, García-Coll & Navia-Manzano, 2017) in school contexts for the development of CM. However, although the abuse of 'ad hoc' protocols meant in the past a departure from scientific approaches, it is now possible to carry out studies, such as those based on observational methodology adapted to the usual conditions of the educational practice. This is not a minor advance, since it implies a reevaluation of the contextualized practice (Anguera, 2017, Anguera & Hernández-Mendo, 2014; Anguera & Hernández-Mendo, 2016; Anguera, Portell, Chacón-Moscoso & Sanduvete-Chaves, 2018) that has been contrasted through football studies (Diana et al., 2017), motor games in triads (Aguilar, Navarro-Adelantado & Jonsson, 2018) or effectiveness in volleyball actions (Palao, Manzanares & Ortega, 2009), among others. Thus, the use of an observational methodology is based on rigor and flexibility to adapt to the spontaneity of the motor situation, which makes it especially suitable.

Differences were found favorable to the boys (Ruiz & Graupera, 2003) in throwing tasks or catching balls with participants aged between 7-8 and 11-12. In this line (Thomas & French, 1985), pitches are common actions in PE classes, being the motor game a device to contrast in practice. Unveiling the hidden and interactive motor language through roles (Parlebas, 2001) can help reveal the quality or adequacy of each decision. Each motor game is described by its internal logic and, among other applications, finding possible asymmetries based on roles or sex involved in each motor game would be useful for help to the teacher. On the other hand, the quality or effectiveness of the behavior can also be affected by the positive (collaboration) or negative (antagonism) sign of the valence (Heider, 1946).

In a context of motor game (Cantó & Ruiz, 2005), girls experience more intense positive emotions than boys when practicing the same cooperative games (Lavega, Lagardera, March, Rovira & Araújo, 2014). Subsequently, it is noted that cooperation is preferred by girls while boys opt for rivalry (Lavega, Alonso, Etxebeste, Lagardera & March, 2014; Muñoz, Lavega, Serna, Sáez de Ocáriz & March, 2017).

From the approach of teaching and games for understanding (TfGU), there were differences between girls and boys when playing at different ages. While the boys surpassed (García & Gutiérrez, 2012) the girls in greater participation, number of shots or in movements with ball, on the other hand the girls scored more than the boys in the development of a spectator role. Despite the repercussion in research of the tactical models (Bunker & Thorpe, 1982, Sánchez-Gómez, Devis-Devis & Navarro-Adelantado, 2014) there was no lack of voices suggesting (Nathan, 2016) the revision of the pedagogical model originally proposed. Thus, starting from previous advances the nonlinear pedagogy transformed the pedagogical application starting from the key concept 'constrains' (Renshaw et al., 2016) to modulate the motor learning resident in the triangle formed by task-apprentice-context. Understanding by task (e.g., the rule and strategic components), apprentice (e.g., emotional factors) and context (e.g., climatological factors).

From the theory of motor action (Parlebas, 1988; Parlebas, 2001; Parlebas, 2018) there are proliferating investigations that study the motor behaviors of the participants from the decisional and emotional points of view. The study conducted in psychomotor games with university students shows that the effectiveness of actions explains a good part of the emotional itinerary of the players (Lavega-Burgués, Lagardera, Prat-ambròs, Muñoz-Arroyave & Costes, 2018). With a similar approach, there has also been a direct relationship between the decisions and emotions of young university students when participating in the paradoxical game 'the seated ball' (Lavega, Prat, Sáez de Ocáriz, Serna & Muñoz-Arroyave, 2018). It is a paradoxical game since players can decide at any time if they want to cooperate with or oppose the rest of the players. In another investigation, this same game has been used to study by means of a sociomotor test the system of elections and rejections of the players (Oboeuf, Collard & Gérard, 2008).

For all of the above, regarding decisional competence (Ruiz-Pérez, Navia, Miñano-Espín, García-Coll & Palomo-Nieto, 2015) is one of the key aspects based on the identification of the level of motor competence of the participants when they try to find the right answers in any motor situation. Therefore, it could be of great interest to provide the teacher with a registration system to identify how their students adapt to participating in the motor tasks during PE classes.

Based on these considerations, the present study proposed the following objectives:

- a) Determining motor behaviour quality (effective and ineffective) of players (girls and boys) when practicing two motor games (1 and 5).
- b) Examining if boys and girls carry out the same type of motor relations (positive and negative valence) in the roles of the game (live and prisoner).
- c) Revealing the predictive capacity of the different variables studied on the quality of motor behaviors (effective and ineffective) associated with the internal logic of the games: type of game (according to motor communication network), valence of motor relations (positive and negative), roles; and associated with the gender of the students.

Method

Design

The present study was based on Quadrant III (Anguera, Blanco, Hernández & Losada, 2011) belonging to N/F/M, which means it is: nomothetic, since different players were observed; following, because teams and players registered were the same in two different moments; and also, multidimensional, because different criteria sets were involved to design the observation tool.

Participants

The selection of participants was intentional (Amatria, Lapresa, Arana, Anguera & Garzón 2016). Five class groups were divided into three public centers in Tenerife and Fuerteventura. The number of participants was 68 girls and 44 boys aged between 12 and 17 ($M = 14.2$, $SD = 2.2$). This study was approved by the schools' boards of principals and by the students' families, who authorized the visual recording of images. All the subjects took part voluntarily with written informed consent from all legal tutors (Declaration of Helsinki).

Instruments

Lince software (Gabin, Camerino, Anguera & Castañer, 2012) was used to design an observational 'ad hoc' tool that allowed to record the motor actions of the players. The instrument combined the characteristics of the category system and the field format. The tool consisted of 19 categories, mutually exclusive (Anguera, 1991), grouped into 3 criteria: a) boy or girl; b) live or prisoner role; c) effective or ineffective actions of the motor behavior. A description of the categories was prepared (Annex 1) to facilitate their understanding. As an example, if a player (G) using the role Live (LT), makes a failed throw (I) but the ball does not reach its destination, it would correspond to the record G(girl)-LT (live, thrower)-I (ineffective).

While an example of collaboration is passing the ball (positive valence), throwing the ball against another player would be a decision of opposition (negative valence). Positive valence (when the decision or sub-role was to cooperate); seven positive decisions (sub-roles) were identified: LP, LSP, PP, PSP, PR, POR and LbR. Negative valence (when the decision was to oppose); eight negative sub-roles were identified: LT, LST, PT, PST, PRv, LbD, LbF and LbRv.

Each category of live and prisoner role includes decisions (sub-roles, Parlebas, 2001) that involve a motor relationship of positive or negative valence (Heider, 1946). While an example of collaboration is passing the ball (positive valence), throwing the ball against another player would be a decision of opposition (negative valence). Thus, the game sub-roles were coded as follows below. Positive valence (when the decision or sub-role was to cooperate); seven positive decisions (sub-roles) were identified: LP, LSP, PP, PSP, PR, POR and LbR. Negative valence (when the decision was to oppose); eight negative sub-roles were identified: LT, LST, PT, PST, PRv, LbD, LbF and LbRv.

Procedure

Two motor games used in a didactic unit were practiced, following the motor communication network criterion (Parlebas, 1988) and previous available researches (Oboeuf, Collard, & Gérard, 2008; Lavega et al, 2018), among others. The first motor game (J1) was called 'the cornered' and developed a confrontation between two teams with an exclusive-stable communication network 2 (symmetric duel, Parlebas, 2001). In this motor game, a soft ball was available so that the players with the live role could perform cooperative motor actions with partners (passing the ball with a bounce) or oppositional motor actions (throwing the ball through the air to an adversary). If a player received a pitch, he would move to the role of

prisoner and would have to crouch in the place where he had received the pitch. If a prisoner gets a ball, he passes to the live role. The winner team had to be capable of capturing all the opponents.

In the second game (J5), known as 'sitting ball', all players could cooperate or oppose each other indiscriminately, so this game had an ambivalent-unstable-fluctuating communication network (Parlebas, 2001). Unlike the previous game, there were no teams since a ball was dealt and it was the players who chose who they allied with by passing it with a bounce (teammates) and with whom they rivaled through pitches (rivals). So, the decision was always individual, but the need to collaborate was vital in order to achieve the goal of becoming the last living player. Thus, only one player could win. The rest of the rules were identical to the previous game.

Each teacher was in charge of carrying out the motor games and protocol actions with his or her own students. Their function was to explain the rules and clarify possible doubts about the game. The experience was carried out during the conventional hours of physical education, so the research team was present during the recordings. Prior to our attendance at the educational centers, two cameras were installed that simulated real recordings to moderate the reactive effect. During the session prior to the final recording, a test of the motor games was made so that the students could ask questions related to the normative application of each game. Finally, the recording of the images was made without interrupting the games. The estimated recording time was never less than three minutes with each game for each of the five natural physical education class groups.

The quality of the records was guaranteed through the agreement between two expert observers. After a period to agree on the mixed registration system, images of the same games from protocol tests were used to finish up the molecularity or categorial amplitude. Then the records of the two observers (inter-observers) were made at two different times (intra-observers). Kappa coefficients were applied both to inter and intra-observers, always reaching values higher than (>.80) which confirmed the quality 'very good' of the records (Altman, 1991).

Data Analysis

The data quality was checked through Cohen's kappa. The analyses were completed with IBM SPSS 24 (IBM Corp., 2016), univariate analysis was applied using crosstab with adjusted residual (Pearson's Chi-square, 2x2) and multivariate classification trees (predictive Chaid model). Chaid model trees were used (Morgan & Sonquist, 1963) to reveal the interactive behavior of all independent and dependent variables. Cross validation and minimum cases in parent node (100) and minimum cases in child node (50) from the variables. For all the analysis, we started with levels of significance ($p < .05$).

Results

The total number of behaviors recorded by the observers was 1259. In the motor game 'the sitting ball' (J5), the boys staged a greater number of effective behaviors ($n = 307$) than the girls ($n = 183$). Ineffective behaviors were less than 100 in both girls and boys.

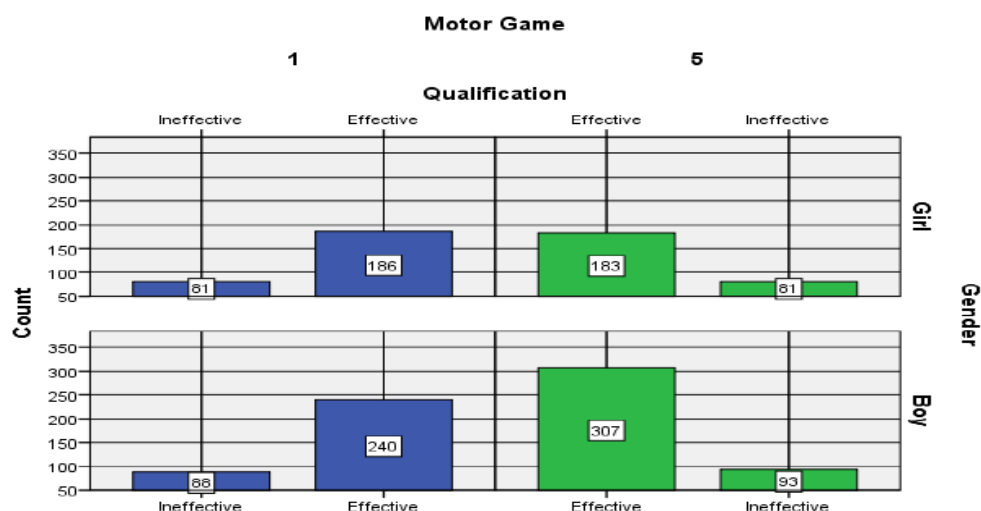


Figure 1. Behaviors recorded by observers based on qualification (effective, ineffective), gender (girl, boy), motor game (exclusive game (1), ambivalent game (5)).

The results of the game (J1) showed a superiority in the effective decisions of boys over girls (J1 = 595, J5 = 664). The girls registered similar values in effective behaviors in both games (J1 = 186, J5 = 183) unlike the boys (J1 = 240, J5 = 307).

Table 1. Crosstabs by gender (girls, boys) and motor behavior quality (effective, ineffective).

Gender	Count, % and adjusted residuals	Effective	Ineffective	Total
Girl	Frecuencias	369	162	531
	% within Gender	69.5%	30.5%	100%
	% within Qualification	40.3%	47.2%	42.2%
	Adjusted residual	-2.2*	2.2*	
Boy	Frecuencias	547	181	728
	% within Gender	75.1%	24.9%	100%
	% within Qualification	59.7%	52.8%	57,8%
	Adjusted residual	2.2*	-2.2*	
Total	Frecuencias	916	343	1259
	%	72.8%	27.2%	100%

Note: * Level of significance $p < .05$

In Table 1, there was a higher participation of boys ($n = 728$, 57.8%) over girls ($n = 531$, 42.2%). It was also observed that in both boys and girls there were significant differences ($p = .026$) in the type of motor behavior, so that there was a higher percentage of effective behaviors ($n = 916$, 72.8%) than ineffective ($n = 343$, 27.2%). However, when comparing the proportional values within each gender, it was evident that while the boys tripled the margins of effectiveness with respect to the ineffectiveness, the girls were closer to double them.

Table 2. Hierarchical ordering of independent predictor variables on dependent variables. Each model has CC (% cases correctly classified through cross validation tree).

1 ^a predictive VARIABLE	1 ^a variable Categories	2 ^a predictive VARIABLE	2 ^a variable Categories	3 ^a predictive VARIABLE	3 ^a Variable Categories
Dependent Variable: QUALITY OF BEHAVIOR (Effective, Ineffective); CC: 72.8% (Figure 2)					
VALENCE RELATIONSHIP (<.001)	Negative	ROLE(<.001)	Live	GENDER(=.025)	Girl
			Prisoner		Boy
	Positive	GAME(=.002)	J1	ROLE(=.022)	Prisoner
			J5		Live
Dependent Variable: Type of GAME (J1, J5); CC: 58.5%					
VALENCE RELATIONSHIP (<.001)	Negative				
	Positive	ROLE (<.001)	Prisoner		
			Live	GENDER(=.046)	Boy
					Girl
Dependent Variable: Type of ROLE (Live, Prisoner); CC: 85.4%					
VALENCE RELATIONSHIP (<.001)	Negative	QUALITY OF BEHAVIOR (<.001)	Ineffective		
			Effective		
	Positive	GAME (<.001)	J1	GENDER(<.010)	Boy
					Girl
			J5	GENDER(<.001)	Boy
				Girl	
Dependent Variable: VALENCE RELATIONSHIP (Positive, Negative); CC: 67.7%					
ROLE (<.001)	Prisoner	GENDER(=.012)	Girl		
			Boy		
	Live	QUALITY BEHAVIOR (<.001)	Ineffective	GAME (<.001)	J1
					J5
			Effective	GAME (<.001)	J1
				J5	
Dependent Variable: GENDER (Girl, Boy); CC: 60.1%					
ROLE (<.001)	Prisoner	VALENCE RELATIONSHIP (=.012)	Positive		
			Negative		
	Live		Ineffective	GAME(=.017)	J1
		QUALITY OF BEHAVIOR (=.006)			J5
		Effective			

Note. The columns order the variables and their categories from highest to lowest predictive capacity. The rows sort the variables, top to bottom, from the largest to the smallest magnitude in the values.

The valence of the relationship was the first predictive variable (independent variable = IV) (<.001) to be considered in three of the five decision trees to explain the variables (dependent variables = DV): quality of behavior (CC: 72.8 %), the type of game (CC: 58.5%) and the type of role (CC: 85%). It was also the second variable with the strongest predictive power to explain the behavior according to the gender of the protagonists. When it comes to explaining the main

variables to be considered in ineffective motor behaviors, the first predictive variable was the negative valence of the motor relations (opposition relation) that had a greater presence in the live role and especially when they were carried out by the girls' ineffective behaviors were more present in game J1 than in game J5.

The variable Role ($p < .001$) was the first predictive variable used to explain the type of valence of the relationships (CC: 67.7%) and the behavior of girls and boys. In the first case, according to the valence of relationships (DV), cooperation was mainly present in the role of prisoner and was mainly played by girls. In contrast, in the live role, from effective and ineffective behaviors emerged games one and five in both cases, showing a greater negative character of the relationship in the game J5, compared to the game J1.

Finally, through the variable gender (DV) (CC: 60.1%) it was clear that boys had more effective decisions ($n = 477$, 63%) than girls ($n = 283$, 37%) in the live role but similar percentages in ineffective decisions, boys ($n = 167$, 54%) and girls ($n = 144$, 46%). Of these effective decisions, although similar percentages were taken in the two motor games, however the girls showed less initiative in the game one with fewer decisions ($n = 153$, 42%) than boys $n = 215$; 58%), this difference was extended in game five when percentages were assigned between girls and boys, respectively ($n = 130$, 33%) ($n = 262$, 67%).

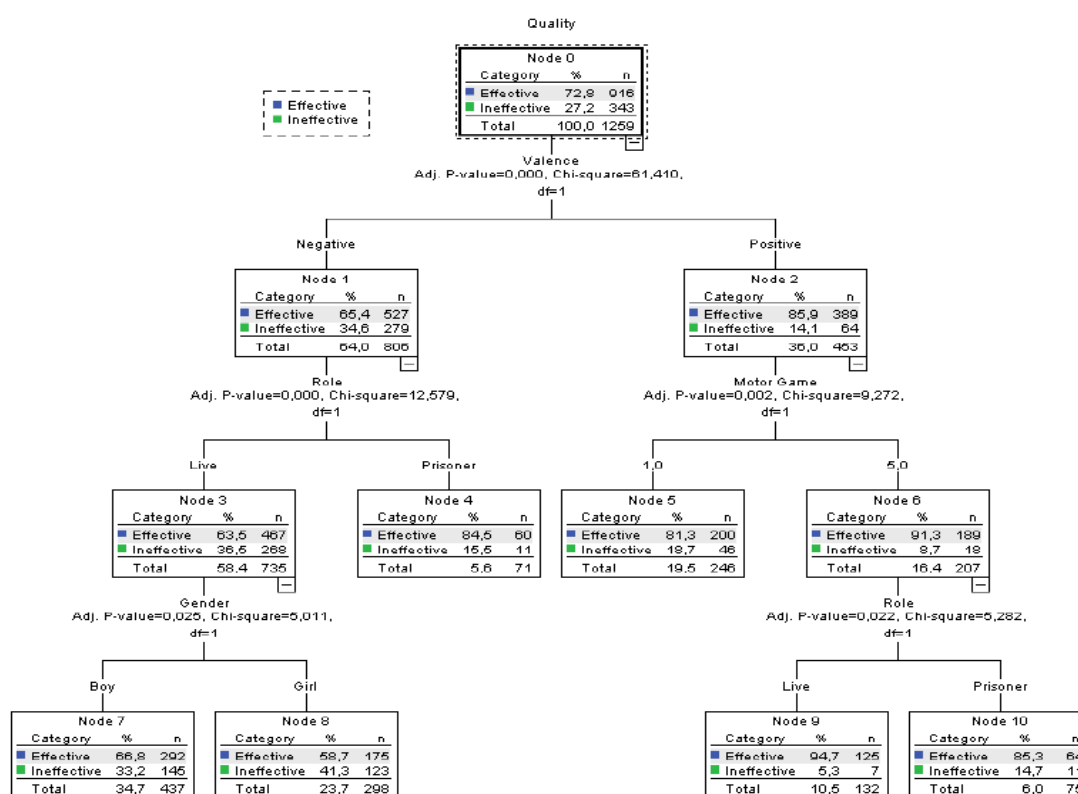


Figure 2. Tree of predictive variables (IV): gender (girl/boy), rol (live/prisoner), valence (positive/negative), game (1.0 'the cornered'/5.0 'the sitting ball'), taking into account over motor behaviour quality (DV): effective / Ineffective.

Given the limited space to include all the trees, we chose to include as an example figure 2 referring to the tree that classifies the different independent variables according to their explanatory capacity on the dependent variable quality of motor behaviors (effective or ineffective) ($p < .001$, Chi square = 61,410).

Node 1 shows that the players mostly performed effective behaviors (72.8%) in relation to ineffective behaviors (27.2%). The first decision that the PE teacher should take to predict the quality of the behaviors should be the valence of the relationships, observing greater efficiency (85.9%) in positive relationships (cooperation, node 2) and greater inefficiency (34, 6%) in negative relationships (opposition, node 1). The valence type of the relationships was associated with different predictive factors.

Cooperation relations depended first on the type of game (J1, node 5), showing that game 1 originated a higher percentage of ineffective behaviors (18.7%) than in game 5 (8.7%). The proportion was reversed in effective behaviors. To predict the type of positive valence motor behavior in J5, the last variable to consider should be the type of role (nodes 9 and 10). Effective and ineffective behaviors were more present in the role of prisoner than in the live role.

The oppositional relations (negative) depended first of all on the type of role (nodes 3 and 4). Effective behaviors were predominantly in the prisoner role (84.5%), unlike the opposition ineffective ones that had a greater presence in the live role (63.5%). In this live role the last predictive variable to consider was gender (nodes 7 and 8). The girls performed a higher percentage of ineffective behaviors (41.3%) than the boys (33.2%). This proportion was inverted in effective behaviors (boys = 66.8%, girls = 58.7%).

Discussion

The aim of this work was to estimate the motor competence in PE class. To achieve this goal, the quality of effective and ineffective motor behaviors from a gender perspective was studied, as well as the type of motor relations of positive and negative valence of the protagonists in two games with a different motor communication network. Likewise, the predictive capacity of the chosen variables was studied by considering as dependent variables the quality of motor behavior, the valence of motor relationship, gender and type of game.

The methodology used has made it possible to respond to these objectives. The context of motor competition is the context of physical education, it is the context of the game, in which girls and boys take the playground for a casual practice. It is necessary to address motor competence (Ruiz, 1995) in natural environments, where spontaneity (Cantó & Ruiz, 2005) brings out the true capacity of the player. The observational methodology has provided the opportunity to study the motor action, linked to the objectives of its protagonists in the context of the game (Aguilar, Navarro-Adelantado & Jonsson, 2018; Chow et al., 2016). The PE teacher, motivated by the search for teaching tools, finds in the analysis of motor episodes a mean to evaluate the motor competence and to know the authors better from the dynamic view of the motor game.

The increase and improvement of motor competence in PE classes has been reviewed and verified (Logan, Robinson, Wilson & Lucas, 2012). By using the game, the teacher has a direct contact with the motor reality of their students, sometimes not very valued. This undervalued character of the motor practice may have been a reason to act with some improvisation, due in part to the lack of validated protocols (Ruiz-Pérez et al., 2017).

The findings show differences between both genders in the effectiveness of their decisional motor behaviors. Boys make more effective decisions than girls in games where there are opponents. This evidence is in line with other studies (e.g., Kountouris, Drikos, Aggelonidis, Laios & Kyprianou, 2015). When assessing motor competence (Ruiz, 1995), the possible differences in girls' and boys' interventions should be recognized, in order to favor an inclusive physical education that does not attend to gender stereotypes or social asymmetries from an asymmetrical social point of view (Knight, 2002; Travers, 2008; Chalabaev, Sarrazin, Fontayne, Boiché & Clément-Guillotin, 2013), which could respond to cultural inferences. There is evidence in this

regard of the masculine model of high motor competence (Kirk, 2004) as a socially ingrained one (Soler, 2009) in PE classes (Oliver & Kirk, 2016).

Examining the motor competence of boys and girls should consider whether the effectiveness or inefficiency of the motor actions is linked to the valence of the game actions (Heider, 1946), that is, to the type of cooperation relationship (positive valence) or opposition (negative valence) performed. The findings confirm that it is the main predictive variable to interpret the decisional quality of the students' interventions. Previous experiences with motor games indicate the preference of girls for cooperation, while boys are comfortable with antagonistic relationships (Lavega, Alonso et al., 2014, Lavega, Lagardera et al., 2014, Muñoz et al., 2017). In relation to the alleged inability of the boys to cooperate, it has been questioned that they are incapable of doing it but, supported again the boys' fondness for antagonism (Kivikangas, Kätsyri, Järvelä & Ravaja, 2014).

To assess motor competence, it is necessary to look at the attribution of meanings conferred by the protagonists in practice (Parlebas, 2018). It is in context how decisions take value, and therefore the consideration of the type of role in which it is involved. In this study, it has been seen that it is the first predictive variable of the type of behavior of girls and boys and of the valence of the motor relations that they play. The analysis of roles in motor games is not novel (Parlebas, 1988), acting as a decisive but hidden supra-structure for the design of tasks or creation of registration systems for the evaluation of motor behaviors.

Recognizing that the roles of a game are associated with different decisions making and relationships, is key to interpreting the results of effective or ineffective students' behavior. In the games examined, the same decisions are not made when they are in the live role than when being in the prisoner role. In each of them, the difficulty of the actions is unequal (when throwing the ball to another living player that moves or passing it to another captive player who is sitting). Hence the need for the PE teacher to know that, according to the internal logic of any game, the learning context will be very different (Bunker & Thorpe, 1982; Renshaw et al., 2016).

The motor game 'the sitting ball' (J5) goes beyond the motor game 'the cornered' (J1) in strategic complexity. The ineffective behaviors are similar in terms of gender and play, although the boys slightly surpassed the girls in this section. The few differences that the girls experienced between game one and the sitting ball contrast with the increase in the first game. This can be understood as a strategic adaptation carried out by boys before the distinctive features of the internal logic of the motor game 'the sitting ball'. Perhaps the girls have perceived the challenge with an identical scheme between the motor game 'the cornered' (J1) and 'the sitting ball' (J5). This is a paradoxical game, with an ambivalent communication (Parlebas, 1988) in which the traditional concepts of partner / adversary lack permanent value and a continuous strategic dynamics appears. Although there is evidence to support that the practice of psychomotor games triggered emotions closely related to the effectiveness of the players, it was also found that the communicative ambivalence and the analysis of the comments expressed by young university students after practicing ' the sitting ball' showed ambivalence in their comments (Lavega-Burgués et al., 2018).

Unveiling the state of motor and decisional competence (Ruiz-Pérez et al., 2015) of students has in the motor game a spontaneous and contextualized alternative to estimate, together with other indicators, an adequate calculation. Perhaps the interactive nature of these games makes them, at the same time, a more socializing and interpersonal education proposal as opposed to a conception of psychomotor competence. The enrichment of the different forms of motor relationship should be contemplated within an ambitious conception of motor competence.

From the methodological point of view, it has been verified that the use of the observational methodology is of great interest to evaluate the motor behaviors of the students. Likewise, the application of the statistical technique of classification trees favors the identification of the predictive force of variables that intervene in the motor competence of the students.

In the section of limitations and future perspectives of research, advances should be made in the use of variables of the internal logic of the games and variables of subjective features of the students who are involved in them. In relation to the internal logic of the games, the number of motor games with different motor relationship structures could be increased; the repertoire of minimum decision units (subroles) could be considered for the role variable to specify the details associated with the motor responses. In relation to student variables, research should move forward by increasing the sample of participants in each age range. From a methodological point of view, the time of observational registration could be increased, together with the use of mixed methods that complement the obtaining of quantitative and qualitative data to delve into the interpretation of the results.

These future lines will add value to work in future research initiatives that help building protocols in the physical education class.

Conclusions

In this investigation three main sections of conclusions can be identified:

1. The study and evaluation of motor competence should be carried out in a contextualized manner, that is, through motor learning situations with a comprehensive and systemic participation of the protagonists. The motor game is an educational resource of the first magnitude to learn and being put to the test.
2. The notion of motor competence should go beyond aspects focused solely on motor execution. This study confirms that favoring a contextualized physical education should consider the variables that determine whether the motor behavior of students will be effective or ineffective. On the one hand, variables related to the internal logic of the game: type of game; valence of the motor relations (cooperation and opposition); and role of the game. These are variables that the PE teacher should recognize, employ and control. On the other hand, favoring a personalized PE also means recognizing the subjective characteristics of the students, such as the gender variable. It is necessary to identify the possible inequalities between girls and boys in order to try to guarantee equal opportunities for both genders.

References

- Altman, D.G. (1991). *Practical statistics for medical research*. London: Chapman and Hall.
- Aguilar, M.; Navarro-Adelantado, V., & Jonsson, G. K. (2018). Detection of Ludic Patterns in Two Triadic Motor Games and Differences in Decision Complexity. *Frontiers in Psychology*, 2259(8), 1-10.
<https://doi.org/10.3389/fpsyg.2017.02259>
- Amatria, M.; Lapresa, D.; Arana, J.; Anguera, M. T., & Garzón, B. (2016). Optimization of game formats in U-10 soccer using logistic regression analysis. *Journal of Human Kinetics*, 54(1), 163-171.
- Anguera, M. T. (1991). *Proceso de categorización*. En M.T. Anguera (Ed.), *Metodología observacional en la investigación psicológica*, 115-167. Barcelona: P.P.U., vol. I.
- Anguera, M. T.; Blanco, A.; Hernández, A.; Losada J. L. (2011). Observational designs: their suitability and application in sports psychology. *Cuadernos de Psicología del Deporte*, 11(2), 63-76.
- Anguera, M. T., & Hernández-Mendo, A. (2014). Metodología observacional y psicología del deporte. Estado de la cuestión. *Revista de Psicología del Deporte*, 23(1), 103-109.
- Anguera, M. T., & Hernández-Mendo, A. (2016). Advances in mixed methods observational studies in sports sciences. *Cuadernos de Psicología del Deporte*, 16(1), 17-30.
- Anguera M. T. (2017). Introduction to Monograph on Observational Data Analysis. *Annals of Psychology*, 33(3), 433-435.
- Anguera, M. T.; Portell, M.; Chacón-Moscoso, S., & Sanduvete-Chaves, S. (2018). Indirect observation in everyday contexts: concepts and methodological guidelines within a mixed methods framework. *Frontiers in Psychology*, 13(9), 1-20.
<https://doi.org/10.3389/fpsyg.2018.00013>
- Ayán, C. (2013). Valoración de la condición física en el contexto de la educación infantil. Aplicaciones prácticas. *Apunts. Educación Física y Deportes*, 112(2), 52-62.
- Barnett, L. M.; Lai, S, K.; Veldman, S. L.; Hardy, L. L.; Cliff, D. P.; Morgan, P. J., ... & Rush, E. (2016). Correlates of Gross Motor Competence in Children and Adolescents: A Systematic Review and Meta-Analysis. *Sports Medicine*, 46(11), 1663-1688.
<https://doi.org/10.1007/s40279-016-0495-z>
- Cantó, R., & Ruiz, L. M. (2005). Comportamiento Motor Espontáneo en el Patio de Recreo Escolar: Análisis de las diferencias por género en la ocupación del espacio durante el recreo escolar. *RICYDE. Revista Internacional de Ciencias del Deporte*, 1(1), 28-45.
- Chalabaev, A.; Sarrazin, P.; Fontayne, P.; Boiché, J., & Clément Guillotin, C. (2013). The influence of sex stereotypes and gender roles on participation and performance in sport and exercise: Review and future directions. *Psychology of Sport and Exercise*, 14(2), 136-144.
<https://doi.org/10.1016/j.psychsport.2012.10.005>
- Chow, J. Y.; Davids, K.; Button, C., & Renshaw, I. (2016). *Nonlinear pedagogy in skill acquisition: An introduction*. London: Routledge.
- Diana, B.; Zurloni, V.; Elia, M.; Cavalera, C. M.; Jonsson, G. K., & Anguera, M. T. (2017). How Game Location Affects Soccer Performance: T-Pattern Analysis of Attack Actions in Home and Away Matches. *Frontiers in Psychology*, 1415(8), 1-11.
<https://doi.org/10.3389/fpsyg.2017.01415>
- Gabin, B.; Camerino, O.; Anguera, M. T., & Castañer, M. (2012). Lince: Multiplatform sport analysis software. *Procedia-Social and Behavioral Sciences*, 46(1), 4692-4694.
<https://doi.org/10.1016/j.sbspro.2012.06.320>

García, L. M., & Gutiérrez, D. (2012). Gender differences in the game behaviour in invasion games. *Physical Education and Sport Pedagogy*, 17(3), 289–301.

Gordon, J.; Halasz, G.; Krawczyk, M.; Leney, T.; Michel, A.; Pepper, D.; Putkiewicz, E., & Wisniewski, J. (2009). Key Competences in Europe (2009). Opening doors for lifelong Learners across the school curriculum and teacher education. CASE Network Reports, 87, 328.

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1517804

Heider, F. (1946). Attitudes and cognitive organization. *The Journal of Psychology*, 21(1), 107-112.

IBM Corp. (2016). *IBM SPSS Statistics for Windows*, Version 24.0. Armonk, NY: IBM Corp.

Kirk, D. (2004). Framing quality physical education: The elite sport model or sport education? *Physical Education and Sport Pedagogy*, 9(2), 185–95.

Kivikangas, J. M.; Kätsyri, J.; Järvelä, S., & Ravaja, N. (2014). Gender differences in emotional responses to cooperative and competitive game play. *PLoS ONE*, 9(7), e100318.

Knight, J. (2002). Sexual stereotypes. *Nature*, 415, 254–256.

<https://doi.org/10.1038/415254a>

Kountouris, P.; Drikos, S.; Aggelonidis, I.; Laios, A., & Kyprianou, M. (2015). Evidence for differences in men's and women's volleyball games based on skills effectiveness in four consecutive Olympic tournaments. *Comprehensive Psychology*, 4(9) 1-7.

<https://doi.org/10.2466/30.50.CP.4.9>

Lavega, P.; Alonso, J. I.; Etxebeste, J.; Lagardera, F., & March, J. (2014). Relationship between Traditional Games and the Intensity of Emotions experienced by Participants. *Research Quarterly for Exercise and Sport*, 85(4), 457-467.

<https://doi.org/10.1080/02701367.2014.961048>

Lavega, P.; Lagardera, F.; March, J.; Rovira, G., & Araújo, P. (2014). Efeito da cooperação motriz na vivência emocional positiva: perspectiva de gênero. *Movimento*, 20(2), 593-618.

Lavega-Burgués, P.; Lagardera, F.; Prat-Ambròs, Q.; Muñoz-Arroyave, V., & Costes, A. (2018). Emotional map of psychomotor games without competition. *Current Psychology*.

<https://doi.org/10.1007/s12144-018-9809-7>

Lavega, P.; Prat, Q.; Sáez de Ocáriz, U.; Serna, J., & Muñoz-Arroyave, V. (2018). Reflection-on-action learning through traditional games. The case of la pelota sentada (sitting ball). *Cultura y Educación*, 30(1), 142-176.

<https://doi.org/10.1080/11356405.2017.1421302>

Logan, S. W.; Robinson, L. E.; Wilson, A. E., & Lucas, W. A. (2012). Getting the fundamentals of movement: a meta-analysis of the effectiveness of motor skill interventions in children. *Child: Care, Health and Development*, 38(3), 305-315.

Morgan, J. N., & Sonquist, J. A. (1963). Problems in the analysis of survey data, and a proposal. *Journal of the American statistical association*, 58(302), 415-434.

Muñoz, V.; Lavega, P.; Serna, J.; Sáez de Ocáriz, U., & March, J. (2017). Estados de ánimo al jugar en solitario o en cooperación: dos vivencias motrices y afectivas desiguales. *Anales de psicología*, 33(1), 196-203.

<https://doi.org/10.6018/analesps.33.1.233301>

Nathan, S. (2016). Badminton instructional in Malaysian schools: a comparative analysis of TGfU and SDT pedagogical models. *SpringerPlus*, 5(1), 1215.

Oboeuf, A.; Collard, L., & Gérard, B. (2008). Le jeu de la "balle assise" : Un substitut au questionnaire sociométrique?. *Les Cahiers Internationaux de Psychologie Sociale*, 77(1), 87-100.

<https://doi.org/10.3917/cips.077.0087>

- Oliver, K. L., & Kirk, D. (2016). Towards an activist approach to research and advocacy for girls and physical education. *Physical Education and Sport Pedagogy*, 21(3), 313-327
- Palao, J. M.; Manzanares, P., & Ortega, E. (2009). Techniques used and efficacy of volleyball skills in relation to gender. *International Journal of Performance Analysis in Sport*, 9(2), 281-293.
- Parlebas, P. (1988). *Elementos de Sociología del Deporte*. Málaga: Unisport.
- Parlebas, P. (2001). *Juegos, deporte y sociedad. Léxico de praxiología motriz*. Paidotribo: Barcelona.
- Parlebas, P. (2018). Une pédagogie des compétences motrices. *Acción Motriz*, 20(1), 89-96.
- Renshaw, I.; Araújo, D.; Button, C.; Chow, J. Y.; Davids, K., & Moy, B. (2016). Why the constraints-led approach is not teaching games for understanding: A clarification. *Physical Education and Sport Pedagogy*, 21(5), 459-480.
- Ruiz, L. M. (1995). *Competencia Motriz. Elementos para comprender el proceso de aprendizaje motor en educación física*. Madrid: Gymnos.
- Ruiz-Pérez, L. M.; Barriopedro-Moro, M. I.; Ramón-Otero, I.; Palomo-Nieto, M.; Rioja-Collado, N.; García-Coll, V., & Navia-Manzano, J. A. (2017). Evaluar la Coordinación Motriz Global en Educación Secundaria: El Test Motor SportComp. *RICYDE. Revista Internacional de Ciencias del Deporte*, 49(13), 285-301. <https://doi.org/10.5232/ricyde2017.04907>
- Ruiz-Pérez, L. M.; Rioja-Collado, N.; Graupera-Sanz, J. L.; Palomo-Nieto, M., & García-Coll, V. (2015). Grami-2: desarrollo de un test para evaluar la coordinación motriz global en la educación primaria. *Revista Iberoamericana de Psicología del Ejercicio y el Deporte*, 10(1), 103-111.
- Sáez de Ocariz, U.; Lavega, P., & March, J. (2013). El profesorado ante los conflictos en la educación física. El caso de los juegos de oposición en Primaria. *Revista Electrónica Interuniversitaria de Formación del Profesorado*, 16(1), 163-176. <http://dx.doi.org/10.6018/reifop.16.1.180101>.
- Soler, S. (2009). Los procesos de reproducción, resistencia y cambio de las relaciones tradicionales de género en la educación física: el caso del fútbol. *Cultura y Educación*, 21(1), 31-42. <https://doi.org/10.1174/113564009787531253>
- Travers, A. (2008). The sport nexus and gender injustice. *Studies in Social Justice*, 2(1), 79-101.

Annex 1:

Table 1. Brief description of the criteria in the observation instrument

NUMBER	CRITERION	CATEGORY	DESCRIPTION
1	Gender	B (boy)	Male motor decision
		G (girl)	Female motor decision
2.1	Live	LT (live, thrower)	Throwing the ball at a rival
		LP (live, passer)	Pass between the person in possession of the ball and a partner
		LST (live, sparrer-thrower)	Sparring before throwing the ball at a rival
		LSP (live, sparrer-passer)	Sparring before passing the ball to a partner
		LbD (live without ball, dodger)	Dodging without the ball, before a throw
		LbF (live without ball, fleer)	Fleeing from a rival throw
		LbR (live without ball, receiver)	Receiving the ball
		LbRv (live without ball, retriever)	Retrieving the ball
2.2	Prisoner	PT (prisoner, thrower)	Throwing the ball at a rival
		PP (prisoner, passer)	Passing the ball to a prisoner or a free player
		PST (prisoner, sparrer-thrower)	Sparring before throwing the ball at a rival
		PSP (prisoner, sparrer-passer)	Sparring before passing the ball to a partner
		PR (prisoner, receiver)	Receiving the ball
		PRv (prisoner, retriever)	Retrieving the ball
		POR (prisoner, opponent releaser)	Friendly pass from a prisoner to another player
3	Motor behavior	E (effective)	Effective motor decision in the context of the game
		I (ineffective)	Ineffective motor decision in the context of the game