Generalitat de Catalunya
INEFC
3.er trimestre (julio-septiembre) 2020
ISSN: 2014-0983

apunts 141
EDUCACIÓN FÍSICA Y DEPORTES

apunts EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.01

OPEN ACCESS

Traditional Dances and their Characteristic Injury Profiles. Systematic Review

Yaiza Taboada-Iglesias[1, 2], Rocío Abalo-Núñez[1, 2], Tania García-Remeseiro[2]

[1] Faculty of Physical Therapy University of Vigo, Spain.
[2] Research group GIES-10(DE-3), Instituto de Investigación Sanitaria Galicia Sur (IIS Galicia Sur), SERGAS-UVIGO, Spain.

Cite this article:
Taboada-Iglesias, Y., Abalo-Núñez, R., & García-Remeseiro, T. (2020). Traditional Dances and their Characteristic Injury Profiles. Systematic Review. *Apunts. Educación Física y Deportes*, *141*, 1-10. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.01

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Yaiza Taboada-Iglesias
yaitaboada@uvigo.es

Section:
Physical activity and health

Original language:
Spanish

Received:
17 Desember 2019

Accepted:
1 April 2020

Published:
1 de julio de 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

Determination of the injury profiles that characterise the sports and artistic disciplines in which the body is the medium is essential to proper injury prevention. Although many studies have been conducted in classical and contemporary dance in this regard, there is very little research and consensus documents dealing with traditional dances that establish individual and standards characteristics for all of them. For this reason, the objective of this study was to ascertain the injury profiles of dancers of different styles of traditional dancing, establishing differences and similarities between them in terms of frequency, location, type and severity and risk factors. A systematic review was performed in the Sport Discus, Medline, Cinahl, Scopus and Web of Science databases. Seventeen (17) results were obtained, representing Irish dance, flamenco, Belly dance, Indian dance, Turkish dance and Morris dance from Great Britain. The results point to a high injury incidence, albeit with differences between the styles. Injury location was also specific, although the lower extremities were particularly prevalent in all styles, except in the Belly dance, where lower back, sacral and pelvic area injuries predominated.

Keyword: injuries, pain, dance, traditional dance, folk dance.

Introduction

Dancing has always been inherent to human development and to that of society, although its origins are somewhat vague. It is considered the foremost form of art, with references dating back to the prehistoric era. From aboriginal dances through to the introduction of dancing into the culture of peoples such as Egypt, India or Greece, dancing gradually branched out into different expressions such as hunting expeditions, births, religious holidays, through to its facet of pure entertainment (Markessinis, 1995). Art and its manifestations, such as dancing and music, have evolved parallel to the development of societies and cultures. In this way, folk dancing may be regarded as a product of a territory's historical evolution.

Despite the broad variety of folk dances, studies related to dancing focus mainly on classical, modern or contemporary dance, addressing topics such as performance, biomechanics, didactics and health.

Movement is the cornerstone of dancing, and the medium of expression is the dancer's body, requiring strenuous training that can lead to injury (Cardoso et al., 2017). For this reason, one of the most important health objectives is injury analysis. Abalo et al. (2013) state that producing an injury and incidence profile must be the point of departure for the proper injury prevention in sport. Moreover, the studies that have been conducted about injury incidence related to sports performance have also been complemented by work addressing the recreational sports perspective (García-González et al. 2015).

The studies performed on injuries in classical dance or ballet point to a predominant location in the lower extremities (Cardoso et al., 2017; Ekegren et al., 2014; Leanderson et al., 2011), with the most frequent cause being overuse (Ekegren et al., 2014; Leanderson et al., 2011). Similarly, modern or contemporary dance injuries are more frequently sustained to the foot and the ankle, as well as the back (Shah et al., 2012).

For the above reasons, the objective of this review was to establish the injury profiles of dancers of different styles of traditional dance, establishing differences and similarities between them in terms of frequency, location, type and severity of lesion and risk factors.

Methodology

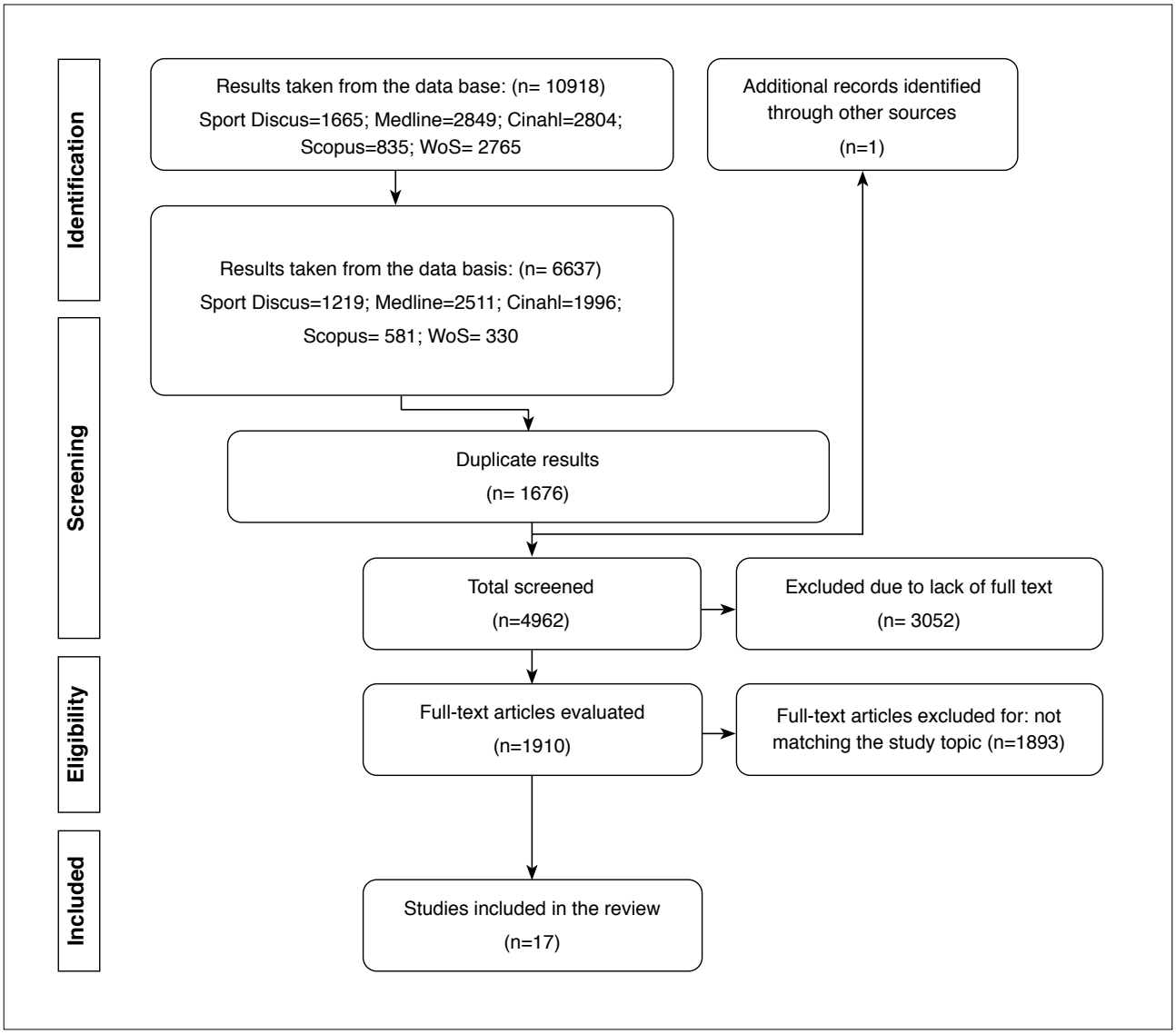
The data collection process for this study involved a systematic review in the following databases: *Sport Discus, Medline, Cinahl Scopus* and *Web of Science (WoS)*. The search was run in using the following descriptors *from Medical Subjects Headings* (MeSH): "WOUNDS & injuries", "FOLK dancing" and "dancing" "Traditional dance". To complete the search, the following keywords were included: "injuries", "athletic injuries", "pain", "injury", "injured", "dance" and "traditional dance" (Table 1).

Screening criteria were applied to all the articles found. Scientific articles published in Spanish, English and French were included and were applied as search filters. Any results from which a full text was not obtained, did not match the topic of the study or were cases, case series and reviews, were excluded. There was no time limit. Moreover, in *WoS* the results were limited to three categories in order to yield more precise results (*Sports Sciences, orthopedics, rehabilitation*). (Figure 1).

Table 1
Search equations in the different databases

Database	Equation
Sport Discus	((DE "WOUNDS & injuries") OR "injuries" OR "pain" OR "injury" OR "injured") AND (Dance OR (DE "FOLK dancing") OR "Traditional dance"))).
Medline	((MH "WOUNDS & injuries") OR "injuries" OR "pain" OR "injury" OR "injured") AND (MH "FOLK dancing") OR (MH "dancing") OR Traditional dance)
Cinahl	((MH "WOUNDS & injuries") OR "injuries" OR "pain" OR "injury" OR "injured") AND (MH "FOLK dancing") OR (MH "dancing") OR Traditional dance)
Scopus	(TITLE-ABS KEY ("injuries") OR TITLE-ABS-KEY ("Injury") OR TITLE-ABS-KEY ("Athletic injuries")) AND (TITLE-ABS-KEY ("Dance") OR TITLE-ABS-KEY ("Traditional dance") OR TITLE-ABS-KEY ("Folk dance"))
Web of Science	Basic search: TOPIC:(injuries) AND TOPIC: (dance) OR TOPIC: (traditional dance) OR TOPIC:(folk dance).

Figure 1
Flowchart of the bibliographic selection process



Results

The characteristics of the studies are included in table 2. The dance style with the greatest body of research was Irish dance, followed by Flamenco. However, the other dances only obtain one result each. To simplify understanding, the results are grouped according to style, whereas table 3 evaluates methodological quality.

Irish Dance

From the numerous studies performed in Irish dance, McGuinness and Doody (2006) analysed the dancers participating in the North American championship of this dance style. It transpired that 79% of the participants sustained at least one injury, with the ankle (31%) and the foot (25%) being the most frequent sites. Sprained ankles and stress fractures of the foot accounted for 29% and 12%, respectively. Sixty-three percent (63%) took more than 21 days to recover. They also observed a significant reduction in ankle injuries, with shoes to absorb impacts and warm-up and recovery periods used. Nevertheless, there are methodological issues with the collection of data related to injuries, clinical assessment and level of activity.

Subsequently, Noon et al. (2010) collected all the medical cases attended to in a company. The results indicated 217 injuries, and most of the dancers sustained multiple injuries, which increased with the type of dance. The injuries were mainly stress fractures (29.9%), most of them located in the sesamoid bones. Patellofemoral pain

Table 2
Characteristics of the articles analysed

Article	Dance style	Type of study	Duration	Tool	Sample size	*Sex*	*Level*
Milner et al., 2019	Belly dance	Retrospective	12 months	Questionnaire	n=254 n=109 questionnaires collected	♀	At least once a week
Aksu et al., 2018	Turkish Dance	Retrospective	9 years	Company archives	n=75 (26,8±5,2 years)	♂ (n=37) and ♀ (38)	Professionals
Cahalan, Bargary and O`Sullivan. 2018	Irish Dance	Retrospective	12 months	Questionnaire	n=37	♂ (n=4) and ♀ (n=33)	Adolescent Elite
Cahalan, Kearney, Bhriain et al., 2018	Irish Dance	Prospective	12 months	Questionnaire	n=50 21= Irish Dance 29= Contemporary Dance	♂ and ♀	Pre-professional
Nair et al., 2018	Indian Dance	Retrospective	Life story	Questionnaire	n=51 professionals n=164 amateur	♂ (n=69) and ♀ (n=146)	Professionals and amateur
Cahalan et al., 2017	Irish Dance	Prospective	12 months	Questionnaires	n=85	♂ and ♀	Elite
Cahalan et al., 2016	Irish Dance	Prospective	12 months	Questionnaires	n=84	♂ and ♀	Elite
Castillo-López, 2016	Flamenco	Cross-sectional	-	Clinical examination and questionnaires	n=44 n=80 feet	♀	Professionals
Cahalan et al., 2015	Irish Dance	Retrospective	5 years	Questionnaire	n=104	♂ (n=30) and ♀ (n=74)	Elite
Castillo-López et al, 2014	Flamenco	Cross-sectional	-	Clinical examination and questionnaires	n=44 n=80 feet	♀	Professionals
Stein et al., 2013	Irish Dance	Retrospective	11 years	OrthoSearch and interview	n=255	♂ (n=8) and ♀ (n=247)	-
Cahalan and O´Sullivan 2013	Irish Dance	Retrospective	-	Online questionnaire	n=178	♂ (n=67) and ♀ (n=111)	Professionals (practising and retired)
Walls et al., 2010	Irish Dance	Cross-sectional	-	Magnetic resonance and questionnaire	n=18	♂ (n=8) and ♀ (n=10)	Professionals
Noon et al., 2010	Irish Dance	Retrospective	7 years	Company medical department archives	n=69	♀	Professionals
McGuinness y Doody, 2006	Irish Dance	Retrospective	The 3 most recent injuries in the last 5 years	Questionnaire	n= 159 X=17,8 years	♂ (n=17) and ♀ (n=142)	Dance students
Tuffery, 1989	Morris Dance	Retrospective	-	Questionnaire	N=523 N=149 responded	♂ and ♀	Amateur
Bejjani et al., 1988	Flamenco	Cross-sectional	-	Clinical examination and questionnaires	n=29	♀	Professionals

n: sample; ♂: male; ♀: female.

Authors and publication dates	Methodological quality criteria							
	1	2	3	4	5	6	7	8
Milner et al., 2019	+	-	-	-	+	+	+	+
Aksu et al., 2018	+	+	+	+	+	-	-	-
Cahalan, Bargary y O`Sullivan, 2018	+	-	-	-	+	+	+	+
Cahalan, Kearney, Bhriain et al., 2018	+	-	+	-	+	+	+	+
Nair et al., 2018	+	-	-	-	+	+	+	+
Cahalan et al., 2017	+	-	+	-	+	+	+	+
Cahalan et al., 2016	+	-	+	-	+	+	+	+
Castillo-López, 2016	+	¿	o	¿	+	+	+	-
Cahalan et al., 2015	+	-	-	-	+	+	+	+
Castillo-López et al., 2014	+	-	-	+	+	+	+	+
Stein et al., 2013	+	+	+	+	-	+	+	+
Cahalan y O´Sullivan, 2013	+	-	-	-	+	+	+	+
Walls et al., 2010	+	+	o	+	+	-	-	+
Noon et al., 2010	+	+	+	+	+	+	-	+
McGuinness y Doody, 2006	+	-	-	-	-	+	+	+
Tuffery, 1989	+	-	-	-	-	+	-	+
Bejjani et al., 1988	-	+	+	+	+	-	-	-

+=yes, -=no, ¿=information not provided, o = not applicable
Methodological quality criteria
1. Definition of injury.
2. Updated record of the fall when it occurred.
3. Memory bias evaluation strategy.
4. Adequate clinical evaluation.
5. The define the duration of the activity or level.
6. Intrinsic risk factor assessment.
7. Extrinsic risk factor assessment.
8. Adequate data analysis (plus if they fulfil two criteria: 1. use of by-group analysis 2. Use of comparative or multivariate analysis 3. + Adequate presentation of results and methods

syndrome accounted for a noteworthy 11.1%. In turn, they showed that most injuries (94.9%) were sustained in the lower extremities. Although they do not take extrinsic factors into account, the results are important on account of the study's high methodological level, since it scored 7 out of a possible 8 points.

Chronic ankle lesions were common in the study by Walls et al. (2010), since only 3 out of 18 Irish dance professionals obtained radiologically normal findings. The most frequent conditions were Achilles tendonites (*n*: 14). Nevertheless, 8 of the participants had no ankle pain, and despite the good methodological quality, they lack variables that analyse the intrinsic and extrinsic factors.

Cahalan and O'Sullivan (2013) focused on injury ratio and risk factors. They collected a total of 396 lesions, although the main methodological problem was the failure to perform *in situ* data collection, not provide a memory bias, thus rendering the clinical assessment deficient. They found that 76.7% of the dancers had sustained a previous injury, mainly to the foot (67.9%) and the ankle (60.6%), as well as a ratio of 2.25 injuries per dancer in the course of their career. Although the severity of most of the injuries was rated as minor, more frequently in the foot and ankle, 33.7% of the dancers did admit that dancing was often or always painful. They also established the risk factors that most perceptively contribute to injury, namely accidents, fatigue or overuse, repeat movements or an unstable stage.

In the same year, Stein et al. (2013) published a study with a high methodological quality (7 points) in which, of 437 diagnosed injuries, 80% were due to overuse and 20.4% were trauma-induced. Fifty-eight percent (58%) of the dancers had one injury, whereas 23.9% had two and 18% three or more diagnoses. Ninety-five percent (95%) of these injuries were located in the hips and lower extremities (33.2% foot, 22.7% ankle, 19.7% knee and 14.4% hip). The most common

type of injury were tendonites (13.3%), followed by apoptosis (11.4%), pain and patellofemoral instability (10.8%), stress fractures (10.1%) and muscular injuries (7.8%). However, the fact that they did not analyse the level of practice must be considered.

Cahalan et al. (2015) observed that 31.7% of Irish dancers sustained significant injuries, which was associated with being female, having a high perception of health problems and psychological, mood, catastrophic problems and failing to do warm-up exercises consistently. They highlighted the foot and the ankle as the most commonly injured areas (48.8%). However, most of the specific diagnoses were pulled muscles (17.2%).

In another study, of all the lesions, 55.8% were located in the foot and ankle and 63.1% of the dancers sustained injuries in this area. It also transpired that the reasons perceived by the dancers are overuse or fatigue (32.5%), accidents (15.6%), previous injuries (13.2%) poor warm-up or stretching (11.3%) and other biomechanical factors (11.3%) (Cahalan et al., 2016).

The article by Cahalan et al. (2017) analyses the biopsychosocial factors associated with foot and ankle injuries, comparing them between Irish dancers who had sustained an injury to that area to those who had not. The results showed that foot and ankle injuries were related to the failure to do a consistent warm-up, have low energy levels and other pains or complaints. Dancers with foot or ankle lesions perceive the greatest risks as being overuse (17.6%) and previous lesions (16.9%).

Cahalan, Bargary and O'Sullivan (2018) established that 84% of elite adolescent dancers had at least one pain episode or injury in 12 months, the most affected areas being the foot and the ankle. Having complaints in parts of the body, pain often or always while they dance and feelings of anger or hostility were regarded as factors significantly associated with injury.

Another study by Cahalan, Kearney, Bhriain et al. (2018) established that pre-professional Irish dancers have an injury incidence of some 10.6 injuries per 1000 hours of exposure. They collected a total of 88 injuries, a mean (SD) of 4.2 (2.5) injuries per dancer which prevented them from dancing, either partially or fully, for a mean period of 10 days. The lower extremities (particularly the foot and ankle, with 23.9%) and the base of the spine were the most frequently injured areas. 57.5% of the injuries did not have a clear diagnosis, and those that did were mostly muscle injuries. Similarly, the main specific cause of injury was overuse. Finally, lack of sleep, general health or increased hours of exercise were associated with injuries.

The main methodological problems in the publications by Cahalan et al. are the failure to record the injury when it occurs, the failure to prevent memory bias and the lack of a suitable clinical assessment. However, the studies by Cahalan, Kearney, Bhriain et al. (2018), Cahalan et al. (2016) and Cahalan et al. (2016) provide a strategy for limiting memory bias by requesting weekly or monthly incidence recording.

Flamenco

Bejjani et al. (1988) found a high incidence of urogenital disorders (50%), one of the dangers of exposure to percussive footwork-derived vibration, in professional dancers from New York. The following areas with the highest incidence were back (28.6%) and head and neck pain (26.8%). Moreover, pain in the extremities was lower than in the other areas. Nevertheless, they did not define the injury nor evaluate intrinsic or extrinsic factors and also presented a poor data analysis.

Castillo-López and Vargas-Macías (2014) analysed pain and hyperkeratosis in the metatarsal area in Andalusian professional dancers. 80.7% of the dancers reported metatarsal pain while dancing flamenco and 84.1% plantar hyperkeratosis with a greater incidence in the heads of the first and second metatarsals. However, they failed to establish a direct significant relationship between both variables and neither did they detect a relationship between pain and shoe heel height.

In the same line, Catillo-López (2016), with a better methodological description than the previous article, found that most professional dancers in this dance style exhibit foot problems. Deformities appear in 76.8% of the cases, 95% have metatarsal pain and 82% plantar hyperkeratosis.

Belly Dance

The Belly dance study was performed by Milner et al. (2019), on a community of dancers of this style from New Zealand, and it shares certain methodological limitations with the other results: they did not record the results as they occurred, there was no data omission strategy and no exhaustive clinical assessment. They collected 40 injuries in the preceding 12 months, establishing an injury ratio of 37% (40 lesions in 109 dancers). Most of the injuries (38%) were located in the spinal, sacral and pelvic areas. Nevertheless, the only variable that predicted injury location was dancer experience, and the most experienced dancers have a greater likelihood of sustaining injury to the lower extremities.

Indian Dance

With regard to the publications on Indians Dance, Nair et al. (2018) indicated that in the different dance styles the distribution of pain among dancers was mainly in the back, followed by the ankles and knees, although the Bharatanatyam and traditional dance styles presented specificities. Moreover, they showed that they do not sustain injuries to the hips, thighs, hands or wrists. It also presented the same methodological limitations as the previous study.

Turkish/Anatolian Dance

Aksu et al. (2018) examined the injuries sustained by the dancers of a professional Anatolian dance company that required surgery; they reported 14 orthopaedic lesions in 18.6% of the dancers, with a prevalence 8.64 times higher in men than in women. Of these, 64% were caused by traumatic injuries and 35.7% by chronic conditions. 85.7% of the injuries were sustained in the lower extremities, all of them in knees affected by impacts and repeat jump reception over long periods of time. All the injuries to the lower extremities occurred during performances, whereas hand or wrist injuries were sustained in rehearsals. Age was not a significant predictive variable of injury.

Certain dance figures or technical executions presented specific injuries. Meniscus injuries occurred after frequent sit-ups and pirouettes in dances and torn anterior cruciate ligament lesions occur after jumps and jump receptions. It should be mentioned that despite a good data collection methodology they failed to provide intrinsic and extrinsic factors and the data analysis should have been more exhaustive.

Morris Dance

Finally, the study by Tuffery (1989) analyses the injuries in Morris dance, a traditional dance in Great Britain, with very low methodological quality. The research showed that 59% of traumatic injuries are sustained by women, although they are not directly age-related. Nevertheless, there was a significant greater incidence of chronic injuries in older dancers.

Seventy percent (70%) of trauma injuries occur in the lower extremities, particularly in the calf and in the ankle, most of the latter involving sprains. It was associated with the dancing surface in 39% of the cases. Similarly, in the relationship between genders, only toe and knee injuries proved to be significantly different, with men sustaining more injuries. Twenty-four percent (24%) of the injuries were classified as mild, 33% as moderate and 43% as severe.

Of the 47 chronic injuries reported, only 11% occurred in women and they were significantly lower than trauma-induced injuries; moreover, significant differences were also found between sexes, with men sustaining more chronic injuries. The main location was the knee.

Discussion

The analysis of the results makes it possible to establish certain similarities and differences between the different traditional dance styles from all over the world. One of the main problems in the studies performed to date is that most of them are retrospective (Aksu et al., 2018; Cahalan, Bargary & O`Sullivan 2018; Cahalan et al., 2015; Cahalan & O´Sullivan 2013; McGuinness & Doody 2006; Milner et al., 2019; Nair et al., 2018; Noon et al., 2010; Stein et al., 2013; Tuffery 1989), with the related drawbacks in terms of loss of information. Only 3 of the 17 results were prospective (Cahalan et al., 2016; Cahalan et al., 2017; Cahalan, Kearney, Bhriain et al., 2018). All the articles presented samples from both sexes, except those by Milner et al. (2019) conducted in Belly dance, those by Beijani et al. (1988), Castillo-López and Vargas-Macías (2014) and Castillo-López (2016) in Flamenco, and the study by Noon et al. (2010) in Irish dance, which only analysed results in women. Moreover, most of the dancers were top-level, and are referred to as professionals, pre-professionals, elite or full-time dance students. Only the study by Tuffery (1989) in Morris dance, that of Milner et al. (2019) in Belly dance and the study by Nair et al. (2018) in Indian dance included *amateur* dancers.

With regard to the methodological quality of the documents included in this research, of the 17 articles, all of them, except for the one focusing on Morris dance (3 points) merited a score of four or more points, although by disciplines (Belly, Indian or Turkish dance) only one article with a score of 5 was found .

Injury incidence

Injuries and pain in the different types of dancing appear to be constant. Approximately 80% of Irish dance (McGuinness & Doody, 2006; Cahalan, Bargary & O'Sullivan, 2018) and Flamenco dancers (Castillo-López & Vargas-Macías, 2014; Catillo-López, 2016) sustained some type of injury or pain. Despite this, Stein et al. (2013) establish lower percentages in Irish dance, although the level of the dancers is not mentioned,

which could affect the results, although this study enjoys greater relevance in terms of methodological quality. In turn, less than half of the Irish dancers sustain injuries when defined as significant (Cahalan et al., 2015). These lower injury ratios are more similar to the ones found in Belly dance (Milner et al., 2019).

On the other hand, most of the Irish dancers presented multiple injuries (Noon et al., 2010). The prospective study by Cahalan, Kearney, Bhriain et al., (2018) reported a mean incidence of 4 injuries per dancer; however, Cahalan and O'Sullivan (2013) indicated that in the course of their career dancers sustain a ratio of 2 injuries, although the study may be biased by the fact that it is retrospective and its methodological quality is below that of the previous one.

Location

A substantial number of injuries are located in the lower extremities in practically all dance styles. Most of the lesions in Irish dance (Noon et al., 2010) that require surgery in Turkish dance (Aksu et al., 2018) and in Morris dance (Tuffery, 1989) are related to each other, albeit with specific characteristics, since the knee is predominant in Turkish dance (Aksu et al., 2018) and the calf and ankle are more prevalent in Morris dance (Tuffery, 1989).

The ankle and the foot are the most frequent locations in Irish dance (Cahalan & O'Sullivan, 2013; Cahalan et al. 2015; Cahalan et al. 2016; Cahalan, Bargary & O`Sullivan, 2018; Cahalan, Kearney, Bhriain et al., 2018; McGuinness & Doody, 2006; Noon et al., 2010; Stein et al., 2013), and while most Flamenco dancers experience metatarsal pain and foot issues (Castillo-López & Vargas-Macías, 2014; Castillo-López, 2016), Bejjani et al. (1988), the researchers found a predominant incidence of urogenital problems derived from exposure to percussive footwork vibration, with the back, head and neck being the worst-hit areas.

In Indian dance, ankle and knee lesions take second place to the more frequent back injuries (Nair et al., 2018). Similarly, in Belly dance, the areas with greatest incidence were the lower back, sacral and pelvic areas, and the more experienced dancers were more likely to sustain injuries to the lower extremities (Milner et al., 2019. These articles received an average score in comparison with the studies performed in other styles.

Type of injury

With regard to type of injury, there is not too much consensus in Irish dance, since while all the studies report almost the same types, different researchers attach different priority to them. Moreover, McGuiness and Doody (2006) place sprained ankles as the most frequent type, followed by stress fractures of the feet. Nevertheless, the latter, and with greater incidence in the sesamoid bones, are the most frequent type in the studies by Noon et al. (2010), which features greater methodological quality, and placing patellofemoral syndrome second. With the same methodological quality, pain and patellofemoral instability, followed by stress fractures, are the second and third most frequent types in the studies by Stein et al., (2013), who identify tendinitis injuries as the most common type of chronic injuries, as do Walls et al. (2010). For Cahalan et al. (2015), the significant injuries with a clear diagnosis were pulled muscles.
Moreover, in Morris dance, as in the Irish dance studies by McGuiness and Doody (2006), most of the injuries are sprained ankles.

Severity

Injury severity is usually established in relation to the time during which the subject is prevented from performing. In this case, McGuiness and Doody (2006) observed that most of the injuries obliged Irish dancers to observe a recovery period of 21 days, meaning that the injuries were classified as serious. Most of the trauma injuries in Morris dance are largely classified as severe (Tuffery, 1989). Nevertheless, in Irish dance, Cahalan and O'Sullivan (2013), with greater methodological quality, established that most of the injuries are of minor severity, although a significant percentage of dancers admit that they always dance in pain. This idea of coping with pain may be concluded on the basis of the results obtained by Castillo-López and Vargas-Macías, (2014), who state that the high percentage of *bailaoras* (Flamenco dancers) suffer metatarsal pain while dancing. Thus, these injuries, regarded as minor, are highly important since they prevent the dancers from dancing in fully-fit conditions.

Risk factors

Most of the injuries that occur in Irish dance are caused by overuse, whereas the percentage of trauma injuries is lower (Stein et al., 2013). Fatigue or overuse and repeat movements are established risk factors perceived by these dancers (Cahalan & O´Sullivan, 2013; Cahalan et al., 2016; Cahalan et al., 2017), although so too are accidents. Chronic injuries therefore take on major importance

(Walls et al., 2010). This is similar to the urogenital injuries in Flamenco dance caused by percussive footwork vibration reported by Bejjani et al. (1988).

The use of shoes to dampen impacts significantly reduces injuries in Irish dance (McGuinness & Doody, 2006), as does a proper warm-up and recovery period. However, Castillo-López and Vargas-Macías (2014) did not find a direct significant relationship between shoe heel height and pain. Warming up was also established as a factor associated with injuries in other studies (Cahalan et al., 2015; Cahalan et al., 2016; Cahalan et al., 2017), among other risk factors, such as being a woman and other health problems.

Conclusions

Traditional dancers present a high incidence of injuries, with differences between dance styles. Belly dance induces lower injury ratios compared to the incidence of significant injuries in Irish dance.

The location of these injuries is specific to dance style. Nevertheless, the lower extremities enjoy particular relevance in all of them, except in the Belly dance, in which the incidence is greater in the lumbar, sacral and pelvic areas. The most affected parts, according to dance type, are: in Irish dance, the knee; In Morris dance, the calf and ankle; in flamenco, urogenital problems, and in Indian dance, the back.

Similarly, and while there is no consensus on injury severity, many dancers admitted that they regularly dance in pain in the Irish and Flamenco styles.

Limitations and future prospects

Despite the extensive variety of traditional dances, studies have not been performed in all of them, whereby it proved impossible to establish the profiles or to study the differences and similarities properly. Another limitation of this work was that most of the studies were retrospective, with the subsequent possible loss of information.

Due to the specificity of each dance, a greater number of studies would be necessary in the specific dances that have yet to be addressed, and the results of the dances studied would need to be expanded. It would also be important to have prospective studies that afford a more objective vision of reality.

References

Abalo Núñez, R., Gutiérrez-Sánchez, Á., & Vernetta Santana, M. (2013). Analysis of incidence of injury in Spanish elite in aerobic gymnastics. *Revista Brasileira de Medicina do Esporte, 19*(5):355-8. https://doi.org/10.1590/S1517-86922013000500011

Aksu, N., Atansay, V., Aksu, T., Koçulu, S., Damla Kara, S., & Karalök, I. (2018). Injuries Requiring Surgery in Folk Dancers: A Retrospective Cohort Study of 9 Years. *Journal of Sports Science, 6*, 108-117. doi: 10.17265/2332-7839/2018.02.006.

Bejjani, F.J., Halpern, N., Pio, A., Dominguez, R., Voloshin, A., & Frankel, V.H. (1988). Musculoskeletal demands on flamenco dancers: A clinical and biomechanical study. *Foot & Ankle, 8*(5), 254-263. https://doi.org/10.1177/107110078800800505

Cahalan, R., Bargary, N., & O`Sullivan, K. (2018). Pain and Injury in Elite Adolescent Irish Dancers. A Cross-Sectional Study. *Journal of Dance Medicine & Science, 22*(2), 91-99. https://doi.org/10.12678/1089-313X.22.2.91.

Cahalan, R., Kearney, P., Bhriain, O.N., Redding, E., Quin, E., McLaughlin, L.C., & O`Sullivan, K. (2018). Dance exposure, well-being and injury in collegiate Irish and contemporary dancers: A prospective study. *Physical Therapy in Sport, 34*, 77-83. https://doi.org/10.1016/j.ptsp.2018.09.006

Cahalan, R., O'Sullivan, P., Purtill, H., Bargary, N., Ni Bhriain, O., & O'Sullivan, K. (2016). Inability to perform because of pain/injury in elite adult Irish dance: A prospective investigation of contributing factors. *Scandinavian Journal of Medicine & Science in Sports, 26*,694-702. https://doi.org/10.1111/sms.12492

Cahalan, R. & O'Sullivan, K. (2013). Injury in Professional Irish Dancers. *Journal of Dance Medicine & Science, 17*(4),150-158. https://doi.org/10.12678/1089-313X.17.4.150

Cahalan, R., Purtill, H., & O'Sullivan, K. (2015). A Cross-Sectional Study of Elite Adult Irish Dancers Biopsychosocial Traits, Pain, and Injury. *Journal of Dance Medicine & Science, 19*(1), 31-43. https://doi.org/10.12678/1089-313X.19.1.31

Cahalan, R., Purtill, H., & O'Sullivan, K. (2017). Biopsychosocial Factors Associated with Foot and Ankle Pain and Injury in Irish Dance. A Prospective Study. *Medical Problems of Performing Artists, 32*(2), 111-117. https://doi.org/10.21091/mppa.2017.2018

Cardoso, A.A., Reis, N.M., Marinho, A.P.R., Vieira, M.C.S, Boing, L, & Guimarães, A.C.A. (2017). Injuries in professional dancers: a systematic review. *Revista Brasileira de Medicina do Esporte, 23*(6), 504-509. https://doi.org/10.1590/1517-869220172306170788.

Castillo-López, J.M. (2016). Resultados y prospectiva de la investigación podológica en el baile flamenco. *Revista del Centro de Investigación Flamenco Telethusa, 9*(11), 18-22. https://doi.org/10.23754/telethusa.091104.2016

Castillo-López, J.M, & Vargas-Macías, A., Domínguez-Maldonado, G., Lafuente-Sotillos, G., Ramos-Ortega, J., Palomo-Toucedo, I.C., Reina-Bueno, M., Munuera-Martínez, P.V. (2014). Metatarsal Pain and Plantar Hyperkeratosis in the Forefeet of Female Professional Flamenco Dancers. *Medical Problems of Performing Artists, 29*(4),193-197

Ekegren, C.L., Quested, R., & Brodrick, A. (2014). Injuries in pre-professional ballet dancers: Incidence, characteristics and consequences. *Journal of Science and Medicine in Sport, 17*(3), 271-5. https://doi.org/10.1016/j.jsams.2013.07.013.

García González, C., Albaladejo Vicente, R., Villanueva Orbáiz, R., & Navarro Cabello, E. (2015). Epidemiological Study of Sports Injuries and their Consequences in Recreational Sport in Spain. *Apunts. Educación Física y Deportes, 119,* 62-70. https://doi.org/10.5672/apunts.2014-0983.es.(2015/1).119.03

Leanderson, C., Leanderson, J., Wykman, A., Strender, L.E., Johansson, S.E., & Sundquist, K. (2011). Musculoskeletal injuries in young ballet dancers. *Knee Surgery, Sports Traumatology, Arthroscopy, 19*(9), 1531-5. https://doi.org/10.1007/s00167-011-1445-9

Markessinis, A. (1995). *Historia de la danza desde sus orígenes*. Madrid: Lib. Deportivas Esteban Sanz.

McGuinness, D., & Doody, C. (2006). The injuries of competitive Irish dancers. *Journal of Dance Medicine & Science, 10*(1-2), 35-39.

Milner, S.C., BCom, A.G., & Bussey, M. (2019). A Retrospective Study Investigating Injury Incidence and Factors Associated with Injury Among Belly Dancers. *Journal of Dance Medicine & Science,*

23(1), 26-33. https://doi.org/10.12678/1089-313X.23.1.26

Nair, S.P., Kotian, S., Hiller, C., & Mullerpatan, R. (2018). Survey of Musculoskeletal Disorders Among Indian Dancers in Mumbai and Mangalore. *Journal of Dance Medicine & Science, 22*(2), 67-74. https://doi.org/10.12678/1089-313X.22.2.67

Noon, M., Hoch, A.Z., McNamara, L., & Schimke, J. (2010). Injury patterns in female irish dancers. *PM & R: the journal of injury, function, and rehabilitation, 2*(11), 1030-4 https://doi.org/10.1016/j.pmrj.2010.05.013

Shah, S., Weiss, D.S., & Burchette, R.J. (2012). Injuries in Professional Modern Dancers: lncidence, Risk Factors, and Management. J*ournal of Dance Medicine & Science, 16*(1), 17-25.

Stein, C.J., Tyson, K.D., Johnson, V.M., Popoli, D.M., d'Hemecourt, P.A., & Micheli, L.J. (2013). Injuries in Irish Dance. *Journal of Dance Medicine & Science, 17*(4), 159-164. https://doi.org/10.12678/1089-313X.17.4.159

Tuffery, A.R. (1989). The nature and incidence of injuries in Morris dancers. *British Journal of Sports Medicine, 23*(3), 155-160. https://doi.org/10.1136/bjsm.23.3.155

Walls R.J., Brennan S.A., Hodnett P., O'Byrne J.M., Eustace S.J., & Stephens M.M. (2010). Overuse ankle injuries in professional Irish dancers. *Foot and Ankle Surgery, 16,* 45-49. https://doi.org/10.1016/j.fas.2009.05.003

Conflict of Interests: No conflict of interest was reported by the authors.

apunts EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.02

OPEN ACCESS

Basic Psychological Needs in Spanish Athletes: validation of the "Basic Needs Satisfaction in Sport Scale"

Cristina De Francisco[1], Francisco José Parra-Plaza[2], Pilar M. Vílchez[2]

[1] Faculty of Health Sciences. Catholic University of Murcia, Spain.
[2] Faculty of Social Sciences and Communication. Catholic University of Murcia, Spain.

Cite this article:
De Francisco, C., Parra-Plaza, F.J., & Vílchez, P.M. (2020). Basic Psychological Needs in Spanish Athletes: validation of the "Basic Needs Satisfaction in Sport Scale". *Apunts. Educación Física y Deportes*, *141*, 11-20. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.02

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Francisco José Parra-Plaza
fjpplaza@ucam.edu

Section:
Human and social sciences

Original language:
Spanish

Received:
11 November 2019

Accepted:
25 March 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

In view of the growing interest in the satisfaction of basic psychological needs in the area of physical activity and sport, different instruments are being used to evaluate the degree of satisfaction or frustration of these needs. One such instrument is the (BNSSS), which is also relevant in that it acknowledges three factors, hitherto not evaluated, in the autonomy dimension (choice, volition and internal perceived *locus* of causality). In Spain, the BNSSS has only been validated for team sports, which is why the primary objective of this study was to validate it for use in any sport (individual or team). The study featured the participation of 795 athletes, 50.8% of whom were men and 49.2% women, with a mean age of 18.36 years (*SD*: 6.06). The EQS 6.3 program was used to perform a confirmatory factor analysis, factorial invariance for the gender, age, competitive level and sport type variables, as well as composite reliability between factors. Good model fit was observed, with comparative fit indexes (CFI) and non-normed fit indexes (NNFI) of .97, and a root mean square error of approximation (RMSEA) of 0.06. Factorial invariance was observed for the proposed subgroups and the composite reliably indexes were above .70. Therefore, the measurement instrument has good psychometric properties that make it possible to assess the satisfaction of basic psychological needs in the Spanish sports setting.

Keywords: competence, autonomy, relatedness, sport, invariance properties.

Introduction

The self-determination theory (SDT) is a macrotheory that addresses numerous questions such as personality development, self-regulation, psychological needs, the impact of social environment on motivation and its effect on behaviour and well-being (Deci & Ryan, 2008). Moreover, SDT holds a particular interest in the sports setting (Pelletier et al., 2013).

One of the core constructs of STD is the basic psychological needs (BSN) theory (BSN; Ryan & Deci, 2000), which asserts the existence of three psychological needs regarded as essential to a person's psychological development: competence, autonomy and relatedness, which must be satisfied in order to achieve optimal psychological development and personal well-being; failure to satisfy them generates frustration and may lead to different psychopathologies (Chen et al., 2015). The competence need comprises an individual's capacity to feel effective with a behaviour or to perform tasks with different levels of difficulty (Deci, 1971). The autonomy need refers to the autonomy that a person has in order to feel that they control their own behaviour or do things of their own accord (DeCharms, 1968). Finally, the relatedness need refers to the feeling or the sensation of being connected, supported or loved by others (Ryan, 1995). According to Ryan & Deci (2000), these needs are applicable to all individuals irrespective of their age, gender or culture.

Different studies have identified numerous benefits produced by satisfaction of the BPN, since this generates more self-determined regulations (Ryan & Deci, 2000), it is related to well-being (Moreno-Murcia & Sánchez-Latorre, 2016) and to other positive consequences (satisfaction with one's life, development of integrity, psychological vitality, positive mood, etc.) in several dimensions of life, such as work (Van den Broeck et al., 2016), education (Méndez-Giménez & Pallasá-Manteca, 2018) and physical exercise (Oliva et al., 2011). On the other hand, the extent to which these needs are frustrated tends to be related to negative consequences (burnout, anxiety, depression, stress, etc.), related to diminished health and well-being (Ryan & Deci, 2002).

The growing interest in the study of the BPN in the physical activity and sport setting (Jowett et al., 2016; Moreno-Murcia et al., 2011) gave rise to the need to design instruments capable of evaluating the degree of satisfaction or frustration of these needs and thus ascertain their influence on and in sport. In the physical activity and exercise context, Vlachopoulos and Michailidou (2006) designed the first tool called Basic Psychological Needs in Exercise Scale which made it possible to measure the degree of satisfaction of needs in a group of members of a fitness club. It was comprised of 12 items equally distributed across three dimensions that corresponded to the three psychological needs. This instrument presented good psychometric properties, presenting Cronbach's values α of .81 for competence, .84 for autonomy and .92 for relatedness, with a good model fit: the comparative fit index (CFI) and non-normed fit index (NNFI) were above .95, the Standardized Root Mean Residual (SRMR) value was below .10 (0.03), as was the Root Mean Square Error of Approximation (RMSEA) value, which was 0.05, inside the RMSEA 90% Confidence Interval (CI).

In the same year, Wilson et al. (2006), using a sample comprised of university athletes, developed the Psychological Need Satisfaction in Exercise Scale, comprised of 18 items, six for each need. In terms of psychometric properties, this questionnaire was a very reliable tool since it presented Cronbach's values of .91 for competence, .91 for autonomy and .90 for relatedness. The χ^2 value (688.03; $\chi^2/df = 5.21$) presented a suitable data fit, as did its CFI and Incremental Fit Index (IFI) values, which were close to .95.

Since these scales focused on physical activity for health, the need to develop tools related to the evaluation of psychological needs in the context of sports performance or of goal-accomplishment emerged. To cover this area, Ng et al. (2011) developed a specific instrument for competitive sport: the Basic Needs Satisfaction in Sport Scale (BNSSS), comprised of 20 items: five items for competence; 10 items for the autonomy dimension, which, taking the study by Reeve et al. (2003) as reference, were split into four items for choice, three for the volition subscale and three items for the internal perceived locus of causality (IPLOC); and finally, five items for the relatedness need. The skill presented the following Cronbach's a values for each subscale: .77 for competence; .82 for autonomy-choice; .61 for autonomy-volition; .76 for autonomy-IPLOC and .87 for relatedness. It also presented the following values: $\chi^2 = 341.70$ ($p < .01$), NNFI =.96, CFI =.97, SMRS =0.07 and RMSEA =.06, (0.4-0.7 of the RMSEA 90% CI). For these reasons it is regarded as generally possessing good psychometric properties of factorial validity and reliability.

On the basis of this last instrument, this study was designed in order to have a measurement tool in Spain that can evaluate the satisfaction of BPN in athletes and is valid for all types of sport, since hitherto there has only been one Spanish version of this instrument applicable to team sports. Hodge et al. (2008) assert that the BPN

are universal and are applicable to all types of sports, although the sample used in their study was comprised of players from a rugby team. This is because sport psychology research requires adapted and validated context-specific instruments and the first step tends to involve team sports on account of ready access to samples. Since some authors have reported that athletes who participate in different types of sport present different psychological profiles and traits (Nia & Besharat, 2010), the main objective of this study was to verify that the Spanish validation of the BNSSS could be used in any type of sport, since validity and reliability data were hitherto only available in team sports (De Francisco et al., 2018). Moreover, specific objectives include replicating the preceding version's factorial structure and checking factorial invariance by gender, age, level and sport type, as well as verifying reliability.

Methodology

Participants

The intentional sampling method was used, and the sample comprised 795 participants from different individual sports (*n*: 350) and in team sports (*n*: 445). 50.8% were males and 49.2% were females. The age of the study participants ranged from 13 years to 56 years (*M*: 18.36; SD: 6.06). 65.8% of the athletes were minors and 34.2% were adults. 74.8% of the athletes competed in local/regional and autonomous community categories, and the remaining 25.2% competed at national and/or international level. The participants' mean number of weekly training sessions was 3.60 (*SD*: 3.48) with an average duration of 102.34 minutes per session (*SD*: 42.49). Moreover, all the athletes who participated in this research were registered with the respective sport federation and engaged actively in the sport (training and competition) at least nine months of the year. Finally, it should be mentioned that none of the participants had sustained a recent injury, which was a study exclusion criterion..

Materials and Instruments

The Spanish version of the BNSSS produced by De Francisco et al. (2018) was used. It is comprised of 20 items, five for measuring competence, 10 for autonomy (four items for autonomy-choice, three items for autonomy-volition and a further three for the internal perceived locus of causality - autonomy-locus) and five items for relatedness. It presents a Likert-type response scale ranging from (1) "Not at all true" to (7) "Very true". The highest numerical value refers to the highest response value, except the fifth item ("In sport, I feel that I am being forced to do things that I don't want to do"; autonomy-volition) which is formulated inversely (a higher numerical value indicates a lower degree of satisfaction).

Moreover, the case report form also contained questions about sociodemographic aspects related to gender and age, as well as training records (type of sport, years of training, training duration, number of weekly training sessions and competitive level).

First of all, the University's Ethics Committee authorisation was requested and obtained with the approval code CE041601. Subsequently, a search for the types of sport in the area was performed and the participants and/or management of sports clubs were contacted to arrange an appointment and to be able to administer the questionnaire. Meetings were arranged at the different sites or premises where each athlete or team did their sports 15 minutes before a training session. Before they completed the questionnaire, the participants were informed about the objective of the study and how to answer the questionnaire and they also signed an informed consent (in the case of minors, this form was signed by the legal sports guardians) providing their approval to participate in the research.

Data analysis

The database was verified to check for possible out-of-range answers or atypical cases, in the course of which 47 missing values were detected and imputed using the median (0.3% of the total data), since when missing values are replaced, the median is a more robust data summary statistic than the mean (Pérez-López, 2004). A database with 795 cases was eventually obtained and was used to calculate the descriptive statistics with the IBM SPSS 21 statistics application.

In view of the previous studies performed about factorial structure in the original version (Ng et al., 2011) and in the Spanish version (De Francisco et al., 2018), a confirmatory factor analysis (CFA) was performed with the EQS 6.3 program (Bentler, 2006), developed for the purpose of performing multivariate analysis methods and structural equation models. The measurement model fit evaluation was performed by calculating the quotient between χ^2 and its degrees of freedom, RMSEA, of which values below 0.08 are indicative of good fit, NNFI, in which the indexes should be above 0.90, and

CFI, in which values above 0.95 are recommended in order to obtain a satisfactory data-model fit (Levy & Varela, 2006).

An invariance analysis was also performed on the basis of three nested models to verify equality of the model between men and women, between minors and adults, elite and low competitive profile and between individual and team sport types. Invariance is traditionally evaluated by calculating the differences obtained in the χ^2 tests. Nevertheless, for this study, the criterion of Cheung and Rensvold (2002) was also used. These authors suggest evaluating the difference in CFI values, where differences above 0.01 between models are regarded as indicative of non-invariance.

The composite reliability index was used to analyse reliability, because this type of analysis takes the existence of multi-dimensionality into account (Dunn et al., 2014), contrary to Cronbach's. In terms of interpretation, index values above 0.7 in descriptive cases or above 0.9 in selective tests are regarded as acceptable (Prieto & Delgado, 2010).

Results

Initial description of the responses

Table 1 displays the descriptive statistics for each item and dimensions. The means were between 4.83 (*SD*: 1.71; item 9, autonomy-choice, which in turn presents the greatest variability) and 6.53 (*SD*: 0.99; item 8, autonomy-volition, which presents the lowest *SD* value). In the dimensions, the highest mean was found in autonomy-volition (*M*: 6.18; *SD*: 0.91) and the autonomy-choice mean proved to be the lowest (*M*: 5.15; SD: 1.26). In terms of data distribution, all the items present a negative asymmetry, with items 8 (autonomy-volition) and 19 (relatedness) presenting the highest values (-2.76 and -2.30, respectively). Finally, the Kurtosis indexes are mainly positive, with item 8 reaching the highest value (8.46, autonomy-volition), followed by items 19 (5.66, relatedness) and one (3.66, relatedness).

Confirmatory factor analysis (CFA)

A CFA was performed based on the factorial structure defined by Ng et al. (2011), as can be seen in Figure 1. Moreover, since the results obtained for the sample did not meet the conditions of normality, the estimation of the parameters of this analysis was performed with asymptotic generalised least squares (AGLS), one of the most commonly used asymptotically distribution-free (ADF) methods used. The use of this method is based on the fact that the results are not altered in cases in which the normality assumption is violated. Finally, since ordinal variables were available, a polychoric correlation matrix was used with the rationale that this type of correlations presents a series of latent variables on which the observable variables or items are constructed.

The factorial loads were statistically significant (Table 2), with values ranging from .442 (item 5, autonomy-volition) to .964 (item 19, relatedness). Finally, all the correlations between factors were also negative (Table 3). The greatest coefficient of correlation was found between autonomy-locus and autonomy-volition (r_{xy}: .982); and the smallest one between autonomy-choice and relatedness (r_{xy}: .741).

Finally, the model fit indexes pointed to a good data fit: the quotient between the χ^2 (544.99) value and its degrees of freedom (160) was 3.40, the RMSEA value was .05 (90% CI; .050-.060), the NNFI was .96 and the CFI was .97

Invariance of the measurement model: gender, age, competitive level and type of sport

An invariance analysis was performed in order to check that the model's general fit was applicable, by means of hierarchically nested models, to the different subgroups of which the research was comprised. The analysis presented the following structure: the 0 model (configuration model) is a base model without restrictions in the estimation of parameters in the different groups with regard to which the subsequent comparisons were made. In this type of models, the indicators that define the measurement structure have the same configurations among the selected groups. Model 1 specified, besides factorial structures, equality or invariance of the factorial loads between groups; and model 2 added the correlations and the variances of the factors.

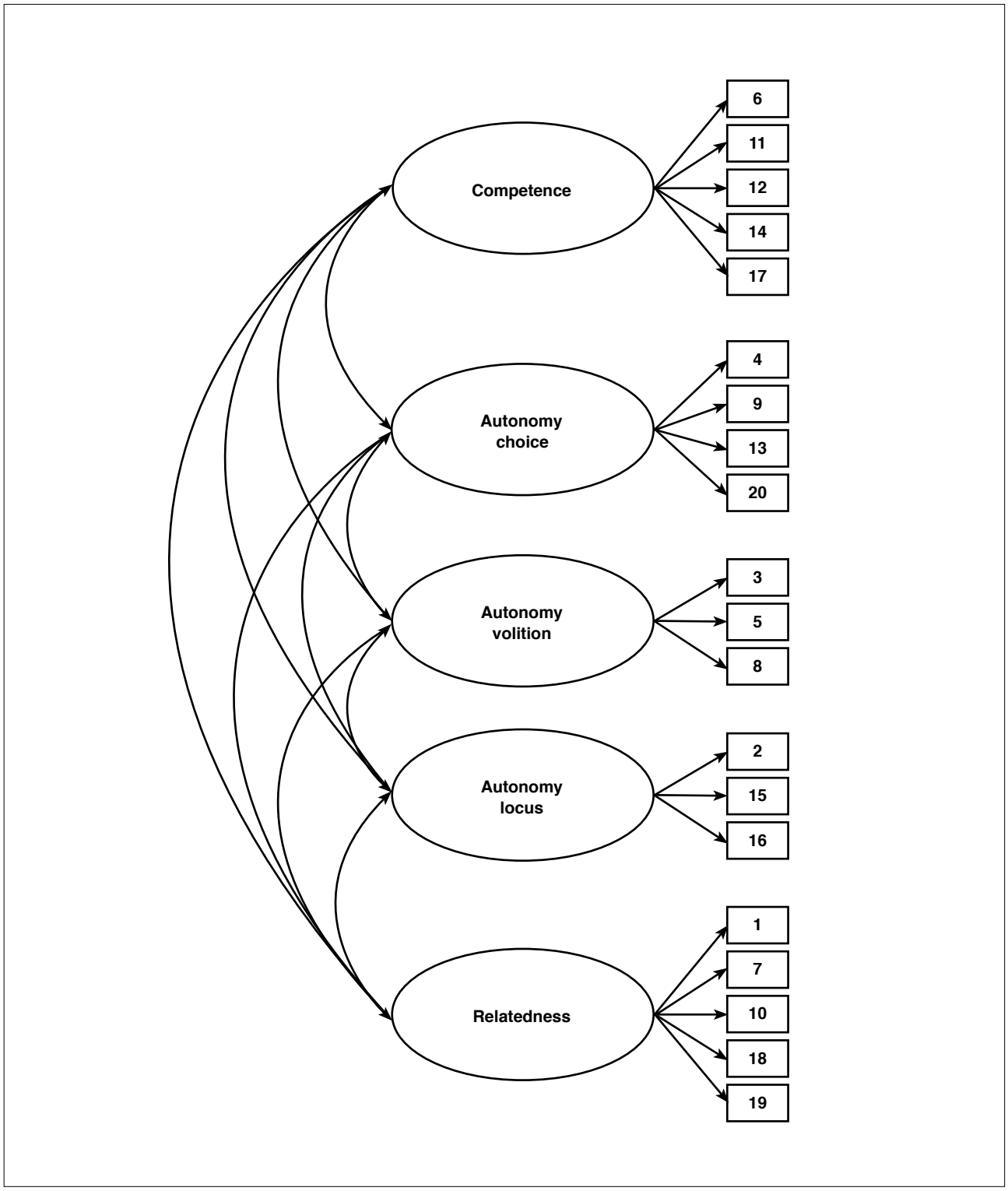
In order to obtain evidence of gender-related invariance, the group of men (n: 404) and the group of women (*n*: 391) were taken. The difference in the CFI values

Table 1
Descriptive statistics of items and dimensions

Ítems	Dimensions	Mean	Standard deviation	Asymmetry	Kurtosis
1. In sport, I have a close relationship with other people.	RL	6,17	1,19	-1,85	3,66
2. In sport, I feel I am pursuing goals that are my own.	AUT_{LC}	5,70	1,34	-1,20	1,04
3. I feel I participate in my sport willingly.	AUT	6,14	1,16	-1,76	3,52
4. In sport, I get opportunities to make choices.	AUT_{EL}	5,40	1,48	-0,97	0,54
5. In sport, I feel that I am being forced to do things that I don't want to do.	AUT	5,87	1,63	-1,52	1,38
6. I can overcome challenges in my sport.	CM	5,82	1,22	-1,37	2,23
7. I show concern for others in my sport.	RL	5,61	1,56	-1,28	1,06
8. I choose to participate in my sport according to my own free will.	AUT	6,53	0,99	-2,76	8,46
9. In my sport, I have a say in how things are done.	AUT_{EL}	4,83	1,71	-0,67	-0,31
10. There are people in my sport who care about me.	RL	6,08	1,26	-1,76	3,13
11. I am skilled at sport.	CM	5,88	1,20	-1,19	1,33
12. I feel I am good at sport.	CM	5,58	1,27	-0,94	0,72
13. In sport, I can take part in the decision making process.	AUT_{EL}	5,04	1,59	-0,69	-0,16
14. I get opportunities to feel that I am good at sport.	CM	5,60	1,25	-0,89	0,57
15. In sport, I really have a sense of wanting to be there.	AUT_{LC}	5,88	1,30	-1,34	1,53
16. In sport, I feel I am doing what I want to be doing.	AUT_{LC}	6,19	1,14	-1,79	3,51
17. I have the ability to perform well in sport.	CM	5,73	1,22	-1,11	1,19
18. In sport, there are people who I can trust.	RL	6,23	1,14	-1,84	3,37
19. I have close relationships with people in sport.	RL	6,38	1,08	-2,30	5,66
20. In sport, I get opportunities to make decisions.	AUT_{EL}	5,34	1,54	-0,90	0,23
1. Competence		5,72	1,00	-1,04	1,30
2. Autonomy choice		5,15	1,26	-0,76	0,42
3. Autonomy volition		6,18	0,91	-1,41	2,14
4. Autonomy internal perceived locus of causality		5,92	1,03	-1,27	1,63
5. Relatedness		6,09	0,94	-1,48	2,20

Note: RL = Relatedness; AUT_{LC} = Autonomy Internal perceived locus of causality; AUT_{VL} = Autonomy Volition; CM = Competence; AUT_{EL} = Autonomy choice.

Figure 1
Original five-factor structure



between model 0 and 1 was less than 0.01 (ΔCFI < -0.001), a result regarded as evidence favourable to equality or invariance. Similar results were observed for the difference of the comparison between models 0 and 2 (ΔCFI= -0.001).

With regard to invariance for age, two groups were formed, one consisting of minors (*n*: 523) and another group of adults (*n*: 272). The difference in the CFI values was below 0.01 for the comparisons of model 0 and 1, and subsequently 2 (ΔCFI = -0.001 and -0.002,

Table 2
Factorial loads, errors and variance

Item	λ	δ	R^2
1	,808	,589	,653
2	,809	,588	,654
3	,878	,478	,772
4	,835	,550	,698
5	,442	,897	,195
6	,857	,515	,735
7	,699	,715	,488
8	,877	,480	,769
9	,753	,658	,567
10	,906	,424	,820
11	,926	,378	,857
12	,883	,470	,779
13	,904	,429	,816
14	,921	,389	,848
15	,890	,456	,792
16	,938	,347	,880
17	,938	,346	,880
18	,918	,397	,842
19	,964	,266	,929
20	,902	,432	,814

Note: λ = factorial loads; δ = error; R2 = variance

Table 3
Correlations between dimensions and composite reliability

Dimensions	Competence	Aut. choice	Aut. *locus*	Aut. volition	Relatedness
Competence	,93				
Aut. choice	,80	,95			
Aut. volition	,86	,75	,82		
Aut. *locus*	,92	,78	,98	,95	
Relatedness	,77	,74	,81	,83	,96

Note. Aut.: autonomy; composite reliability index on diagonal

respectively), thus offering evidence of invariance of the model between the groups of adults and minors.

As for competitive level, the sample was divided into two groups, non-elite athletes (*n*: 592) versus elite competitive athletes (*n*: 203). For this model, CFI differences below 0.01 were found for model 0 with regard to 1 (ΔCFI = -0.001) and 0 with regard to 2 (ΔCFI < -0.001), thus confirming the invariance between athletes that engage in sport at different competitive levels.

Finally, the sample was divided into athletes who competed in individual sports (*n*: 350) and in team sports (*n*: 445). The differences in the CFI values were also below 0.01 for both model 1 (ΔCFI = 0.001) and model 2 (ΔCFI = 0.002) when they were compared to model 0. This points to factorial invariance between individual and team sports.

Reliability analysis

Table 3 displays the results obtained for composite reliability as well as the correlations between factors. For this model, the greatest index of reliability was found for the relatedness dimension (.96) and the lowest index was found for autonomy-volition (.82), the latter being above the limit of .70.

Discussion

The results indicate that the structure of the original version of the questionnaire and its Spanish version was replicated, presenting a good overall fit similar to those obtained in the preceding versions. Mention need only be made of the low factorial load for item 5, which nevertheless was above .40(*"In sport, I feel that I am being forced to do things that I don't want to do"*; autonomy-volition) in both Spanish versions. With regard to factorial structure, there are no data in other cultures/languages, barring a Portuguese version (Do Nascimiento, 2015), which failed to maintain the five-dimension structure addressed by Ng et al. (2011). This author grouped, once again, autonomy in a single dimension, without maintaining the distinctive characteristic of the BNSFS, and only 12 items of the 20 original items translated presented suitable factorial loads.

With regard to the mean scores observed, it should be mentioned that, as occurs with the team sport version (De Francisco et al., 2018), the lowest score was recorded in item 9 (autonomy-choice) and the highest one in item 8 (autonomy-volition). This result could be accounted for by culture, since some items seem to be more important than others in the same context depending on the provenance of the sample (Chen et al., 2015).

Moreover, all the items presented negative asymmetry, as in the two previous versions, demonstrating that the distribution frequency presents more values below the mean than above it, irrespective of language, or in other words that the answers are distributed below the mean. It should also be noted that in both Spanish versions, item 8 (*I choose to participate in my sport according to my own free will; autonomy-volition*) presents the highest mean, asymmetry and Kurtosis values. Therefore, most of the participants obtained a high score in this item, meaning that in Spanish culture doing sports is conceived purely as a matter of free will, without sensations of pressure (Gómez et al., 2009).

With regard to invariance, a triple-nested model analysis was performed for the gender, age, competitive level and type of sport variables. Applying the criterion indicated by Cheung and Rensvold (2002), with regard to invariance there are no differences between

Table 4
Model invariance in gender age, competitive level and type of sport

		χ^2	*df*	*p*	NNFI	CFI	RMSEA	RMSEA 90% IC	$\Delta\chi^2$	Δ*gl*	ΔCFI
Gender	Modelo 0	904,68	320	<0,01	0,979	0,982	0,068	0,063-0,073	--	--	--
	Modelo 1	927,87	331	<0,01	0,979	0,982	0,067	0,062-0,072	23,19	11	*0,001
	Modelo 2	961,48	341	<0,01	0,979	0,981	0,068	0,063-0,073	56,08	21	-0,001
Age	Modelo 0	916,66	320	<0,01	0,978	0,981	0,069	0,063-0,074	--	--	--
	Modelo 1	966,46	331	<0,01	0,977	0,980	0,070	0,064-0,075	49,80	11	-0,001
	Modelo 2	999,96	341	<0,01	0,977	0,979	0,070	0,065-0,075	150,02	21	-0,002
Competitive level	Modelo 0	1437,64	320	<0,01	0,996	0,997	0,094	0,089-0,099	--	--	--
	Modelo 1	1596,08	331	<0,01	0.996	0,996	0,098	0,093-0,103	158,44	11	-0,001
	Modelo 2	1831,90	341	<0,01	0,995	0,996	0,105	0,100-0,110	394,26	21	*0,001
Type of sport	Modelo 0	959,34	320	<0,01	0,979	0,982	0.071	0,066-0,076	--	--	--
	Modelo 1	1013,36	331	<0,01	0.979	0,981	0,072	0,067-0,077	54,02	11	-0,001
	Modelo 2	1085,40	341	<0,01	0,977	0,980	0,074	0,069-0,079	126,06	21	-0,002

Note: χ^2 = chi-squares; *df* = degrees of freedom; *p*= p value; NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; IC = confidence interval; Δ= difference between values; Model 0 = confidence model; Model 1 = invariant factorial loads; Model 2 = factorial loads and variances/invariance factor covariances, *< 0.001

any of the groups in relation to factorial structure (factorial loads, correlations between factors, factor variances). These results constitute evidence that the resulting tool is valid for evaluating the degree of satisfaction of BPN, irrespective of the group answering the questionnaire, gender, age, competitive level (elite or non-elite), or whether an individual or team sport is involved. The validation by De Francisco et al. (2018) yielded the same results in terms of gender, age and competitive level, although these authors did not verify invariance with regard to type of sport, since they only had participants who engaged in team sports.

This research made it possible to verify that the Spanish version may be applied, without any variations, to any type of sport. With regard to results on invariance in other countries, Do Nascimiento (2015) only checked factorial invariance by gender. The analysis of invariance is regarded as particularly interesting in view of its applicability to comparative studies, since if a tool does not fulfil the established invariance criteria, any conclusions subsequently drawn in a study comparing different sample groups may be rendered invalid.

The composite reliability index presented good values for each dimension, which validates this tool, thus confirming the absence of errors in the measurement performed. Moreover, and as occurs with the original version and the Spanish version for team sports, the lowest value is obtained for autonomy-volition, 0.61 and 0.60, respectively. Possibly, and since, as Reeve et al. (2003) assert, this is the dimension that requires particular attention, since it is a broader concept of self-regulation and may present significant differences. As in their research, this dimension presents lower values.

Conclusion

The results of this study allow us to confirm that the Spanish version of the BNSSS has good psychometric properties, maintaining the five-dimension factorial structure addressed by Ng et al. (2011) to evaluate the satisfaction of BPN in federation sports in Spain, constituting a breakthrough in sport psychology in that it develops a measurement tool for all types of sport, taking into account the three-factor division in the autonomy dimension.

Agradecimientos

This work enjoyed the assistance of the Spanish Ministry of Economy and Competitiveness within the framework of project PSI2014-56935-P.

References

Bentler, P. M. (2006). *EQS Structural Equations Program Manual* (Vol. 6). Multivariate Software.

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegen, S., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion, 39*(2), 216-236. https://doi.org/10.1007/s11031-014-9450-1

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233-255. https://doi.org/10.1207/S15328007SEM0902_5

De Francisco, C., Parra, F. J., Arce, C., & Vílchez, M. P. (2018). Preliminary empirical validation of the "Basic Needs Satisfaction in Sport Scale" with a sample of Spanish athletes. Frontiers in Psychology, 9, 1057. https://doi.org/10.3389/fpsyg.2018.01057

DeCharms, R. (1968). *Personal Causation*. Academic Press.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18*(1), 105-115. https://doi.org/10.1037/h0030644

Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology, 49*(3), 182-185. https://doi.org/10.1037/a0012801

Do Nascimento, J. R. (2015). *A Contribuição dos Traços de Perfeccionismo, Medida pela Motivação, para a Coesão de Grupo no Futsal de Alto Rendimento* [Tesis doctoral,. Universidade Estadual de Maringá]. Repositorio Institucional UEM. https://bit.ly/3aTq5tX

Dunn, T. J., Baguley, T., & Brunsden, V. (2014). From alpha to omega: a practical solution to the pervasive problem of internal consistency estimation. *British Journal of Psychology, 105*(3), 399–412. https://doi.org/ 10.1111/bjop.12046

Gómez, M. L., Ruiz, F. J., García, E. M., Granero, A. G., & Piéron, M. (2009). Motivaciones aludidas por los universitarios que practican actividades físico-deportivas. *Revista latinoamericana de psicología, 41*(3), 519-532.

Hodge, K., Lonsdale, C., & Ng, J. Y. (2008). Burnout in elite rugby: Relationships with basic psychological needs fulfilment. *Journal of Sports Sciences, 26*(8), 835-844. https://doi.org/10.1080/02640410701784525

Jowett, G. E., Hill, A. P., Hall, H. K., & Curran, T. (2016). Perfectionism, burnout and engagement in youth sport: The mediating role of basic psychological needs. *Psychology of Sport and Exercise, 24*, 18-26. https://doi.org/10.1016/j.psychsport.2016.01.001

Levy, J. P., & Varela, J. (2006). *Modelización con Estructuras de Covarianzas en Ciencias Sociales*. Netbiblo.

Méndez-Giménez, A., & Pallasá-Manteca, M. (2018). Enjoyment and Motivation in an Active Recreation Program. *Apunts. Educación Física y Deportes, 134,* 55-68. https://doi.org/10.5672/apunts.2014-0983.es.(2018/4).134.04)

Moreno-Murcia, J. A., Marzo, J. C., Martínez-Galindo, C., & Conte-Marín, L. (2011). Validación de la Escala de "Satisfacción de las Necesidades Psicológicas Básicas" y del Cuestionario de la "Regulación Conductual en el Deporte" al contexto español. *Revista Internacional de Ciencias del Deporte, 7*(26), 355-369. https://dx.doi.org/10.5232/ricyde2011.02602

Moreno-Murcia, J. A., and Sánchez-Latorre, F. (2016). The effects of autonomy support in physical education classes. R*evista Internacional De Ciencias Del Deporte 43,* 79–89. https://dx.doi.org/10.5232/ricyde2016.04305

Ng, J. Y., Lonsdale, C., & Hodge, K. (2011). The Basic Needs Satisfaction in Sport Scale (BNSSS): instrument development and initial validity evidence. *Psychology of Sport and Exercise, 12*(3), 257-264. https://doi.org/10.1016/j.psychsport.2010.10.006

Nia, M. E., & Besharat, M. A. (2010). Comparison of athletes' personality characteristics in individual and team sports. *Procedia-Social and Behavioral Sciences, 5*, 808-812. https://doi.org/10.1016/j.sbspro.2010.07.189

Oliva, D. S., Marcos, F. M. L., Miguel, P. A. S., Corrales, F. R. G., & Calvo, T. G. (2011). Self-Determination Theory and Prosocial Behaviours in Young Football Players. *Apunts Educación Física y Deportes, 103*, 31-37.

Pelletier, L. G., Rocchi, M. A., Vallerand, R. J., Deci, E. L. & Ryan, R. M. (2013). Validation of the revised sport motivation scale (SMS-II). *Psychology of Sport and Exercise, 14*(3), 329-341. https://doi.org/10.1016/j.psychsport.2012.12.002

Pérez-López, C. (2004). *Técnicas de análisis multivariante de datos. Aplicaciones con SPSS*. Pearson-Prentice Hall.

Prieto, G., & Delgado, A. R. (2010). Fiabilidad y validez. *Papeles del Psicólogo. 31,* 67–74.

Reeve, J., Nix, G., & Hamm, D. (2003). Testing models of the experience of self-determination in intrinsic motivation and the conundrum of choice. *Journal of Educational Psychology, 95*(2), 375-392. https://doi.org/10.1037/0022-0663.95.2.375

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality, 63*(3), 397-427. https://doi.org/10.1111/j.1467-6494.1995.tb00501.x

Ryan, R. M., & Deci, E. L. (2000). The darker and brighter sides of human existence: Basic psychological needs as a unifying concept. *Psychological Inquiry, 11*(4), 319-338. https://doi.org/10.1207/S15327965PLI1104_03

Ryan, R. M. & Deci, E. L. (2002). *Overview of Self-Determination Theory: An organismic dialectical perspective*. En E.L. Deci, y R.M. Ryan, (Eds.), Handbook of Self-Determination Research (pp. 3-33). The University of Rochester Press.

Van den Broeck, A., Ferris, D. L., Chang, C. H., & Rosen, C. C. (2016). A review of self-determination theory's basic psychological needs at work. *Journal of Management, 42*(5), 1195-1229. https://doi.org/10.1177/0149206316632058

Vlachopoulos, S. P., & Michailidou, S. (2006). Development and initial validation of a measure of autonomy, competence, and relatedness in exercise: The Basic Psychological Needs in Exercise Scale. *Measurement in Physical Education and Exercise Science, 10*(3), 179-201. https://doi.org/10.1207/s15327841mpee1003_4

Wilson, P. M., & Rodgers, W. M. (2004). The relationship between perceived autonomy support, exercise regulations and behavioral intentions in women. *Psychology of Sport and Exercise, 5*(3), 229-242. https://doi.org/10.1016/S1469-0292(03)00003-7

Conflict of Interests: No conflict of interest was reported by the authors.

apunts EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.03

OPEN ACCESS

Motor Skills Competence in Preschool Education

Pablo García-Marín[1], Natalia Fernández-López[1]

[1] Faculty of Teacher Training, University of Santiago de Compostela, Spain.

Cite this article:
García-Marín, P., & Fernández-López, N. (2020). Motor Skills Competence in Preschool Education. *Apunts. Educación Física y Deportes*, *141*, 21-32. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.03

Editor:

ISSN: 2014-0983

***Corresponding author:**
Pablo García-Marín
pablo.garcia@usc.es

Section:
Educación física

Original language:
Spanish

Received:
12 November 2019

Accepted:
23 March 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

The purpose of this study was to analyse competence in fundamental motor skills of Galician preschoolers. A descriptive ex-post facto design was used. The sample was composed of 80 participants (68.2±4.0 months) from three Galician state schools. Motor skills were evaluated with the Test of Gross Motor Development, 2nd edition (TGMD-2). The scores achieved were 93.3±13.1 (percentile 37.3±25.9) in gross motor coefficient, 9.2±2.3 (percentile 41.7±23.5) in the locomotor skills subtest and 8.6±2.5 (percentile 36.1±24.7) in the object control skills subtest. In the comparisons by gender, differences were found in striking (male = 6.3±2.0; female = 4.9±2.2; p = .004) and dribbling (male = 4.3±1.8; female = 2.9±2.3; p = .003). The qualitative analysis was used to identify the performance criteria which the preschoolers in the sample found most difficult to master. In locomotor skills, the worst performance was in bending the non-support leg in running. In object control skills it was the position of the hands when gripping the bat. In conclusion, preschoolers' competence in fundamental motor skills needs to be improved by optimising teaching-learning processes.

Keywords: motor development, preschoolers, gender, assessment, TGMD.

Introduction

Fundamental motor skills are regarded as the basic vocabulary of motor development, the building blocks of the most complex and specialised motor responses (Gallahue et al., 2011). They also allow us to rise successfully to the motor challenges of daily life and adapt to the features of a changing environment (Castañer et al., 2012). Gallahue et al. (2011) classify them into locomotor, object control and balance. Their development takes place in tandem with the maturation of the brain between the ages of four and ten (Malina et al., 2004), although if the right stimuli are received, good levels of competence can be achieved from the age of six (Gallahue et al., 2011).

Learning and developing motor skills is positively influenced by a wide variety of biological, psychosocial and environmental factors, which include: teacher training and proficiency (Adamo et al., 2016); the characteristics of the setting and facility (Barnett et al., 2013; Castañer et al., 2012); the level of motor coordination (Sánchez-Lastra et al., 2019); effective laterality based on contralateral synergy, i.e. when the non-dominant limb provides postural support to help the dominant limb achieve gestural precision (Castañer et al., 2012; Castañer et al., 2018); and competence as perceived by the actual children (LeGear et al., 2012). However, much of the research has focused on assessing the impact of specific programmes on motor competence in motor skills (Bardid et al., 2017; Robinson et al., 2016; Veldman et al., 2017).

The significance of achieving good motor development in childhood lies in its potential positive impact on other human dimensions (biological, cognitive, affective, social and psychological). Thus, associations have been found between motor skills and reading and writing (Callcott et al., 2015) or the ability to control attention, emotions and impulses (Robinson et al., 2016). Becker et al. (2014) believe that these benefits might have a positive influence on academic performance in primary school. Consequently, the number of studies quantifying physical activity derived from motor skills has increased (Adamo et al., 2016; Foweather et al., 2015).

The assessment of motor skills can be geared towards the quantitative or qualitative performance of motor execution. In the qualitative form, a series of motor pattern indicators are assessed in order to identify the degree of maturity of each skill (Hardy et al., 2010). Subsequently, motor activities more specifically based on the needs of the students and the indicators which they have not yet mastered can be programmed (Foulkes et al., 2015). One of the most widely used instruments in qualitative assessment is the Test of Gross Motor Development, 2nd edition (TGMD-2) (Ulrich, 2000).

Results from previous studies using the TGMD-2 found poor values in the gross motor coefficient of 267 Canadian preschoolers (5±.9 years) (LeGear et al., 2012) and 284 Brazilian preschoolers (3-6 years) (Spessato et al., 2012). In other studies with samples of 168 English preschoolers (4.65±.58) (Foulkes et al., 2015), 425 Australian preschoolers (4 years) (Hardy et al., 2010), and 339 U.S. preschoolers (3-5 years) (Kit et al., 2017), scores for locomotor skills were higher than for object control skills.

Studies comparing female and male preschoolers found no differences in gross motor coefficient (Foulkes et al., 2015; Hardy et al., 2010). The same result was obtained with a sample of 71 Europeans (5.58±, 5-6 years) (Stock et al., 2014). By contrast, in Cliff et al. (2009), female preschoolers scored higher in a sample of 46 Australians (3-5 years).

When the comparison focused on object control skills, most male preschoolers demonstrated greater competence (Foulkes et al., 2015; Hardy et al., 2010; Kit et al., 2017; Spessato et al., 2012). The same conclusion was reached with samples of 93 (3-5 years) and 1,123 (5.9±1.6 years) Belgian (Bardid et al., 2013; Bardid et al., 2017), 76 Australian (4.1±.68 years) (Barnett et al., 2013) and 99 English preschoolers (4.6±.5 years) (Foweather et al., 2015). However, in Cliff et al. (2009) female preschoolers scored higher, and Stock et al. (2014) found no gender differences.

In terms of locomotor skills, several studies found no differences by gender (Bardid et al., 2017; Foulkes et al., 2015; Foweather et al., 2015; Spessato et al., 2012). By contrast, female preschoolers performed better in others (Cliff et al., 2009; Hardy et al., 2010; Kit et al., 2017; Stock et al., 2014).

More specifically, competence in running, galloping and hopping was higher in female preschoolers, while it was higher in male preschoolers for striking, kicking, throwing and catching (Foulkes et al., 2015; Hardy et al., 2010).

Only one study was found in Spain which evaluated TGMD-2 motor skills in preschoolers (González et al., 2009) with a sample of 70 Asturians between 4 and 6 years old. Other research either focused on one specific motor skill or assessed different skills. Consequently, in order to improve knowledge of motor competence in children, this study was undertaken with the following objectives: a) to evaluate and compare general and specific (locomotor and object control) competence in the fundamental motor skills of five-year-old Galician preschoolers;

b) to identify the qualitative performance criteria of the motor patterns which are most difficult to master.

Methodology

The research design was ex-post facto descriptive using accidental sampling.

Participants

The sample was comprised of 80 participants, 34 female (69.5±4.1 months; 21.9±3.2 kg; 117.1±3.03 cm; 15.9±1.7 kg · m-2) and 46 male (68.9±3.9 months; 23.3±3.5 kg; 118.5±3.06 cm; 16.5±1.9 kg · m-^{2}).

The inclusion criteria were: a) be aged between 60 and 71 months; b) be in the last year of preschool stage; and c) be healthy and not have been diagnosed with physical or intellectual disability prior to the research. Any participants who did not complete all the trials in the TGMD-2 were excluded.

The sample was obtained from three state preschools in Galicia in towns with more than 90,000 inhabitants. Based on Galician Statistics Institute figures, the educational level of family members resident in the schools' catchment areas was as follows: university (15.9%), secondary and/or vocational training (34.0%), primary (19.0%) and no studies (31.1%). In financial terms, according to the Institute the monthly income per family unit was: up to €1,000 (18.6%); from €1,001 to €2,000 (31.6%); from €2,001 to €3,000 (25.1%); more than €3,001 (24.7%). The schools' education plans showed that less than 5% of all the students enrolled came from abroad.

The research team interviewed the teachers at each school to learn about the conditions in which the participants' motor education was conducted. In two of the schools, the preschool teachers themselves were in charge of motor activities, while in the other school it was the primary school physical education specialist. The specific time devoted to motor development was one lesson of between 45 and 60 minutes a week. These lessons were mainly geared towards developing perceptive motor abilities and fundamental motor skills. The teaching resources normally used were motor circuits, motor games, traditional games and free play. The number of students per teacher and classroom ranged from 21 to 25. Generally, the lessons were held in indoor sports venues with surface areas ranging from 420 to 730 m^2. Exceptionally, and weather permitting, the sessions were held in the schools' playgrounds (2,100-2,700 m^2).

Instruments

The fundamental motor skills were assessed using the TGMD-2 (Ulrich, 2000). This instrument consists of two subtests, one for six locomotor skills (Figure 1) and the other for six object control skills (Figure 2).

The material needed to administer the test consists of two cones, a 12-cm bag, a batting tee, a 10-cm softball, a baseball bat, a 20-cm basketball and soccer ball, a 10-cm foam ball, a tennis ball and tape.

The test provides a gross motor coefficient based on the scores achieved in the twelve skills assessed; a score for the locomotor skills, a score for the object control skills and an independent score for each skill. The theoretical age of motor development and the percentiles can also be estimated on the basis of these scores. The reliability of the instrument (Cronbach's α) calculated by Ulrich (2000) for locomotor skills, object control skills and gross motor coefficient was 0.85, 0.88 and 0.91, respectively.

Procedure

The study was conducted in compliance with the rules and ethical principles of the Declaration of Helsinki for research involving human participants. The schools' permission and the informed consent of the participants' legal guardians were also secured.

To guarantee measurement reliability, the two test examiners conducted two training sessions in which they assessed ten preschoolers who were not in the sample but were the same age.

Subsequently, inter- and intra-examiner agreement was calculated with the Kappa coefficient. For this purpose, other schoolchildren were evaluated on two occasions at a two-week interval. The reliability achieved in all the tests was greater than 0.82.

To administer the test, the examiners called the participants in individually. Firstly, they were given a verbal description and a technical demonstration of the skill. Then they were given time to do the test. Each motor skill was evaluated twice in a row. In each attempt, the motor patterns that were performed correctly were given 1 point and the incorrect ones 0 points. All the participants were examined by the two assessors who agreed on the record at the end of each test.

Statistical analysis

The means and standard deviations were calculated for gross motor coefficient, the locomotor skills scale, the object control skills scale, each one of the independent

Figure 1
TGMD-2 locomotor skills.

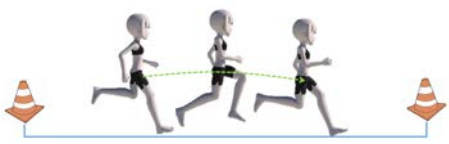
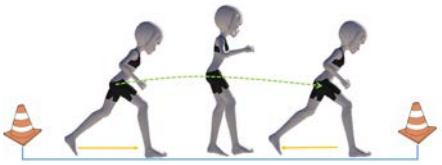
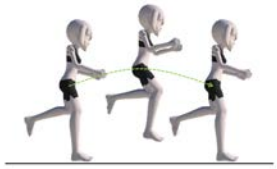
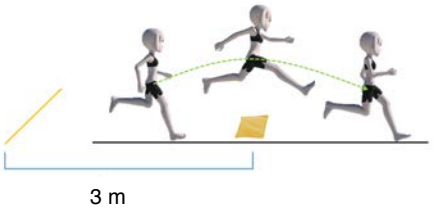
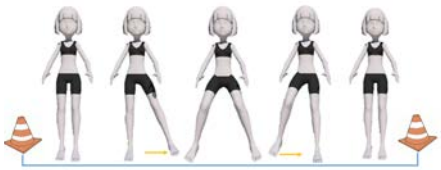
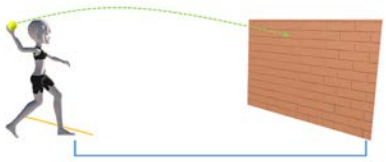
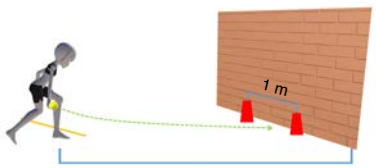
Run as fast as possible over a distance of 15 m marked by two cones.	 15 m	• Arms move in opposition to legs, elbows bent. • Brief period when both feet are off the ground. • Narrow foot placement landing on heel or toe. • Non-support leg bent approximately 90º.
Gallop a distance of 8 m marked by two cones.	 8 m	• Arms bent and lifted to waist level. • A step forward with the lead foot followed by a step with the trailing foot which lands next to or just behind the first one. • Brief period where both feet are off the ground. • Maintain a rhythmic pattern for four consecutive gallops.
Hop three times on the preferred leg and three more on the non-prefe-rred leg.		• The non-support leg swings forward in pendulum fashion to generate force. • The foot of the non-support leg remains behind the body. • Arms are bent and swing forward to generate force. • Take off and land three consecutive times on dominant foot. • Take off and land three consecutive times on non-preferred foot.
Leap over a 12-cm bag with takeoff on one foot and a 3-m run-up.	 3 m	• Take off on one foot and land on the opposite foot. • Period where both feet are off the ground longer than in running. • Forward reach with the arm opposite the lead foot.
Jump horizontally with feet together as far as possible using a line painted on the floor as a guideline.		• Preparatory movement includes bending both knees with arms stretched out behind body. • Arms extended forcefully forward and upward reaching full extension above the head. • Take off and land on both feet simultaneously. • Arms are thrust downward during landing
Slide sideways a distance of 15 m marked by two cones and taking as a guideline a straight line painted on the ground.	 15 m	• Body turned sideways so shoulders are aligned with the line on the floor. • A step sideways with lead foot followed by a slide of the trailing foot until it reaches the lead foot. • At least four continuous step-slides to the right. • At least four continuous step-slides to the left.

Figure 2
TGMD-2 object control skills.

Strike a 10-cm stationary ball at waist height.		• Dominant hand grips bat above non dominant hand. • Non-preferred side of body faces the imaginary thrower with feet parallel. • Hip and shoulder rotation during swing. • Transfer body weight to front foot. • The bat hits the ball.
Dribble a 20-cm ball four times in a row while stationary. Catch the ball with both hands when at the end of bouncing.		• Contact ball with one hand at waist level. • Push ball with fingertips (not a slap). • Ball contacts floor in front of or to the outside of foot on the preferred side. • Maintain control of ball for four consecutive bounces without having to move the feet to retrieve it.
Catch a 10-cm ball with both hands tossed by a person 5 m away. Only tosses between the catcher's shoulders and waist are valid.	 5 m	• In the preparation phase hands are in front of the body and elbows are bent. • Arms extend while reaching for the ball as it arrives. • Ball is caught by hands only.
Run up and kick a 20-cm ball against the wall. The ball is placed 6 m from the wall and the child starts their run-up 3 m from it.	 3 m 6 m	• Rapid continuous approach to the ball. • An elongated stride immediately prior to ball contact. • Non-kicking foot placed even with or slightly behind the ball. • Kicks ball with instep or toe of preferred foot.
Overhand throw a tennis ball as hard as possible against the wall 6 m away.	 6 m	• Windup begins with downward movement of hand and arm. • Rotate hip and shoulders to a point where the non-throwing side is facing the wall. • Weight is transferred by stepping with the foot opposite the throwing hand. • Follow-through beyond ball release diagonally across the body toward the non-preferred side.
Underhand roll a tennis ball as hard as possible against the wall 6 m away and sending the ball between two cones that are 1 m apart.	 1 m 6 m	• Preferred hand swings down and back, reaching behind the trunk while the chest faces the cones. • Stride forward with foot opposite the preferred hand toward the cones. • Bend knees to lower body. • Release ball close to the floor so ball does not bounce more than 10 cm high

motor skills and performance criteria. A comparative analysis by gender was conducted. The analysis of variance (ANOVA) was used for the quantitative variables which met the assumption of normality with the Kolmogorov-Smirnov test and the Mann–Whitney U test was used for those that did not. The Chi-square test was applied in the performance criteria and the intensity of the association was estimated by means of Cramér's V. The performance criteria most difficult to master were identified by choosing the ones yielding a competence percentage of less than 10% with respect to Ulrich (2000). The significance level in all the tests was $p \leq .05$. The entire analysis was performed with the SPSS software package, version 20.0 (SPSS Inc., Chicago, IL, USA).

Results

The gross motor coefficient achieved by the participants was 93.3±13.1 (37.3±25.9 percentile). No difference was found between the two genders (female = 92.6±11.6; percentile 35.1±24.3; male = 93.7±14.2; percentile 38.9±27.2; $F_{1.78} = .148$; $p = .701$). Figure 3 shows the levels of motor development achieved following Ulrich's reference values (2000). The percentage of preschoolers who did not reach the average equivalent to their age was 37.5% (female: 39.1%; male: 35.3%).

The score achieved in the locomotor skills subtest was 9.2±2.3 (percentile 41.7±23.5) and in the object control skills subtest 8.6±2.5 (percentile 36.1±24.7). No differences by gender were found in the locomotor skills subtest (female: 8.9±1.7; percentile 37.4±19.1; male: 9.4±2.7; percentile 44.8±26.0; F1.78: .926; p: .339) or in the object control skills subtest (female: 8.6±2.7; percentile 37.8±25.7; male: 8.5±2.4; percentile 34.8±24.2; $F_{1.78,}$ 050; p: .824).

Male preschoolers had significantly higher locomotor skill scores than in object control (t: 3,196; df: 45; p: .003). In female preschoolers, no differences were found between the two subtests (t: .635; df: 33; p: .530).

Of all the motor skills analysed, significant differences were only found by gender in striking (female: 4.9±2.2; male: 6.3±2.0; $F_{1.78}$: 8.718; p: .004) and dribbling (female: 2.9±2.3; male: 4.3±1.8; Z: -2.931; p: .003) (Table 1).

The percentages of preschoolers who demonstrated competence in the performance criteria for locomotor and object control skills are shown in Tables 2 and 3, together with differences by gender.

Figure 3.
GMS development levels for each gender

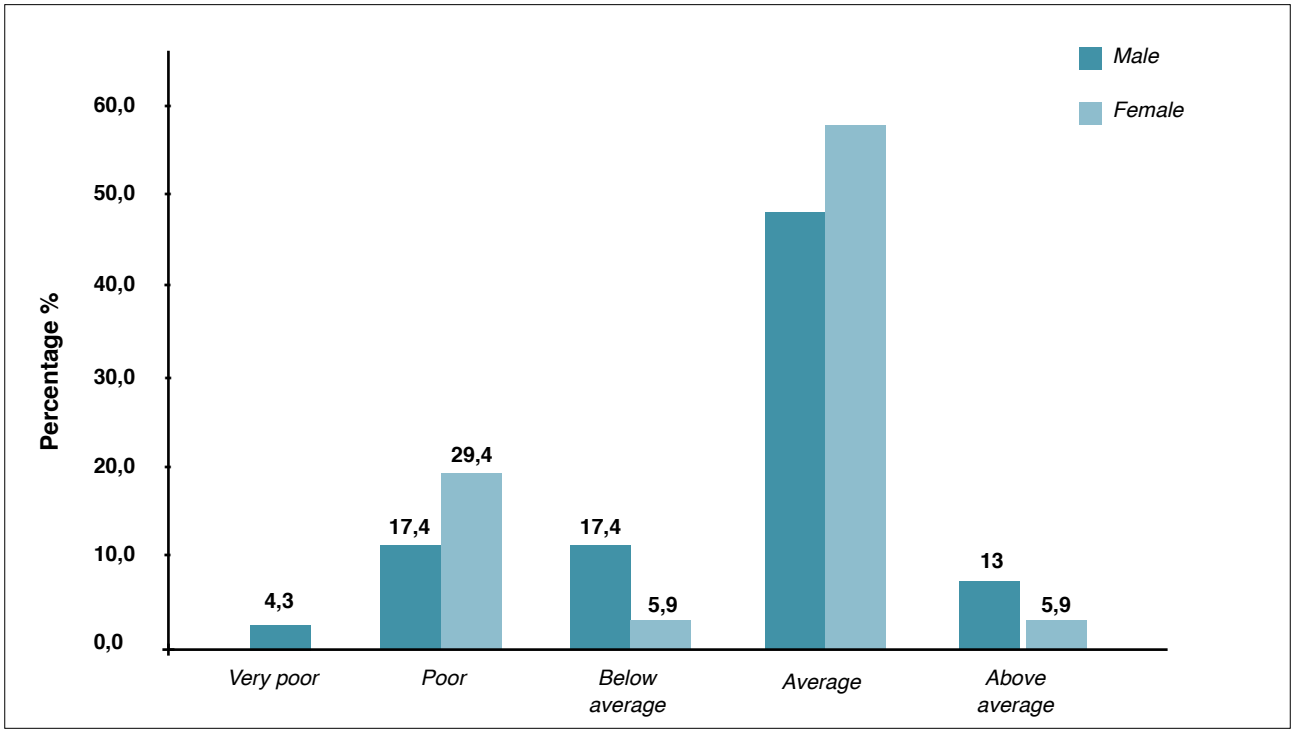


Table 1
Comparison of non-standardised motor skills scores by gender.

Scale	Motor skill	Male	Female	Z	F	*p*
Locomotor s.	Run	5,6±1,9	5,6±2,1	-,059	-	,953
	Gallop	6,2±1,1	5,9±1,5	-,514	-	,608
	Hop	5,9±2,1	5,9±1,7	-,416	-	,677
	Leap	4,0±1,7	3,9±1,3	-,539	-	,590
	Horizontal jump	5,3±1,7	4,8±1,6		1,714	,194
	Slide	6,4±2,0	6,8±1,2	-,203	-	,839
Object control s.	Striking a stationary ball	6,3±2,0	4,9±2,2	-	8,718	,004*
	Stationary dribble	4,3±1,8	2,9±2,3	-2,931	-	,003*
	Catch	4,1±1,3	4,5±1,4	-	1,245	,268
	Kick	5,3±1,8	4,7±1,4	-	2,567	,113
	Overhand throw	3,9±1,5	4,3±2,0	-	,928	,338
	Underhand roll	5,3±1,6	4,9±1,5	-	1,398	,241

** Significant differences p ≤ ,05.*

Discussion

The gross motor coefficient achieved by the participants in this study was low, consistent with LeGear et al. (2012) and Spessato et al. (2012), and 37.5% of the preschoolers evaluated did not achieve age-appropriate theoretical motor development.

The poor performance of the sample might be explained by several factors. Firstly, the preschools analysed spent devoted one 45-60-minute lesson per week to motor classes. Considering the impact of engaging in physical activity on motor skill competence (Adamo et al., 2016), it might be questioned whether such a weekly frequency and time would be sufficient to produce good motor development. Indeed, despite the importance of motor skills in preschoolers, the legislation on preschool education does not specify the number of hours and lessons which should be dedicated to this subject area. As a result, each school decides for itself and there is no guarantee that there will be sufficient minimum provision to promote their students' motor skills.

The second reason could be to do with the teachers who taught the motor skills lessons. This is because in one case they were led by the primary school physical education specialist with no training in the preschool stage and in the other two by preschool education graduates. Since the level of achievement of motor skills in preschoolers is influenced by teacher proficiency (Adamo et al., 2016; Stock et al., 2014), it would be more appropriate for the classes to be led by preschool teachers with extensive specialised training in motor skills. Therefore, the importance of training in motivational teaching methodologies and strategies should be underscored. Previous studies have shown that teachers' ability to implement personal responsibility and autonomy strategies has a positive impact on students' participation, effort, commitment and leadership by improving their decision-making capacity and promoting a constructive view of a more active lifestyle (Camerino et al., 2019; Prat et al., 2019).

Another possible explanation might be the over-use of free play during lessons. Preschoolers are known to use skills such as running and some types of jumping in this type of play quite often. However, others such as dribbling a ball, galloping and sliding sideways are not part of their regular play. Accordingly, the predecessors of this study found better results in motor competence when the activities were supervised by a specialist who diversified skill performance (Bardid et al., 2013; Bardid et al., 2017; Robinson et al., 2016; Stock et al., 2014; Veldman et al., 2017).

The high number of students in the class and the relationship between the performance area and the student-teacher ratio should be added to the above reasons. True et al. (2017) argue that the number of preschoolers in a 3-5 year-old class should not exceed 12. In addition, the recommended student-teacher ratio would be 8:1, while the optimal area for motor performance would be 13 m2 per student indoors and 23 m2 per student outdoors. Based on these reference values, it follows that the space available to the preschoolers in the sample (16.4 m2 per student in the worst case of indoor space) was more than sufficient. However, in all the preschools, the maximum

Table 2
Percentage of male and female preschoolers demonstrating competence in performance criteria for locomotor skills, chi-square value and Cramer's V.

LS performance criteria	Male	Female	Total	Dif.	X^2	*p*	*V*
Running (R)							
1. Arms move in opposition to legs, elbows bent	52,2	35,3	45,0	28,0	2,251	,134	
2. Brief period when both feet are off the ground	87,0	88,2			,029	,864	
3. Narrow foot placement landing on heel or toe (not on the whole area of the sole)	60,9	70,6	65,0	28,0	,812	,368	
4. Non-support leg bent approximately 90º (e.g. near the buttocks)	34,8	47,1	40,0	42,0	1,228	,268	
Galloping (G)							
1. Arms bent and lifted to waist level	17,4	23,5	20,0	12,0	,460	,497	
2. A step forward with the lead foot followed by a step with the trailing foot which lands next to or just behind the first one	100	94,1			2,775	,096	
3. Brief period when both feet are off the ground	91,3	76,5			3,374	,066	
4. Maintain a rhythmic pattern for four consecutive gallops	82,6	70,6			1,620	,203	
Hopping (H)							
1. The non-support leg swings forward in pendulum fashion to generate force	13,0	17,6	15,0	39,0	,325	,569	
2. The foot of the non-support leg remains behind the body	47,8	17,6	35,0	26,0	7,827	,005	,313
3. Arms are bent and swing forward to generate force	26,1	41,2	32,5	17,5	2,029	,154	
4. Take off and land three consecutive times on preferred foot	82,6	82,4			,001	,976	
5. Take off and land on three consecutive times on non-preferred foot	69,6	64,7			,210	,646	
Leap over an object with run-up (L)							
1. Take off on one foot and land on the opposite foot	47,8	58,8			,948	,330	
2. Period when both feet are off the ground longer than in running	73,9	76,5			,068	,794	
3. Forward reach with the arm opposite the lead foot	39,1	23,5			2,169	,141	
Horizontal jump from standing start (HJ)							
1. Preparatory movement includes bending both knees with arms stretched out behind body	56,5	35,3			3,533	,060	
2. Arms extended forcefully forward and upward reaching full extension above the head	56,5	41,2			1,841	,175	
3. Take off and land on both feet simultaneously	43,5	41,2	42,5	31,5	,042	,837	
4. Arms are thrust downward during landing	52,2	47,1			,205	,651	
Slide sideways (S)							
1. Body turned sideways so shoulders are aligned with the line on the floor	65,2	52,9			1,228	,268	
2. A step sideways with lead foot followed by a slide of the trailing foot until it reaches the lead foot	78,3	88,2			1,347	,246	
3. At least four continuous step-slides to the right	73,9	82,4			,799	,372	
4. At least four continuous step-slides to the left	60,9	70,6			,812	,368	

Diff.: Difference with Ulrich (2000) in the percentage of participants demonstrating competence.

Table 3
Percentage of male and female preschoolers demonstrating competence in performance criteria for object control skills, chi-square value and Cramer's V.

OCS performance criteria	Male	Female	Total	Dif.	X^2	*p*	*V*
Striking (ST)							
1. Dominant hand grips bat above non-preferred hand	39,1	17,6	30,0	50,0	4,297	,038	,232
2. Non-preferred side of body faces the imaginary thrower with feet parallel	34,8	23,5	30,0	29,0	1,179	,278	
3. Hip and shoulder rotation during swing	73,9	41,2			8,730	,003	,330
4. Transfers body weight to front foot	47,8	23,5			4,924	,026	,248
5. The bat hits the ball	39,1	35,3	37,5	25,5	,123	,726	
Stationary dribble (SD)							
1. Contacts ball with one hand at waist level	52,2	35,3			2,251	,134	
2. Pushes ball with fingertips (not a slap)	23,1	17,6			,799	,372	
3. Ball contacts floor in front of or to the outside of foot on the preferred side	47,8	23,5	37,5	25,5	4,924	,026	,248
4. Maintains control of ball for four consecutive bounces without having to move the feet to retrieve it	21,7	23,5	22,5	10,5	,036	,850	
Catching (C)							
1. In the preparation phase hands are in front of the body and elbows are bent	56,5	64,7	60,0	23,0	,546	,460	
2. Arms extend while reaching for the ball as it arrives	60,9	76,5			2,169	,141	
3. Ball is caught by hands only	47,8	41,2			,349	,555	
Kicking (K)							
1. Rapid continuous approach to the ball	73,9	47,1	62,5	14,5	6,015	,014	,274
2. An elongated stride immediately prior to ball contact	43,5	23,5			3,420	,064	
3. Non-kicking foot placed even with or slightly behind the ball	34,8	47,1	40,0	47,0	1,228	,268	
4. Kick ball with instep or toe of preferred foot	60,9	41,2	52,5	31,5	3,040	,081	
Overhand throw (OT)							
1. Windup begins with downward movement of hand and arm	30,4	29,4			,010	,921	
2. Rotate hip and shoulders to a point where the non-throwing side is facing the wall	30,4	17,6			1,705	,192	
3. Weight is transferred by stepping with the foot opposite the throwing hand	43,5	70,6			5,805	,016	,269
4. Follow-through beyond ball release diagonally across the body toward the non-preferred side	21,7	41,2	30	23	3,517	,061	
Underhand roll (UR)							
1. Preferred hand swings down and back, reaching behind the trunk while the chest faces the cones	43,5	41,2	42,5	15,5	,042	,837	
2. Stride forward with foot opposite the preferred hand toward the cones	52,2	29,4			4,145	,042	,228
3. Bend knees to lower body	82,6	76,5			,460	,497	
4. Release ball close to the floor so ball does not bounce more than 10 cm high	43,5	52,9			,702	,402	

Diff: Difference with Ulrich (2000) in the percentage of participants demonstrating competence.

number of students per class and the student-teacher ratio were far exceeded, thereby affecting quality of practice.

The findings of this study are consistent with others which found no differences in gross motor coefficient by gender (Foulkes et al., 2015; Hardy et al., 2010; Stock et al., 2014). It therefore coincides with Foulkes et al. (2015) and Hardy et al. (2010) who ascribe these data to the similarity in physical and physiological characteristics of both genders at these ages.

As in Stock et al. (2014), no gender differences were found in the analysis of the locomotor and object control skills subtests. However, as in other studies, a comparison of each motor skill independently showed a greater proficiency of male preschoolers in striking and dribbling (Foulkes et al., 2015; Hardy et al., 2010). Furthermore, the analysis of the performance criteria revealed that all the differences were in object control skills. Thus, the percentage of male preschoolers demonstrating competence was higher for almost all performance criteria except for weight transfer in throwing. In locomotor skills, the only difference was in the non-support leg position in hopping.

The main reason accounting for the differences in object control skills based on gender is linked to the specificity of the stimuli and participation in activities which stimulate one type of skill or another. Thus, Kit et al. (2017) explained the better performance of male preschoolers by their greater engagement in activities that involve the use of balls, such as football or basketball. Meanwhile, Barnett et al. (2013) found an inverse relationship between the level of competence in object control skills and participation in dance classes, an activity with greater involvement of female preschoolers. In addition, Bardid et al. (2017) noted that male preschoolers received more feedback and technical corrections during object control skills, thus helping them to progress in mastering these skills. In this paper, the sports played and the type of feedback received by the students were not known, which is a limitation that means the above arguments cannot be discussed and will have to be addressed in future research.

The qualitative evaluation using the TGMD-2 made it possible to identify the performance criteria which the preschoolers analysed found most difficult to master. To improve their competence in locomotor skills, activities should be directed toward arm-leg coordination to generate more force in running and jumping (hopping and horizontally). In running, they would also need increased hip joint mobility when in the air and also landing on the heel or toe. In galloping, the only factor to be improved would be arm position. In hopping, the action of the non-support leg should be improved by swinging it forward to increase the force exerted on the other one. Finally, in horizontal jumps, leg coordination exercises should be addressed to land on both feet at the same time.

With regard to object control skills, it was found that participants would need to strengthen their perceptual-motor skills to better coordinate their movements with the objects in striking, dribbling and kicking. An immature pattern was also identified in the preparation positions in striking, catching, kicking and underhand rolling, and several points in these actions revealed shortcomings in the movements and positions which allow the skill to be executed with balance.

By identifying the performance criteria that have not yet been mastered, teaching and learning processes can be planned to meet students' specific needs. In order to improve the participants' level of motor skills, it is recommended to expand the teaching resources used in the sessions by introducing short motor activities, motor stories, motor songs and learning environments. All these resources make it possible to encourage varied experimentation with motor skills in a recreational and global way, thereby linking motor development to the three curricular areas (1. Self-knowledge and personal autonomy; 2. Knowledge & Understanding of the World, and 3. Languages: communication and representation). Similarly, motor stimulation through the use of interactive technological environments with immersive experiences which simulate different feelings of presence (exergames) is an innovative and effective resource that can be used to develop fundamental motor skills (Castañer et al., 2011).

Conclusions

The analysis of fundamental motor skills competence evinced a poor level of performance by the preschoolers in the sample analysed. Given the benefits of a good level of motor development for perceptual, cognitive, psychological, affective and social skills, as well as its impact on academic performance, it would be advisable to expand practice opportunities in preschools. To this end, the guidelines below should be followed:

- Activities should be led by preschool teachers with extensive training in body expression teaching and the ability to introduce active and innovative methodologies and motivating teaching strategies.
- The specificity of the stimuli in motor competence calls for the introduction of both locomotor and object control skills in teaching approaches while bearing in mind that object control skills are more complex.

• When the intention is to improve competence in fundamental motor skills, organised activities should predominate over free play. This does not mean that free play should be excluded from lessons, since it can be very helpful, for example, in fostering motor creativity.
• Feedback and communication from teachers to students should enhance their motivation and facilitate the progression of their motor skills, regardless of gender and type of activity.
• Addressing students' needs calls for a qualitative assessment of the state of their fundamental motor skills development.
• Education legislation should be updated and specify a sufficient length of time to ensure motor development in preschools. It would also be advisable to reduce the student-teacher ratio.

References

Adamo, K., Wilson, S., Harvey, A. L., Grattan, K. P., Naylor, P.-J., Temple, V. A., & Goldfield, G. S. (2016). Does Intervening in Childcare Settings Impact Fundamental Movement Skill Development? *Medicine and Science in Sports and Exercise, 48*(5), 926-932. https://doi.org/10.1249/MSS.0000000000001092

Bardid, F., Deconinck, F. J., Descamps, S., Verhoeven, L., De Pooter, G., Lenoir, M., & D'Hondt, E. (2013). The effectiveness of a fundamental motor skill intervention in pre-schoolers with motor problems depends on gender but not environmental context. *Research in Developmental Disabilities, 34*(12), 4571-4581. https://doi.org/10.1016/j.ridd.2013.09.035

Bardid, F., Lenoir, M., Huyben, F., De Martalaer, K., Seguers, J., Goodway, J. D., & Deconick, F. J. (2017). The effectiveness of a community-based fundamental motor skill intervention in children aged 3–8 years: Results of the "Multimove for Kids" project. *Journal of Science and Medicine in Sport, 20*(2), 184-189 https://doi.org/10.1016/j.jsams.2016.07.005.

Barnett, L., Hinkley, T., Okely, A. D., & Salmon, J. (2013). Child, family and environmental correlates of children's motor skill proficiency. *Journal of Science and Medicine in Sport, 16*(4), 332-336. https://doi.org/10.1016/j.jsams.2012.08.011

Becker, D. R., McClelland, M. M., Loprinzi, P., & Trost, S. G. (2014). Physical activity, self-regulation, and early academic achievement in preschool children. E*arly Education and Development, 25*(1), 56-70. https://doi.org/10.1080/10409289.2013.780505

Callcott, D., Hammond, L., & Hill, S. (2015). The Synergistic Effect of Teaching a Combined Explicit Movement and Phonological Awareness Program to Preschool Aged Students. *Early Childhood Education Program, 43*(3), 201-211. https://doi.org/10.1007/s10643-014-0652-7

Camerino, O., Valero-Valenzuela, A., Prat, Q., Manzano Sánchez, D., & Castañer, M. (2019). Optimizing Education: A Mixed Methods Approach Oriented to Teaching Personal and Social Responsibility (TPSR). *Frontiers in psychology, 10,* 1439. https://doi.org/10.3389/fpsyg.2019.01439

Castañer, M., Andueza, J., Hileno, R., Puigarnau, S., Prat, Q., & Camerino, O. (2018). Profiles of Motor Laterality in Young Athletes' Performance of Complex Movements: Merging the MOTORLAT and PATHoops Tools. *Frontiers in psychology, 9,* 916. https://doi.org/10.3389/fpsyg.2018.00916.

Castañer, M., Andueza, J., Sánchez-Algarra, P., & Anguera, M. T. (2012). Extending the analysis of motor skills in relation to performance and laterality. In O. Camerino, M. Castañer, & M. T. Anguera (Eds.), *Mixed Methods Research in the Movement Sciences: Case Studies in Sport, Physical Education and Dance* (119-145). Routledge.

Castañer, M., Camerino, O., Parés, N., & Landry, P. (2011). Fostering body movement in children through an exertion interface as an educational tool. *Procedia-Social and Behavioral Sciences, 28,* 236-240. https://doi.org/10.1016/j.sbspro.2011.11.046

Cliff, D. P., Okely, A. D., Smith, L. M., & McKeen, K. (2009). Relationships between Fundamental Movement Skills and Objectively Measured Physical Activity in Preschool Children. *Pediatric Exercise Science, 21*(4), 436-449. https://doi.org/10.1123/pes.21.4.436

Foulkes, J. D., Knowless, Z., Fairclough, S. J., Stratton, G., O´Dwyer, M., Ridgers, N. D., & Foweather, L. (2015). Fundamental movement skills of preschool children in Northwest England. *Perceptual and Motor Skill, 121*(1), 260-283. https://doi.org/10.2466/10.25.PMS.121c14x0

Foweather, L., Knowles, Z., Ridgers, N. D., O´Dwyer, M. V., Foulkes, J. D., & Stratton, G. (2015). Fundamental movement skills in relation to weekday and weekend physical activity in preschool children. *Journal of Science and Medicine in Sport, 18*(6), 691-696. https://doi.org/10.1016/j.jsams.2014.09.014

Gallahue, D. L., Ozmun, J., & Goodway, J. (2011). *Understanding motor development: infants, children, adolescents*. Boston: McGraw-Hill

González, Z., Cecchini, J. A., López, J., & Riaño, C. (2009). Disponibilidad de las Habilidades Motrices de 4 a 14 años. Aplicabilidad del test de Desarrollo Motor Grueso de Ulrich. *Aula abierta, 27*(2), 19-28

Hardy, L. L., King, L., Farrel, L., MacNiven, R., & Howlett, S. (2010). Fundamental movement skills among Australian preschool children. *Journal of Science and Medicine in Sport, 13*(5), 503-508. https://doi.org/10.1016/j.jsams.2009.05.010

Kit, B. K., Akinbami, L. J., Isfahani, N. S., & Ulrich, D. A. (2017). Gross Motor Development in Children Aged 3–5 Years, United States 2012. *Maternal and Child Health Journal, 21*(7), 1573-1580. https://doi.org/10.1007/s10995-017-2289-9.

LeGear, M., Greyling, L., Sloan, E., Bell, R. I., Willianm, B. L., Naylor, P. J., & Temple, V. A. (2012). A window of opportunity? Motor skills and perceptions of competence of children in kindergarten. *International Journal of Behavioral Nutrition and Physical Activity, 9*(29). https://doi.org/10.1186/1479-5868-9-29

Malina, R. M., Bouchard, C., & Bar-Or, O. (2004). *Growth, Maturation and Physical Activity*. Champaign: Human Kinetics

Prat, Q., Camerino, O., Castañer, M., Andueza, J., & Puigarnau, S. (2019). The Personal and Social Responsibility Model to Enhance Innovation in Physical Education. *Apunts. Educación Física y Deportes, 136,* 83-99. https://doi.org/10.5672/apunts.2014-0983.es.(2019/2).136.06

Robinson, L. E., Palmer, K. K., & Bub, K. L. (2016). Effect of the Children's Health Activity Motor Program on Motor Skills and Self-Regulation in Head Start Preschoolers: An Efficacy Trial. *Frontiers in Public Health, 4*(173), 1-9. https://doi.org/10.3389/fpubh.2016.00173

Sánchez-Lastra, M. A., Varela, S., Cancela, J. M., & Ayán, C. (2019). Improving children's coordination with proprioceptive training. *Apunts. Educación Física y Deportes, 136,* 22-35. https://doi.org/10.5672/apunts.2014-0983.es.(2019/2).136.02

Spessato, B., Gabbard, C., Valentini, N., & Rudisill, M. (2012). Gender differences in Brazilian children's fundamental movement skill performance. *Early Child Development and Care, 183*(7), 916-923. https://doi.org/10.1080/03004430.2012.689761

Stock, M., Oliveira, B., & Cristina, N. (2014). Guided play and free play in an enriched environment: Impact on motor development. *Motriz, 20*(2), 177-185. https://doi.org/10.1590/S1980-65742014000200007

True, L., Pfeiffer, K. A., Dowda, M., Williams, H. G., Brown, W. H., O'Neill, J. R., & Pate, R. R. (2017). Motor competence and characteristics within the preschool environment. *Journal of Science and Medicine in Sport, 20*(8), 751-755. https://doi.org/10.1016/j.jsams.2016.11.019

Ulrich, D. A. (2000). *Test of Gross Motor Development: Examiner's Manual*. Austin: PRO-ED.

Veldman, S., Palmer, K. K., Okely, A. D., & Robinson, L. E. (2017). Promoting ball skills in preschool-age girls. *Journal of Science and Medicine in Sport, 20*(1), 50-54. https://doi.org/10.1016/j.jsams.2016.04.009

Conflict of Interests: No conflict of interest was reported by the authors.

apunts
EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.04

OPEN ACCESS

Hidden Curriculum in Physical Education: A Case Study

Alexandra Valencia-Peris[1], Joan Salinas-Camacho[1], Daniel Martos-García[1]

[1] University of Valencia, Valencia, Spain.

Cite this article:
Valencia-Peris, A., Salinas-Camacho, J., & Martos-García, D. (2020). Hidden Curriculum in Physical Education: A Case Study. *Apunts. Educación Física y Deportes*, *141*, 33-40. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.04

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Alexandra Valencia-Peris
Alexandra.valencia@uv.es

Section:
Educación física

Original language:
Catalan

Received:
5 May 2019

Accepted:
3 March 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

The basic objective of this study about hidden curriculum (HC) is not only to understand a school experience but also to understand, in general terms, the relationship between schooling and society. This study sets out to explore the ideologies transmitted through HC in the Physical Education (PE) subject as seen through a secondary education class. An ethnographic method was used, in the course of which information was collected by means of participant observation and semi-structured interviews, one with the teacher and seven with pupils from the group selected on account of their role in the group or because they had been involved in certain situations of interest observed. The qualitative analysis process of the data consisted of reducing the information based on thematic criteria, data exposition and comment and the verification of conclusions. The main findings suggest that both pupils and teachers, albeit differently, regard PE as having an instrumentalist nature removed from the functions, challenges and competencies currently attributed to it. Moreover, pupils and teachers alike perceived personal effort as the factor which most strongly conditioned evaluation, although the teaching staff clearly did so on the basis of a specific discourse of performance ideology. Teachers attached greater priority to the smooth and normal evolution of the session in the face of possible individual incidents in the course of the class, even ignoring such incidents in order to be able to continue to attend to the class. Such situations may condition pupils' participation and motivation in PE classes through the perception of such fears and insecurities derived from public opinion about their motor interventions.

Keywords: faculty, pedagogy, ideology of performance, healthism.

Introduction

In 1968, Philip W. Jackson published *Life in Classrooms,* a book compiling the outcomes of the extensive ethnographic research he had conducted in different schools in the United States. This immersion in school life him to identify ideas that were transmitted implicitly to pupils through the set of routines and forms of organisation in schools. The author coined the term Hidden Curriculum (HC) for this ensemble of ideas which go largely unnoticed by the educational community. Despite the relevance of his work, Jackson was not the first scholar to draw attention to the hidden transmission of ideas in the educational system. Classic authors of the stature of Durkheim or Gramsci had already attributed competencies to schools that fell way outside official academic curricula. The relationship between HC and reproduction theories subsequently prompted authors such as Henry Giroux, and numerous others, to analyse and challenge these ideas and develop critical pedagogy as a practice for turning the school into a driver of social change rather than an instrument of reproduction.

Research into HC in physical education (PE) has its clear point of departure in the work of Linda L. Bain (1975). From her very first publication, this researcher sought to describe the different ways in which HC acts in PE classrooms. Initially, her analysis of the study of HC in PE focused on personal values culled from the literature up until that time (Bain, 1976). These values were rights and obligations in the classroom for which no provision was made in academic syllabuses, and they became an opportunity to explore the student's HC as it is developed in the PE subject depending on pupil gender and social provenance. Bain (1985; 1990) went on to correct her initial research and extended her study of HC by observing the meanings or significance attached to classroom routines by teachers and pupils, bringing in a feminist outlook which ultimately spawned myriad related research. In doing so, she broke away from the line pursued in her earlier work, asserting that the basic objective of studying HC is not merely to understand the school experience (schooling), but rather to understand the relationship between schooling and society.

Other authors of international repute have since investigated the phenomenon of HC and PE, as noted by Devís et al., (2005). Cases in point would be Tinning (1990), Kirk (1992) or Fernández-Balboa (1993), who studied the ideologies that prevail in PE. These studies are founded on the notion that PE is not neutral and that its specific deployment is driven by the interests of certain groups (Kirk & Tinning, 1990). Some examples of this are technocratic rationality (Fernández-Balboa & Muros, 2006), which is obsessed with accomplishing objectives regarded as non-problematic by deploying increasingly more efficient methodologies (Bain, 1990), or the ideology of performance, associated with the former, which sees pupils' bodies as an instrument at the service of the values associated with competitive sport and the school as a training ground (Crum, 2017; Devís, 2001; Molina & Beltrán, 2007). As Kirk explained (1990), the ideology of performance has allowed PE to seek to justify its presence on the school curriculum, as healthism (Colquhoun, 1990) is now doing, a growing discourse in these parts and one which, while it may not adhere to educational parameters and does admit critical analysis, would appear to promote performance or appearance (Bain, 1990) and prescribes what medicine recommends to PE (Devís & Peiró, 1992).

Another point of interest in the study of HC in PE stems from questions of gender and sexuality (Devís et al., 2005). Besides the studies by Bain, mention should also be made of Patricia Griffin (1989), who produced an interesting ethnographic study in which she concluded that male and female pupils have scant interaction with each other and that male students tend to behave more aggressively, whereas the conduct of female pupils is characterised by a penchant for cooperation and more verbal, rather than physical, behaviours. According to Griffin, these findings lead to the conclusion that gender is the most important socialising agent in PE, meaning that understanding it is key in transforming reality. Therefore, it transpires that these questions of gender, as well as sexuality, implicitly permeate many of the teaching actions of PE teachers, thereby conditioning the way that pupils participate in the subject and the practice of physical activity (Beltrán-Carrillo & Devís, 2019).

More recently, studies such as those by Olson et al., (2016) or Casey (2017) have established a very close link between the term HC and ideology and discourse, striving to keep HC in PE on the latter's pedagogical and sociological research agenda.

In the light of the foregoing, the objective of this study is to ascertain which of these ideologies are transmitted through hidden curriculum in a secondary school PE class.

Methodology

The study is based on a qualitative research methodology using the educational ethnography strategy, which is the result of applying ethnographic practice and anthropological reflection to the study of the school as an institution (Velasco and Díaz de Rada, 2006). It is a

single-case study which involves a process of investigation characterised by a detailed, systematic and in-depth examination of the case in question (Stake, 2007)

The researcher was involved in this study for a period of two months, in the form of two weekly sessions, thereby fulfilling the requirements pertaining to being in the field, in the environment being studied, thus enabling him to become familiar with and recognise many of the events and details of the reality observed, while also being able to act to extend his information and exchange impressions with the participants. On the other hand, in certain cases this presence could modify the research setting or make the participants feel awkward.

Participants

This study was conducted in the PE subject of a second-year compulsory education public school in the city of Valencia numbering 23 pupils, 12 girls and 11 boys. The school where the research was conducted is public and is located in the centre of the city of Valencia. The majority of the pupils are from Spanish-speaking families with an average socio-economic level, employed in the services sector or as freelance workers, according to the School's Educational Project. The teacher is a 32-year-old male who has taught PE in different academic years and also in the Spanish Baccalaureate. He was also the tutor of one of the authors of the study who, over a two-month period, did his teacher training 22 hours a week participated at the school. During the observation period, and before the interviews were held, the student or trainee teacher informed and secured the consent of the families and the teacher by means of a letter. He also informed the school management and guidance department, who gave their approval following a small personal interview in the course of which the research procedures were explained.

Materials and Instruments

The ethnographic method uses a set of resources to compile and analyse the elements being studied, such as participant observation, interview and documentary analysis (Álvarez, 2008). For the purpose of data triangulation, in this study the information was collected by means of participant observation and semi-structured interviews, one with the teacher and seven with pupils from the group (four girls and three boys), selected on account of their role in the group or because they had been involved in certain situations of interest. This selection was performed firstly by means of convenience sampling, leveraging the predisposition of two girl pupils to participate in the research. These two initial interviews were followed by a snowball sampling selection strategy in which pupils mentioned and/or recommended by the previous interviewees were chosen with a view to obtaining access to participants who might otherwise be more difficult to identify through simple observation, albeit with an evident relationship with the object of study (Hammersley & Atkinson, 2001). Therefore, both data collection tools enable us to study certain elements from different standpoints and compare them from the perspective of the observer.

Procedure

The research was conducted during the first term of 2017, and involved the observation of a total number of 13 one-hour-long PE sessions (8 sessions of the Rugby tag teaching unit and 5 acrobatic gymnastics sessions).

In methodological terms, the pupils learnt basic rugby skills and tactics based on pure global and global polarising attention practice strategies (Sánchez-Bañuelos, 1989) through a task setting-based command style (Mosston & Ashworth, 1993). In short, a style based on a classic session structure with scant pupil participation, as in the case described by Prat et al. (2019). This style took the form of different modified games intended from the outset to place the technical elements and the rules of the sport in a real-game situation context. The same strategies and styles were applied in acrobatic gymnastics, with an organisation based on pairs and groups of three for pupils to execute different figures in an ascending order of difficulty. The trainee teacher did the field work, taking on the role of observer-participant (Sparkes & Smith, 2014) during his work experience at the school or, in other words, through partial and sporadic participation. Throughout this observation period, the author used note-taking as a method for recording information, analysed chronologically and intelligibly. Elements such as class organisation, spontaneous pupil distribution, inter-group interactions and group-teacher interactions were used for note-taking purposes. Moreover, the semi-structured interviews were held in sessions agreed to in advance with the teacher to ensure that the absence of a given pupil would not disrupt the normal course of the classes as planned by the teacher. The interviews were held in a corner of the gym and were recorded on a mobile telephone over a variable time (between 26 and 42 minutes). The questions were based on predetermined categories taken from a bibliographic review performed in advance dealing with the scientific evidence of HC in PE: technocratic rationality, gender questions and questions of origin. Examples of the first

category of questions are provided below, although some of them were modified in the course of the interview: "What is the purpose of PE? What role do you think PE plays in your education? In your opinion, which pupils in the class are best at PE and why?".

The credibility criteria, which in qualitative research may be defined as the sum of reliability and validity (Goetz & LeCompte, 1988) must be underpinned by ethical principles. Thus, to guarantee credibility, the literature recommends accurate designs, detailed descriptions or a critical review of drafts, besides the observance of ethical behaviour, such as the use of pseudonyms, informed consent or the confirmation of the transcriptions (Sparkes & Smith, 2014), among other aspects. In this regard, this study provides a detailed description of the setting and the methodological procedure, thus enabling it to be replicated. Moreover, a certain triangulation of techniques and informants was used, yielding data which, when discussed with other studies, provide a consistent narrative. Finally, and to guarantee ethical conduct, the participants' well-being was never threatened or compromised, pseudonyms were used, participation was voluntary and the consent of the pupils, their families and the teacher involved was secured.

Data Analysis

All the recordings were transcribed literally and analysed together with the observer-participant's field data notebook. The qualitative data analysis process consisted of data reduction, exposition of the data and the verification of conclusions (Massot et al., 2004). In other words, activities related to selection, focalisation and the abstraction of units of meaning based on thematic criteria. Although the study in general used a mixed coding and categorisation process, the categories selected and presented in this article were determined deductively. More specifically, categories that refer, in one way or another, to some of the specific ideologies of HC in PE: "Being in tip-top shape", "Effort" and "Participation". Similarly, and due to space constraints, categories related to gender and/or origin questions have been excluded.

Results and Discussion

Characterisation of the PE sessions

The 2nd-year secondary-school PE session generally began after between seven and ten minutes had elapsed. This time was used by pupils to leave their backpacks in the changing rooms and to assemble in a specific place in the gym equipped with a small table and a blackboard/whiteboard. The teacher was a young person who maintained a cordial relationship with the pupils. Many of the boys and girls greeted him on seeing him and sat down to wait. The teacher would then take the class register, make the relevant announcements and then go on to explain the first activity in the session.

The class apparently unfolded on a substantially routine and incident-free basis. In this regard, the actual teacher referred to the group in question as "a highly integrating group" and that "in general, the group's predisposition has been quite high this year" (Observer's notebook, 7.2.2017). Therefore, and *a priori*, the educational context may be regarded as ideal, with a non-disruptive group of pupils evincing no discriminatory behaviour and attitudes and positively predisposed towards the teaching-learning process. Following the examples of Tinning (1992), the classes were well-taught, as embodied in the orderliness of the group, the teacher's control over the latter and participation.

Although, as has already been mentioned, the relationship between the pupils and the subject was apparently ideal, the pupils' perception of the subject had to be verified beyond the evident amusement and excitement they got out of it. The function attributed by the pupils to PE in the school syllabus and the significance afforded to the content and activities in the sessions are two elements that need to be analysed to be able to understand the prevailing teaching paradigms in this context.

PE helps you to stay in good shape

When we asked the pupils about the objective of the subject or the main purpose sought by the teacher in giving the class, the most frequent answer was to improve health and transmit healthy lifestyle habits:

It is useful because there are people who, if they do not do physical education, do no sport, and it also helps to increase sport a little and for us to be healthier, so to speak ***(Empar, pupil).***

Other students were of the same opinion as **Empar** and also stated that this was the main objective of the subject. This trend represents a limited and instrumentalist view of the functions of PE, making it a curricular element intended solely to keep the school population within acceptable health parameters. This could be constructed as a **healthist** function of PE (Colquhoun, 1990; Tinning, 1990) which devalues the pupils' social functions and all-round development, to name but some issues, and which have been attributed to it in recent years (López Pastor et al., 2016).

Nevertheless, this idea is usually totally linked to the use of free time in a responsible way that is beneficial to health (Devís, 2001).

It is like teaching us to move and not spend the day playing video-games. I mean, running, doing a bit of sport rather than lounging on the sofa all day. Also to teach us that sport can be good fun and healthy at the same time ***(Pau, pupil).***

The subject was addressed as a way of generating resources that they could leverage to fill their leisure time, both at school and in adult life (Devís, 2001). In fact, this link between PE and leisure and recreation was very close in some cases, to the extent that the subject was regarded as a space for leisure or recreation in the school syllabus.

PE is used more or less to get some exercise and, at least as far as I'm concerned, as a form, of amusement, isn't it? I mean it's about getting away from the whole classroom thing, chairs and desks and homework and all that… As well as having a bit of fun, doing activities… It's about not just sitting around, but getting some exercise, moving your muscles ***(Pau, pupil).***

Therefore, the pupils regarded PE not necessarily as a subject that provides motor training through motor training, but rather as one that fulfils the sole function of amusement (Tinning, 1992). When the teacher was questioned about the main objective of his subject, he said that his basic premise in designing classes was to convey a set of values, an intention which was apparently removed from the pupils' perceptions. And the operative word is "apparently removed", because the subject ultimately continues to be regarded as an instrument, either to improve health or to instil values, and this divests it of its educational mainstays, leading it to be associated with the prevailing technical discourse. Education through movement, if we recall Arnold's taxonomy (1991), is fully embodied in this point. Moreover, the pupils' perception is often related to the way in which the teacher imparts the subject beyond any explicit intentions the teacher may have. In this regard, authors such as Bain (1976) found that the real intention of PE teaching staff was, first and foremost, to increase pupil participation and amusement, keeping them occupied and active in the course of the sessions while avoiding conflicts. This purpose fits in better with the perception of the pupils in this study than with the teacher's claims with regard to the subject's priorities.

Nevertheless, when the focus was taken away from subject in general and the usefulness of the teaching of motor skills was addressed specifically, the main reason why the teacher regarded movement education as indispensable was for the purpose of teaching health-related content. The conception of PE as a tool dedicated to improving the body shared by the teacher and pupils is clearly reminiscent of the body-machine metaphor (Barrett Beryl, 1996). This dual perspective of the body, and a highly technocratic attitude to the subject, was internalised by the pupils, who in some cases actually equated physical fitness with academic achievements in PE. This was the case of one girl who was asked which students were best at PE:

Student: Yes, I think it is a boy, but there are also girls.

Researcher: And why a boy rather than a girl?

Student: Because he's short and very athletic, so…

Researcher: But being short is not always an advantage…

Student: Maybe, but he's really skilled. He's a good runner, he plays rugby, he's athletic, he's a good dancer…

(Esther, pupil).

Effort is what matters most

Talking about PE in instrumental terms partly helps to underscore one of the problems regarded as most relevant by the teacher: how to get the pupils to understand the way they would be evaluated. On the one hand, the teacher regarded the effort made by pupils as an essential factor when evaluating them, particularly their attitude in each session. Nevertheless, he also acknowledged that it would be easier for the more adroit pupils to get higher marks or grades in the subject. This belief, which is limiting, is consistent with a performance ideology applied to PE according to which people who perform better, more efficiently or have better motor skills are positively rated, whereas less competent pupils are rated more poorly, to the extent of generating intolerance and rejection of them (Molina & Beltran, 2007). Moreover, this view constitutes a conception of evaluation anchored in a traditional approach in which teachers are the keystone around which the entire evaluation process is constructed and this process is implemented by means of general and one-way hetero-evaluations based on gauging motor performance while nevertheless failing to give due consideration to pupils' individual progression in their teaching-learning process (Alvarez, 2001). Unfortunately, the pupils did not see this as an impediment to getting good marks or grades in PE since they ended up accepting the assessment of effort as an important component of grading.

(…) the effort you make also matters: some people are good at it but make no effort in any class, whereas others are not very good but try hard. That is different. Not only how good you are at it affects your grade ***(Marcos, pupil).***

Although the teacher subscribed to the discourse of the performance ideology, most of the pupils admitted

that their motor skills as such improved little in the PE sessions, and the fact is that, as Devís and Peiró (1992) point out, the time periods provided for in school teaching units are insufficient to guarantee any real improvement in motor development. Consequently, greater value was attached to what you were (anthropometrically and physiologically) than what you learnt (López Pastor, 1999)

It is therefore evident that both teachers and pupils regarded work and individual effort (either solo or as part of a group) as a key element in evaluations and in grading in the PE subject. This culture of effort establishes the foundations of an individualistic and meritocratic conception of academic life, concepts that are embedded in the liberal conception of physical exercise and sport studied by HC investigators of the ilk of Bain (1975) or Fernández-Balboa & Muros (2006). These conceptions lead one to wonder whether equal opportunities and the likelihood of success are directly proportional to the effort made by individuals. In this case, PE justifies this idea, seeking to turn effort into a measurable phenomenon, disregarding other aspects such as each pupil's social and affective context, which also determines their behaviour and actions in and out of class.

I don't want to participate

In the initial sessions of the acrobatic gymnastics didactics unit, we observed one situation which was both frequent and telling:

The teacher started to explain a game called "meatball" or the "conveyor belt" in which one pupil crawls over his or her classmates who are lying very close to each another on the floor and who also perform rolling movements so that the body of the pupil on top of them will be "conveyed" more easily. When ***Marta*** *realised what the game was about, she protested silently, looking extremely concerned. She lay down on the floor at the beginning of the activity. However, when it was her turn to be the "meatball" she flatly refused, opted out of the game, sat down in a corner of the gym and started to cry. The teacher continued without a word, and my trainee teacher-colleague went over to talk to her (Observer's notebook, 14.3.2017).*

The pupil reacted in a similar fashion on two further occasions, whenever the contact was with boys. However, on other occasions, when contact was only with female classmates, the pupil presented no rejection (Observer's notebook, 24.3.2017). When the pupil was asked about these situations in the course of an interview, she said that she was very tall and that she was frightened of hurting her back. The fact that the activities in which she refused to take part involved a very low physical risk (such as the aforementioned "meatball" game) but did require physical contact with other pupils, male and female, and that she had no problems participating in more demanding activities involving a greater physical risk (such as building a two-tier human figure) with classmates of the same gender leads us to consider the possibility that Marta was not being entirely truthful. This situation is illustrative of the teacher's inability to intervene effectively, and, it must also be said, of the investigator's failure to coax a sincere version of the events from the pupil. However, a similar example reported in the article by Monforte and Pérez-Samaniego (2017) about fear and PE refers to how while girls may be more willing to talk about the experience of fear, doing so may lead them to be labelled particularly as failed neoliberal subjects. Moreover, according to Molina and Beltrán (2007), a personal characteristic is not what (negatively) affects a pupil most, but rather the fact that such a characteristic is made public. Apparently, what prevented this girl from cooperating normally with her classmates, and more particularly with boys, was the possibility of them finding out how much she weighed. In this regard, when this pupil was asked about what she felt the PE teacher was trying to teach in his classes, she responded as follows:

Well, I think he is trying to make us all closer to each other, have greater self-confidence… Maybe I am not explaining myself very clearly, but he wants everyone to get to know each other better, but physically, not mentally, I mean he wants us to know who the strongest person is… I don't know, I think it is something like that ***(Marta, pupil).***

With this reflection, we may deduce that she often regarded the PE classes as a place where pupils lost their privacy and intimacy, as Bain had already observed (1975). She interprets it as an obligation to act and interact with her classmates in a way that brings her hang-ups and insecurities to light. Some specific examples are displaying skills in public, that classmates overstep the physical contact barrier or having to be on top of others. The outcome is that such experiences may increase pupils' lack of interest in physical activity and even in the subject (Beltrán-Carrillo & Devís, 2019). More specifically, and according to the aforementioned authors, these pupils (particularly obese boys and girls with a low skill level) suffer the consequences of classes and an evaluation which are geared towards physical performance. Moreover, they are impacted by the influence of the discourse of masculinity and healthism in teachers' expectations and evaluations, biased by possible body prejudices, and they (the girls) experience feelings of discomfort and embarrassment at having to expose their body or a lower level of skill or performance under the

superior gaze of teachers and male classmates. Consequently, this study agrees with Monforte and Pérez-Samaniego (2017) with regard to the need to extend the repertoire of stories such as that of XX to enable teachers to acknowledge fear as a component of their pedagogical practice, since it may help to generate a deeper and more sensitive understanding of the practice of teaching.

Conclusions

PE is a subject with characteristics and needs that make it significantly different to other school subjects. These singularities make it, first of all, an inexhaustible source of situations, dynamics and meanings that are difficult to interpret or, to put it differently, that may have multiple interpretations. According to the specific findings of our research, numerous elements that we could identify as HC were detected in the PE class First of all, pupils regard the improvement of health and the learning of habits and resources that can be used in their free time as the main objectives of PE. This conception is at odds with the teacher's primary objective, namely to transmit values through motor activities. Notwithstanding, both conceptions afford PE an instrumentalist vision, removed from the functions and challenges it is currently supposed to embody (López-Pastor et al., 2016; Moreno et al., 2012).

On the other hand, pupils and teachers alike perceive personal effort to be the factor that brings the greatest influence to bear upon the evaluation, and therefore on the grade, of the student, even although the teacher states their intention to give the highest marks to pupils with the best motor skills, an aspect clearly rooted in the discourse of performance ideology. Therefore, the teacher's priority hinges on ensuring that the session unfolds smoothly, under their control, to pre-empt possible individual incidents in the course of the class. With this intention, they actually even fail to address certain conflicts in order to continue dealing with the group in general, which echoes the findings of Sánchez-Hernández et al. (2019). These types of situations can condition pupil participation and motivation in PE classes, through the perception of these fears and insecurities derived from public opinion resulting from their motor performance.

The main limitations of our study include its short observation period, which might have reduced our understanding of the educational reality being studied, and the decision, due to space constraints, not to present all the issues related to the social class, gender, sexuality or provenance of the pupils, aspects regarded as important in research into HC in PE.

Nevertheless, it should be emphasised that the study of HC, particularly in PE, is a complex phenomenon which moreover takes numerous social factors and problems into account. For this reason, any scientific contribution conducted to further knowledge and to explore the different facets of such a multi-faceted concept may be deemed indispensable if we are to move towards a more inclusive school PE model that embraces the individual characteristics and needs of all pupils, male and female.

References

Álvarez, C. (2008). La etnografía como modelo de investigación en educación. *Gazeta de antropologia*, 24(1). http://hdl.handle.net/10481/6998

Álvarez, J. M. (2001). *Evaluar para conocer, calificar para excluir*. Morata.

Arnold, P. J. (1991). *Educación física, movimiento y curriculum*. Morata.

Bain, L. (1975) The Hidden Curriculum in Physical Education. *Quest* (24), 92-101. https://doi.org/10.1080/00336297.1975.10519851

Bain, L. (1976). Description of the hidden curriculum in secondary physical education. *Research Quarterly. American Alliance for Health, Physical Education, Recreation, and Dance*, 47(2), 154-160. https://doi.org/10.1080/10671315.1976.10615355

Bain, L. (1985). The Hidden Curriculum Re-examined. *Quest* (37), 145-53. https://doi.org/10.1080/00336297.1985.10483829

Bain, L. (1990). A critical analysis of the hidden curriculum in physical education. En D. Kirk and R. Tinning (Eds.), *Physical education, curriculum and culture: Critical issues in the contemporary crisis* (pp. 19-34). The Falmer Press.

Barbero, J. I. (1996). Cultura profesional y currículum (oculto) en Educación Física. Reflexiones sobre las (im)posibilidades del cambio. *Revista de Educación*, 311, 13-49. http://www.educacionyfp.gob.es/revista-de-educacion/numeros-revista-educacion/numeros-anteriores/1996/re311/re311-02.html

Beltrán-Carrillo, V. J. & Devís-Devís, J. (2019). El pensamiento del alumnado inactivo sobre sus experiencias negativas en educación física: los discursos del rendimiento, salutismo y masculinidad hegemónica. *RICYDE. Revista internacional de ciencias del deporte*. 55(15), 20-34. https://doi.org/10.5232/ricyde2019.05502

Casey, A. (2017). Student interactions in the hidden curriculum. *European Physical Education Review*, 23(3), 366-371. https://doi.org/10.1177/1356336X16642189

Colquhoun, D. (1990). Images of Healthism in Health-based Physical Education. En D. Kirk & R. Tinning (Eds.), *Physical Education, Curriculum and Culture* (pp. 225-251). Falmer Press.

Crum, B. (2017). How to win the battle for survival as a school subject? Reflections on justification, objectives, methods and organization of PE in schools of the 21st century. Retos, 31, 238-244. https://recyt.fecyt.es/index.php/retos/article/view/53496

Devís, J. (2001). *La educación física, el deporte y la salud en el siglo XXI*. Editorial Marfil.

Devís, J. & Peiró, C. (1992). Ejercicio físico y salud en el currículum de la educación física: modelos e implicaciones para la enseñanza. En J. Devís & C. Peiró, *Nuevas perspectivas curriculares en educación física: La salud y los juegos modificados* (pp. 27-45). Inde.

Devís, J., Fuentes, J. & Sparkes, A. C. (2005) ¿Qué permanece oculto del Currículum Oculto? Las Identidades de Género y de Sexualidad en la Educación Física. *Revista Iberoamericana de Educación*, 39, 73-90. https://rieoei.org/RIE/article/view/805

Fernández-Balboa, J. M. (1993). Sociocultural characteristics of the hidden curriculum in physical education. *Quest*, 45(2), 230-254. https://doi.org/10.1080/00336297.1993.10484086

Fernández-Balboa, J. M. & Muros, B. (2006) The Hegemonic Triumvirate-Ideologies, Discourses, and Habitus in Sport and Physical Education: Implications and Suggestions. *Quest* (58), 197-221. https://doi.org/10.1080/00336297.2006.10491879

Giroux, H. (1989). *Critical Pedagogy*, the State and Cultural Struggle. Albany: State U of NY P.

Goetz, J. P. & Lecompte, M. D. (1988). *Etnografía y diseño cualitativo en investigación educativa*. Ediciones Morata.

Griffin, P. S. (1989). Gender as Socializing Agent in Physical Education, en T. J. Templin & P. G. Schempp (Eds), S*ocialization into Physical Education: Learning to Teach*, pp. 219-234. Benchamark Press.

Hammersley, M. & Atkinson, P. (2001). *Métodos de investigación*. Paidós.

Jackson, P. (1968). *La vida en las aulas*. Holt, Rinehart, and Winston.

Kirk, D. (1990). *Educación física y currículum*. Universitat de València.

Kirk, D. (1992). Physical Education, Discourse and Ideology: Bringing the Hidden Curriculum Into View. *Quest*, 44, 35-56. https://doi.org/10.1080/00336297.1992.10484040

Kirk, D. & Tinning, R. (1990). Introduction: Physical Education, Curriculum and Culture. En D. Kirk & R. Tinning (Eds.), *Physical Education, Curriculum and Culture* (pp. 1-21). Falmer Press.

López-Pastor, V.M. (1999). *Prácticas de evaluación en educación física: estudio de casos en primaria, secundaria y formación del profesorado*. Universidad de Valladolid.

López Pastor, V., Pérez, D., Manrique, J. & Monjas, R. (2016). Los retos de la Educación Física en el siglo XXI. *Retos* (29), 182-187. https://www.redalyc.org/pdf/3457/345743464037.pdf

Massot, I., Dorio, I. & Sabariego, M. (2004). Estrategias de recogida y análisis de la información. En R. Bisquerra (coord.), *Metodología de la investigación cualitativa* (pp. 329-366). La Muralla.

Molina, J. & Beltrán, V. (2007). Incompetencia motriz e ideología del rendimiento en educación física: el caso de un alumno con discapacidad intelectual. *Motricidad: Revista de Ciencias de la Actividad Física y del Deporte* (19), 165-190. https://recyt.fecyt.es/index.php/ejhm/article/view/56264

Monforte, J. & Pérez-Samaniego, V. (2017). El miedo en Educación Física: una historia reconocible. *Movimento*, 23(1), 85-99. https://doi.org/10.22456/1982-8918.71272

Moreno, A., Campos, M. & Almonacid, A. (2012). Las funciones de la educación física escolar: una mirada centrada en la justicia social y la reconstrucción del conocimiento. *Estudios pedagógicos*, 38(esp), 13-26. https://doi.org/10.4067/S0718-07052012000400002

Mosston, M. & Ashworth, S. (1993). *La enseñanza de la Educación Física, la reforma de los estilos de enseñanza*. Editorial Hispano Europea.

Olson, R., Laidlaw, P. & Steel, K. (2016). 'No one wants to be taught from a textbook!' Pre- service health and physical education teachers' reflections on skill acquisition and a new curriculum. *European Physical Education Review*, 23(4), 499-516. https://doi.org/10.1177/1356336X16658222

Prat, Q., Camerino, O., Castañer, M., Andueza, J. & Puigarnau, S. (2019). The Personal and Social Responsibility Model to Enhance Innovation in Physical Education. *Apunts. Educación Física y Deportes*, 136, 83-99. https://doi.org/10.5672/apunts.2014-0983.es.(2019/2).136.06

Sánchez-Bañuelos, F. (1989). *Bases para una didáctica de la EF y el deporte*. Gymnos.

Sánchez-Hernández, N., Martos-García, D. & Soler, S. (2019). La (re)construcción de la identidad profesional de las profesoras de EF: de la complicidad y la reproducción de las relaciones de género a la disposición al cambio educativo. *Revista Complutense de Educación,* 30(3), 879-893. https://doi.org/10.5209/RCED.59504

Sparkes, A. C. & Smith, B. (2014). *Qualitative Research Methods in Sport*, Exercise and Health. Routledge.

Stake, R. (2007). *Investigación con estudio de casos*. Morata.

Tinning, R. (1990). *Ideology and physical education*: *Opening Pandora's box*. Deakin University.

Tinning, R. (1992). *Educación Física: La escuela y sus profesores*. Universitat de València.

Velasco, H. & Díaz de Rada, A. (2006). *La lógica de la investigación etnográfica. Un modelo de trabajo para etnógrafos de escuela*. Trotta.

Conflict of Interests: No conflict of interest was reported by the authors.

apunts
EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.05

Proxemic Behaviour in Pre-service Teacher Training in Physical Education

Sonia Asún-Dieste[1], Mª Rosario Romero-Martín[1], José Luis Aparicio-Herguedas[2], Antonio Fraile-Aranda[3],

[1] Faculty of Health Sciences and Sport, University of Saragoss, Huesca, Spain.
[2] Faculty of Education, University of Valladolid, Segovia, Spain.
[3] Faculty of Education and Social Work, University of Valladolid, Valladolid, Spain.

OPEN ACCESS

Cite this article:
Asún-Dieste, S., Romero-Martín, Mª.R., Aparicio-Herguedas, J.L., & Fraile-Aranda, A. (2020). Proxemic Behaviour in Pre-service Teacher Training in Physical Education. *Apunts. Educación Física y Deportes*, *141*, 41-48. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.05

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Mª Rosario Romero Martín
rromero@unizar.es

Section:
Physical Education

Original language:
Spanish

Received:
1 November 2019

Accepted:
30 March 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

Pre-service university training in Spain is currently the domain of generic and specific skills which enable graduates to respond effectively to social demands. The main occupation of the physical activity professionals consists of managing groups or individuals who are practising and learning motor activities. The necessary interaction that takes place in this process leads communication skills to play a major role in training. The students in this study led simulated teaching sessions and evaluated themselves and their classmates. Following the sessions, they produced self-reports that revealed proxemic difficulties. These difficulties straddled four categories: Teacher orientation and position; group position and organisation; teacher movement and physical and affective distance-immediacy established between teacher and students. They realised that poor teacher position and orientation vis-à-vis the group hampered proper communication, even leading to disruptive behaviour. They also realised that group organisation cannot be left to chance, in view of its influence on the methodological models followed and their importance in learning, and that the proxemic behaviour of students in a class can provide valuable information for teachers, both for learning and with regard to the emotions that condition the session, such as inhibition in certain body expression exercises. Finally, the students underscored the importance of both physical and emotional immediacy to create an optimal teaching and learning space.

Keyword: non-verbal communication, proxemics, pre-service teacher training, physical education, self-assessment, peer assessment.

Introduction

Pre-service university training in Spain requires that students master general and specific competencies, which means going beyond the traditional training model based on the accumulation of knowledge. This study on pre-service training of physical education (PE) teachers analyses the presence of non-verbal communication competence in students (Ortiz-Camacho, 2000) since the differences found in previous studies among expert and novice teachers in this question (Castañer et ál., 2010)) suggest that studying this competence in PE teacher training is of paramount importance.

Connecting with the relational and emotional dimension is of the essence Álvarez-Núñez in non-verbal communication in the classroom, as is facilitating the transmission of "that which, in their opinion, delivers greatest educational value: attitudes, beliefs, emotions, feelings, expectations, values, prejudices, states of mind" (2012, page 24).

Non-verbal communication straddles three areas of study (Davis, 1995; Knapp, 2007): kinesics (gestures and movements), paralanguage (non-verbal components of speech once the content has been removed) and proxemics, on which this study focuses. Castañer (1993) introduced a fourth area, chronemics, which studies the time factor in non-verbal communication.

Proxemics represents "the study of man's perception of space and the use he makes of it" (Hall et ál., 1968, page 83); it is about analysing proxemic uses based on physical distances, body orientation and movement, the person's spatial orientation or mobile positions. Therefore, proxemics deals with the study of space expressed as territoriality; with the distance between people; the occupation of space, movements and the consequences and significances of all the foregoing as aspects related to non-verbal communication.

With regard to distances, Hall et ál. (1968) establish four spatial areas in relation to the person which fluctuate depending on the context of the interaction:) intimate distance (up to 45 cm); 2) personal distance (45-120 cm); 3) social distance (120-360 cm), and 4) public distance (more than 360 cm). Some studies focus on people's reactions in their threatened space (the smaller the physical distance, the greater the affective relationship, seeking closeness with people we like, Davis, 1995). In education, non-verbal immediacy refers to the psychological and emotional closeness perceived between people, which transcends the physical, where immediacy conditions the relationships between teachers and students (Álvarez de Arcaya, 2002).

In terms of territoriality, human beings maintain primary mechanisms (Almeida & Ortiz, 2016), seeking spaces where we feel less threatened or more comfortable. Murcia and Ruiz (2010) refer to the organisation of objects and people in the classroom space so that the teacher, in an open classroom, can distribute the "disruptive" objects (a camera) throughout the room in order to obtain a balanced occupation of space by the students.

Rodríguez-Gallego (2012) refers to the concept of proxemic competence as that which, together with the kinesics and paralanguage competences, are aspects that should be interpreted and leveraged by the teacher to control the class and to establish distances with the students. Observing the layout of groups in the class gives the teacher a better understanding of the where the group is in the learning process; for example, in the case of exercises involving body expression, more consolidated groups tend to open up more to the audience whereas the less consolidated ones close up (Mateu et ál., 1992) more, possibly as a protection strategy.

However, besides the implications for teaching techniques, a knowledge of the meanings of the proxemic setting may help the teacher to recognise the emotional reactions occurring in the group. Depending on the methodological options they decide to implement, teachers can generate a class climate conducive to student creativity and autonomy; the idea is to generate a space for expression where students can symbolise, project themselves and create, which takes on particular relevance in contents such as body expression, where the creation of this space clearly conditions the evolution of the session (Romero-Martín, 2015).

Finally, several authors address the effects of non-verbal communication on learning (Castañer et ál. 2010), and assert that optimising teachers' communication styles has a positive and direct effect on student learning. Álvarez de Arcaya (2002) shows that a proper use of non-verbal communication has a positive effect on learning, which suggests that non-verbal competence, kinesics, proxemics, paralanguage and also chronemics (Castañer, 1993) should be pursued in pre-service teacher training.

Consequently, the objective of this study was to ascertain pre-service PE teacher training students' perceptions of their teaching competence in terms of proxemic non-verbal communication, following simulated sessions in which they role-played as teachers.

Metodología

Design

A qualitative study was designed, using content analysis as a technique for interpreting the written

reports. The work was geared towards ascertaining and interpreting the training phenomenon as part of the social phenomenon (Strauss & Corbin, 1998) on the basis of the study participants' subjective experiences (Gibss, 2007). Content analysis consists of coding and categorising verbal or behavioural data so that they can be classified and tabulated (Fox, 1987), counting frequencies and categorisations (López Noguero, 2002) and illustrating the written results to convey the descriptive nature of the qualitative paradigm involved (Bogdan & Biklen, 2007).

Participants

The participants included 120 university students aged between 18 and 26 years (M: 20,6; SD: 4.88), 50 from the Master's Degree in Primary Education of the University of Valladolid, and 70 from the Degree in the Sciences of Physical Activity and Sport of the University of Saragossa. The inclusion criteria were: be currently taking the body expression subject, attend regularly and choose the training evaluation route; the exclusion criterion was refusal to allow their data to be included in this research.

Instruments

The data collection instrument was a self-reported evaluation in which each student had to rate their own performance, also including the assessments made by their peers, using a rubric for communication skills, own information obtained from their own insights and the video analysis of the exercise. The self-report was a 500-word essay in which the students had to write down their thoughts about the most positive and negative aspects of their communication skills and propose improvement strategies.

Procedure

The students took part in a personal and group-based process of reflection about their teaching within a training evaluation system that utilised self- and peer-assessment strategies. The students initially signed an informed consent for their data to be included in the research and for video- and audio recording. Confidentiality was guaranteed, as was as the application of techniques to guarantee anonymity.

The methodological procedure consisted of six simulated sessions (Alonso et ál., 2016) in which the participants took it in turns to act as teachers, applying body expression didactic knowledge, and subsequently as observers, rating their peers on a rubric. Each teacher was evaluated by two observers who gave them verbal feedback at the end of the session. The teaching exercises were recorded in video and the peer assessment was recorded in audio. At the end of the process, each student completed a self-report drawing from all the information sources.

Data analysis

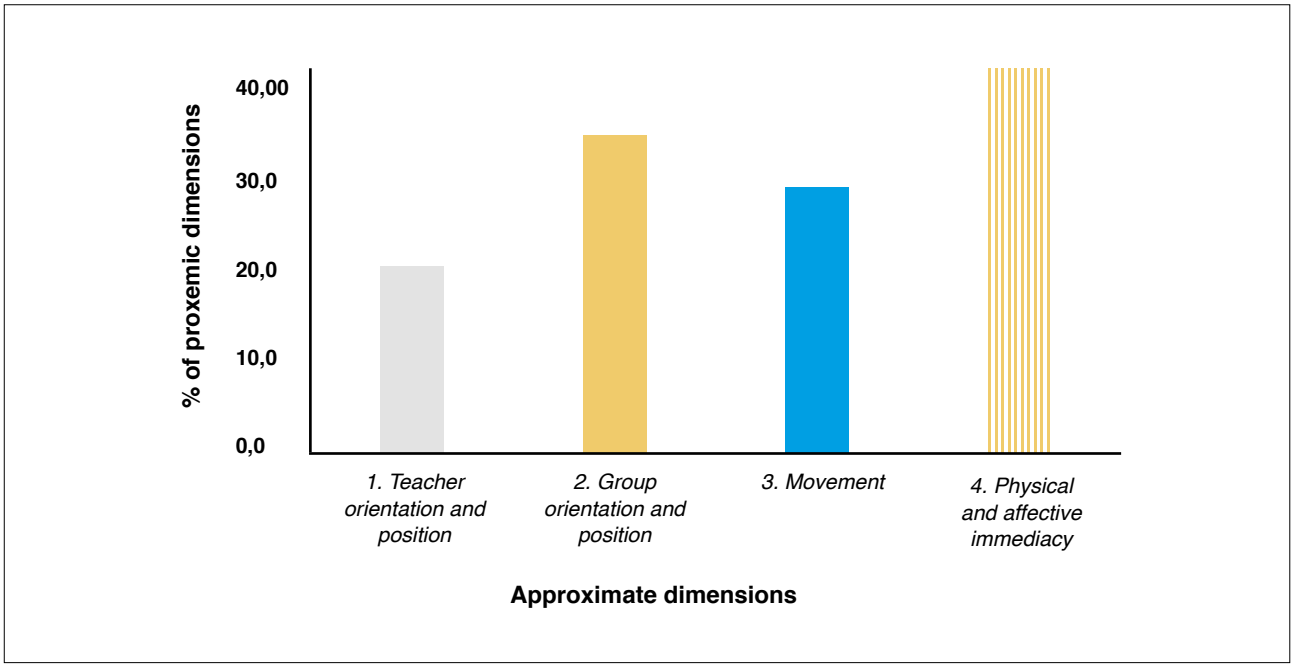
The self-reports were analysed using the ATLAS.ti software, which assigned an alphanumerical code to each comment depending on its position in the text and on the attributes of the person in question. This was followed by a further two analysis cycles to glean a better understanding of the phenomenon being studied (Saldaña, 2015). In the first cycle, two investigators analysed the meaning or significance of the comments, and categories or groups of codes were produced by means of a process of reflection and consensus (Friese, 2014). The continuous feedback from the members of the research team and their constant participation in the regeneration and fine-tuning of the emerging codes, code groups and categories afforded the study greater credibility, reliability and transfer (Guba, 1985).

In the second cycle, another investigator attributed the comments to the categories provided, thus obtaining a second categorisation. The extent of agreement between both codes was measured using the Kappa Index, whose value was = .795 (asymptotic standard error: 060; approx. sb: 10.964; approx. sig.:.000), indicated a satisfactory degree of agreement according to the Fleiss' kappa. This process yielded four categories within the proxemic communicative competence: 1) teacher orientation and position; 2) group-class orientation and position;3) teacher movement, and 4) participating student-teacher physical and affective immediacy. Finally, the percentages of comments assigned to each category were calculated and used to expound the results with the help of significant comments that were representative of the categories obtained.

Results

The students, male and female, after role-playing as teachers in the simulated classes, detected proxemic performance difficulties (Figure 1.) which were analysed and allowed us to produce the percentages in the aforementioned categories: 1) (19.2%); 2) (32.9%); 3) (27.4%), and 4) (39.7%).

Figure 1
Proxemic categories as percentages



1. Teacher's orientation and position with regard to the group

19.2% of the proxemic comments referred to the teacher's orientation towards the group for the purpose of informing as a factor that was not only important in ensuring that the message was clear but also in preventing disruptive behaviour in the group:

"One error that I saw and which is clear in the video was that during my explanation to the smaller groups I turned my back on the participants and they got distracted" (6:40.D1:A1-UZ)

"...the way the class was organised to provide the explanation was not right since, as you can see in the video, the students were organised adequately for the beginning of the activity but not for the explanation, as some of them were unable to see and could probably hardly hear me on account of the distance" (6:143-D1:A1-UZ).

The teacher's orientation as a proxemic element was seen to boost communication with the learners and guarantee the effective transmission of information. Moreover, when the teacher's position with regard to the group was equidistant, all the learners were seen to enjoy equal access to the information. Finally, it was detected that teachers, before beginning their explanations, should check that the pupils are predisposed to actively listening to ensure that they all focus on the teacher.

2. Group position and organisation

32.9% of the observations referred to the position and organisation of the group in space and the related implications. 24.7% were related to the consequences of a given group distribution:

"Maybe a semicircular distribution would have been better, since I ended up focusing more on one end of the row in which they were distributed, forcing interaction from them, while neglecting the other side". (1:28-D1:A1-VA)

"The students should have remained in the same place for the short conclusion and I should have gone straight into the activity with them so as not to disrupt the atmosphere created in the session. Putting them in the mirror disrupted the routine and led them to disconnect". (1:131-D1:A1-VA)

2.7% of the observations referred to how the teacher had distributed the group:

"To wrap up, and compared to the session given in the "teaching-learning processes" subject, I corrected the organisation of the class for the explanation". (1:22-D1:A1-CH);

"There was a point when the distribution of the group did not work out as I had planned and I was concerned and unsettled on seeing that things might not go according to plan". (1:23-D1:A1-VA).

The remaining 5.5% mentioned group reactions related to other spatial behaviours:

"…The students gradually moved towards the wall-bars… This unsettled me a bit as I was unsure how to deal with the situation. Now, having seen the video, I think that I could have placed some cones on the floor from the beginning to mark out the space and keep the pupils inside it…" (6:157-D6:D1.A1-UZ)

"In my opinion, the class went well, although sometimes the pupils got distracted and I had to call them to order"; (6:156-D6-CH)

On distributing the students in a semicircle, the teacher established a better proxemic relationship and interaction to permit a clear transmission of the information about the class activities. In the analysis of the pupils' spatial behaviour and the teacher's interpretation, the group was seen to move towards outlying areas of the exercise area, since fear of ridicule and inhibition tend to surface in activities such as dancing or body expression.

3. Teacher movement in the space, moving around

EMovement around the room accounted for 27% of proxemics-related comments:

"I tried to move about in order to supervise the pupils and make sure that the they were doing the activity properly. That said, neither did I over-engage with them". (1:20.1-D1:A1-CH)

"Moreover, I am always in the same place to change the music, which means that I switch off a little from the group doing the choreography and have to pay more attention to the music". (01:37-D1:A1-VA)

"…one negative aspect was that I remained in the same place for too long once the two groups had been formed". (1:79-D1:A1-VA)

On numerous occasions, the teachers acknowledged that they were not moving about enough or had no intention of interacting with the pupils, which could mean that they were not attending to the group properly, although they justified this by the need to do something else, such as change the music.

"Finally, we went through all the steps from the top and did a mini-choreography. I walked round to encourage, correct and motivate the different pairs". (1.12-D1:A1-CH)

"I was moving around all the time to be able to see, correct and help as far as possible, and the position I took up to give the explanations was correct". (01:21-D1:A1-CH);

On other occasions, the teacher mingled with the groups or addressed them directly in order to help or give the students new information or feedback about technical and organisational aspects.

4. Physical and effective distance-immediacy

The fact that the teacher was too far away from their pupils made it more difficult to monitor the group and have visual contact with it, thereby also hampering communication and interaction.

"I wasn't close enough to them, I was a bit too far away, as I already mentioned, although I do make visual contact with them, I smile at them and try to make sure they know that I am there and can help them at any point. I would summarise my performance in two words: kind but distant". (6:113-D1:A1-UZ)

Many comments referred to the fact that distances rendered emotional immediacy between teacher and students difficult. Mention was also made of tactile communication and the positive effect of emotional immediacy on motivation:

"…Interacting more with the entire group, being a bit closer to them (perhaps trying to motivate them with a bit more push, is linked to this), (1:4.1-D1:A1-CH)

"There is no tactile communication, I do go through the motion, but I find tactile communication very difficult, perhaps out of insecurity. I have always been shy and reserved, I do not touch other people and always keep a space between myself and the person I'm talking to" (1:114-D1.A1-VA).

"In my case I think it has a lot to do with feelings, since as I feel insecure and embarrassed, my communicative competence goes out the window and I tend to seem colder and shy away from my colleagues, or else refrain from engaging with them or motivating them. I should have been closer and more approachable". (6:112-D6:D1.A1.UZ)

To conclude, the distance-immediacy issue, firstly physical and subsequently emotional, between the teachers and the pupils may have conditioned the interaction between them. Teacher closeness to the group facilitated verbal and non-verbal communication and the group's perception of the level of attention, resulting in a more empathic relationship. Similarly, teacher-pupil emotional immediacy facilitated feedback for motivating, correcting, elaborating upon information, etc. Therefore, closeness between teachers and pupils would seem to be conducive to better physical and emotional communication.

Discussion

The study of the perception of proxemic space in PE students in simulated body expression sessions is used to observe the type of concerns and insecurities which in any event they can take into account as a key element in their professional teaching competence.

Teacher orientation

PE teachers must strike a balance between information-giving time and exercise time in their classes. For this purpose, teachers should limit their own talking (Seners, 2002, page 214). If the teacher is talking to a large group (Galera, 2001), they must make sure that all the pupils understand them (Seners, 2002), for which purpose the pupils must be in their visual field (Pieron, 1999), whereby these pupils tended to take up a position facing the group, in line with the study by Castañer et ál. (2015). The students-teachers were aware of the importance and difficulty of taking up the right position in front of the pupils to ensure that both verbal and non-verbal messages were conveyed clearly. This question would appear to be independent of the methodological model used in the session, and there are no exact rules regarding the organisation of space: everything will depend on the objectives pursued and the teaching activity (Seners, 2002). In any event, the choice of model will condition communication style, as concluded by Alves et ál. (2015) in their study with fitness trainers. Resources for adapting teacher orientation in order to show all the angles of execution or in order to face pupils or enter a group with a circular formation are some of the technical aspects that the future teachers should consider.

Spatial organisation of the group

The teachers in the study opine that it is indispensable to organise the group properly in space to guarantee that their instructions will be heard and heeded, since failing to do so may ostensibly even give to disruptive behaviours, as also observed in the studies by Target and Cathelineau (1990). On the basis of research work dealing with pre-service teacher training, Pieron (1999) concluded that the greatest concern was related to organisational functions. The position of the teacher with regard to the pupils when explaining content or providing feedback can condition both interaction and the evolution of the session. A position of superiority, in which the teacher stands and the pupils are seated, conveys a message of hierarchy that brings an influence to bear upon the effective transmission of the teaching message (as of Knapp, 2007).

The study also compiles information about the pupil's position in space and the consequences. In this regard, Ochoa and Aguilar (2000) concluded that pupils may take up a position in the back rows to go unnoticed, whereas sitting or standing in the front rows denotes an interest in learning or in paying greater attention. This similar situation occurs in the gymnasium and seems to be related to the concept of territoriality developed by Knapp (2007).

These students also perceive the difficulty of redirecting their spatial responses, since these decisions are highly significant; for example, retreating towards a certain position in the room when the teacher introduces an unexpected or difficult idea or instruction, or which generates anxiety. The group's behaviour and its significance or meaning resembles that of someone who adapts to (Ekman, 2012) a situation of nervousness or insecurity.

Pupil attention: teacher movement

If work is assigned to the pupils, the teacher no longer has to give information to the group overall (Target & Cathelineau, 1990), allowing them to move about the room freely and attend to the pupils. They may give feedback or new information about the skill, set a new objective or elaborate upon an existing one (Pieron, 1999). They can also avail themselves of guided discovery to steer responses back on course (Mosston & Ashworth, 2009). These students-teachers are aware of this and ascribe their scant movement to insecurity and lack of experience and to the short class time available.

Moreover, these students alluded to the position of the teachers vis-à-vis the group, more centred than to the sides, in line with the findings of the study by e Castañer et ál. (2013), who showed that novice teachers, on account of their insecurity and lack of experience, used the centre area more for teaching, whereas experienced teachers tended to move more towards the sides or the peripheral area.

Therefore, the organisation of the teacher-pupil communication model in the class goes way beyond mere understanding of the messages related to the content of the session, since it involves methodological decisions and affects communicative and emotional interaction in the class and learning, and can also optimise the communicative styles of teachers that have a positive effect on student learning (Castañer et ál., 2010).

Physical and emotional immediacy

The students-teachers frequently mentioned the psychological and emotional immediacy or closeness between them and their colleagues who took the role of pupils in the simulation exercises. The extent of immediacy was deemed important and they were aware of this importance in guaranteeing a proper in-class teaching-learning flow. The question of non-verbal immediacy as reported by Álvarez de Arcaya (2002) emerged, an issue which, while somewhat removed from physical dimension is highly meaningful or significant.

Another noteworthy aspect is related to the use of the students' own space. In proxemic terms, contact with another person means entering the closest spatial domain of the four defined by Hall et ál. (1968): the intimate space. This space is normally reserved for family and close friends, although access is sometimes afforded to other people (Ochoa & Aguilar, 2000), such as teachers in teaching interaction. In PE classes, the teacher provides manual assistance (Galera, 2001) in the performance of exercises or uses the tactile channel if he or she detects that this is the preferred from of acquiring information, and which is different in each pupil (visual, auditory, kinaesthetic; Target and Cathelineau, 1990). In this work, some teachers related this issue to shyness; however, tactile kinaesthetic behaviour is a powerful resource for PE teachers in the aforementioned types of assistance and also serves to break down emotional barriers between learner and teacher. Moreover, the pedagogical treatment of this aspect acquires particular relevance in certain contents, such as body expression or dancing, where it is indispensable in certain technical actions such as holding positions in folkloric dances or in *portés* in classic dancing.

Conclusions

The students who taught simulated sessions realised the importance of non-verbal communication and of the meanings and implications of proxemic elements in teaching interaction. More specifically, the decisions taken by teachers regarding orientation, position and movements in space are highly charged with meaning and significance that transcend mere effectiveness in transmitting a message.

Kinesics, and more particularly physical and affective immediacy during the process of interaction and communication between teachers and pupils, must be regarded as a substantive element since it can condition the quality and effectiveness of feedback, a key aspect in effective learning; it is undoubtedly an aspect that warrants further research.

In summary, it may be concluded that an inadequate management of proxemic aspects by future teachers can have a negative effect on session dynamics and student learning.

References

Almeida, M. & Ortiz, E. (2016). Desarrollo de habilidades para la comunicación no verbal en la formación inicial del comunicador social. *Revista Electrónica Formación y Calidad Educativa, IV*(2), 137-146. http://www.refcale.uleam.edu.ec/

Alonso, M. C., Gómez-Alonso, M. T., Pérez-Pueyo, Á. & Gutiérrez-García, C. (2016). Errores en la intervención didáctica de profesores de educación física en formación: perspectiva de sus compañeros en sesiones simuladas. *Retos: nuevas tendencias en educación física, deporte y recreación, 29,* 229-235. https://dialnet.unirioja.es/servlet/articulo?codigo=5400876

Álvarez de Arcaya, H. (2002). Influencias de la comunicación no verbal en los estilos de enseñanza y en los estilos de aprendizaje. *Revista de Educación, 334,* 21-32. http://www.revistaeducacion.educacion.es/re334/re334_03.pdf

Álvarez Núñez, Q. (2012). La comunicación no verbal en los procesos de enseñanza-aprendizaje: el papel del profesor. I*nnovación educativa, 22,* 23-37. http://www.usc.es/revistas/index.php/ie/article/viewFile/725/707

Alves, S., Franco, S., Castañer, M., Camerino, O., Rodrigues, J. e Hileno, R. (2015). El análisis de la comunicación paraverbal cinésica y proxémica de los instructores de Fitness mediante patrones temporales (T-patterns). *Cuadernos de Psicología del Deporte, 5*(1), 111-122. https://doi.org/10.4321/S1578-84232015000100011

Bogdan, R. C. & Biklen, S. K. (2007). *Qualitative Research for Education: An Introduction to Theory and Methods*. Allyn y Bacon.

Castañer, M. (1993). El comportamiento no verbal del educador físico. *Apunts: Educación física y deportes, 33,* 40-48.

Castañer, M., Camerino, O., Anguera, M. T. & Jonsson, G. (2010). Observing the paraverbal communicative style of expert and novice PE teachers by means of SOCOP: A sequential analysis. *Procedia - Social and Behavioral Sciences, 2*(2), 5162-5167. https://doi.org/10.1016/j.sbspro.2010.03.839

Castañer, M., Camerino, O., Anguera, M. T. & Jonsson, G. (2013). Kinesics and proxemics communication of expert and novice PE teachers. *Quality and Quantity, 47*(4), 1813-1829. https://doi.org/10.1007/s11135-011-9628-5

Castañer, M., Camerino, O., Anguera, M. T. & Jonsson, G. (2015). Paraverbal Communicative Teaching T-Patterns Using SOCIN and SOPROX Observational Systems. En *M. S. Magnusson, J. K. Burgoon y M. Casarrubea, M. (Eds.). Discovering Hidden Tem poral Patterns in Behavior and Interaction. T-Pattern Detection and Analysis with THEME* (p. 83-100). Human Press. https://doi.org/10.1007/978-1-4939-3249-8_4

Davis, F. (1995). *La Comunicación No Verbal*. Alianza Editorial.

Ekman, P. (2012). *El rostro de las emociones*. RBA.

Fox, D. (1987). *El proceso de la Investigación en Educación*. Eunsa.

Friese, S. (2014). *Qualitative data analysis with ATLAS. ti*. SAGE Publication.

Galera, A. D. (2001). *Manual de didáctica de la educación física I: una perspectiva constructivista moderada. Funciones de impartición.* Paidós.

Gibss, G. (2007). *Analyzing Qualitative Data*. SAGE Publication.

Guba, E. (1985). Criterios de credibilidad en la investigación naturalista. En *J. Gimeno Sacristán y A. Pérez Gómez. La enseñanza: su teoría y su práctica* (p. 148-166.). Akal.

Hall, E. T., Birdwhistell, R. L., Bock, B., Bohannan, P., Richard, A., Diebold, A., ... Vayda, A. P. (1968). Proxemics [and Comments and Replies]. *Current Anthropology, 9*(2/3), 83-108. http://www.jstor.org/stable/2740724

Knapp, M. L. (2007). *La comunicación no verbal. El cuerpo y el entorno*. Paidós Ibérica.
López Noguero, F. (2002). El análisis de contenido como método de investigación. XXI, *Revista de Educación, 4,* 167-179. http://hdl.handle.net/10272/1912
Mateu, M., Troguet, M. & Durán, C. (1992). *Actividades Corporales de Expresión*. Paidotribo.
Mosston, M. & Ashworth, S. (2009). *La Enseñanza de la educación física: la reforma de los estilos de enseñanza.* Hispano europea.
Murcia, M. & Ruiz, N. (2010). Proxémica y estilos de aprendizaje en el aula de básica primaria. *Revista Actualidades Pedagógicas, 55,* 165-174. https://ciencia.lasalle.edu.co/cgi/viewcontent.cgi?article=1071&context=ap
Ochoa, J. & Aguilar, V. M. (2000). Docente y discente: comunicación más allá de las palabras. *Nueva época, 4*(8), 61-75. http://educacionyciencia.org/index.php/educacionyciencia/article/view/151
Ortiz-Camacho, M. M. (2000). *Comunicación y lenguaje corporal: bases y fundamentos aplicados al ámbito educativo*. Proyecto Sur de Ediciones.
Pieron, M. (1999). *Para una enseñanza eficaz de las actividades físico-deportivas*. INDE.
Rodríguez-Gallego, M. R. (2012). Cómo evaluar la competencia comunicativa a través de rúbricas en educación superior. *Didac, 60,* 27-31. https://idus.us.es/xmlui/handle/11441/42955
Romero-Martín, M. R. (2015). *Expresión corporal en Educación Física.* Prensas Universitarias de Zaragoza.
Seners, P. (2002). *La leçon d´EPS.* Vigot.
Strauss, A. & Corbin, J. (1998). *Basics of Qualitative research. Techniques and procedures for developing grounded theory*. SAGE Publication.
Target, C. & Cathelineau, J. (1990). *Pédagogie sportive*. Vigot.

The contribution of each author

The work is collaborative, although a distinction may be made between certain roles.

- Leading author: Design of the study. Design of the procedure Application of the experience. Data processing and methodology. Writing. Review of technical aspects and content in the different versions.
- Second author: Application of the experience. Preparation of the introduction, discussion and conclusions and review of background. Writing of the document and formal aspects.
- Third author: Application of the experience. Processing of the information. Data processing and methodology. Background study. Writing. Review of technical aspects and content in the different versions.
- Fourth author: Design of the study. Design of the procedure Application of the experience. Background study. Writing. Review of technical aspects and content in the different versions.

Conflict of Interests: No conflict of interest was reported by the authors.

apunts
EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.06

OPEN ACCESS

Analysis of Throwing Performance in Elite Women's Beach Handball

Gonzalo Dol[1], Victoria Onetto[1], Valentina Carbonell[1], Andrés González-Ramírez[1,2]

[1] Instituto Universitario Asociación Cristiana de Jóvenes, Montevideo.
[2] Instituto Superior de Educación. Montevideo.

Cite this article:
Dol, G., Onetto, V., Carbonell, V., & González-Ramírez, A. (2020). AAnalysis of Throwing Performance in Elite Women's Beach Handball. *Apunts. Educación Física y Deportes*, *141*, 49-54. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.06

Editor:

ISSN: 2014-0983

***Corresponding author:**
Gonzalo Dol.
gon_dol@hotmail.com

Section:
Sports Training

Original language:
Spanish

Received:
14 November 2019

Accepted:
19 March 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

The objective of this study was to ascertain the differences in throwing performance between winning and losing elite female beach handball teams. An observational methodology was used, and an ad hoc instrument was created for data collection. The sample consisted of 2,160 throws in 38 matches of the Women's Senior Beach Handball World Championships in Kazan in 2018. The results showed significant differences in the number of goals, goalkeeper saves and blocking between winners and losers (p<0.01). Spectacular throws were more numerous than simple throws. The spin shot was the resource most utilised by both winners and losers, although there were significant performance differences in favour of the winners (p<0.01). The winning teams executed a greater number of in-flight shots (p<0.01), more effectively and scoring a greater number of points (p<0.01) with this type of shot.

Keyword: notational analysis, spectacular throws, performance

Introduction

Ever since its beginnings, from the end of the 20th century until the present day, beach handball has been regarded as a growing sport, both regionally and in the rest of the world (Morillo *et al.,* 2015; Zapardiel, 2018a; Zapardiel, 2018b). This modality has major differences with court handball and is regarded as a new sport (Crispim *et al.,* 2010; Gomes da Silva *et al.,* 2017; Morillo *et al.,* 2015). According to Morillo (2009, page 34), "for these and other reasons, both the offensive and defensive tactics of beach handball are significantly different to those of court handball. Beach handball is not handball played on the beach".

Beach handball features a wide variety of throws, some of which are used in court handball, as well as others that are exclusive to this modality. According to rule 9:2 of the 2014 Rules of the Game of the International Handball Federation (IHF), goals scored by means of the so-called creative or spectacular shots, which include spin and in-flight (T) shots, are awarded two points. The former is "specific to beach handball, since performing such a shot on a court makes no sense, as no extra points are awarded for it" (Morillo, 2009, page 45). This shot is executed by means of a full-body turn in the air followed by a shot on goal. "The only requirement is that the spin be full-body and that the player's feet and hips be facing the centre of the goal when the throw is made" (Real Federación Española de Balonmano, RFEB, 2014a, page 1). Moreover, the in-flight throw is one in which "a player throws the ball into the air for her teammate, who jumps when the ball is already in the air, to catch and shoot before touching the ground" (RFEB, 2014b, page 1). This type of throw is similar to the one used in court handball.

Another one of the specific techniques and rules of beach handball, and which distinguishes the latter from court handball, is the permanent situation of numerical superiority of the attacking team. In the attacking phase, the goalkeeper is replaced by a fourth player called the "specialist", whose goals are also worth two points (Crispim *et al.,* 2010; Gomes da Silva *et al.,* 2017; Morillo *et al.,* 2015).

Concluding attacking moves in collective sports, and more particularly in beach handball, is decisive in matches, since it will determine success or failure and will bring an influence to bear on each team's final placement in the tournament. For this reason, effective throwing is an essential variable to performance. Effectiveness is defined as the number of shots on- or off-target, depending on the partial objectives of each match (Lozano *et al.,* 2016; Pascual *et al.,* 2010). There is an abundance of studies addressing attacking effectiveness, and more particularly on the effectiveness of throws in handball. On the contrary, the body of research dealing with effectiveness analysis in beach handball is still scant, particularly in women's beach handball (Lara & Sánchez, 2018; Morillo *et al.,* 2015; Morillo *et al.,* 2016; Zapardiel a and b, 2018).

For this reason, this study set out to determine the differences in throwing performance between winning and losing teams in elite female beach handball.

Methodology

The sample was comprised of 2,160 throws corresponding to 38 matches from the 2018 Women's Senior Beach Handball World Championships held in Kazan (Hernández *et al.,* 2014). All the throws executed in the matches directly involving teams classified in the Main Round were analysed: Brazil, Chinese Taipei, Denmark, Spain, Greece, Norway, Paraguay, Poland, Russia, Thailand, Uruguay and Vietnam.

The observational methodology was used, with an ideographic, punctual and multidimensional design (Anguera & Hernández-Mendo, 2013). Data collection was performed by means of an ad hoc observation instrument comprised of a combination of field forms and a system of categories designed specifically for this research (Table 1). The study was approved by the Research Ethics Committee of the IUACJ (CEIUACJ).

The recording instrument used was the Lince software (Gabín *et al.,* 2012). The data obtained were exported to the Microsoft Excel and SPSS 25 computing applications, which were used for the statistical analysis.

Table 1
Systems of categories in the observation instrument for the beach handball throw study.

Criteria	Categories
Match	Each one of the matches selected in the sample.
Team	Teams selected for this study (GRE, NOR, BRA, ESP, TPE, THA, PAR, POL, VIE, RUS, DEN, URU).
Type of throw	In-flight (FLY), spin (SPN), dive shot (DS), jump shot (JS) and standing shot (SS).
Shot value	One point (1), two points (2) or zero points (0).
Effectiveness	Goal (GOL), goalkeeper save (GS), shot deflected (SD) and block (BLO).
Final result	Winner (WIN) and loser (LOS).

Table 2
Differences between winners and losers in shot effectiveness. Significant differences (*) (p<0.05) and (**) (p<0.01).

Final result		Goal	Block	Goalkeeper save	Out of play	Total
Winners	Count	752	25	224	112	1113
	Relative frequency	67,6%	2,2%	20,1%	10,1%	100,0%
	Corrected residual	5,4 **	-4,0 **	-3,6 **	-1,1	
Losers	Count	589	58	279	121	1047
	Relative frequency	56,3%	5,5%	26,6%	11,6%	100,0%
	Corrected residual	-5,4 **	4,0 **	3,6 **	1,1	
Total	Count	1341	83	503	233	2160
	Relative frequency	62,1%	3,8%	23,3%	10,8%	100,0%

To guarantee data quality, inter-observer and intra-observer concordance was confirmed with Cohen's Kappa, with results above 0.80 obtained in all the criteria.

The results were processed by means of central tendency statistical tests, as well as the chi-square test of association between variables and corrected residuals. The Shapiro-Wilk and Mann-Whitney U tests were used for the normality study.

Results

Significant differences were observed between the winning and losing teams in throwing effectiveness ($p < 0.01$). The winning teams scored a greater number of goals and a lower number of their shots ended in goalkeeper saves and blocks ($p < 0.01$) (Table 2).

Spectacular (spin and in-flight) throws accounted for 67.4% of the total. The spin shot was by far the most-used type by winning and losing teams alike (Figure 1). A significant association was observed between the final result and throw-type variables ($p < 0.01$). More specifically, the winners made twice as many in-flight throws as the losers ($p < 0.01$). On the other hand, the losers performed a greater number of spin and jump shots ($p < 0.01$) (Figure 1).

91.3% of the goals obtained were 2-point throws,

Figure 1.
Differences between winners and losers in terms of the use of different types of throws. Significant differences (**) (p<0.01).

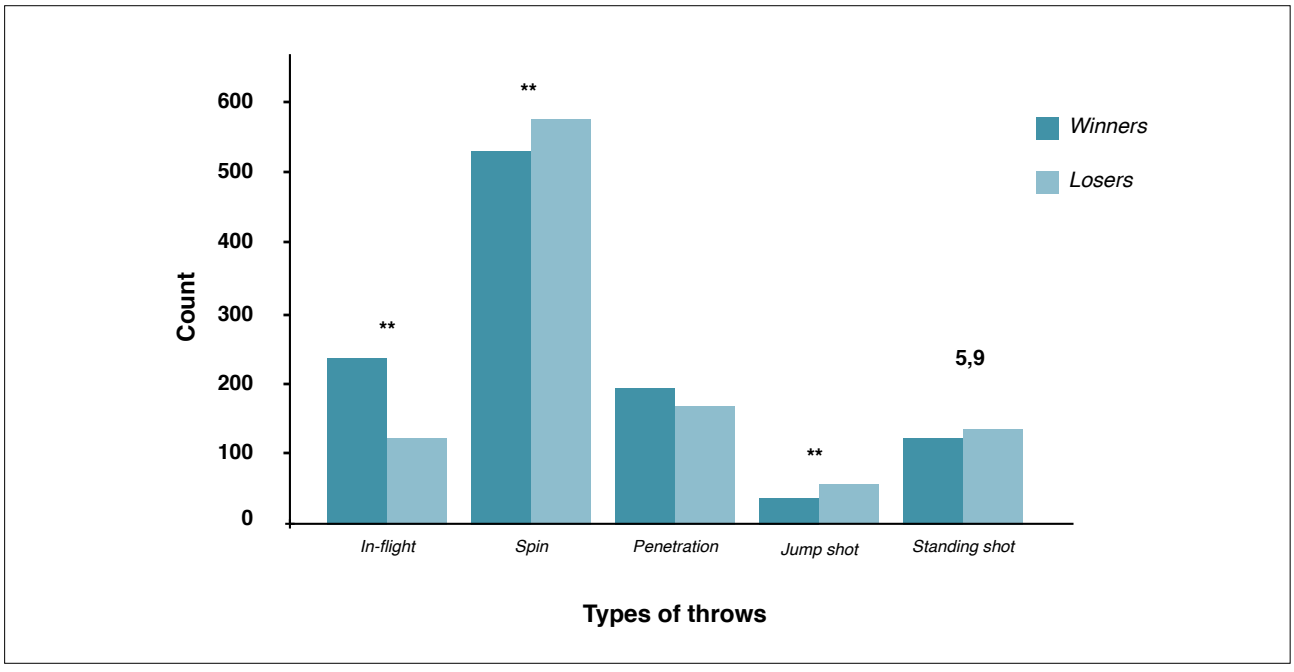


Table 3
Differences between winners and losers in points scored from the different types of shot. Significant differences (**) (p<0.01).

Resultal		In-flight	Spin	Dive shot	Jump shot	Standing shot	Total
Winners	Total points	314	660	237	42	181	1434
	Percentage of total points	21,9% **	46,0% **	16,5%	3,0%	12,6%	100,0%
Losers	Total points	137	607	186	45	157	1132
	Percentage of total points	12,1% **	53,6% **	16,4%	4,0%	13,9%	100,0%

distributed as follows: spin shots 45.8%, in-flight 16.3%, specialist 17.9%, goalkeeper 1.8% and penalties 9.5%. With regard to the teams' scores, there was also a significant association between the end result and points obtained variables ($p<0.01$). The most important differences were observed in the number of points obtained from spin shots by the losers and the in-flight shots by the winners ($p<0.01$) (Table 3).

Despite the greater use of the spin shot and its importance in the total number of points scored by the losing teams, the effectiveness of these shots was significantly lower compared to the winning teams ($p<0.01$) (Table 4). There were also significant differences in jump and standing shots ($p<0.05$) (Table 4).

The differences in the effectiveness of the throws were also reflected in terms of the points scored by the teams with the different types of shot. These differences were significant in both the spin shot ($p<0.01$) and in the standing shot ($p<0.05$) (Table 5).

Table 4
Differences between winners and losers in effectiveness by type of shot. Significant differences (*) (p<0.05) and (**) (p<0.01).

Type of throw	Final result	Goal	Block	Goalkeeper save	Out of play	Total
In-flight	Winners	69,4%	0,9%	19,4%	10,3%	100,0%
	Losers	59,7%	0,8%	26,9%	12,6%	100,0%
Spin	Winners	64,1% **	3,9% *	21,1% *	10,9%	100,0%
	Losers	54,4% **	7,0% *	26,7% *	12,0%	100,0%
Dive shot	Winners	71,9%	0,5%	19,8%	7,8%	100,0%
	Losers	63,0%	3,0%	24,8%	9,1%	100,0%
Jump shot	Winners	63,6% *	0,0%	21,2%	15,2%	100,0%
	Losers	41,1% *	8,9%	33,9%	16,1%	100,0%
Standing shot	Winners	73,4% *	0,8% *	17,7%	8,1%	100,0%
	Losers	59,4% *	5,3% *	25,6%	9,8%	100,0%

Table 5
Means and medians (in brackets) of performance obtained per match for the different types of shot. Significant differences (*) (p<0.05) and (**) (p<0.01) based on the Mann-Whitney U test.

	In-flight	Spin	Dive shot	Jump shot	Standing shot	Total, general
Winners	1,25 (1,33)	1,27 (1,25) **	1,01 (1,00)	1,01 (1,00)	1,47 (1,73) *	1,29 (1,30)
Losers	1,16 (1,20)	1,05 (1,02) **	0,58 (0,45)	0,58 (0,45)	1,18 (1,00) *	1,08 (1,08)
Total	1,21 (1,33)	1,16 (1,17)	0,77 (0,63)	0,77 (0,63)	1,32 (1,33)	1,19 (1,19)

Discussion

With regard to the objective of ascertaining throwing performance, it transpired that the levels of effectiveness in the throws executed by winners and losers alike slightly surpassed the previous studies performed in European beach handball, in which values of 53% and 54% were obtained in 2013 and 2015 (Lara & Sánchez, 2018) and 55.5% in 2017 (Zapardiel, 2018a).

Moreover, the results were better than those obtained in court handball (Blanco, 2012; Cabrera & González, 2015; Montoya, 2010). This is clearly due to the situations of the constant numerical superiority of the attacking team over the defending team in beach handball (Morillo, 2009), generating offensive openings, since the space-player ratio is greater, affording greater freedom of action to each one of the players, which translates into greater mobility for movements (Crispim *et al.,* 2010). In turn, comparing the situations of numerical superiority to court handball, the results were slightly greater than those observed in the World Championships held in Serbia in 2013, where the average of means between winners and losers was 60.6% in shots in the situation of superiority (Trejo & Planas, 2018).

A comparison between winners and losers yields significant differences in the number of goals, goalkeeper saves and blocks. These results reveal the greater offensive capacity of winning teams over losing teams. At the same time, defensive pressure, coupled with goalkeeper effectiveness, is conducive to a greater likelihood of winning (González *et al.,* 2017; Jiménez *et al.,* 2017; Teles & Volossovitch, 2015).

Creative or spectacular shots outnumbered simple shots. The spin shot was clearly the priority type of throw in both winners and losers and may be regarded as the main offensive resource used in positional attacks (Morillo et al., 2015; Lara et al., 2018; Lara & Sánchez, 2018).

The significant differences in the use of in-flight shots by winners and the spin shot by losers may be related to the technical difficulties involved in the execution of these shots. In this regard, Morillo (2009, page 46) refers to the importance of the pass leading up to the in-flight shot, where the "relationships established by two players beforehand" are essential to the proper execution of this technical move. Moreover, major technical and tactical difficulties are involved, since the ball must be controlled in the air and be thrown very quickly before the player touches the ground (RFEB, 2014b). On the other hand, the spin shot involves greater ball control when the ball is actually thrown.

In the simple throws, jump shots are used significantly more by the losing teams, which may be due to the greater difficulty involved in achieving optimal shot circumstances, i.e., a good zone, good body position and dodging opponents as far as possible. This difficulty would constitute the defensive strong point of the winners, who present fewer gaps in their defensive structure and greater opposition in their individual defensive technical and tactical actions (Laguna, 2005).

The greater use made of the spin shot by losers and of the in-flight shot by winners is also mirrored in the distribution of these shots in the total points obtained, where significant differences are observed (Table 3). It should be noted that more than half of all the points scored by the losers come from spin shots (Lara & Sánchez, 2018). The use of the spin shot by the losers and its relevance in point-scoring contrasts with the effectiveness of this type of shot, which is significantly lower than in the winners. Clearly lower values were observed in goals scored, goalkeeper saves and blocks received.

One noteworthy point refers to throwing performance (table 5), where 91.3% of the goals scored were double points, thus fulfilling the objective referred to by Morillo, which "[...] is geared towards obtaining a double-point throwing situation, or in other words, a throw by the double goalkeeper or a spin or in-flight shot by the other players" (2009, page 38).

Once again, significant differences are found in the points obtained through spin shots, where the mean value obtained by the losers was very low, namely 1.05 points per shot, compared to the 1.27 obtained by the winners. Moreover, in the simple shots, the differences lay in the standing shots, where the winners performed better, essentially through goals scored from penalties and full-court goals scored by goalkeepers.

Conclusions

In woman's beach handball, the creative or spectacular shots were the most frequent throws, with the spin shot prevailing over the in-flight shot. The winning teams evinced a greater offensive capacity, and significant differences were observed between winners and losers in the use of the different types of throws, as well as in their effectiveness and performance in terms of points scored. These results may constitute a contribution in training in concluding moves successfully, particularly in female beach handball, in which there are fewer studies. One limitation of this study is the fact that the results only come from this competition and cannot be mainstreamed. Further studies that continue to develop research into technique and tactics in women's beach handball are called for.

References

Anguera, M. T. & Hernández-Mendo, A. (2013). La metodología Observacional en el ámbito del deporte. *E- balonmano. Revista de Ciencias del Deporte, 9 (*3), 135-161.

Blanco, P. (2012). El análisis observacional del rendimiento en el lanzamiento de balonmano de la selección española promesas. *E-balonmano. Revista de Ciencias del Deporte, 8* (2), 83-92.

Cabrera, I. & González, A. (2015). Eficacia del ataque de los juegos ODESUR y Campeonato Panamericano de Handball Mayores Masculino 2014. *Revista Universitaria De La Educación Física Y El Deporte, 8* (8), 68-76.

Crispim, M., Gomes de Almeida, A., & Bergamo, V. (2010) Análise das ações motoras no handebol de areia. *Revista Hórus, 4* (1), 112-125.

Gabín, B.; Camerino, O; Anguera M. T. & Castañer, M. (2012). Lince: multiplatform sport analysis software. P*rocedia-Social and Behavioral Sciences, 46,* 4692–4694. https://doi.org/10.1016/j.sbspro.2012.06.320

Gomes da Silva, P.; Moreira, D.; de Paiva, G.; de Souza, R.; dos Santos, L. & Magno, J. (2017). Estrategia motriz en el balonmano playa: un análisis praxeológico. *Acción motriz: tu revista científica digital, 19,* 59-70.

González Ramírez, A., Bermúdez Pírez, S. G., Martínez Martín, I., & Chirosa Ríos, L. J. (2017). Goalkeepers' Effectiveness in the ODESUR Games and the Pan-American Handball Championship in 2014. *Apunts. Educación Física y Deportes, 130,* 95-105. https://doi.org/10.5672/apunts.2014-0983.es.(2017/4).130.08

Beltrán, J. (2017). *E-learning y gamificación como apoyo al aprendizaje de programación*. Tesis doctoral no publicada, Universidad de Extremadura.

Hernández, R., Fernández, C. & Baptista, P. (2014). *Metodología de la Investigación. 6ª* ed. México D.F: Mc Graw Hill.

International Handball Federation (2014). Rules of the game. Beach Handball.

Jiménez, J.; Espina, J. & Manchado, C. (2017) Análisis histórico de la efectividad de los lanzamientos a portería de balonmano masculino. *Retos, 32,* 228- 232.

Laguna, M. (2005). Jugar y hacer jugar. La formación de jugadores para el ataque posicional. Conferencia pronunciada en VII Seminario Internacional de la Asociación de Entrenadores de Balonmano "Memorial Domingo Bárcenas", Zaragoza.

Lara, D., Sánchez, J.A., Morillo, J.P & Sánchez, J.M. (2018). Estructura de juego del balonmano playa. *Revista Internacional de Deportes Colectivos, 11* (34), 89-100.

Lara, D. & Sánchez, J.A. (2018). Análisis cualitativo del balonmano playa femenino: 2013-2017. *Revista Internacional de Deportes Colectivos, 11* (35), 84-95.

Lozano, D., Camerino, O., & Hileno, R. (2016). Dynamic Offensive Interaction in High Performance Handball. *Apunts. Educación Física y Deportes, 125,* 90-110. https://doi.org/10.5672/apunts.2014-0983.es.(2016/3).125.08

Montoya, M. (2010). *Análisis de las finalizaciones de los jugadores extremo en balonmano* (Tesis doctoral inédita). Universidad de Barcelona. Barcelona.

Morillo, J.P. (2009). *Balonmano playa*. Sevilla: Wanceulen Editorial Deportiva. S. L.

Morillo, J.P., Reigal, E. y Hernández-Mendo, A. (2015). Análisis del ataque posicional de balonmano playa masculino y femenino mediante coordenadas polares. *Revista Internacional de Ciencias del Deporte, 11,* 226-244. https://doi.org/10.5232/ricyde2015.04103

Morillo, J.P., Reigal, E. & Hernández-Mendo, A. (2016). Relaciones entre el perfil psicológico deportivo y la ansiedad competitiva en jugadores de balonmano playa. *Revista de Psicología del Deporte, 25* (1), 121-128.

Pascual, X.; Lago, C. & Casáis, L. (2010). La influencia de la eficacia del portero en el rendimiento de los equipos de balonmano. *Apunts. Educación física y deportes, 99* (1), 72-81.

RFEB (2014a). *El giro 360 en balonmano playa*. Recuperado de: http://www.rfebm.com/noticia/el-giro-360%C2%BA-en-balonmanoplaya.

Real Federación Española de Balonmano (2014b). *El "fly" en estado puro*. Recuperado de: https://www.rfebm.com/noticia/el-fly-espectacularidad-en-estado-puro.

Teles, N., & Volossovitch, A. (2015). Influência das variáveis contextuais no desempenho das equipes nos últimos 10 minutos do jogo de handebol. *Revista Brasileira de Educação Física e Esporte, 29* (2), 177-187. https://doi.org/10.1590/1807-55092015000200177

Trejo Silva, A., & Planas Anzano, A. (2018). Offensive Efficacy in Numerical Inequality Situations in Female Handball. *Apunts. Educación Física y Deportes, 131,* 95-107. https://doi.org/10.5672/apunts.2014-0983.es.(2018/1).131.07

Zapardiel, J.C. (2018a). Beach handball European Championships Analysis Zagreb 2017. *EHF Web Periodical*. January 1-27.

Zapardiel, J. C. (2018b). M18 W18 Beach Handball Euros Championship Analysis ULCINJ 2018. *EHF web Periodical. October* 1-13.

Conflict of Interests: No conflict of interest was reported by the authors.

apunts
EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.07

OPEN ACCESS

Non-organised Extracurricular Physical and Sport Practice: gender, educational stage and physical activity index

Myriam Alvariñas-Villaverde[1], Miguel González-Valeiro[2]

[1] Faculty of Education and Sport Sciences, University of Vigo, Spain.
[2] Faculty of Sport Sciences and Physical Education, University of A Coruña, Spain.

Cite this article:
Alvariñas-Villaverde, M., & González-Valeiro, M. (2020). Non-organised Extracurricular Physical and Sport Practice: gender, educational stage and physical activity index. *Apunts. Educación Física y Deportes*, *141*, 55-62. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.07

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Myriam Alvariñas-Villaverde
myalva@uvigo.es

Section:
Sport management, active leisure and tourism

Original language:
Spanish

Received:
9 October 2019

Accepted:
27 January 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

There are very few studies on the types of non-organised physical and sport practice outside the school setting. Therefore, this paper consisted of describing these activities and analysing their relationship with other variables: gender, educational stage and physical activity index. The research design was quantitative, cross-sectional and descriptive. It involved 1,040 students, 521 boys and 519 girls (M = 12.30; SD = 3.08) enrolled in 26 Galician schools and aged between 10 and 17. The *International Questionnaire on Physical Education, Health and Lifestyle* was administered. The results showed that the most popular activities were soccer, walking, cycling, basketball and running. Significant differences were found in some of the activities studied in terms of gender and school stage. The physical activity index was higher in boys and in primary students. Very low levels of physical activity were observed. Differences were also found between active and less active people in some of the sports. The information obtained helps to identify the features of how free time is spent in Galician society. This type of evidence makes it possible to address participation needs in childhood and adolescence better by enabling future actions in the community and sports management settings.

Keyword: informal practice, sex, age, physical activity level.

Introduction

Nowadays there is ample confirmation of the importance of physical activity during childhood and adolescence. The evidence linking it to a positive impact on health is of paramount interest (Janssen & LeBlanc, 2010).

The options for exercising in physical activity and doing sports and complying with the WHO recommendations in the primary and secondary school stages are varied and can be implemented in a more or less organised fashion. These recommendations call for at least 60 minutes a day of moderate or vigorous physical activity which should be mostly aerobic. Performing muscle- and bone-strengthening activities at least three times a week is also recommended (World Health Organization, 2010).

Physical education (PE) classes are an organised practice learning setting which is crucial for promoting healthy activity (González-Calvo et al., 2018; Martínez-Martínez et al., 2012). Research has also been conducted on the study of organised practice, albeit in non-formal contexts (Nuviala et al., 2009), which can also help to meet these recommendations.

However, as Gil-Madrona et al. (2017) point out, there are less data on participation in non-organised activities which "may reflect the physical activity habits of schoolchildren better because they are dependent on their own motivation" (p. 82). These activities are not systematised but rather are performed autonomously with no need for guidance and supervision.

School recess has been advocated in particular as an opportunity for physical exercise within this type of non-organised activity, and international data are available in this regard (Ridgers et al., 2012; Hall-López et al., 2017). For example, Aznar et al. (2011) showed that children had high peaks of moderate to vigorous physical activity coinciding with breaks at school. However, literature that specifically addresses participation in non-organised activities outside the school setting is scant.

In Spain, this kind of data was included in the study on schoolchildren's sport habits carried out by the Spanish National Sports Council (CSD), the Deporte Joven Foundation and the Alimentum Foundation in 2011. It was conducted in Spain's 17 regions and Ceuta and Melilla with 17,632 participants aged 6 to 18. One of its findings is that the most frequent non-organised activities are cycling, soccer and running; it also takes quite a few "neutral" activities into account, although there are still gender differences. Marques et al. (2015) also provide input on this question in a study of 2,580 students at seven Portuguese state primary and secondary schools. Besides the differences between boys and girls in this area, one of the most relevant results concerning participation in non-organised activities is that soccer is a sport played by the most active people in certain age groups.

With regard to the above, studies on sports habits need to be extended in schoolchildren in Galicia, where this research was conducted. One out of every two people aged over 15 in this region is not active in their free time and inactivity is higher in women (Pérez-Ríos et al., 2015).

For these reasons, the purpose of this study was to analyse the relationship between the types of non-organised extracurricular physical and sports activities and other variables: gender, educational stage and physical activity index (PAI).

Methodology

Participants

A total of 1,040 students (49.9% girls and 50.1% boys) aged 10 to 17 with an average age of 12.30+ 3.08 years participated in the study. They were studying in 26 schools in Galicia (Spain), 56.9% of which were state, 35.8% state-assisted and 7.3% private. The schools were selected from the seven main towns and cities in the area: A Coruña (24.6%), Lugo (15.5%), Ourense (20.4%), Pontevedra (9.2%), Santiago de Compostela (14.4%), Vigo (11.3%) and Ferrol (4.5%). 56.3% of the students were in 5th and 6th year of primary education and 43.7% in 2nd and 4th year of secondary education. One class group (the one with the greatest number of students) per school year was chosen from each school to be part of the sample.

Instrument

The International Questionnaire on Physical Education, Health and Lifestyle, adapted to Spanish and validated by Mourelle (2014), was used as a data collection instrument. It was divided into four blocks: (1) personal data, (2) lifestyle, (3) attitudes and perceptions, and (4) assessment of school, PE and doing physical and sports activity. Cronbach's alpha (Cronbach, 1951) was greater than 0.87.

This paper addressed the study of non-organised physical and sports activities. More specifically, the participant was asked to indicate which activity they did most outside class hours without being in a club or association and which lasted at least twenty minutes. To make it clear that the question referred to the informal setting, the questionnaire included examples of activities such as: walking, running, cycling, swimming, playing

soccer in the street, basketball in the park, volleyball in the garden or on the beach, etc.

In addition, the Finnish PAI was used to calculate the level of physical activity, which is indicative of the likelihood of future physical and sports activity (Telama et al., 2005; Telama et al., 2006). Recent papers (Marques & Carreiro da Costa, 2013; Marques et al., 2015; Mota et al., 2008) were based on this index using the sum of five items in the questionnaire: frequency of participation in physical activity per week; participation in non-organised physical activity; participation in organised physical activity; intensity and participation in sports competitions. Each item was measured on a four-point scale, so the index ranged from 5 to 20.

This index allowed the participants to be divided into two categories, as in Marques et al. (2015), by classifying them as more or less active, distinguishing between participants who were *not very active* (scores of 12 or less) and those who were *active* (scores of above 12).

Procedure

This study had two research teams, one of which gathered and anonymised the data and then sent them to the other team for analysis.

For data collection, the administrators of the selected schools were contacted and the relevant documents were sent to them so that they would be aware of the study and in case any clarifications were required. The parents or legal guardians and students were given precise information about the study's objectives and contents and signed specific informed consent forms. The questionnaire was administered by staff from the research group and always in the presence of PE teachers. The protocol was approved by the University of A Coruña as it comes under a general proposal of the Euro-American Physical Activity, Education and Health Network (REAFES). In studies carried out in Portugal, the same protocol was approved by the Ethics Committee of the Faculty of Human Motor Skills and the Portuguese Ministry of Education.

Data analysis

The analysis of the frequencies of the activities performed led ballet, rhythmic gymnastics and dance to be grouped in a single variable called rhythmic expressive activities. Similarly, the karate, judo and taekwondo options formed the martial arts group, while net sports were paddle tennis, table tennis, tennis, volleyball and badminton. Finally, skating, inline skating, skateboarding and roller hockey comprised the small-wheel activities variable. The other variable contained numerous sports and physical activities with very low participation rates.

The chi-square test was used to establish the relationship between non-organised physical and sports activities and gender, school stage and the PAI ($p < .05$). Levene's test and Student's t were also used to describe the PAI by gender and stage ($p < .05$). Statistical analysis was conducted using SPSS Statistics 24.0.

Results

The analysis of the results revealed that the most popular activities were soccer (26.9%), walking (21.9%) and cycling (11.8%). They were followed by basketball and running, with percentages hovering around 10%, and swimming at 7.7%. A further 32 physical and sports activities were reported by the students encompassing a wide variety of disciplines with percentages always below 2% (accounting for 4% of the total participants). Some of them could be considered more common or well-known, such as tennis (1.4%), going to the fitness centre (1%) and artistic gymnastics (0.1%). Others might be regarded as more alternative, for instance boxing (0.2%), parkour (0.1%) and kitesurfing (0.1%).

1.6% of the participants engaged in rhythmic and expressive activities. Martial arts activities totalled 0.6%. Net sports accounted for 2.9% of the total and small-wheels for 1.8%.

An association between gender and some activities was confirmed. Table 1 shows the results for the categories in which significant differences between girls and boys were observed. Firstly, soccer is mainly played by boys and very little by girls ($p < .001$). Nevertheless, the percentage of girls taking part in it is higher than the figure for rhythmic expressive activities, disciplines traditionally chosen by women (the figure for dance is 3.5%). Statistically significant differences were also found in the analysis of the relationship between gender and activities such as walking, cycling, running, swimming and rhythmic expressive activities; these activities are practiced mostly by girls.

By contrast, no gender impact was seen in participation in basketball (p: .151), net sports (p: .864) or small-wheel activities (p: .492).

Turning to educational stage, there were statistically significant relationships in soccer ($p < .001$) and cycling (p: 021), in which the highest proportion of practitioners were primary school pupils. Similarly, differences were observed in running and walking ($p < .001$) with secondary school students showing higher participation

Table 1
Physical activity performed by gender

Category	♂ (n = 521)	♀ (n = 519)	X^2	*p*
Soccer	47,6% (248)	6,2% (32)	226, 883	.000***
Walking	9% (47)	34,9% (181)	101,529	.000***
Cycling	14,1% (73)	14,1% (73)	4,979	.025*
Running	7,5% (39)	11,9% (62)	5,899	.015*
Swimming	5% (26)	10,4% (54)	10,734	.001**
Rhythmic expressive activities	0,4% (2)	6% (31)	26,435	.000***

p = *< .05; **< .01; ***< .001

percentages. No significant differences were observed in the remaining options (basketball *p*: .074, swimming *p*: .156, net sports p: .836, rhythmic expressive activities *p*: .607 and small-wheel activities $p = .748$). Before the description of the relationship between the physical activity performed and the PAI, the data defining the PAI with respect to the sample used are shown. Calculating Student's t for the PAI revealed significant differences by both gender and educational stage, and the level of physical activity was higher in boys and in the primary stage. Of all the students, 712 (68.5%) can be considered not very active; however, only 328 (31.5%) are really active.

Associations were identified between the PAI and the type of informal activity chosen. The data showed relationships between active people and soccer ($p < .001$) and between not very active people and swimming ($p < .01$) and walking ($p < .001$). In the remaining categories, the performance of these activities was assumed to be independent of the level of physical activity (cycling *p*: .648, basketball *p*: .109, running *p*: .847, net sports *p*: .262, rhythmic expressive activities *p*: .179 and small-wheel activities *p*: .113).

Discussion

Doing physical and sports activity delivers many health benefits in childhood and adolescence, such as reducing overweight and obesity rates and improving cardiovascular and bone mineral density aspects. Furthermore, the benefits are not only physical but also social and mental (Gracia-Marco et al., 2010; Janssen & LeBlanc, 2010).

This research aimed to describe the type of non-organised extracurricular physical and sports practice in which students engaged by providing new data about the range

Table 2
Physical activity performed by educational stage

Category	Primary (n =585)	Secondary (n =455)	X^2	*p*
Soccer	32,6% (191)	19,6% (89)	22,287	.000**
Walking	15,6% (91)	30,1% (137)	31,673	.000**
Cycling	13,8% (81)	9,2% (42)	5,228	.021*
Running	6,5% (38)	13,8% (63)	15,770	.000**

p = *< .05; **< .001

and specific types of activities. Non-organised activities may entail greater participation, as there are more options to choose from (Gil-Madrona et al., 2014). Girls and boys were found to take part in them to a greater extent than in organised ones, and more particularly the advantage of these activities is that they can be performed at will during free time (Marques et al., 2015).

In this study, participation was highly concentrated in particular activities, and even more so in the case of boys. A general analysis of the data revealed that the most popular activities are soccer, walking and cycling, followed by basketball, running and swimming. These data are consistent with the literature about non-organised activities outside the school setting. CSD et al. (2011) present similar data to this study. The most popular activities include soccer and cycling (both 18%), running (12%) and basketball (10%); however, walking and swimming are not among the activities in which young people take part.

The results showed significant differences between girls and boys with respect to the type of activities performed. Boys' participation was particularly strong in soccer, as almost 50% of them played it. This sport also ranks first among boys in other studies on extracurricular activity (Calvo-Ortega & Perrino-Peña, 2017; CSD et al., 2011; Gracia-Marco et al., 2010; Marques et al., 2015; Seabra et al., 2007).

Girls reported walking, running, cycling, swimming and expressive activities more often than boys, meaning they did more non-cooperation-opposition, low-contact activities and their practice was more diversified.

As in this research, other studies addressing the type of physical and sports activities chosen report differences between girls and boys in both childhood and adolescence (Aznar et al., 2011; Gracia-Marco et al., 2010; Marques et al., 2015). Boys tend to opt for activities which they consider appropriate to their gender role and make them feel more competitive (Alvariñas-Villaverde & Pazos-González, 2018). This topic has been extensively studied in recent decades and mainly explained in terms of gender socialisation and its impact on the behaviour of girls and boys in this field (Babkes-Stellino & Sinclair, 2014; Calvo-Ortega & Perrino-Peña, 2017). Thus, girls are known to

Table 3
PAI by gender and educational stage

Variable		N			*Levene's test*		*Student's t*	
			Mean	*DE*	*F*	*Sig.*	*t*	*Sig. (2-sided)*
Gender	Boys	521	11,45	3,310	1,721	0,190		.0001
	Girls	519	9,70	3,161			8,680	
Stage	Primary	585	10,87	3,285	0,699	0,403		.001
	Secondary	455	10,20	3,398			3,225	

Table 4
Physical activity performed by PAI

Category	Not very active (n =712)	Active (n =328)	X^2	*p*
Soccer	21,8% (155)	38,1% (125)	30,474	.000**
Walking	25% (178)	15,2% (50)	12,487	.000**
Walking	9,1% (65)	4,6% (15)	6,564	.007*

p = *< .01; **< .001

prefer lighter and less "sporty" activities, while boys are more likely to engage in more competitive sports and activities (Babkes-Stellino & Sinclair, 2014).

As for individual versus group sports, it was confirmed that girls are more attracted to individual sports and boys to group sports. Moreno, Martínez and Alonso (2006) also report this trend in their study on attitudes towards physical activity and sports performance by gender. Similarly, in the survey of sports habits in Spain (Ministry of Education, Culture and Sports, MEC, 2015) almost 70% of women do this type of sport. Alvariñas-Villaverde and Novoa (2015) found that the main extracurricular activities of secondary school students in the four provinces of Galicia conformed to this pattern. This is also the case in the study by Calvo-Ortega and Perrino-Peña (2017) carried out with adolescents in the Region of Castile and León. This preference is observed by CSD et al. in terms of non-organised participation since girls' three main activities are cycling, running and inline skating.

Another noteworthy aspect is that the proportion of girls who played soccer and did rhythmic expressive activities was practically the same, suggesting a shift towards activities considered traditionally masculine or a hint of a departure from classically feminine activities. In addition, no differences were found in net sports, basketball or small-wheel activities, which might allow us to relate these findings to other studies in which there is a significant amount of neutral physical and sports activities (CSD et al., 2011; Gracia-Marco et al., 2010; Seabraet al., 2007).

In this regard, recent studies have underscored changes in terms of doing away with stereotypes in the minds of students (Alvariñas-Villaverde & Pazos-González, 2018; Gil-Madrona et al., 2017). If behaviour is factored in, then soccer is also a girls' sport in studies such as that of Seabraet al. (2007) conducted with over 12,000 students in Portugal. Similarly, in Spain neither is it one of the least played sports according to data by the CSD et al., which place soccer in fifth and fourth position in organised and non-organised activities, respectively. In the study by Alvariñas-Villaverde and Novoa (2015), soccer is in seventh place in the extracurricular activities of girls, ahead of athletics, basketball, tennis, rhythmic gymnastics, Pilates and volleyball. Consequently, the king of sports in Spain (López-Albalá, 2016) enjoys increasingly greater presence in women's leisure time activities in childhood and adolescence.

As for differences by educational stage, relationships were observed with regard to soccer and cycling, which were more popular in primary school. Running and walking were also more popular in secondary school. The fact that there were no statistically significant differences in the rest of the activities suggests that the stage variable is not a major determinant in the choice of activities in the informal setting and in relation to non-organised activity.

When the PAI is calculated, it transpires that the proportion of people who were not very active was very high, almost 70%. This figure is consistent with previous studies. For instance, after a major review in which they analysed compliance with healthy physical activity recommendations by school-age students, Calahorro-Cañada et al. (2014) stressed this point and the need for studies geared towards generating intervention programmes to help to increase these levels. A comparison of the secondary school stage data with figures produced by Marques and Carreiro da Costa (2013) shows much lower PAIs (15.15 versus 10.20). This index therefore places Portuguese students in the moderately active range and Galician students in the not very active bracket.

Similarly, and consistent with the literature, significant gender differences were found insofar as the level of physical activity was higher in boys than in girls (Aznar et al., 2011; Martínez-Martínez et al., 2012; Mota et al., 2008). An exception to this is the paper by Calahorro-Cañada et al. (2015) which analyses the physical activity of primary and secondary school students using accelerometers and finds no significant differences in this respect.

The PAI was also better in the primary than in the secondary stage, as previously noted by Aznar et al. (2011) and Martínez-Martínez et al. (2012), among others. In Marques and Carreiro da Costa (2013) the PAI decreases with age in secondary school students.

Finally, this paper broached the question of a possible relationship between a person's level of physical activity and their choice of non-organised extracurricular sport. Although the activity performed was independent of the PAI in most options, the results confirm associations between active people and soccer and less active people and swimming and walking; this seems reasonable, since in principle the latter do not call for such high levels of fitness and energy expenditure and are individual activities with less contact. Marques et al. (2015) also show that soccer is a sport for the most active people (girls in the 13-15 age group and boys in the 13-15 and 16-18 age groups). Meanwhile, Mota et al. (2008) unsurprisingly observe, in relation to organised and non-organised free-time sports activities, that active people do more than not very active people. As a side note, and given that the same PAI is used in this study, this index is also related to another type of recreational activities. Active girls are significantly more involved in individual artistic activities (in music, reading, art or crafts) than less than active ones. Similarly, active people engage more in social leisure activities such

as going to parties or meeting friends than their non-active counterparts.

The results of this study help to identify the features of how free time is spent in Galician society. As Gil-Madrona et al. (2014) point out, this type of knowledge should be used to improve compulsory physical activity and cater to students' interests. Furthermore, these data provide evidence to meet children and young people's participation needs in the community and sports management settings better. As Telama et al. (2005) pointed out, it should also be borne in mind that the activities in which adults take part may have been learned at an early age (carryover value), so if this knowledge is turned into opportunities to build physical and sporting habits they may be transferred into adulthood and drive healthier lifestyles.

This paper has also prompted consideration of student accessibility to particular settings for safe performance in safe venues and with accessible resources. Since it concerns the region of Galicia, which boasts a major variety of natural spaces (mountains, sea, rivers, etc.) and a rainy and cold climate at certain times of the year, it is essential that the relevant institutions make an effort to improve these activities.

Conclusions

The levels of physical activity in the seven towns and cities of Galicia are very low. The most popular non-organised extracurricular activities are soccer, walking, cycling, basketball and running. There is an association between some activities and the PAI, school stage and gender. The information gathered may be useful for improving decision-making and measures to promote both school and out-of-school activities, with an emphasis on improving planning, mainly for secondary school students.

One of the limitations of the research is the fact that data gathering was cross-sectional and self-reported. An objective method of quantifying the level of physical activity outside school hours (accelerometry, pedometer, etc.) would improve the quality of the paper. Furthermore, the study is set in an urban environment, meaning that it is impossible to achieve a global vision of participation given the significance of the countryside in a region such as Galicia. Consequently, using more objective tests and ascertaining the features of rural populations would be welcome in future studies.

References

Alvariñas-Villaverde, M. & Novoa, A. (2015, 7-9 de mayo). *Estilo de vida deportiva en estudiantes gallegas* [comunicación]. Congreso Internacional de Ciencias del Deporte y la Educación Física, Pontevedra, España.

Alvariñas-Villaverde, M. & Pazos-González, M. (2018). Estereotipos de género en Educación Física, una revisión centrada en el alumnado. *Revista Electrónica de Investigación Educativa, 20*(4), 154-163. https://doi.org/10.24320/redie.2018.20.4.1840

Aznar, S., Naylor, P. J., Silva, P., Pérez, M., Angulo, T., Laguna, M., Lara, M. T. & López-Chicharro, J. (2011). Patterns of physical activity in Spanish children: a descriptive pilot study. *Child: Care, Health and Development, 37*(3), 322-328. https://doi.org/10.1111/j.1365-2214.2010.01175.x

Babkes-Stellino, M. & Sinclair, C. (2014). Examination of children's recess physical activity patterns using the activities for daily living-playground participation (ADL-PP) instrument. *Journal of Teaching in Physical Education, 33*, 282-296. https://doi.org/10.1123/jtpe.2013-0156

Calahorro-Cañada, F., Torres-Luque, G., López-Fernández, I. & Carnero, E. A. (2014). Niveles de actividad física y acelerometría: Recomendaciones y patrones de movimiento en escolares. *Cuadernos de Psicología del Deporte, 14*(3), 129-14.

Calahorro-Cañada, F., Torres-Luque, G., López-Fernández, I. & Carnero, E. A. (2015). Análisis fraccionado de la actividad física desarrollada en escolares. *Revista de Psicología del Deporte, 2*, 373-379.

Calvo-Ortega, E. y Perrino-Peña, M. (2017). Hábitos físico-deportivos en adolescentes de Castilla y León. *Movimento, 23*(4), 1341-1352. https://doi.org/10.22456/1982-8918.71852

Consejo Superior de Deportes, Fundación Deporte Joven y Fundación Alimentum (2011). *Los hábitos deportivos de la población escolar en España*. Madrid: Autor.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297-334.

Gil-Madrona, P., Cachón-Zagalaz, J., Díaz-Suárez, A., Valdivia-Moral, P. & Zagalaz-Sánchez, M. L. (2014). Las niñas también quieren jugar: La participación conjunta de niños y niñas en actividades físicas no organizadas en el contexto escolar. *Movimento, 20*(1), 103-124.

Gil-Madrona, P., Valdivia-Moral, P., González-Víllora, S. & Zagalaz-Sánchez, M. L. (2017). Percepciones y comportamientos de discriminación sexual en la práctica de ejercicio físico entre los hombres y mujeres preadolescentes en el tiempo de ocio. *Revista de Psicología del Deporte, 26*(2), 81-86.

González-Calvo, G., Bores-García, D., Hortigüela-Alcalá, D. & Barba-Martín, R. A. (2018). Adherence to a Physical Exercise Program in School and Extracurricular Activities. *Apunts. Educación Física y Deportes, 134*, 39-54. https://doi.org/10.5672/apunts.2014-0983.es.(2018/4).134.03

Gracia-Marco, L., Tomas, C., Vicente-Rodríguez, G., Jiménez-Pavón, D., Rey-López, J. P., Ortega, F. B., Lanza-Saiz, R. & Moreno, L. A. (2010). Extra-curricular participation in sports and socio-demographic factors in Spanish adolescents: The AVENA study. *Journal of Sports Sciences, 28*(13), 1383-1389. https://doi.org/10.1080/02640414.2010.510846

Hall-López, J. A., Ochoa-Martínez, P. Y., Zuñiga, R., Monreal, L. R. & Sáenz-López, P. (2017). Moderate-to-vigorous physical activity during recess and physical education among Mexican elementary school students. *Retos, 31,* 137-139.

Janssen, I. & LeBlanc, A. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity, 7*(40), 1-16. https://doi.org/10.1186/1479-5868-7-40

López-Albalá, E. (2016). Mujeres deportistas españolas: estereotipos de género en los medios de comunicación. *SOCIOLOGIADOS. Revista de Investigación Social, 1*(2), 87-110. https://doi.org/10.14198/socdos.2016.1.2.04

Marques, A. & Carreiro da Costa, F. (2013). Levels of Physical Activity of Urban Adolescents According to Age and Gender. *International Journal of Sports Science, 3*(1), 23-27. https://doi.org/10.5923/j.sports.20130301.05

Marques, A., Martins, J., Peralta, M., Carreiro da Costa, F. & Piéron, M. (2015). Do boys and girls share the same characteristics when they are equally classified as active or inactive? *Revista Iberoamericana de Psicología del Ejercicio y el Deporte, 10*(2), 267-274. https://doi.org/10.5923/j.sports.20130301.05

Martínez-Martínez, J., Contreras, O. R., Aznar, S. & Lera, A. (2012). Niveles de actividad física medido con acelerómetro en alumnos de tercer ciclo de Educación Primaria: actividad física diaria y sesiones de Educación Física. R*evista de Psicología del Deporte, 21*(1), 117-123.

Ministerio de Educación, Cultura y Deporte (MEC) (2015). *Encuesta de hábitos deportivos en España 2015*. Madrid: Ministerio de Educación, Cultura y Deporte.

Moreno, J. A., Martínez, C. & Alonso, N. (2006). Actitudes hacia la práctica físico-deportiva según el sexo del practicante. *Revista Internacional de Ciencias del Deporte, 2*(3), 20-43. https://doi.org/10.5232/ricyde2006.00302

Mota, J., Santos, M. P. & Ribeiro, J. C. (2008). Differences in leisure-time activities according to level of physical activity in adolescents. *Journal of Physical Activity & Health, 5*(2), 286-293. https://doi.org/10.1123/jpah.5.2.286

Mourelle, M. (2014). *Relación de los agentes sociales con el índice de práctica de actividad física de los escolares de 10 a 16 años de las urbes* gallegas [Tesis de Doctorado, Universidade da Coruña. Repositorio institucional https://ruc.udc.es/dspace/handle/2183/13602

Nuviala, A., Munguía, D., Fernández, A., Ruiz, F. & García, E. (2009). Typologies of occupation of leisure-time of Spanish adolescents. The case of the participants in physical activities organized. *Journal of Human Sport and Exercise, 4*(1), 29-39.

Pérez-Ríos, M., Santiago-Pérez, M. I., Rodríguez-Camacho, E., Suanzes, J. & Hervada, X. (2015). Inactividad física en Galicia: Tendencia e impacto de cambios en la definición. *Gaceta Sanitaria, 29*(2), 127-130. https://doi.org/ 10.1016/j.gaceta.2014.09.007

Ridgers, N. D., Salmon, J., Parrish, A., Stanley, R. M. y Okely, A. D. (2012). Physical activity during school recess: A sistematyc review. *American Journal of Preventive Medicine, 43*(3), 320-328.

Seabra, A. F., Mendonça, D. M., Thomis, M. A., Malina, R. M. y Maia, J. A. (2007). Sports participation among Portuguese youth 10 to 18 years. *Journal of Physical Activity Health, 4*(4), 370-380.

Telama, R., Yang, X., Hirvensalo, M. y Raitakari, O. (2006). Participation in organized youth sport as a predictor of adult physical activity: a 21-year longitudinal study. *Pediatric Exercise Science, 17*, 76-88. https://doi.org/10.1123/pes.18.1.76

Telama, R., Yang, X., Viikari, J., Välimäki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood: a 21-year tracking study. *American Journal of Preventive Medicine, 28*(3), 267-273. doi: 10.1016/j.amepre.2004.12.003

Organización Mundial de la Salud (2010). *Global recommendations on Physical Activity for Health*. Geneva: Author.

Conflict of Interests: No conflict of interest was reported by the authors.

apunts EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.08

OPEN ACCESS

Hybridisation of the Teaching Personal and Social Responsibility Model and Gamification in Physical Education

Alfonso Valero-Valenzuela[1, 2] AV, David Gregorio García[1, 2], Oleguer Camerino[3, 4 *] OC y David Manzano[1, 2] DM

[1] Faculty of Sport Sciences, University of Murcia, Murcia, Spain.
[2] Health, Physical Activity and Education Research Group (SAFE), University of Murcia, Murcia, Spain.
[3] National Institute of Physical Education of Catalonia (INEFC), Motricity Observational Lab, University of Lleida (UdL), Lleida, Spain.
[4] Institute of Biomedical Research of Lleida (IRBLLEIDA), University of Lleida (UdL), Lleida, Spain.

Cite this article:
Valero-Valenzuela, A., Gregorio García, D., Camerino, O., & Manzano, D. (2020). Hybridisation of the Teaching Personal and Social Responsibility Model and Gamification in Physical Education. *Apunts. Educación Física y Deportes*, *141*, 63-74. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.08

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Oleguer Camerino Foguet
ocamerino@inefc.es
http://lom.observesport.com

Section:
Sports Pedagogy

Original language:
Spanish

Received:
23 December 2019

Accepted:
28 February 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

The purpose of this study was to analyse the outcome of a teaching intervention based on hybridising the Teaching Personal and Social Responsibility (TPSR) pedagogical model and innovative gamification strategy. It uses a mixed methods analysis consisting of the observation of teacher-student interaction and student motivation questionnaires to demonstrate the impact of this innovative teaching approach on both genders. The sample consisted of 55 students from a school in the Region of Murcia (28 girls and 27 boys) aged 13 to 17 (M = 14.29; SD = 0.875) from two courses in 2nd- and 3rd-year lower secondary education. The observational analysis of the teacher's performance and teacher-student interactions was conducted by recording ten sessions on video, coded with the Personal and Social Responsibility Observation (SORPS) instrument and recorded with the LINCE v.2.0 software. The THEME v.6 Edu. software was used to obtain the behavioural temporal patterns (t-patterns). The Secondary Education Motivation Scale (EME-S) was administered to analyse the students' self-determined motivation and the data were entered in the SPSS v.22.0 statistical program to perform the Wilcoxon signed-rank test. The results showed a clear assignment of autonomy and responsibility to the participants in the teacher's behaviours which generated greater self-determined motivation among the students. In conclusion, the application of a programme based on hybridising the TPSR pedagogical model and gamification is effective in improving student levels of autonomy, responsibility and motivation.

Keyword: pedagogical innovation, pedagogical model, t-pattern detection, mixed methods re-search

Introduction

Around the 1970s, leading figures in the area of physical education (PE) such as Muska Mosston introduced concepts including learning strategies and teaching styles to open up new perspectives for teachers and move away from the military ap-proach prevalent in PE (Mosston & Ashworth, 2002). This allowed progress to be made in the didactic aspects of PE at that time by shifting from a teacher-centred teaching-learning process to a more student-focused approach (Menéndez & Fer-nández-Río, 2016a).

Over the years, fresh concepts relevant to education in general were introduced, such as Joyce and Weil's (1985) teaching model, defined as a structured plan used to shape the curriculum, teaching materials and teaching practice. For PE in particu-lar, it was defined as the curriculum model by Jewett et al. (1995), seen as a general pattern for creating contextualised programmes that include learning objectives, con-tent, procedures and environments, or the instructional model by Metzler (2011) re-ferring to a teaching intervention based on learning theories, educational context, objectives, content, class management, teaching strategies and styles and assessment (Menéndez, 2017).

However, Haerens et al. (2011) subsequently introduced the new pedagogical model concept which emphasises the interdependence between teaching (teacher), learning (student), context and content in order to build teaching programmes or units which facilitate student learning by creating learning environments that are consistent with these models (Peiró & Julián, 2015).

Innovation in PE's pedagogical models

Against this backdrop of innovation, Blázquez (2016) underscores the importance of introducing active methodologies and how to implement them as a curricular component which fosters skills development, motivation and active participation. Pedagogical models are part of these active methodologies which, together with model-based practice (MBP), are replacing teacher-centred teaching (Hastie & Casey, 2014).

The more tried and tested pedagogical models (PM) include the Teaching Games for Understanding (TGFU) model (Thorpe & Bunker, 1989); the Teaching Personal and Social Responsibility (TPSR) model (Hellison, 2011); the Cooperative Learning (CL) model (Johnson et al., 2013); the Sport Education (SE) model (Siedentop et al., 2011) or the Health-Based Physical Education (HBPE) model (Haerens et al., 2011). Not all PMs can be applied to all educational contents and/or contexts, which means that they have to be used and combined with each other and also be mixed with innovative methods and new pedagogical strategies.

The Teaching Personal and Social Responsibility (TPSR) model

The TPSR model (Hellison, 1995) emerged as a physical activity programme aimed at young people at risk of social exclusion in the cities of Chicago and Port-land in the United States. The purpose of the programme was to provide this group with a series of learnings, behaviours and values through the development of re-sponsibility which would be useful for the fulfilment of their personal lives. Hellison (2011) worked on values through physical activity and sport based on five progres-sive and cumulative levels of responsibility with concrete and simple goals: a) re-spect for the rights and feelings of others; b) participation and effort; c) personal au-tonomy; d) helping others and leadership; and e) activity outside the context of sport.

Over the last decade, the TPSR model has been used much more widely to work on values through physical activity, thus making it a core component in PE (Escartí et al., 2011; Belando et al., 2012; Sánchez-Alcaraz et al., 2016).

The gamification method

Gamification (GF) is the use of game mechanics in non-game environments to stimulate motivation, concentration, effort, loyalty and other positive values common to games (González & Mora, 2015). However, in education gamification also refers to the use of game features to engage students, motivate them and promote learn-ing and problem-solving (Beltrán, 2017).

It is important to note that while gamification does include game features for them to be leveraged in the educational framework, it is not a question of using games in themselves but rather of taking some of their features and operating mechanics to enhance the learning experience (Deterding et al., 2011). The constituent features of gamification are: dynamics (rewards, status, achievements, competition, altruism, feedback or fun); mechanics (levels, avatars, missions or challenges, virtual goods, gifts or prizes); aesthetics (images that are pleasing to the player's eye); motivation through challenge; problems and goal (Kapp, 2012; Zichermann & Cunningham, 2011).

Gamification has been introduced in PE as a new method for teaching teams and has become established as an emerging learning strategy since it provides positive aspects such as fostering motivation, student interest in learning, greater perfor-mance and adherence to physical activity (PA) (Escarvajal & Martín-Acosta, 2019; Menéndez & Fernández-Río, 2016b; Navarro et al., 2017; Ordiz, 2017; Quintero et al., 2018).

Hybridisation of pedagogical models in PE

The current emergence of new pedagogical models runs in lockstep with their hy-bridisation with diverse teaching methods, a surge of combinations currently put for-ward as an innovative teaching strategy. The inclusion of this type of method in the current educational system is becoming increasingly more significant, since it fur-nishes students with a greater role, participation, autonomy and self-regulation (Puigarnau et al., 2016) and most importantly provides them with greater motivation (Fernández-Río et al., 2016).

TPSR is closely associated with the Sports Education Model (SEM) because they both share certain approaches to responsibility (Siedentop et al., 2011). One of the first studies in which these two models were used in conjunction was rugby (Gordon & Doyle, 2015) where significant improvements in student behaviour were achieved. The recent study by Menéndez and Fernández-Río (2016a) in educational kickbox-ing (non-contact) for 4th-year lower secondary students also stands out. The other major pedagogical model hybridised with TPSR is cooperative learning (CL) (Merino et al., 2017) due to the connections between the two models; the teaching-learning process is student-centred; learning takes place in a participatory context; the student takes responsibility for active learning and social interaction (Fernández-Río, 2014).

There are few projects in this innovation strand that build TPSR into a gamification project. The purpose of this study was to implement a teaching strategy based on hybridising the TPSR pedagogical model (providing greater prominence, participa-tion, autonomy and self-regulation) with gamification to observe behavioural patterns in a teacher's performance and their impact on the motivation, differentiated by gen-der, of their PE students over a school term.

Methodology

Participants

The single case study sample consisted of a PE teacher with experience in active methodologies and 55 teenage PE students (28 girls and 27 boys) aged 13-17 (M = 14.29; SD= .875) from two uniform 2nd- and 3rd-year secondary school courses in a state school in the Region of Murcia. The sample was chosen for accessibility and convenience since the teacher used a methodology based on combining TPSR with gamification (TPSR+GF). The exclusion criteria were students who had already taken classes with this type of methodology. The participants, and their parents or legal guardians in the case of underage students, were informed about the study following the guidelines (consent, confidentiality and anonymity) of the University of Murcia's Ethics Committee (ID: 2380/2019).

Instruments used

The *observation instrument* (Table 1) was the Personal and Social Responsibil-ity Observation System (SORPS) (Prat et al., 2019) based on teaching communica-tion (Castañer et al., 2010), validated by experts and tailored to gamification. This instrument consisting of six exhaustive criteria and 22 exclusive categories within the same criterion allowed categorisation of the teacher's performance, recorded on video, and the response of the students in the ten sessions in the innovation programme.

The recording instrument (Figure 1) was the Lince Plus v.1.1. free software (Soto et al., 2019), whose multiplatform versatility allowed visualisation of two images of the session, entry of the SORPS categories, quick coding from the recorded images and automatic log transformation for further processing.

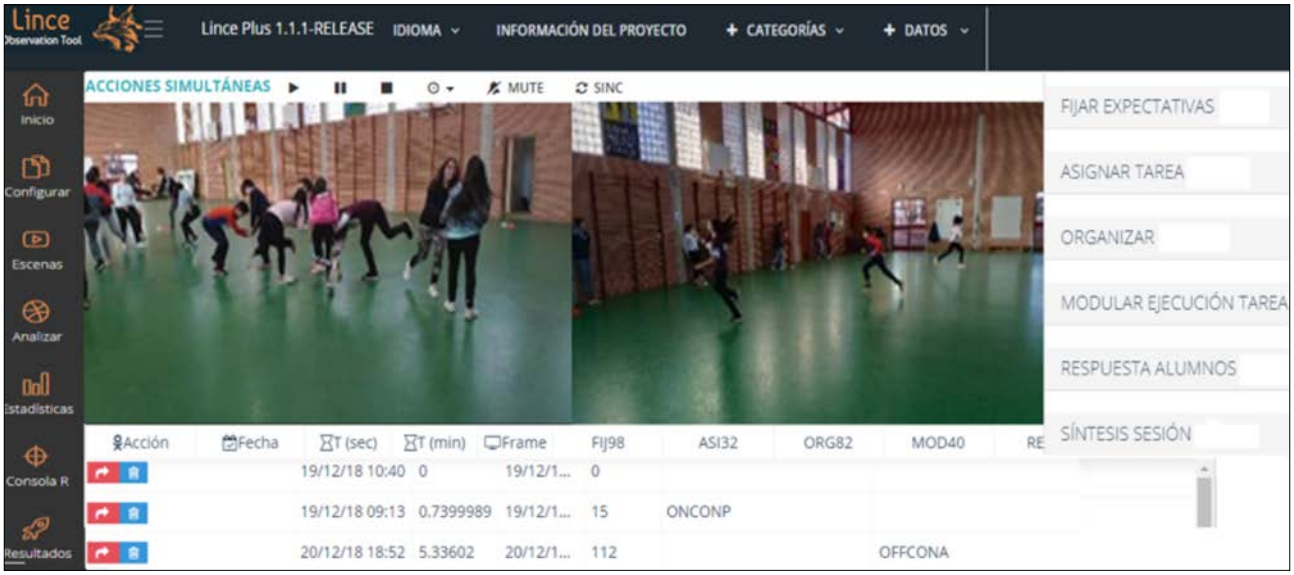
The *motivation questionnaire* was the Secondary Education Motivation Scale (EME-S) (Núñez et al., 2010). It consists of 28 items divided into seven subscores: amotivation, external regulation, introjected regulation, identified regulation, intrin-sic motivation - intrinsic motivation to know (IM-to know), intrinsic motivation towards accomplishments (IM-to accomplish things), and intrinsic motivation to experience stimulation (IM-to experience stimulation). Each subscale consists of four items. The

Table 1
TPSR+GF observation system

Criterion	Category	Code	Description
Expectations	Objective of session	OBS	Prospects and aims of the session
	Objective of task	OBT	Prospects and aims of the task
	Objective of gamification	OBG	Objectives of gamification (music/videos, decoration, etc.)
	Undefined objective	UOB	Not generate session expectations or objectives
Explanation	Imposition Instructions	IMP	Without the possibility to include changes
	Shared	SHA	Proposals are allowed to be decided in common
	Dynamics	DYN	Generate emotions (curiosity), social interrelationships, etc.
Organisation	Established	EST	Spaces and materials are mandated
	Distribution of Function	DIS	Functions and roles are allocated
	Suggested	SUG	Teachers pose opportunities to pupil's interventions
Task adjustments	Negative Evaluation	NEG	Rebuke to the students
	Redirect	RED	Correct student's responses
	Positive Evaluation	POS	Encourage and motivate the students
	Proposals	PRO	Formulate new options to be successful
	Rewards	REW	Offer rewards for good task performance
Student's responses	Reproduction	REP	Replicate tasks or situations
	Unbalances	UNB	Disarranged or disordered responses (talking, distractions, etc.)
	Autonomy and Leadership	AUT	Drive initiatives
	Self-Assessment	SAS	The student evaluates their own performance
Session summary	Guided summary	GUS	The teacher summarises the session
	Shared summary	SHU	The students take part in the session summary
	Non-existent summary	NSU	The sessions end without being summarised

answers were recorded using a seven-point Likert scale from 1) *Does not corre-spond at all to* (7) *Fully corresponds*. The scales were grouped into intrinsic motivation (IM-to know, IM-to accomplish things and IM-to experience stimulation), extrin-sic motivation (identified regulation, introjected regulation and external regulation) and amotivation. The self-determination index was also calculated (SDI, Vallerand, 1997) using the formula [SDI = (Intrinsic M. x 2+Identified R.) - (Introjected R.+External R./2 - (Amotivation x 2)].

Figure 1
Lince Plus recording instrument with a session log (Soto et al., 2019)



Design and Procedure

This descriptive observational study used a mixed method of multilevel triangula-tion (Anguera et al., 2014; Castañer et al., 2013) (Figure 2) for the convergence of the qualitative data from observation of the teacher and the quantitative data from the students' motivational perception.

Once the school and the PE teacher had been informed of the objective of the study and been asked to participate with the endorsement of the University of Mur-cia's Ethics Committee, the students completed an informed consent form (they and their parents or legal guardians).

The intervention was conducted throughout the 2018/19 school year by hybridis-ing TPSR+GF, a new methodological association in PE, over 10 sessions lasting 55 minutes each using a gamification intervention project called "The Enigma of Sen-eb" (Melero et al., 2019). By designing learning scenarios consisting of a motivating aesthetic and activities, the students were encouraged to tackle challenges which took them from the Late Modern Period to Egyptian mythology, while taking in oth-ers such as Aztec, Nordic, Chinese, Greek-Roman and Mesopotamian, in search of "The Root" of PE (Seneb in Egyptian hieroglyphs) to safeguard worldwide physical, psychosocial and emotional health. Hence, affective social relationships, decision-making, social skills enhancement and their transfer outside the school environ-ment were fostered during this intervention (Tarin-Moreno et al., 2013), as were other aspects such as creativity, group membership and motivation.

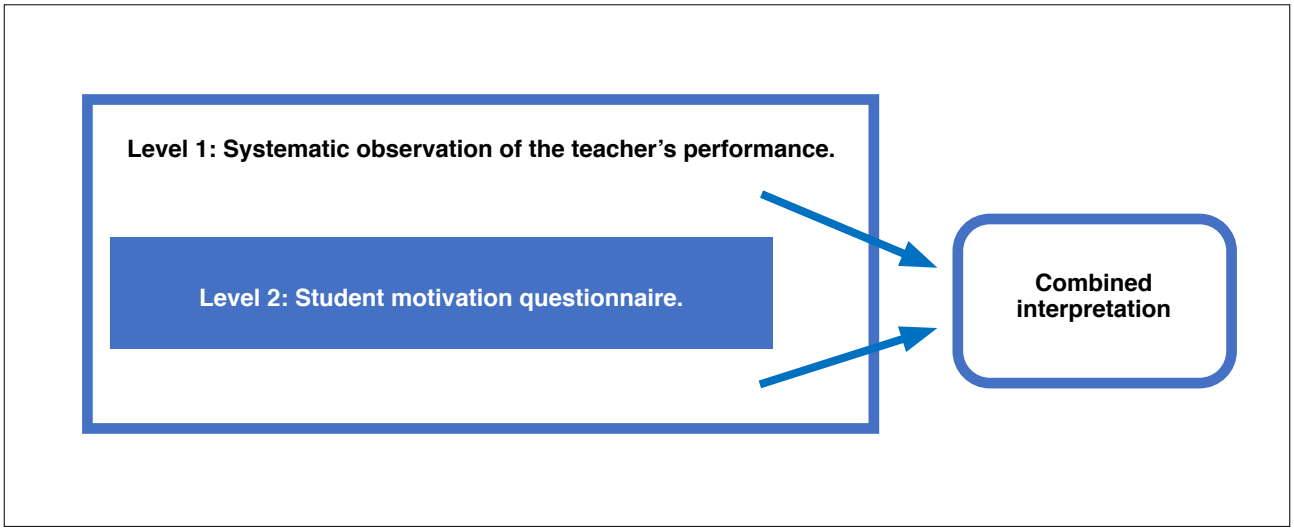
The main objectives of the session were to explore and experience a recreation-al competitive structure and reflect upon the emotional and affective aspects pro-duced by games with winners and losers.

In the first session, lasting approximately 15 minutes, the student participants filled in the questionnaires in the presence of the PE teacher and the lead re-searcher in case any clarification was required. After this initial assessment, video recordings were made of the 10 sessions in the course of the term; five sessions of 2nd-year and five sessions of 3rd-year lower secondary. A Panasonic digital cam-era (Lumix FZ-100) and a wireless microphone worn by the teacher were used. The observers were trained beforehand to check the quality of their record-keeping by calculating the inter-observer and intra-observer reliability concordance using Cohen's kappa coefficient (Cohen, 1960), in which they obtained a mean value of more than 0.86 (Hernández-Mendo et al., 2014).

Data Analysis

Temporal pattern (t-pattern) detection was used, which has yielded excellent re-sults in previous studies (Casarrubea et al., 2018; Castañer et al., 2011; Lozano et al, 2016). In the first analysis to identify the most relevant t-patterns of teacher per-formance and student response, the

Figure 2
Multilevel triangulation of the design



log from Lince Plus (Soto et al., 2019), the set of the 10 sessions, was exported in .txt format to the Theme v.6 Edu. software (Mag-nusson, 2000) and the search parameters of three constitutive multi-events and a significance of .005 were added, as in the study by Prat et al. (2019).

Subsequently, the SPSS v.22.0 statistical program (Statistical Package for the Social Sciences, SPSS Inc.) was used to perform a descriptive and inferential analysis of the results of the participants' initial and final questionnaires in order to de-termine the impact of the intervention on their self-determined motivation. The data-base was pruned to detect atypical cases, and two participants were eliminated as they had a $p < .01$ value in the Mahalanobis distance. Data normality was calculat-ed; for quantitative variables, yielding a value of $p < .05$ in the Kolmogorov-Smirnov test; for categorical variables, yielding a significance level of $p < .05$. Cronbach's test was used to analyse reliability, yielding a value of ($> .70$). Finally, the Wilcoxon signed-rank test for related samples was applied to compare proportions and means of the data collected in the pretest and posttest questionnaires and to see whether there were any significant differences with a significance level of $p < .05$.

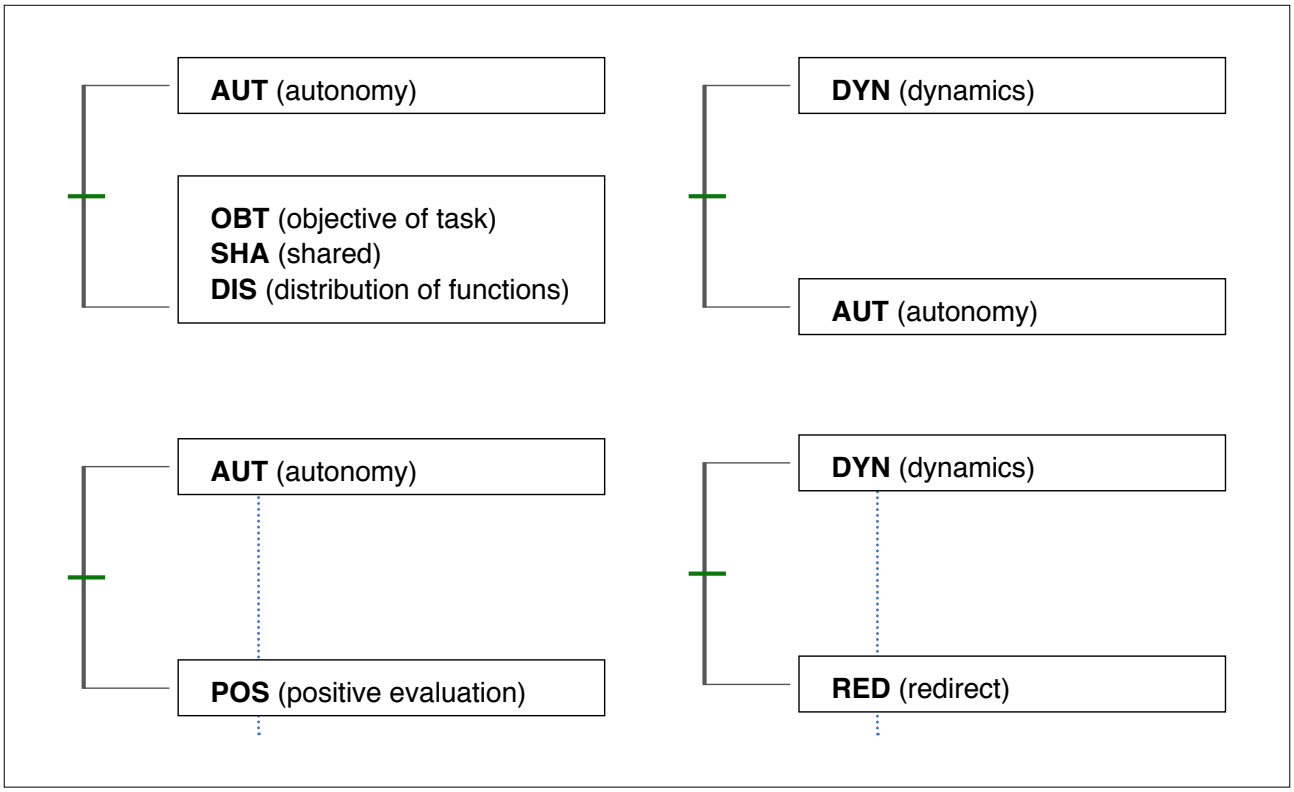
Results

Teacher performance and student response

Four t-patterns representative of the interactive behaviour were obtained with the following interrelated behaviour depicted in the dendrograms below (Figure 3); teacher behaviours that reinforce student autonomy (AUT) and generate shared explanations (SHA) and focus on the objectives of task (OBT) and on distribution of functions (DIS). This reinforcement of autonomy (AUT) was followed by a positive assessment in the form of positive evaluation (POS) or was preceded by generation of emotions by the teacher (DYN). This emotion generation promoted curiosity and interpersonal relations (DYN) among the students, which consequently stimulated autonomy and leadership (AUT) and led to redirection of the task (RED) on another occasion by the teacher.

The more exhaustive analysis of the teacher's performance obtained in the course of the 10 sessions is provided below in the form of a plot (Figure 4). The plot shows how the teacher engaged in a series of behaviours which improved the stu-dents' autonomy and leadership, redirected disarranged or disordered responses and generated curiosity and encouraged social interrelationships and companion-ship by motivating them.

Figure 3
T-pattern dendrogram of teacher performance and student response



These behaviours have been highlighted in Figure 4 in different colours and differentiated areas:

- The lower area (green area, lines 1-5) shows how the autonomy and leadership response of the students (AUT) was repeated with: self-assessment (SAS), shared task or explanation (SHA) and distributing roles in collaborative activities (DIS).
- In the intermediate area (red area, lines 12-22), creating dynamics generating curiosity and emotions, social interrelations (DYN) and companionship (112 times) stood out. Consideration should also be given to the stimulus which emerged with distributing roles, collaborative activities, challenges, tri-als/missions or scoring systems (DIS) combined with exciting dynamics (DYN) that earned rewards (REW).
- In the intermediate area (yellow area, lines 53-57), formulating proposals (PRO) or new options to be successful which were combined with drive initiatives (AUT) were observed; objectives of task (OBT), task proposals (SHA) and distribution of function (DIS) also appeared.
- In the upper area (purple area, lines 67-80), redirection of the student's re-sponse (RED) combined with autonomy and leadership (AUT) and unbalances (UNB) with more regulatory teaching action were particularly prominent, although in lockstep he offered rewards (REW) and positive evaluations (POS) to motivate the students.

Students' perception of their level of motivation

Although there are no significant differences in the relationship between the pre-test and posttest motivation variables (Table 2), differences do emerge in the level of student amotivation (p: .008). This also led to significant changes in the SDI among students, increasing by 1.12 points on average from the beginning (3.41) to the end (4.53) (p = .040).

Figure 4
Teacher and student behaviour distribution plot for all sessions

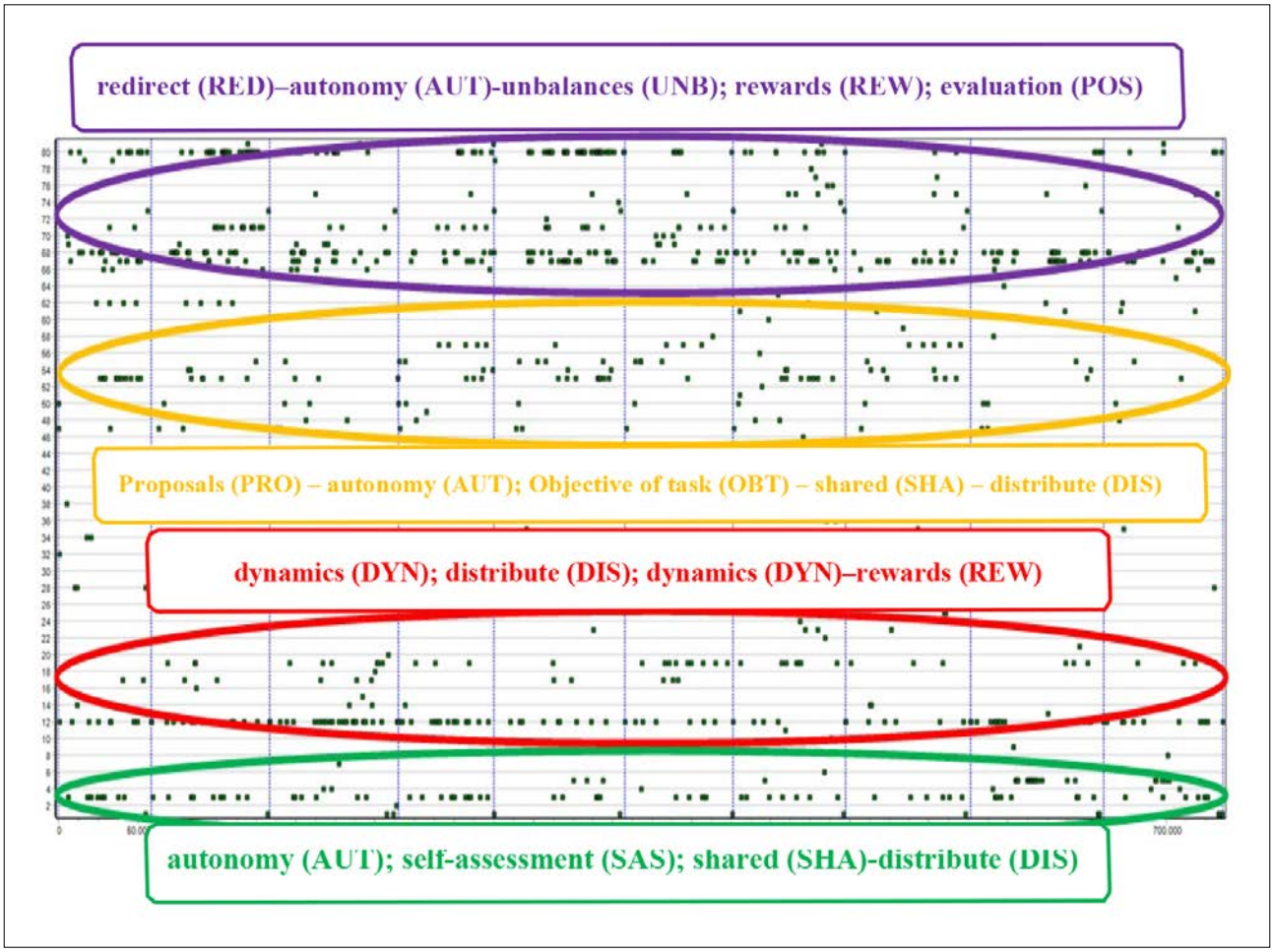


Table 2
Data on student opinions before and after the intervention.

Variables	Pretest		Posttest			
	M	(SD)	M	(SD)	Z	Sig.
Amotivation	2.74	(1.64)	2.14	(1.45)	-2.671	.008**
Intrinsic motivation	4.50	(1.42)	4.42	(1.48)	-.134	.894
Extrinsic motivation	5.38	(1.05)	5.35	(1.07)	-.372	.710
Self-determination	3.41	(4.63)	4.53	(4.47)	-2.057	.040*

Key: M = mean; SD = standard deviation; Z = Wilcoxon signed-rank test value; Sig.= asymptotic significance (2-sided); * = difference has a significance level p < .05; ** = difference has a significance level p < .01

These adjusted data can be seen in Figure 5, where the significant differences between the result of the pretest self-determination index (PRESDI) and the result of the posttest self-determination index (POSSDI) stand out.

The comparison of these data by gender (Table 3) revealed differences between them. In the case of boys, there was no change in their perception of motivation in any of the variables and therefore no change in their SDI. By contrast, girls present-ed a major fall in amotivation (*p*: .003). which was reflected in a significant increase in their SDI (p: .000).

Discussion and Conclusions

The purpose of this study was to implement a strategy based on the hybridisation of the TPSR+GF pedagogical model and to verify the behavioural patterns of a teacher's actions and their impact on the motivation of their lower secondary PE students.

Teacher's communication scenario

This study found that the teacher's performance enhanced his teaching by seek-ing greater initiative and res-

Figure 5
Differences in the level of motivation before and after the intervention

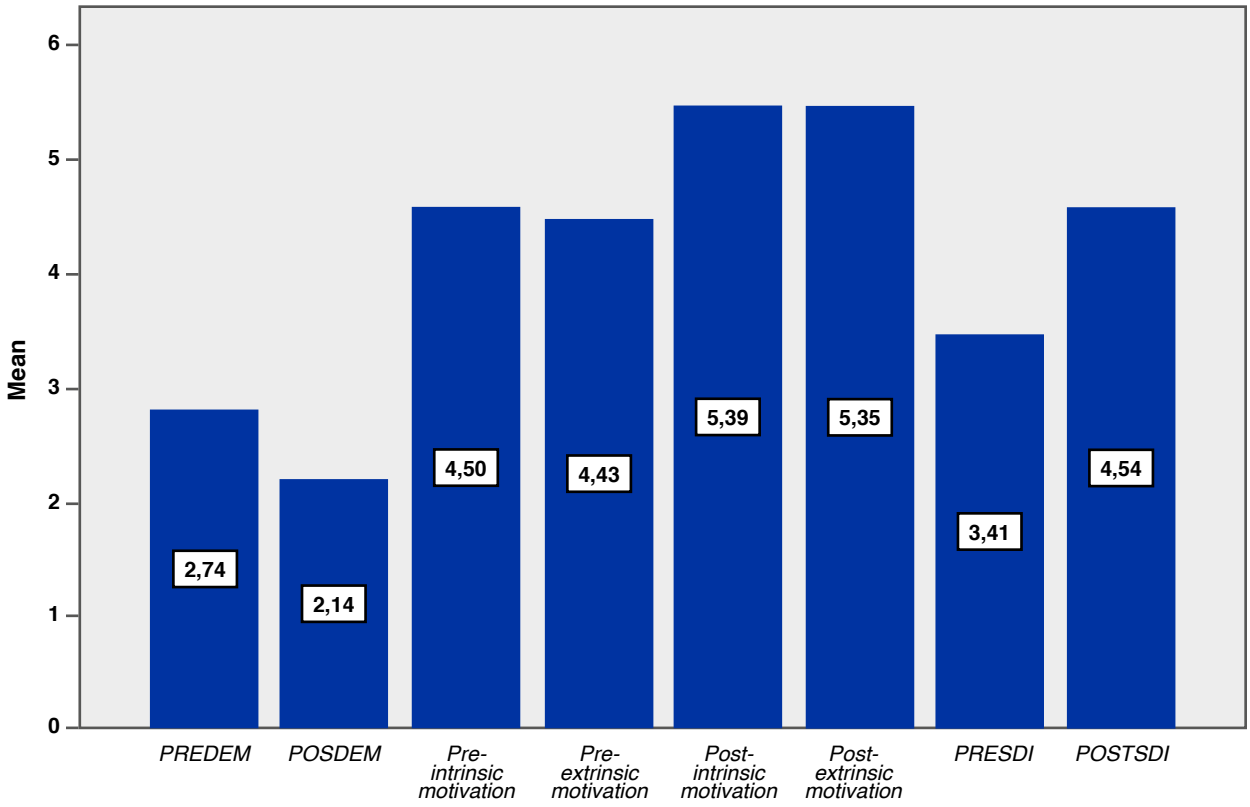


Table 3
Values of student opinions before and after the intervention, by gender

	Boys (*n* = 27)						Girls (*n* = 28)					
	Pretest		Posttest				Pretest		Posttest			
Variables	M	(SD)	M	(SD)	Z	Sig.	M	(SD)	M	(SD)	Z	Sig.
AM	2.90	(1.75)	2.50	(1.66)	-.992	.321	2.59	(1.53)	1.79	(1.14)	-3.00	.003**
IM	4.61	(1.40)	4.18	(1.58)	-1.43	.151	4.39	(1.46)	4.66	(1.36)	-1.24	.214
EM	5.31	(1.05)	5.12	(1.17)	-1.10	.269	5.45	(1.07)	5.57	(.95)	-.577	.564
SDI	3.42	(4.67)	3.33	(5.02)	-.456	.648	3.41	(4.68)	5.69	(3.59)	-3.48	.000**

AM: Amotivation; IM: Intrinsic Motivation; EM: Extrinsic Motivation; SDI: self-determination index. M: mean; SD = standard deviation; Z : Wilcoxon signed-rank test value; n: number; Sig: asymptotic significance (2-sided); ** = difference has a signifi-cance level p < .01.

ponsibility from the students, including proposing collaborative activities in which roles and functions were established with proposals for trials and challenges explained in shared fashion among the students. This pro-gressive empowerment, a basic pillar of the TPSR, made it possible to promote de-cision-making and the assumption of management roles in the session in the inno-vative teaching strategies (Pérez & Hortigüela, 2020). Similar results were found in studies in which a programme based on TPSR was used in isolation, such as a de-crease in aggressive behaviours and interruptions (Cecchini et al., 2007; Escartí et al., 2011) and an improvement in attitudes of respect, participation and effort and personal autonomy (Walsh et al., 2010).

This work utilised a gamified environment featuring a narrative combined with the use of an aesthetic packed with visually appealing images for the player, rewards such as badges or totems, seeking to generate curiosity in the students to feel more competent and autonomous (Kapp, 2012; Zichermann & Cunningham, 2011). This type of strategy is viewed as crucial in redirecting participants in the case of unbal-anced responses and stimulating autonomous resolution, thus achieving an improvement in their understanding (Romar et al., 2015; Prat et al., 2019; Sánchez-Alcaraz et al., 2019).

This innovation proposal drawing on methodological hybridisation and its com-munication scenario allows teachers to improve teaching behaviours based on autonomy, participation and effort on the part of students, as indicated by similar stud-ies (Camerino et al., 2019; Prat et al., 2019).

Students' perception of their level of motivation

The students' amotivation diminished after the intervention, while their SDI in-creased, which is very encouraging considering the dynamics followed. What probably reduced their demotivation were the incentives with a climate packed with ex-ternal stimuli: distribution of roles, generation of challenges, scoring systems typical of gamification dynamics (Kapp, 2012; Zichermann & Cunningham, 2011). Similar studies also included improvements in other aspects which impact the constructive climate of the session, such as the generation of conflict between peers. Mention should be made of the study by Navarro et al. (2017), where a gamification project in PE led to improved student motivation for both the subject and also regular PA performance. The students were more interested in attending classes, conflicts were reduced during the period studied and conviviality at the school improved. In relation to these results, numerous studies have revealed the importance of stu-dents' perceptions of the motivational climate in PE classes and its impact on their intrinsic motivation and SDI (Moreno-Murcia et al., 2008; Moreno-Murcia, Huéscar & Ruiz, 2018).

In terms of gender differences, there was a notable decrease in amotivation and a large increase in self-determination in girls, with no differences in motivation after the programme among boys. These results contrast with the bulk of studies to date in which boys have always shown greater satisfaction with the subject than girls (Gómez-Rijo et al., 2011), indicating a greater appreciation for the subject and the PE teacher since they see the subject as a fun activity and relate more to the teach-er than the girls do, who find PE and sport boring (Sánchez-Alcaraz & Gómez-Mármol, 2015). In the same line as this research, the study by Manzano-Sánchez, Valero-Valenzuela, Conde and Ming (2019) found that applying TPSR in lower secondary education yielded improvements in responsibility in both groups, albeit only in girls in terms of intrinsic motivation and meeting basic psychological needs.

Practical applications of the study

On the basis of this study, it is recommended to combine basic pedagogical models with specific techniques and follow these practical suggestions:

- Bear in mind the participants' organisational and self-management limitations.
- Try out the pedagogical models separately first and then blend them with other innovative pedagogical strategies and methods.
- Tailor assessment to the proposal of this study so that it will be continuous and instructive.
- Leverage group conflicts once they have emerged as part of the teaching-learning process.
- Work on a preliminary level of autonomy in order to consolidate self-management.

Motor skill teachers ought to study new alternatives since PE innovation must seek new horizons. They should also cater to the new needs of their participants so as to achieve adherence to physical activity and sport in students' daily lives.

Acknowledgements

The authors acknowledge the support of the projects awarded by: 1) The Ministry of Economy and Competitiveness, State Programme for Knowledge Generation and Scientific and Technological Improvement of the R&D System, "New Research Approach in Physical Activity and Sport from the Mixed Methods Perspective (8PGC2018-098742-B-C31)"; 2) The Ministry of Science, Innovation and Universities, coordinated project "New Approach to Research in Physical Activity and Sport from the Mixed Methods Perspective (NARPAS_MM) (SPGC201800X098742CV0)"; 3) The Government of Catalonia through the Design Research and Innovation Group (GRID). Technology and multimedia and digital application to observational designs (Grant No. 2017 SGR 1405)".

References

Anguera, M. T., Camerino, O., Castañer, M., & Sánchez-Algarra, P. (2014). Mixed methods en la investigación de la actividad física y el deporte. *Revista de Psicología del Deporte, 23*(1) 123-130.

Belando, N., Ferriz-Morell, R., & Moreno-Murcia, J. A. (2012). Propuesta de un modelo para la mejora personal y social a través de la promoción de la responsabilidad en la actividad físico-deportiva. *Revista Internacional de Ciencias del Deporte*, *8*(29), 202-222. https://doi.org/10.5232/ricyde2012.02902

Beltrán, J. (2017). *E-learning y gamificación como apoyo al aprendizaje de programación*. Tesis doctoral no publicada, Universidad de Extremadura.

Blázquez, D. (Ed)(2016). *Métodos de enseñanza en Educación Física. Enfoques innovadores para la enseñanza de competencias*. Barcelona: Inde.

Camerino, O., Valero-Valenzuela, A., Prat, Q., Manzano, D., & Castañer, M. (2019). Optimizing Education: A Mixed Methods Approach Oriented to Teaching Personal and Social Responsibility (TPSR). *Frontiers in Psychology*, 10, 14-39. https://doi.org/10.3389/fpsyg.2019.01439

Casarrubea M, Magnusson MS, Anguera MT, Jonsson GK, Castañer M, Santangelo A, Palacino M, Aiello S, Faulisi F, Raso G, Puigarnau S, Camerino O, Di Giovanni G & Crescimanno G. (2018) T-pattern detection and analysis for the discovery of hidden features of behaviour. *Journal of Neuroscience Methods, 310*, 24-32 doi: 10.1016/j.jneumeth.2018.06.013 - PMID: 29935197

Castañer, M., Camerino, O., Parés, N. & Landry, P. (2011). Fostering body movement in children through an exertion interface as an educational tool. *Procedia - Social and Behavioral Sciences, 28*, 236-240.

Castañer, M., Camerino, O., Anguera, M. T., & Jonsson, G. K. (2010). Observing the paraverbal communicative style of expert and novice PE teachers by means of SOCOP: a sequential análisis. *Proc. Soc. Behav. Sci.2*, 5162–5167. https://doi.org/10.1016/j.sbspro.2010.03.839

Castañer, M., Camerino, O., & Anguera, M. T. (2013). Mixed Methods in the Research of Sciences of Physical Activity and Sport. *Apunts. Educación Física y Deportes*, *112*, 31-36. https://doi:10.5672/apunts.2014-0983.es.(2013/2).112.01

Cecchini, J. A., Montero, J., Alonso, A., Izquierdo, M., & Contreras, O. (2007). Effects of Personal and Social Responsibility on fair play in sports and self-control in school-aged youths. *European Journal of Sport Science, 7*(4), 203-211. https://doi.org/10.1080/17461390701718497

Cohen, J. (1960). A coefficient of agreement for nominal scales. Educational and *Psychological Measurement, 20*, 37-46. https://doi.org/10.1177/001316446002000104

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). *From game design elements to gamefulness: defining "gamification"*. Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments, 9-15. https://doi.org/10.1145/2181037.2181040

Escartí, A., Pascual, C., & Gutiérrez, M. (2011). Propiedades psicométricas de la versión española del Cuestionario de Responsabilidad Personal y Social en contextos de educación física. *Revista de Psicología del Deporte, 20*(1), 119-130.

Escarvajal, J. C., & Martín-Acosta, F. (2019). Análisis bibliográfico de la gamificación en Educación Física. *Revista Iberoamericana de Ciencias de la Actividad Física y el Deporte, 8*(1), 97-109.

Fernández-Río, J. (2014). Another step in Models-based practice: hybridizing Cooperative Learning and Teaching for Personal and Social Responsibility. *Journal of Physical Education, Recreation and Dance, 85*(7), 3-5. https://doi.org/10.1080/07303084.2014.937158

Fernández-Río, J., Calderón, A., Hortigüela, D., Pérez-Pueyo, A., & Aznar, M. (2016). Modelos pedagógicos en educación física: consideraciones teórico-prácticas para docentes. *Revista Española de Educación Física y Deportes*, *413*, 55-75

Gómez-Rijo, A., Gómez-Medina, S., & Martínez, I. (2011). Efectos del género y la etapa educativa del estudiante sobre la satisfacción y la desmotivación en Educación Física durante la educación obligatoria. Ágora *para la Educación Física y el deporte, 13*(2), 183-195.

González C., & Mora, A. (2015). Técnicas de gamificación aplicadas en la docencia de Ingeniería Informática. *Revisión, 8*(1), 29-41.

Gordon, B., & Doyle, S. (2015). Teaching Personal and Social Responsibility and Transfer of Learning: Opportunities and Challenges for Teachers and Coaches. *Journal of Teaching in Physical Education*, *34*(1), 152-161. https://doi.org/10.1123/jtpe.2013-0184

Haerens, L., Kirk, D., Cardon, G., & De Bourdeaudhuij, I. (2011). Toward the development of a pedagogical model for health-based physical education. *Quest*, *63*(3), 321–338. https://doi.org/10.1080/00336297.2011.10483684

Hastie, P. A., & Casey, A. (2014). Fidelity in Models-Based Practice Research in Sport Pedagogy: A Guide for Future Investigations. *Journal of Teaching in Physical Education, 33*, 422-431. https://doi.org/10.1123/jtpe.2013-0141

Hellison, D. (1995). *Teaching personal and social responsibility through physical activity*. Champaign, IL: Human Kinetics.

Hellison, D. (2011). *Teaching responsibility through physical activity* (3th Ed.). Champaign, IL: Human Kinetics.

Hernández-Mendo, A., Castellano, J., Camerino, O., Jonsson, G., Blanco-Villaseñor, Á., Lopes, A., & Anguera, M. T. (2014). Programas informáticos de registro, control de calidad del dato, y análisis de datos. *Revista de psicología del deporte*, *23*(1), 111-121.

Jewett, A.E., Bain, L.L., & Ennis, C.D. (1995). *The curriculum process in physical education*. Dubuque, IA: Brown & Benchmark.

Joyce, B. & Weil, M. (1985). *Modelos de enseñanza*. Madrid: Anaya.

Johnson, D. W., Johnson, R. T., & Holubec, E. J. (2013). *Cooperation in the Classroom* (9th ed.). Edina, MN: Interaction Book Company.

Kapp, K. (2012). The gamification of learning and instruction: Game-based methods and strategies for training and education. *International Journal of Gaming and Computer-Mediated Simulations, 4*(4). https://doi.org/10.4018/jgcms.2012100106

Lozano, D., Camerino, O., & Hileno, R. (2016). Dynamic Offensive Interaction in High Performance Handball. *Apunts. Educación Física y Deportes, 125,* 90-110. https://doi.org/10.5672/apunts.2014-0983.es.(2016/3).125.08

Manzano-Sánchez, D., Valero-Valenzuela, A., Conde, A. & Ming, C. (2019). Applying the Personal and Social Responsibility Model-Based Program: Differences According to Gender between Basic Psychological Needs, Motivation, Life Satisfaction and Intention to be Physically Active. *International Journal of Environmental Research and Public Health, 16*(13), 2326, 1-10. https://doi.org/10.3390/ijerph16132326

Melero, D., García-Ruiz, J., Merino-Barrero, J.A., Manzano-Sánchez, D., Valero-Valenzuela, A. & Ardoy, D.N. (2019). El enigma de Seneb. Aplicación de un programa educativo híbrido basado en el modelo de responsabilidad personal y social y la gamificación para el fomento de la condición física, aspectos psicosociales, hábitos de vida, rendimiento cognitivo y académico en educación física. *Revista Española de Educación Física y Deportes, 427(*4), 101-111.

Magnusson, M. S. (2000). Discovering hidden time patterns in behavior: T-patterns and their detection. *Behavior Research Methods, Instruments & Computers, 32*, 93-110. https://doi.org/10.3758/BF03200792

Menéndez, J. I. (2017). *Educación deportiva y responsabilidad personal y social: modelos pedagógicos para la inclusión de alumnado con Necesidades Educativas Especiales*. En III Congreso Internacional Virtual innovación pedagógica y praxis educativa. *INNOVAGOGÍA* 2016 (pp. 266-276). AFOE. Asociación para la Formación, el Ocio y el Empleo.

Menéndez, J. I., & Fernández-Río, J. (2016a). Hibridación de los modelos de Educación Deportiva y Responsabilidad Personal y Social: una experiencia a través de un programa de kickboxing educativo. *Retos. Nuevas Tendencias en Educación Física, Deporte y Recreación*, *30*, 113-121.

Menéndez, J. I., & Fernández-Río, J. (2016b). Violencia, responsabilidad, amistad y necesidades psicológicas básicas: efectos de un programa de Educación Deportiva y Responsabilidad Personal y Social. *Revista de Psicodidáctica, 21*(2), 245-260. https://doi.org/10.1387/RevPsicodidact.15269

Merino, J. A., Valero, A., & Belando, N. (2017). El modelo de responsabilidad personal y social. Variables de estudio asociadas a su implementación. *EmásF: revista digital de educación física*, *49*, 60-77.

Metzler, M.W. (2011). *Instructional models for physical education (3th Ed.)*. Scottsdale, AZ: Holcomb Hathaway.

Moreno-Murcia, J. A., Conte, L., Hellín, P., Hellín, G., Vera, J. A., & Cervelló, E. (2008). Predicción de la motivación autodeterminada según las estrategias para mantener la disciplina y la orientación motivacional en estudiantes adolescentes de educación física. *Apuntes de Psicología, 26*(3), 501-516.

Moreno-Murcia, J., Huéscar, E., & Ruiz, L. (2018). Perceptions of Controlling Teaching Behaviors and the Effects on the Motivation and Behavior of High School Physical Education Students. *International journal of environmental research and public health, 15*(10), 2288. https://doi.org/10.3390/ijerph15102288

Mosston, M., & Ashworth, S. (2002). *Teaching physical education (5thEd.)*. San Francisco: B. Cummings.

Navarro, D., Martínez, R., & Pérez, I. J. (2017). El enigma de las 3 efes: fortaleza, fidelidad y felicidad. *Revista Española de Educación Física y Deportes*, *419*, 73-85.

Núñez, J. L., Martín-Albo, J., Navarro, J. G., & Suárez, Z. (2010). Adaptación y validación de la versión española de la Escala de Motivación Educativa en estudiantes de educación secundaria postobligatoria. *Estudios de Psicología, 31*(1), 89-100. https://doi.org/10.1174/021093910790744590

Ordiz, T. (2017). Gamificación: La vuelta al mundo en 80 días. *Revista Infancia, Educación y Aprendizaje, 3*(2), 397-403. https://doi.org/10.22370/ieya.2017.3.2.755

Peiró, C., & Julián, J.A. (2015). Los modelos pedagógicos en educación física: un enfoque más allá de los contenidos curriculares. *Tándem. Didáctica de la educación física*, *50*, 9-15.

Pérez, A., y Hortigüela, D. (2020). ¿Y si toda la innovación no es positiva en Educación Física? Reflexiones y consideraciones prácticas. *Retos. Nuevas Tendencias en Educación Física, Deporte y Recreación*, *37*, 579-587.

Prat, Q., Camerino, O., Castañer, M., Andueza, J., & Puigarnau, S. (2019). The Personal and Social Responsibility Model to Enhance Innovation in Physical Education. *Apunts. Educación* Física y *Deportes*, *136*, 83-99. https://doi.org/10.5672/apunts.2014-0983.es.(2019/2).136.06

Puigarnau, S., Camerino, O., Castañer, M., Prat, Q., & Anguera, M.T. (2016). El apoyo a la autonomía en practicantes de centros deportivos y de fitness para aumentar su motivación. *RICYDE-Revista Internacional de Ciencias del Deporte, 43*(12), 48-64. https://doi.org/10.5232/ricyde2016.04303

Quintero, L. E., Jiménez, F., & Area, M. (2018). Más allá del libro de texto. La gamificación mediada con TIC como alternativa de innovación en Educación Física. *Retos*, *34*, 343-348.

Romar, J. E., Haag, E., & Dyson, B. (2015). Teachers' experiences of the TPSR (Teaching Personal and Social Responsibility) model in physical education. Ágora *para la educación física y el deporte, 17*(3), 202-219.

Sánchez-Alcaraz, B. J., Cañadas, M., Valero, A., Gómez, A., y Funes, A. (2019). Resultados, dificultades y mejoras del modelo de responsabilidad personal y social. *Apunts. Educación F*ísica *y Deportes,136*, 62-82. https://doi.org/10.5672/apunts.2014-0983.es.(2019/2).136.05

Sánchez-Alcaraz, B.J., y Gómez-Mármol, A. (2015). Percepción de esfuerzo, diversión y aprendizaje en alumnos de educación secundaria en las clases de Educación Física durante una Unidad Didáctica de CrossFit. Murcia. *SPORT TK Revista Euroamericana de Ciencias del Deporte, 4*(1), 63-68. https://doi.org/10.6018/239841

Sánchez-Alcaraz, B. J., Gómez-Mármol, A., Valero, A., de la Cruz, E., y Díaz, A. (2016). El modelo de responsabilidad personal y social a través del deporte como propuesta metodológica para la educación en valores en adolescentes. *Espiral. Cuadernos del Profesorado, 9*(18), 16-26. https://doi.org/10.25115/ecp.v9i18.997

Siedentop, D., Hastie, P. A., & Van Der Mars, H. (2011). *Complete guide to Sport Education (2ªEd.)*. Champaign: Human Kinetics.

Soto, A., Camerino, O., Iglesias, X., Anguera, M. T., & Castañer, M. (2019). LINCE PLUS: Research Software for Behaviour Video Analysis. *Apunts. Educación Física y Deportes*, *137*, 149-153. https://doi.org/10.5672/apunts.2014-0983.es.(2019/3).137.11

Tarín-Moreno, S., Pascual, C., & Escartí, A. (2013). La formación

en el proceso de implementación del programa de responsabilidad personal y social: un estudio de casos. *Revista Fuentes*, *14*, 125-146.

Thorpe, R., & Bunker, D. (1989). A changing focus in games teaching. In L. Almond (Ed), *The place of physical education in schools* (pp. 42-71). London: Kogan Page.

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In *Advances in experimental social psychology*. Academic Press. https://doi.org/10.1016/S0065-2601(08)60019-2

Walsh, D. S., Ozaeta, J., & Wright, P. M. (2010). Transference of responsibility model goals to the school environment: exploring the impact of a coaching club program. *Physical Education and Sport Pedagogy, 15*(1), 15-28. https://doi.org/10.1080/17408980802401252

Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. Boston: O'Reilly Media.

Conflict of Interests: No conflict of interest was reported by the authors.

apunts EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.09

OPEN ACCESS

Comparison of Physical Demands between Possession Games and Matches in Football

Javier Vilamitjana[1], Gabriel Heinze[2], Pablo Verde[3], Julio Calleja-González[4]

[1] CeNARD National Center of High Performance Athletics, Buenos Aires, Argentina.
[2] Crespo Sports and Cultural Association, Entre Ríos, Argentina.
[3] University of Düsseldorf, Düsseldorf, Germany.
[4] University of the Basque Country (UPV/EHU), Spain.

Cite this article:
Vilamitjana, J., Heinze, G., Verde, P., & Calleja-González, J. (2020). Comparison of Physical Demands between Possession Games and Matches in Football. *Apunts. Educación Física y Deportes*, *141*, 75-86. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.09

Editor:
© Generalitat de Catalunya
Departament de la Presidència Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Javier Vilamitjana
vilamitjana@yahoo.com

Section:
Physical preparation

Original language:
Spanish

Received:
2 September 2019

Accepted:
29 January 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

The main purpose of this study was to examine the extent to which possession games (POS) are efficient in stimulating the physical and physiological demands of competition and their relationship with the player's position in competitive matches. A descriptive study was conducted with 19 professional footballers in Argentina (24.7±4.8 years, 74.5±6.2 kg, 176.3±5.3 cm). Load was monitored by GPS and heart rate (HR) of each player in 16 competitive matches (eight observations for each tactical system: 1- 3-4-3 and 1-4-2-1-3) and during three POS formats: 6 vs. 6, 7 vs. 7 and 8 vs. 8 (eight observations for each format). The average (AHR) and maximum (MHR) heart rate and the HSLR (distance travelled >14.9 kph, per minute) and HILR (distance travelled >19.9 kph, per minute) metabolic load rates were analysed. When the sample means were compared, both metabolic rates were significantly lower in POS, but with HSLR values representing 69-75% of the level reached in matches. The AHR value in POS was similar to competition (except 8 vs. 8), while the MHR was significantly lower in POS. When performance between playing positions was compared, no significant differences were observed in the HILR and the HSLR for central defenders and midfielders or in all playing positions for the AHR. In conclusion, possession games could be used to recreate the physical and physiological demands to which players are exposed during competition, significantly influencing their internal-external load.

Keyword: physical performance, playing positions, tactical training, metabolic load rate, heart rate.

Introduction

Small-sided games (SSGs) are played on smaller pitches, often under modified rules and with fewer players than regulation football (Hill-Haas et al., 2011). The use of such games in professional player training is based on the premise that greater performance improvements are achieved when the specific demands of the sport are transferred (Dellal et al., 2011; Little, 2009). Accordingly, SSGs enable players to get as close as possible to real competitive situations, and the physical, physiological, technical and tactical demands of a match can largely be reproduced (Dellal et al., 2011; Dellal et al., 2012).

Global positioning system (GPS) technology has been used in professional football to quantify movement demands on players during training or in competition, providing movement parameters such as frequency and amount of impacts, distances, speeds, accelerations and decelerations (Casamichana et al., 2015). Several authors have analysed these parameters during different types of small-sided games: number of players per team (Brandes et al., 2012; Hill-Haas et al., 2009), modification of certain rules (Hill-Haas et al, 2009), relative area per player (Casamichana & Castellano, 2010; Dellal et al., 2011; Porres et al., 2010), comparison with competition (Casamichana et al., 2015; Dellal et al., 2012), floaters (Casamichana et al., 2018), etc. In terms of playing positions, a study conducted by Lacome et al. (2017) compared three SSG formats (6 vs. 6, 7 vs. 7 and 8 vs. 8) to competitive matches and then differentiated performance by the players' positions on the pitch, concluding that central defenders accumulated more distance at high intensity than the other positions in the 6 vs. 6 format.

Studies exploring rules inherent to tactical or strategic outcomes have also been published. For example, Fradua et al. (2013) extrapolated SSG sizes from the actual pitch (11 vs. 11) to investigate variables related to tactics in the game and concluded that pitch size is a variable which influences ball possession. Thus, a variation in pitch size can create favourable and also unfavourable conditions for attack and defence (Silva et al., 2016; Vilar et al., 2014). Equally, in the review by Hill-Haas et al. (2011), the authors suggested that "conventional" SSGs could facilitate the development of a core tactical concept with an appropriate game context, although this will depend on its design. This fresh line of analysis leads to a new concept in sports games: the "possession game". Possession games (POS) are similar to conventional SSGs but have some different implications. In an SSG, player deployment is totally random and the occupation of space is not pre-established, whereas in a POS the ownership of space is pre-established on the basis of intelligent occupation whereby the players who keep possession of the ball are deployed in such a way that the interrelationship between them and the space is as effective and efficient as possible, thereby making it possible to retain possession of the ball during the session. The primary objective of this kind of training is to generate unoccupied spaces through individual and group movements in order to build up play and attack with greater fluidity, thus promoting factors inherent in strategy and tactics with greater transference to specific match situations. In high-performance football, many teams use this type of game as part of their training sessions to emulate real competitive situations. Gaudino, et al. (2014) compared conventional SSGs and POS with 5, 7 and 10 players on each side in which no more than two touches were allowed in both games, whereas in the POS they had to keep the ball as long as possible. No detailed designs were given for each format and performance was not compared to competition. In other cases, and with the aim of evaluating modifying the rules on some tactical principles (attacking game patterns), Machado et al. (2016) used two types of POS called "small-sided conditioned games" or SSCG (6 vs. 6) in which ball possession time, number of passes, players involved in each attacking action, etc. were compared, although no physical and physiological parameters or transfers to specific game situations were evaluated.

Against this backdrop, the first objective of this study was to compare physical and physiological demands between POS and competition, since the former seek to reproduce basic principles of play which will subsequently be applied during competition. The second objective was to examine these demands in relation to the player's position during competitive matches on the assumption that the metabolic load rates in all POS formats are close to the levels observed in competition.

Methodology

Participants

A descriptive observational study was carried out with 19 players belonging to the same club in the Argentinian Professional Football League, Series B, during the 2016-17 season (age: 24.7 $\pm$ 4.8 years; body mass: 74.5 $\pm$ 6.2 kg; height: 176.3 $\pm$ 5.3 cm; fat percentage: 9.7 $\pm$ 2.5 %).

The players were grouped by their position on the pitch: central defenders (CD: n=4), full-backs (FB: n=3), midfielders (CM: n=5), wingers (WIN: n=5) and forwards (FOR: n=2). The goalkeepers were involved in the activities but excluded from the study because the distance and intensities evaluated during training and/or matches differed from those for outfield players (Clemente et al., 2013). Furthermore, they were only involved in the POS in their specific role as goalkeepers.

Before the start of the season, the players were evaluated using FIFA's medical protocol. None of them presented any ailments, pathologies or injuries and no medical prescriptions were issued. All the participants were informed of the research objectives and volunteered to participate in the study, which did not disrupt scheduled training. The study protocol was approved by the local Institutional Review Board and drafted in accordance with the Declaration of Helsinki (as revised at Fortaleza, 2013).

Procedure

The data for each match were gathered during the 2016-17 season. In terms of the two tactical formations used by the coach in the course of the competition, 52% of the games were played using the 1-3-4-3 formation (goalkeeper; three central defenders; two full-backs, two midfielders; one forward and two wingers) and 48% using the 1-4-2-1-3 formation (goalkeeper; two central defenders, two full-backs; three midfielders; one forward and two wingers). All the matches were played on natural grass football pitches with standard dimensions.

During the season, each player's GPS and heart rate were monitored 16 times (eight observations for each tactical system). In order to rule out possible effects of performance loss due to mental fatigue or incidents related to match strategies, only players who completed the first half of each game (Paul et al., 2015; Lacome et al., 2017) under normal conditions and with the same role on the pitch were considered.

In each competitive micro-cycle, the players performed five sessions with the ball lasting 45 minutes net (average) in each session, one to two weekly strength sessions and the match (the average total distance per micro-cycle was 31.6 km).

Instruments and measurements

All the physical and physiological parameters were assessed using the Zephyr™ GPS 10 Hz monitoring system and telemetric heart rate measurement (previously validated by Brooks et al., 2013; Kim et al., 2013). In order to limit inter-unit error, each player used the same GPS module and frequency meter for both POS and matches (Buchheit et al., 2013). The units were switched on 15 minutes before the beginning of each activity following the Zephyr™ (USA) instruction manual. After the recording of the activity, the data were downloaded to a laptop and analysed with the OmniSenseTM v4.1.4 software.

The following parameters were monitored: distance travelled at moderate intensity, in metres (14.9-19.8 kph); distance travelled at high intensity, in metres (19.9-25.2 kph); distance travelled at sprint, in metres (above 25.2 kph); average heart rate (AHR; bpm), and maximum heart rate (MHR; bpm). Speed classification was based on the system used by Di Salvo et al. (Di Salvo, et al., 2009; Di Salvo, Pigozzi, González-Haro, Laughlin & De Witt, 2013) and the four study variables were obtained from these parameters (Table 1).

Possession games: design

Three basic principles of play were considered when the POS was designed: a) ball possession through individual movements towards group movements (deep movements, diagonal movements, etc.); b) passing, depending on the unoccupied space and on the different movements (side

Table 1
Study variables and their definitions.

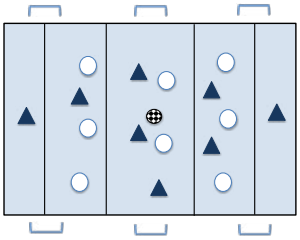
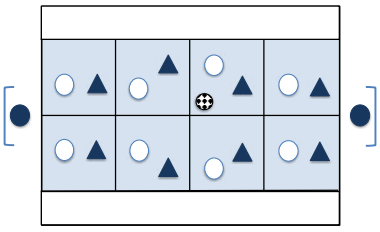
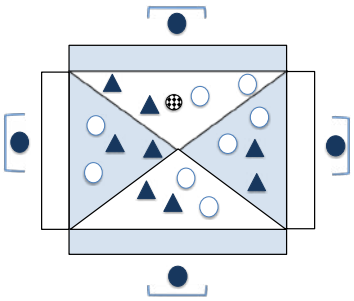
Variable	Definition
High speed load rate (HSLR)	Quotient between distance travelled at moderate intensity, high intensity and sprint by the amount of time of each activity in metres per minute.
High intensity/sprint load rate (HILR)	Quotient between distance travelled at high intensity and sprint by the amount of time of each activity in metres per minute.
Average heart rate (AHR)	Average heart rate obtained during the observed period in beats per minute.
Maximum heart rate (MHR)	Maximum heart rate obtained during the period observed in beats per minute

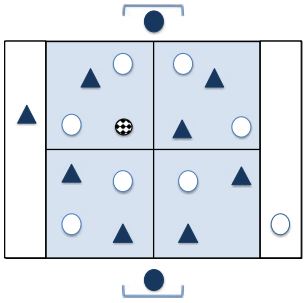
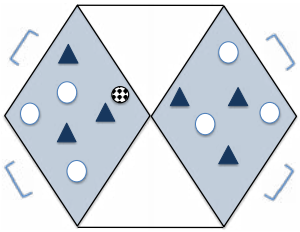
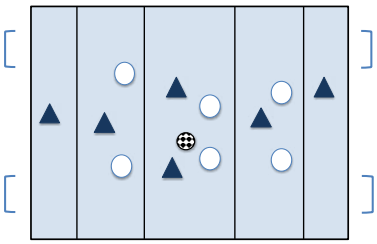
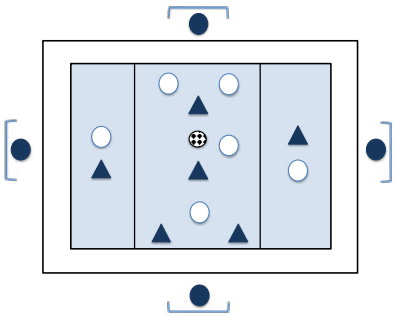
pass looking for width, vertical pass looking to advance, through pass between the lines, etc.); and finally, (c) ball recovery, which involves intercepting an opposing player in possession of the ball and thus prevent him from moving forward in the attack. Based on these principles, three POS formats were selected: 6 vs. 6, 7 vs.7 and 8 vs. 8. As a proposal, different specific POS options were designed by the authors of this study, each one with well-defined objectives for the attacking and defensive system (Table 2). In order to establish a common denominator, the same combined design was established and tested for the different formats, hence four designs with a clearly-defined structure and objectives were ultiately obtained for each POS format (Table 2).

The games were played "with no limit on the number of touches" (except at the time of shooting) on natural grass football pitches with standard dimensions.

The dimensions of each design were selected based on the observations described in the paper by Fradua et al. (2013): the relative playing area (m2 per player) between 65-110 m2 and the ratio between the pitch length-width distances from 1:1 to 1:1.3. The average measurements of each format are shown in Table 3. The same monitoring procedure was performed for each POS design as in matches. It was conducted in two rounds in series lasting eight minutes (two minutes of recovery between series) and each design was evaluated

Table 2
Proposed seven POS designs for the three formats studied.

N	Format*	Design: organisation and objectives	Diagram
1	8 vs.8 (34x48) 6 vs. 6 (25x38)	Organisation: 5 areas arranged vertically with 6 mini-goals placed five metres from each touchline. Objective: possession of the ball between the areas to generate movement from one side to the other in order to clear the areas around the goals. Meanwhile, the defenders have to move based on the ball, occupying the area where the ball is and the two adjacent strips and attempt to recover it as quickly as possible. No more than one player from each team can occupy each square and goals may be scored in any of the six goals.	
2	8 vs. 8 (34x48) 7 vs. 7 (30x40)	Organisation: 8 squares and two 5-metre strips at the sides; a goal (with a goalkeeper) five metres from each goal line. The game begins with 1 vs. 1 in each square. Objective: possession of the ball to generate spaces between the squares. For a player to be eligible to shoot, the ball must travel from one side to the other through at least four squares. The defenders have to press, trying to recover the ball as quickly as possible. No more than one player from each team can occupy each square and goals may be scored in either goal.	
3	8 vs. 8 (30x32 + banda lateral de 5 metres)	Organisation: 1 square comprised of 4 triangles plus a 5-metre strip at the base of each triangle; a mini-goal five metres from each base; 4 players from each team are arranged in two opposite triangles and try to win possession of the ball between the triangles. Objective: for a player to be eligible to shoot, five passes must be made, followed by a pass between the lines to set up a player on the same team, but from the opposite triangle and coming from the sides. No more than two players from each team may occupy each triangle and goals may be scored in any of the four goals.	

4	8 vs. 8 (34x44) 7 vs. 7 (30x40)	Organisation: 4 squares and a 5-metre strip on each of the sides; two goals (with goalkeeper) five metres from each goal line. Objective: possession of the ball with the aim of creating clear spaces between the squares to create scoring opportunities. The defenders have to press to recover the ball. Variations: for a player to be eligible to shoot, the ball must: 1. travel through at least three squares; 2. travel through all the squares; 3. travel from one side to the other. No more than two players from each team may occupy each square. Goals may be scored in either goal.	
5	7 vs. 7 (25x30 cada rombe) 6 vs. 6 (22,5x25 cada rombe)	Organisation: double diamonds joined together forming 2 triangles in the middle; four mini-goals (five metres from one side of each diamond); 2 teams of 6 or 7 players divided equally (3-3 or 4-3). Objective: possession of the ball between the diamonds until 5 passes are made, then 1 player from the same team has to "go down" or move to the adjacent triangle to shoot with a single touch. No more than two players from each team can occupy each diamond and goals may be scored in any of the four goals.	
6	6 vs. 6 (25x34)	Organisation: 5 areas arranged vertically with 2 mini-goals placed five metres from each goal line. Objective: possession of the ball between the areas to reach the final zone with a through pass. The defenders have to press to recover the ball as quickly as possible. Variations: for a player to be eligible to shoot, the ball must: 1. travel through at least two areas; 2. travel through three areas, and 3. travel through four areas, reaching the end zone in each variant in order to score. Goals may be scored in any of the four goals.	
7	7 vs. 7 (30x46) 6 vs. 6 (26x36)	Organisation: 3 areas arranged vertically, with a 5-metre strip around the pitch; 4 goals (with goalkeeper) five metres away from each side of the pitch. Objective: possession of the ball between the areas with the aim of reaching the aforementioned strip with a through pass. The defenders have to press to recover the ball. Variations: for a player to be eligible to shoot, the ball must: 1. travel through at least two areas; 2. travel through all three areas, and 3. move from one side to the other. Goals may be scored in any of the four goals.	

* In brackets, the width and length of the pitch used in each design (in metres).

on different days during the season (total: eight observations for each format).

Statistical analysis

A preliminary exploratory analysis was carried out followed by a normality and homogeneity test. Descriptive statistical measurements such as mean and standard deviation (SD) were calculated for each position and condition. A linear mixed-effects model was used to determine position and condition effects. For each response variable the fixed effects were the condition and the position. The player was considered to be a random effect. This model makes it possible to calculate the condition and position effect separately, considering an autocorrelation between observations made about the same player. The model was adjusted using the restricted maximum likelihood (REML) method. The results

Table 3
Dimensions and time spent on the three POS formats (mean ± SD)

POS format	Time (min)	Pitch area (m^2)	m^2 per player	Length/width ratio
6 vs. 6	2 x 8	895 ± 48,4	74,6 ± 4,0	1:1,3 ± 0,1
7 vs. 7	2 x 8	1207,5 ± 116,9	87,6 ± 6,7	1:1,3 ± 0,1
8 vs. 8	2 x 8	1585 ± 55,6	99,1 ± 3,5	1:1,3 ± 0,1

include the table with the estimation of the model's parameters, standard errors and *p*-values. Statistically significant differences were reported at a level of 5% (probability of type I error). The statistical calculations were performed with the R statistical software version 3.4.3. The statistical report was prepared with the knitr statistical package which makes it possible to replicate all aspects of the analysis.

Table 4
Values obtained for each study variable by tactical position for the three POS formats and the two tactical systems (mean ± SD). n=19 corresponds to sample data.

	6 vs 6	7 vs 7	8 vs 8	1-3-4-3	1-4-2-1-3
HILR (mpm)					
CD	2,7 ± 1,1	2,8 ± 1,7	2,4 ± 1,2	4,3 ± 1,0	5,1 ± 0,4
FB	3,1 ± 1,2	3,1 ± 1,7	2,6 ± 1,2	8,8 ± 2,3	9,0 ± 0,8
CM	2,2 ± 1,3	3,4 ± 2,5	3,1 ± 1,3	5,1 ± 1,0	5,3 ± 1,5
FOR	2,8 ± 1,0	5,0 ± 2,2	3,3 ± 1,2	9,7 ± 1,4	10,4 ± 1,1
WIN	3,0 ± 1,7	2,3 ± 1,5	3,7 ± 1,6	7,3 ± 1,9	11,6 ± 2,2
n=19	2,7 ± 1,1*	3,5 ± 2,1*	3,0 ± 1,2*	7,0 ± 2,6	7,9 ± 2.8
HSLR (mpm)					
CD	15,7 ± 3,3	13,9 ± 5,1	11,5 ± 4,2	14,8 ± 1,4	17,7 ± 0,5
FB	19,1 ± 5,0	17,4 ± 3,6	15,9 ± 2,3	25,4 ± 6,1	24,4 ± 2,4
CM	14,6 ± 2,3	15,0 ± 5,2	16,1 ± 2,8	18,0 ± 3,2	21,0 ± 3,7
FOR	15,4 ± 2,9	19,6 ± 4,4	15,7 ± 1,1	25,3 ± 2,9	25,3 ± 0,8
WIN	12,5 ± 4,4	13,4 ± 6,6	11,0 ± 4,2	19,5 ± 2,9	24,9 ± 0,1
n=19	15,5 ± 3,5*	16,2 ± 4,9*	14,4 ± 3,3*	20,5 ± 5,2	22,3 ± 3,8
AHR (bpm)					
CD	172,6 ± 11,6	168,7 ± 14,3	166,8 ± 12,1	167,8 ± 9,5	170,9 ± 2,1
FB	173,9 ± 4,3	174,1 ± 8,5	166,3 ± 5,7	178,2 ± 5,3	176,1 ± 7,9
CM	170,8 ± 4,6	170,9 ± 8,5	169,5 ± 10,6	173,0 ± 6,4	175,7 ± 6,8
FOR	172,2 ± 13,7	171,5 ± 4,7	165,2 ± 5,0	173,9 ± 4,6	174,6 ± 2,4
WIN	166,3 ± 12,2	163,7 ± 13,0	160,1 ± 4,9	159,8 ± 14,4	161,7 ± 14,0
n=19	171,6 ± 6,7	170,3 ± 9,0	166,3 ± 8,2*	171,6 ± 8,4	173,0 ± 8,5
MHR (bpm)					
CD	186,0 ± 9,2	184,2 ± 11,0	182,2 ± 10,6	191,7 ± 8,8	192,8 ± 5,8
FB	186,4 ± 4,7	189,2 ± 2,1	183,1 ± 0,4	197,4 ± 3,6	196,5 ± 3,5
CM	186,1 ± 2,4	188,6 ± 5,8	184,9 ± 7,5	195,0 ± 4,6	196,8 ± 3,4
FOR	189,3 ± 13,5	188,0 ± 1,9	181,9 ± 8,7	197,5 ± 4,9	198,2 ± 3,9
WIN	178,6 ± 12,7	182,7 ± 7,1	170,6 ± 9,3	183,1 ± 7,6	183,2 ± 10,6
n=19	186,2 ± 6,2*	187,0 ± 6,1*	181,8 ± 8,4*	194,1 ± 6.9	194,8 ± 6,3

* $p < 0{,}001$ vs. 3-4-3 and 4-2-1-3

Results

The box plots for each study variable are set out in figures 1, 2, 3, 4, 5 and 6. The means (± SD) of the metrics for the different playing positions are shown in Table 4.

When the values obtained in the means between the POS formats and the two tactical systems are compared, both the HILR and the HSLR are significantly lower than the means obtained in matches ($p < 0.001$). In the case of the HILR, these values represent between 38.6 and 50% in the 1-3-4-3 formation, and between 37.5 and 48.6% in the 1-4-2-1-3 formation (Figure 1). For the HSLR, the values represent a higher percentage: 70 to 75.2% for 3-4-3 and 69.2 to 72.3% for 4-2-1-3 (Figure 1).

With regard to cardiovascular performance during effort, the AHR value in POS was no different from in matches, with the exception of 8 vs. 8 where between 5 and 7 fewer bpm were observed in both tactical formations (3.1 to 3.9% less) (Figure 2). However, for MHR the sample averages in POS are significantly lower than in matches (4 to 7% lower, 7 to 13 fewer bpm) ($p < 0.001$) (Figure 2).

To compare performance between playing positions on the pitch, the values of all the POS formats were grouped together and compared with the ones obtained in matches (both tactical formations): significant differences were observed in the HILR and HSLR variables in the positions FB ($p < 0.01$), WIN ($p < 0.001$) and FOR ($p < 0.01$) (figures 3 and 4). These differences represent 29.9%, 30.7% and 44.6%, respectively, in the HILR, while the percentage differences are even greater for the HSLR (67%, 63.2% and 68.3 %, respectively).

With regard to the cardiovascular response to effort obtained for each position, no significant differences were observed in the AHR between the three POS formats and matches. By contrast, the mean MHR values differed significantly between POS and matches in all playing positions (figures 5 and 6).

Discussion

The primary objective of this study was to compare the physical and physiological demands between POS and competition and subsequently to examine these demands in relation to player position during competitive matches. The analysis of the POS data describes competition-like

Figure 1
Box plots for the high intensity/sprint load rate (HILR; mpm) and high speed load rate (HSLR; mpm) variables for each POS format and the two tactical formations in matches.

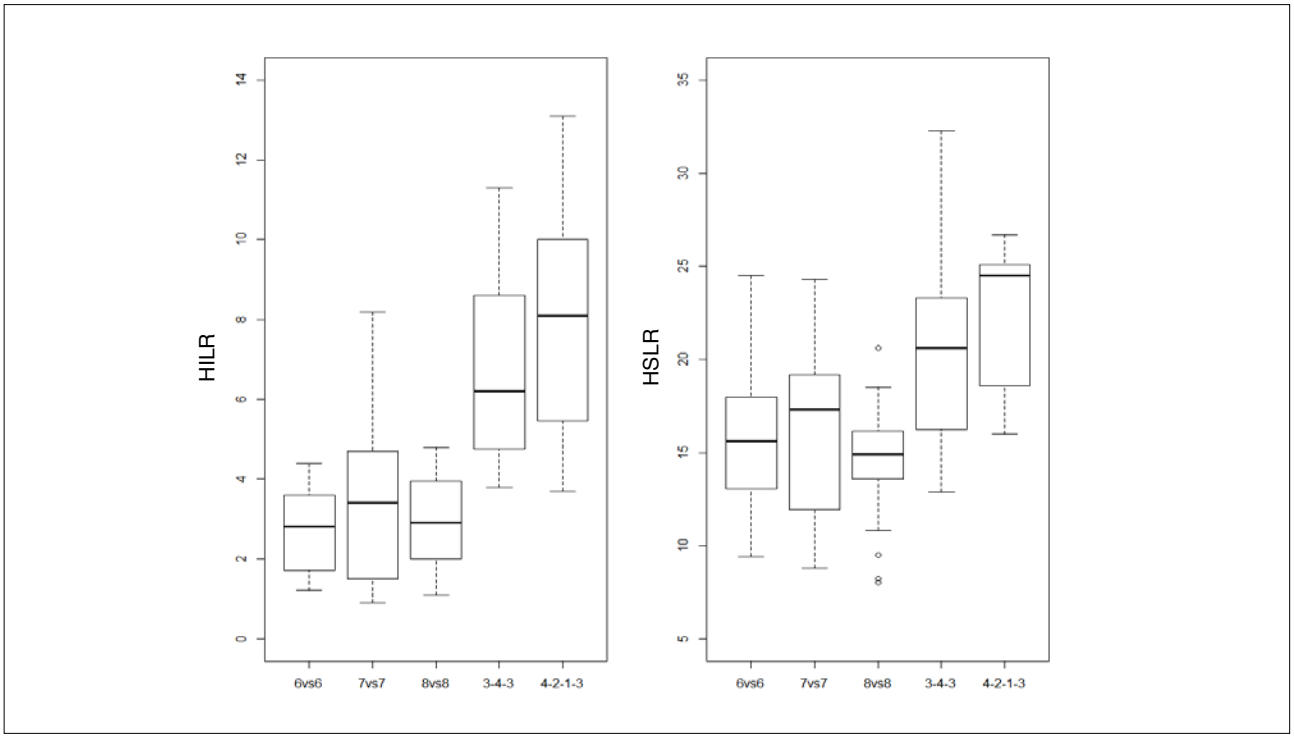


Figure 2
Box plots for the maximum heart rate (bpm) and average heart rate (bpm) variables for each POS format and the two tactical formations in matches.

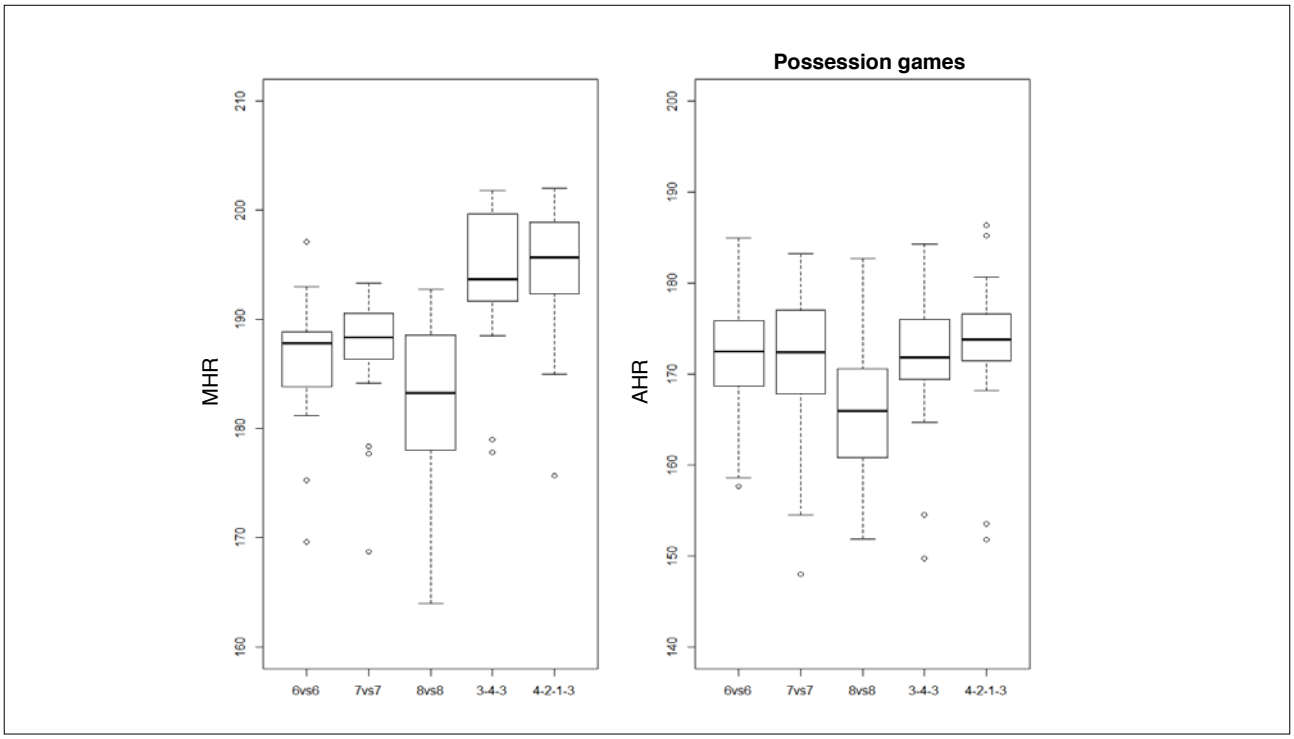


Figure 3.
Box plots for the high intensity/sprint load rate (HILR; mpm) variable for each playing position between POS and matches (both tactical formations).

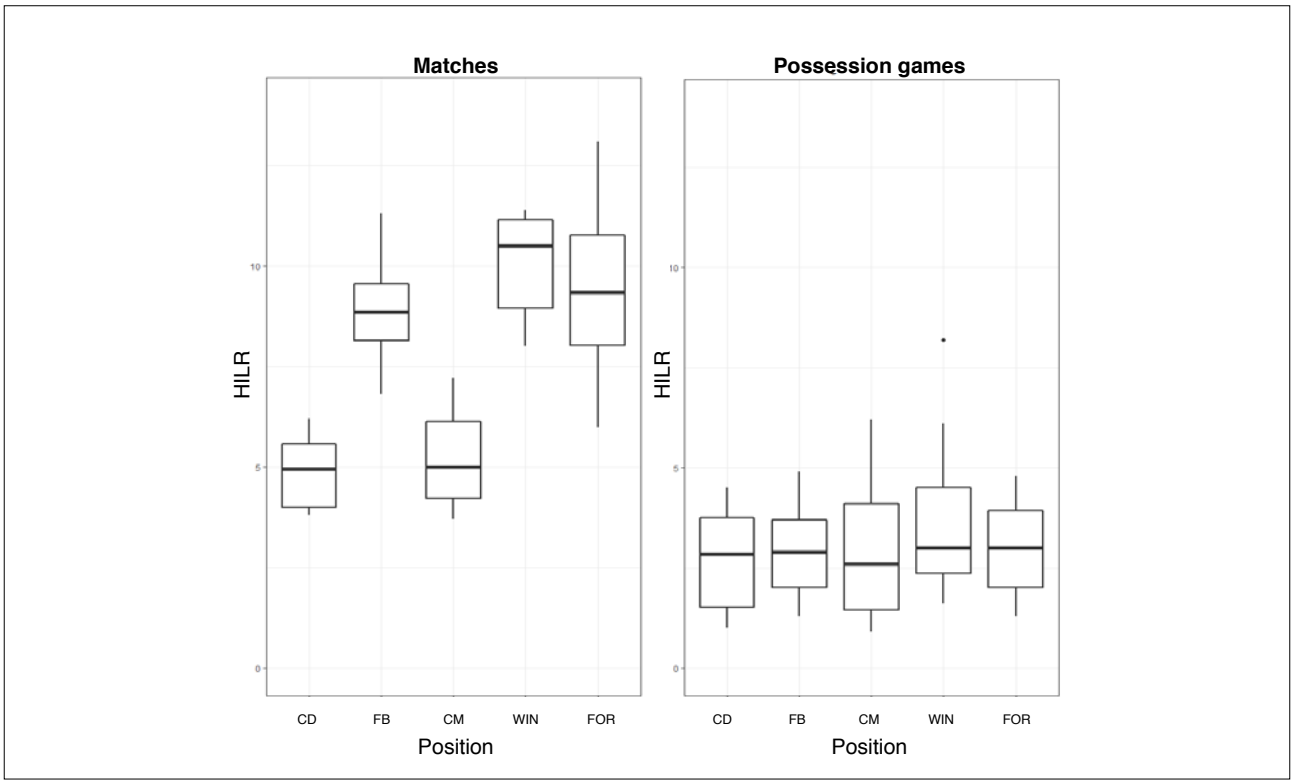
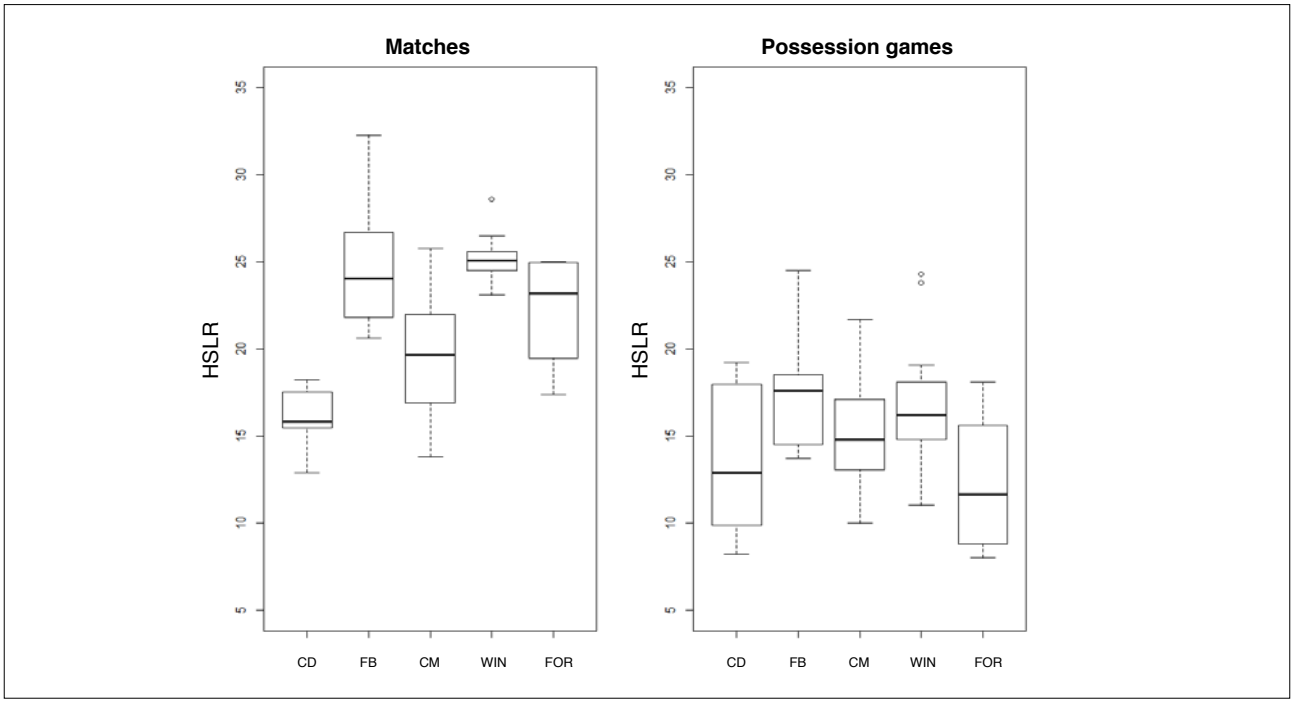


Figure 4.
Box plots for the high speed load rate (HSLR; mpm) variable for each playing position between POS and matches (both tactical formations).



performance in central defender and midfielder positions, and cardiovascular response is also similar to match performance in the 6 vs. 6 and 7 vs. 7. Although the metabolic rate variables are significantly lower than in competition, the accumulated distances based on the number of metres above 14.9 kph is a sufficient yardstick

Figure 5
Box plots for the average heart rate (bpm) variable for each playing position between POS and matches (both tactical formations).

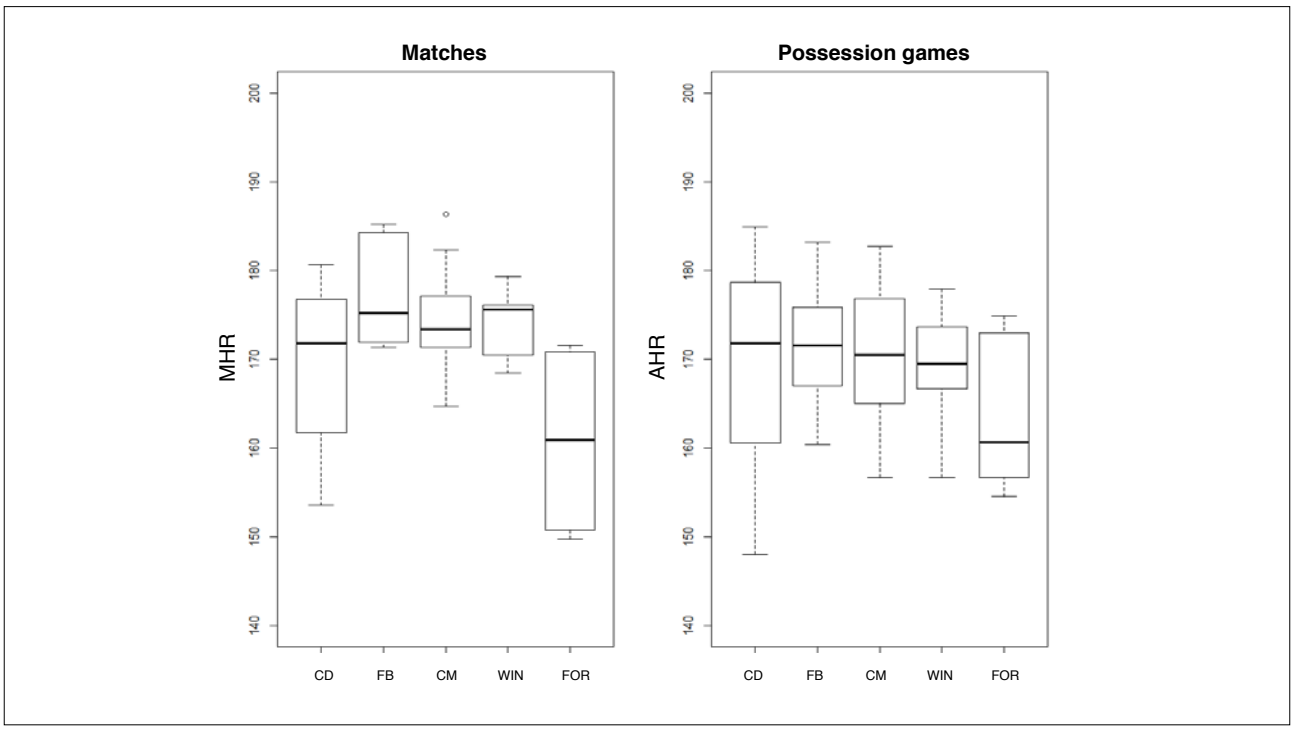
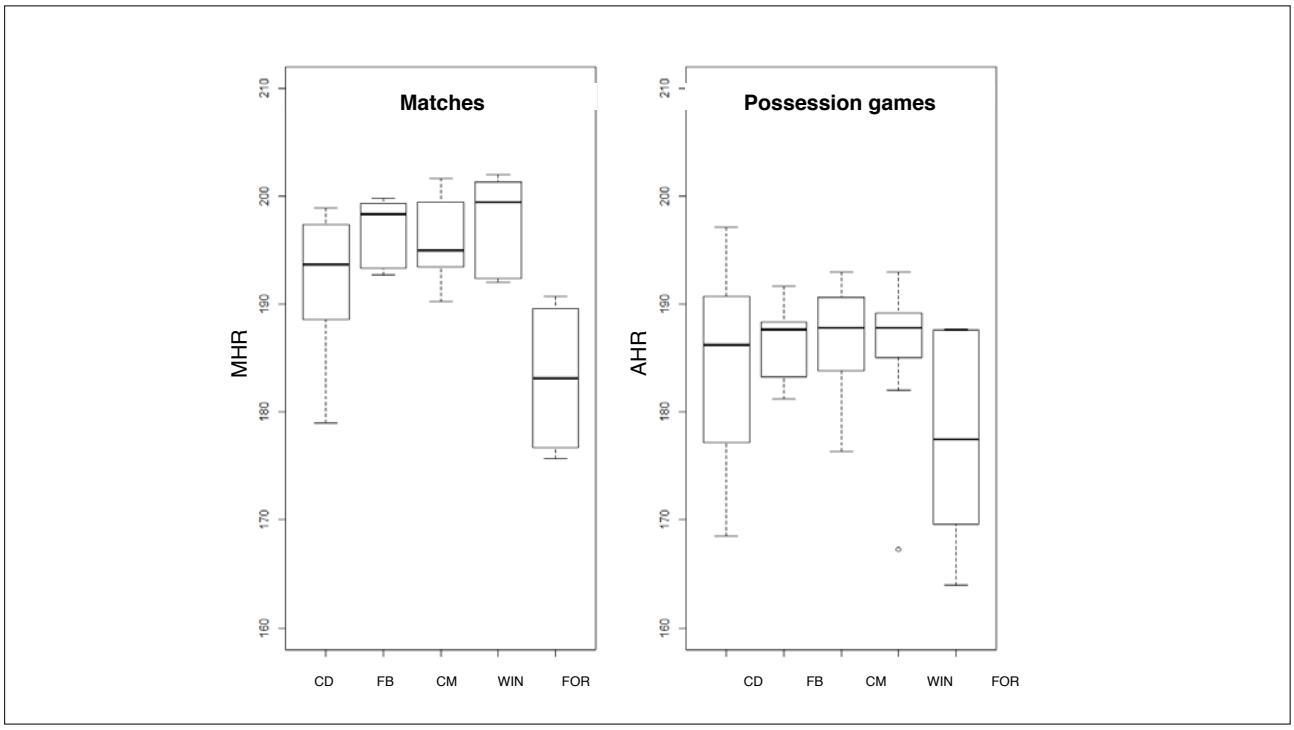


Figura 6.
Box plots for the maximum heart rate (bpm) variable for each playing position between POS and matches (both tactical formations).



for assessment when stimulating these intensities (69 to 75% in both tactical formations). In a study using a similar methodology, Lacome et al. (2017) compared conventional small-sided games (4 vs. 4, 6 vs. 6, 8 vs. 8 and 10 vs. 10) and competitive matches (1-4-3-3 formation) and concluded that only the 10 vs. 10 format allowed players to reach intensities and distances similar to those obtained during matches. In relation to the HILR variable, other research has found low percentages in high-intensity running and sprinting in small-sided games with the same format as this study (Owen et al., 2014). Owen et al. (2014) report that these formats do not induce high-speed movement compared to ones with larger pitches and therefore more players (9 vs. 9 to 11 vs. 11). In another study by Gaudino et al. (2014), the authors compared small-sided games with possession games in three different formats (5 vs. 5, 7 vs. 7 and 10 vs. 10) and reached the same conclusion as Owen et al. (2014), while further arguing that this effect was due to a larger pitch area and less pressure from opponents, with greater options for passing between players. In the comparison of performances between playing positions, significant differences were identified in the HILR and HSLR variables for the FB, WIN and FOR positions. Lacome et al. (2017) observed significant levels of differentiation when comparing SSG formats at speeds above 14.4 kph: central defenders covered a greater distance at that speed than midfielders in the 6 vs. 6 format, while full-backs covered a greater distance than forwards in the 8 vs. 8.

With regard to effort-related cardiac response, the mean AHR values in POS are similar to matches (with the exception of 8 vs. 8), and the same applies when these values are compared by playing position. Research by Casamichana et al. (Casamichana et al., 2013; Casamichana et al., 2015) analysed physiological variables such as the AHR in three SSG formats (3 vs. 3, 5 vs. 5 and 7 vs. 7) and found significant correlations with external load measurements such as total distance travelled, although the strength of the relationships diminished when this variable was associated with actions performed at high speed (> 18 kph) or sprints (> 21 kph). Lacome et al. (2018) compared large SSGs (40x55 metres, 18 players, 118 m2 per player) with smaller ones (25x30 metres, 13 players, 61 m2 per player) and found an MHR of 79.3-80.6%, whereas in this study values ranging from 91.4 to 92.1% were observed. These differences might be explained by the design of each game: when comparing performances between POS and SSGs, it ought to be borne in mind that the continuous interaction of core concepts related to the basic principles of POS are very different in SSGs, where the instructions are contingent on one-, two- or three-touch play and scoring as quickly as possible. In fact, during POS there is a

compelling need to generate movement from the individual to the group to create free spaces and then, when the ball is lost, the obligation to recover it in fresh possession. This might well be a significant factor in the evaluation of physical performance parameters. Authors such as San Román-Quintana et al. (2013) found that the number of touches allowed per individual possession in SSGs (7 vs. 7) impacted physical and physiological demands and, unlike other authors, they noted a greater cardiac response and greater distances travelled in the formats with free-touch play (higher AHR during free-touch SSGs: 159.4 ± 10.7 bpm compared to two-touch SSGs: 146.9 ± 8.4 bpm). In contrast to the foregoing, Gaudino et al. (2014) concluded that all high-intensity-related parameters were higher during SSGs compared to POS. However, their study does not specifically describe the design of the POS except for some differences in relation to the SSGs: no goalkeepers were used, the pitch area per player was higher to make up for the absence of goalkeepers, and the only instruction mentioned was the highest possible possession of the ball versus the action of the opponent.

Study limitations

The main limitation of this study lies in the small number of players included by tactical role, since only 19 footballers were involved, with a range of two to five players in each subgroup. A study involving a larger number of players in each playing position is therefore suggested to achieve more robust conclusions.

Future lines of research

Further study of the various POS formats is a pressing need. Hitherto, the emphasis has been on an infinite number of exercises proposed, with variations in pitch size, number of players in each team, game instructions and different designs in the shape of the pitch to be used. Factors inherent to modifying particular rules and transfer to specific game situations should also be empirically investigated. It would additionally be crucial to inform coaches and fitness trainers about how changing the rules in the game, such as delimiting areas, their format and design, number of players, etc., impacts physical, physiological and motor demands.

Conclusions

The data obtained from this study describe a cardiovascular performance in the 6 vs. 6 and 7 vs. 7 formats that is consistent with matches, whereas in the central defender and midfielder positions, the HSLR and HILR levels are similar to competition values. Based on the foregoing, possession games could be used to stimulate the physical and physiological demands to which players are subjected during competition, thereby profoundly influencing their internal and external load.

Acknowledgements

The authors would like to thank all the players at the club for their participation in this study and also our colleagues Mariano Toedtli, Julio Vaccari and Diego Navone who helped to carry it out.

References

Brandes, M., Heitmann, A., y Müller, L. (2012). Physical Responses of Different Small-Sided Game Formats in Elite Youth Soccer Players. *Journal of Strength and Conditioning Research, 26*(5), 1353-1360. https://doi.org/10.1519/JSC.0b013e318231ab99

Brooks, K., Carter, J., y Dawes, J. (2013). A Comparison of VO2 Measurement Obtained by a Physiological Monitoring Device and the Cosmed Quark CPET. *Journal of Novel Physiotherapies, 1*(3). https://doi.org/10.4172/2165-7025.1000126

Buchheit M., Haddad Al H., Simpson B., Palazzi D., Bourdon P., Di Salvo V., y Mendez-Villanueva A. (2013). Monitoring accelerations with GPS in football: time to slow down? *International Journal of Sports Physiology and Performance, 9*(3), 442-445. https://doi.org/10.1123/ijspp.2013-0187

Casamichana, D., y Castellano, J. (2010). Time-motion, heart rate, perceptual and motor behaviour demands in small-sides soccer games: Effects of pitch size. *Journal of Sports Sciences, 28*(14), 1615-1623. doi.org/10.1080/02640414.2010.521168

Casamichana, D., Castellano, J., Calleja-González, J., San Román, J., y Castagna, J. (2013). Relationship between indicators of training load in soccer players. *Journal of Strength and Conditioning Research, 27*, 369-374. https://doi.org/10.1519/JSC.0b013e3182548af1

Casamichana, D., y Castellano, J. (2015). The Relationship Between Intensity Indicators in Small-Sided Soccer Games. *Journal of Human Kinetics, 45*, 119-128. https://doi.org/10.1515/hukin-2015-0040 119

Casamichana, D., San Roman J., Calleja J., y Castellano, J. (2015). *Cuantificación de las cargas durante los juegos reducidos*. Los juegos reducidos en el entrenamiento del fútbol. España, Barcelona: Fútbol de Libro.

Casamichana Gómez, D., Gómez Díaz, A. J., Cos Morera, F., & Martín García, A. (2018). Wildcard Players during Positional Games. *Apunts. Educación Física y Deportes, 133,* 85-97. https://doi.org/10.5672/apunts.2014-0983.es.(2018/3).133.06

Clemente, F., Couceiro, M., Martins, F., Ivanova M., y Mendes, R. (2013). Activity profiles of soccer players during the 2010 world cup. *Journal of Human Kinetics, 8*(38), 201-211. https://doi.org/10.2478/hukin-2013-0060.

Dellal, A., Chamari, K., Owen, A., Wong, D., Lago-Penas, C., y Hill-Haas, S. (2011). Influence of the technical instructions on the physiological and physical demands within small-sided soccer games. *European Journal of Sport Science, 11,* 353–359. https://doi.org/10.1080/17461391.2010.521584

Dellal, A., Owen, A., Wong, D., Krustrup, P., Van Exsel, M., y Mallo, J. (2012). Technical and physical demands of small vs. large sided games in relation to playing position in elite soccer. *Human Movement Science, 31,* 957-969. https://doi.org/10.1016/j.humov.2011.08.013

Di Salvo, V., Gregson, W., Atkinson, G., Tordoff, P., y Drust, B. (2009). Analysis of High Intensity Activity in Premier League Soccer. I*nternational Journal of Sports Medicine, 30,* 205 – 212. https://doi.org/10.1055/s-0028-1105950.

Di Salvo, V., Pigozzi, F., González-Haro, C., Laughlin, M., y De Witt, K. (2013). Match Performance Comparison in Top English Soccer Leagues. *International Journal of Sports Medicine, 34,* 526–532. https://doi.org/10.1055/s-0032-1327660

Fradua L., Zubillaga A., Caro O., Fernández-García A., Ruiz-Ruiz C., y Tenga, A. (2013). Designing small-sided games for training tactical aspects in soccer: Extrapolating pitch sizes from fullsize professional matches. *Journal of Sports Sciences, 31*(6), 573–581. https://doi.org/10.1080/02640414.2012.746722

Gaudino, P., Giampietro, A., y Iaia, M. (2014). Estimated metabolic and mechanical demands during different small-sided games in elite soccer players. *Human Movement Science, 36,* 123–133. https://doi.org/10.1016/j.humov.2014.05.006

Hill-Haas, S., Coutts, A., Rowsell, G., y Dawson, B. (2009). Generic versus small sided game training in soccer. *International Journal of Sports Medicine, 30*(3), 636-642. https://doi.org/10.1055/s-0029-1220730

Hill-Haas, S., Dawson, B., Impellizzeri, F., y Coutts, A. (2011). Physiology of small sided games training in football. A systematic review. *Sports Medicine, 41*(3), 199-200. https://doi.org/10.2165/11539740-000000000-00000

Kim, J., Roberge, R., Powell, J., Shafer, A., y Jon Williams, W. (2013). Measurement accuracy of heart rate and respiratory rate during graded exercise and sustained exercise in the heat using the Zephyr BioHarness. *International Journal of Sports Medicine, 34*(6), 497-501. https://doi.org/10.1055/s-0032-1327661

Lacome, M., Simpson B., Cholley, Y., Lambert, P., y Buchheit, M. (2017). Small-Sided Games in elite soccer: Does one size fits all? *International Journal of Sports Medicine, 17,* 1-24. https://doi.org/10.1123/ijspp.2017-0214

Lacome, M., Simpson, B., Cholley, Y., y Buchheit M. (2018). Locomotor and Heart Rate Responses of Floaters During Small-Sided Games in Elite Soccer Players: Effect of Pitch Size and Inclusion of Goalkeepers. *International Journal of Sports Physiology and Performance, 13,* 668-671. https://doi.org/10.1123/ijspp.2017-0340

Little, T. (2009). Optimizing the use of soccer drills for physiological development. *Strength and Conditioning Journal, 31*(3), 67-74. https://doi.org/10.1519/SSC.0b013e3181a5910d

Machado, J., Alcântara, C., Palheta, C., Dos Santos, J., Barreira, D., y Scaglia, A. (2016). The influence of rules manipulation on offensive patterns during small-sided and conditioned games in football. *Motriz Revista de Educação Física 22*, 1–9.

Owen, A., Wong, D., Paul, D., y Dellal, A. (2014). Physical and technical comparisons between various sided games within professional soccer. *International Journal of Sports Medicine, 35,* 286–292. https://doi.org/10.1055/s-0033-1351333

Paul D., Bradley P., y Nassis G. (2015). Factors affecting match running performance of elite soccer players: shedding some light on the complexity. *International Journal of Sports Physiology and Performance,10*(4), 516–519. https://doi.org/10.1123/ijspp.2015-0029

Porres D., Paz Fernández J., Fernandez Gonzalo R., Cervera J., y Yagüe Cabezón J. (2010). Variabilidad de la carga fisiológica en los pequeños juegos de fútbol en función del espacio. *Apunts. Educación Física y Deportes, 102*, 4to cuatrimestre, 70-77.

Montoya Porres, D., de Paz Fernández, J. A., Fernández Gonzalo, R., Mercé Cervera, J., & Yagüe Cabezón, J. M. (2010). Variability in Physiological Burden in Reduced Area Football Games Based on Space. *Apunts. Educación Física y Deportes, 102,* 70-77.

San Román-Quintana, J., Casamichana, D., Castellano, J., Calleja-González, J., Jukic´ I., y Ostojic´ S. (2013). The influence of ball-touches number on physical and physiological demands of large-sided games. *International Journal of Fundamental and Applied Kinesiology, 45*(2), 171-178.

Silva, P., Vilar, L., Davids, K., Araújo, D., y Garganta, J. (2016). Sports teams as complex adaptive systems: manipulating player numbers shapes behaviors during football small-sided games. *Springerplus, 5,* 191. https://doi.org/10.1186/s40064-016-1813-5

Vilar, L., Duarte, R., Silva, P., Chow, J., y Davids, K. (2014). The influence of pitch dimensions on performance during small-sided and conditioned soccer games. *Journal of Sports Science, 32*(19), 1751-1759. https://doi.org/10.1080/02640414.2014.918640

Conflict of Interests: No conflict of interest was reported by the authors.

apunts EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020
https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.10

SCIENTIFIC NOTES

OPEN ACCESS

3D Kinematic Analysis of the Ollie Maneuver on the Skateboard

Luana Bianchini Wood[1], Ana Oliveira[1], Karini Santos[1], André Rodacki[1], Jerusa Lara[1]

[1] Universidade Federal do Paraná, Brazil.

Cite this article:
Bianchini Wood, L., Oliveira, A., Santos, K., Rodacki, A., & Lara, J. (2020). 3D Kinematic Analysis of the Ollie Maneuver on the Skateboard. *Apunts. Educación Física y Deportes*, *141*, 87-91. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.10

Editor:

ISSN: 2014-0983

***Corresponding author:**
Ana Oliveira
cpo.ana@hotmail.com

Section:
Scientific Notes

Original language:
Engish

Received:
6 December 2019

Accepted:
18 March 2020

Published:
1 July 2020

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

This study aims to analyze the tridimensional kinematics of the ollie maneuver on the skateboard and to compare static and dynamic maneuver performance, i.e., without and with a previous row, respectively. Six male participants were analyzed. Thirty-four reflective markers were placed on the skateboarder's body and four reflective markers on the board. The tridimensional analysis was captured by eleven cameras (100 Hz) (Vicon® system). The analysis of the ollie skateboard maneuver was performed in two different ways: a) without (static maneuver) and b) with (dynamic maneuver) a previous row. The joint angles (ankle, knee and hip), during maximal height center of mass of participants and the skateboard, were compared using the Student's T-test. The correlation between the center of mass of the participant and the skateboard was calculated using the Pearson Correlation. No significant differences were observed in the maximum height of the joint angles and centers of mass of the participants and the skateboard. The maximal height of the participant's and the skateboard's center of mass did not present a significant correlation. The results showed that there is no difference between performing the ollie skateboard maneuver with (static) or without (dynamic) a previous row. However, training to increase the height and improve the performance of the maneuver in general is essential for the skateboarder to achieve a higher score and a greater likelihood of success in sports competitions.

Keywords: biomechanics, performance, sports.

Introduction

Skateboard or skateboarding is a radical sport that consists of the practitioners moving and performing maneuvers while balancing on the skateboard. The skateboard is composed of a plate made of different layers of woods, called shapes, two pairs of wheels and two trucks which join the wheels to the shape (Silva, 2006). This sport will be included in the Tokyo Olympics in 2021. Skateboarding has approximately 8.5 million practitioners in Brazil, according to a survey commissioned by the Brazilian Skateboard Confederation in 2015. One important feature of the sport, particularly street skateboarding (one of the variations of the modality), is to overcome obstacles, and height of maneuver is of the utmost importance in improving performance.

One essential maneuver that constitutes the basis for the other maneuvers executed in the modality (Tesler, 2000; Meira et al., 2003 cited by Silva, 2006) is the ollie, characterized by a jump, in the course of which both skateboard and athlete ascend and return to the ground in a continuous movement (Bridgman & Collins, 1992 apud Silva, 2006). Thus, improving performance in the ollie maneuver in terms of height can lead to an improvement in the maximum height achieved in other maneuvers (Silva, 2006).

The execution of the ollie maneuver can be influenced by the skateboarder's motor abilities, such as balance, agility, flexibility, coordination, muscular resistance and other psychological and physiological aspects. It is also emphasized that motor characteristics, such as acceleration in the lead-up to the jump maneuver, can also influence performance (Santos, 2008). To maximize maneuver height, the practitioner's arms play an important role in generating balance and in producing displacement of the center of mass in the vertical direction (Meira et al., 2003). This is very important, since maneuver height is a preponderant factor in the sport for overcoming obstacles, and the ollie is the most basic maneuver in street skateboarding.

The literature contains studies involving the development of specific questionnaires for skateboarders (Rodríguez-Rivadulla et al., 2019), and the kinetics of skateboarding have been analyzed in order to understand injures (Determan et al., 2010), although performance-related kinematic analyses are underrepresented in the scientific literature. However, since this type of analysis contributes to the development of the sport, the aim of this study is to analyze and compare the kinematics of the ollie maneuver in static and movement situations.

Methods

Six male participants (23.3 $\pm$ 4.2 years), who had been skateboarders for 9.0 ($\pm$ 4.2) years, with experience in the ollie dynamic and static maneuver, took part in this study.

Anthropometric measurements of leg length and bone diameter measurements of the knee, ankle, hand, wrist and elbow were taken, and 34 reflective markers (Full Body Sacro Plug-in-Gait biomechanical protocol) were placed on the skateboarders' body and four markers on the skateboard shape (Figure 1). The tridimensional analysis was captured by eleven infrared optical capture cameras of the Vicon® system (Denver, USA), with 100 Hz acquisition frequency, synchronized from one MX Control (Giganet) unit. A biomechanical model for skateboards was created in the Vicon® for the calculation of the center of mass (COM).

For the purpose of data collection, the participant performed three valid static map maneuvers. Attempts were deemed invalid when the participant did not complete the maneuver phases, such as failing to finish the landing on the skateboard, or when the system was unable to capture any of the points marked on the subject's body or on the skateboard used in the biomechanical protocol. Subsequently, the participant was instructed to perform the dynamic maneuver, where the paddle preceded the ollie. The "pop" of the maneuver was to be executed on top of a mark, placed 3 meters after the start of a 10-meter-long walkway. Three valid attempts were also considered for the dynamic maneuver.

Graphs with the trajectory of the skateboard and the participants' center of mass (COM) and the right and left hip, knee and ankle angles were used to describe the static and dynamic maneuver movement. A comparison of both the participant's and the skateboard's COM height was performed in the static and the dynamic maneuver, with and without paddling, for which purpose Cohen's t and d tests were performed.

To calculate the skateboard's COM, a routine developed in the MatLab® environment was used, considering the shape as a geometric solid, and the center of the main diagonal was translated to the wheel axis. The skateboarder's center of mass was also calculated by a routine created in MatLab®.

Descriptive statistics (mean and standard deviation) were used for bilateral hip, knee and ankle angles in both of the ways in which the ollie maneuver was performed. In addition, the paired T-test was carried out to compare differences between variables. The Cohen's d effect size was calculated to compare the technical execution of the maneuver.

Figure 1
Position of the reflective markers on the skateboard.

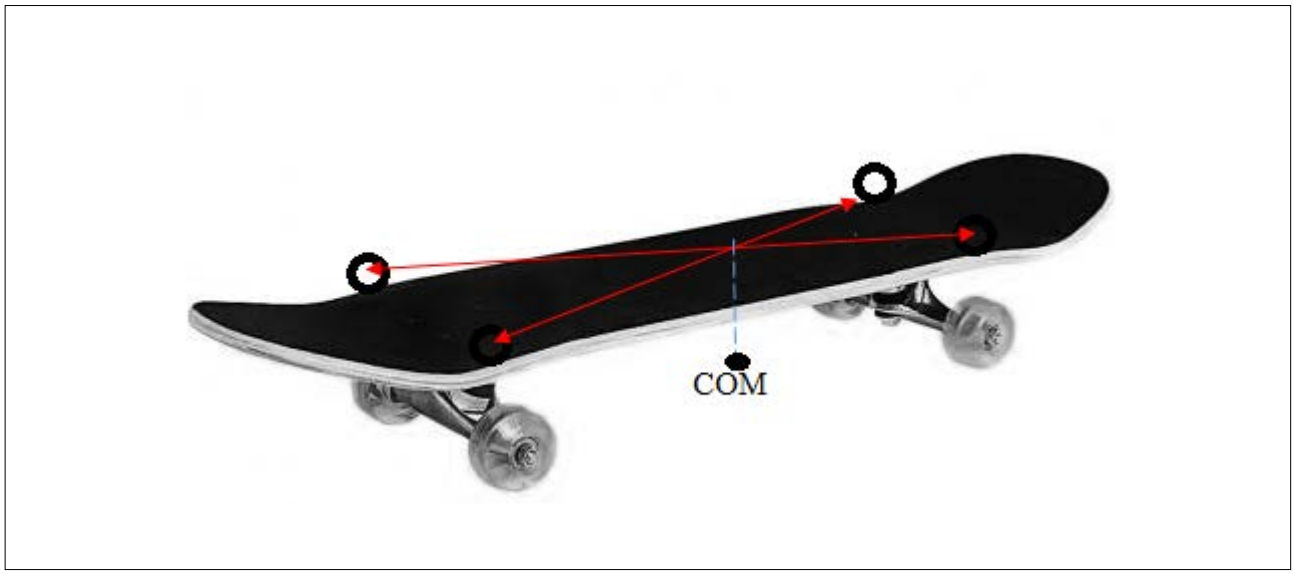
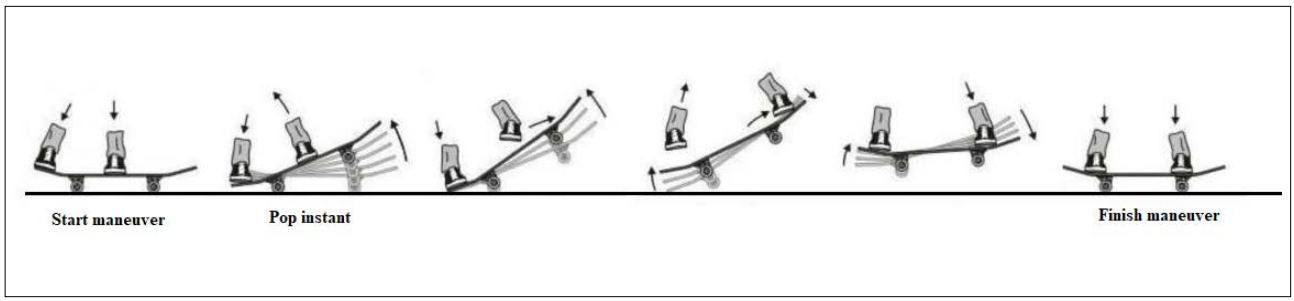


Figure 2
Ollie maneuver



The respective correlations of the COM of the skateboard, the participants and their joint angles (left, right and left hip, knee and ankle) were tested with the Pearson Correlation Coefficient for both maneuver situations, i.e. static and dynamic. Statistical tests were performed in the SPSS software and the significance level set was $p \leq 0.05$.

Results

Table 1 presents the height of the center of mass and joint angles during the maneuver. The participant's COM reached an average height of 0.18 (± 0.07) m during the static maneuver and 0.18 (± 0.06) m during the dynamic maneuver. The skateboard's COM did not present any differences between static and dynamic maneuvers, and the skateboard COM reached the height of 0.24 (± 0.01) m. Therefore, there is no significant difference in the maximum height of centers of mass when the maneuver is performed statically or dynamically.

No significant differences were observed between maneuver styles (static and dynamic) when the participant's and the skateboard's COM were considered. However, a large effect size was observed in right ankle angle during the maximum height of both COM (0.81 and 0.82 m) and in the right knee at the skateboard's maximum COM (0.87 m).

During the static maneuver, the left knee angle (which is forward on the skateboard) was highly correlated ($r = 0.85$ $p = 0.03$) with the skateboard's maximum COM height, hence the greater the flexion in the front knee, the higher the skateboard COM height. In the dynamic maneuver, the left knee angle at the maximum height instant of the participants ($r = 0.98$ $p = 0.00$) and of the skateboard COM ($r = 0.85$ $p = 0.03$) presented a high correlation with the maximum skateboard height. In the other words, the greater the knee

flexion angle the greater the skateboard height obtained. The left ankle angle (in plantar flexion) at the maximum height instant of the center of mass of the participant ($r = -0.91$ $p = 0.00$) and the skateboard ($r = -0.83$ $p = 0.00$) presented a high inverse correlation with the maximum skateboard height, i.e., the greater the plantar flexion angle the lower the skateboard height obtained. Ideally, the front ankle was in dorsiflexion.

Participant and skateboard COM trajectory during the dynamic ollie maneuver and joint angles (hip, knee and ankle) of the right and left limbs are displayed in Figure 3. During both maneuvers, the athlete reached the maximum skateboard height before reaching the maximum body height (COM).

Discussion

This study aimed to analyze and compare static and dynamic ollie maneuver kinematics. The results tally with the literature pertaining to COM height. The skateboard's COM rises 0.06 m more than the skateboarder's COM compared to the study by Jr Bridgman & Collins (1992), who found that the skateboarder's COM was 55% higher than that the skateboard's. This may be related to the fact that the score is awarded according to skateboard height or to the extent that high obstacles are overcome.

Similarly, no correlation was observed between the participant's COM and the skateboard's COM, and although the skateboarder can no longer raise their COM, they can flex their lower limbs, bringing the skateboard closer to their body and increasing their COM, which may account for the absence of any correlation between the participant's and the skateboard's COM. The slight plantar flexion performed during the squat can be related to the instability of the skateboard's shape. In fact, Kremnev & Kuleshov (n.d.) point out that the skateboarder may present instability, although the feet remain on the skateboard, the body weight is shifted mostly to the toes, while shortening-stretching the lower limb muscles.

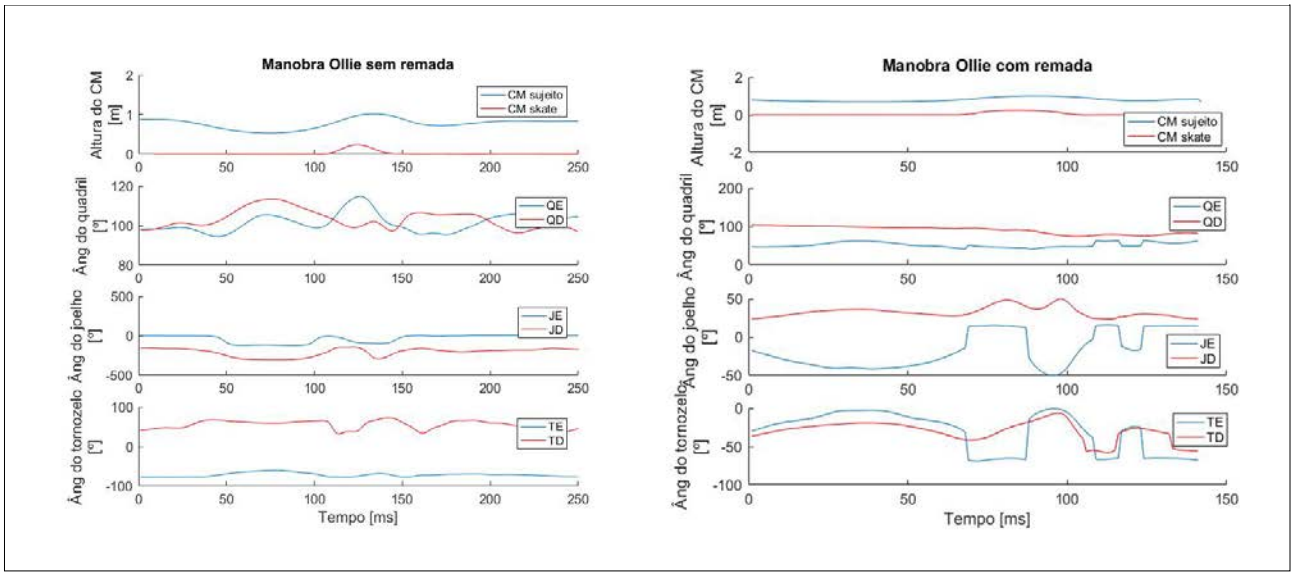
The absence of an ankle and hip trajectory pattern in both maneuvers may be linked to the COM adjustment the skateboarder needs to perform to maintain balance. Balance adjustment is performed through the integration of the sensory motor system, which generates different muscle responses to correct for possible postural deviations (Lemos; Teixeira, 2009). Bridgman & Collins (1992) reported a parabolic trajectory of skateboarders' center of mass, as well as the extension of the lower limbs during the ascent movement, followed by flexion and a further extension to a controlled landing, as observed in this study.

In the study by Bridgman & Collins (1992), the participants' and skateboard's center of mass follow similar trajectories, although body segments present complex trajectories without a specific pattern. These findings are similar to the results obtained in this study. Extensor muscles will increase strength, and consequently the height of the maneuver, as seen with Silva (2006), in which 50.6% of ollie jump variance is accounted for by the variable knee extensor strength of the knee-dominant limb.

Table 1
Participant's and skateboard's height center of mass, joint angles (right and left) at the maximum instant of the center of mass of the participant and the skateboard and during static (no-row) and dynamic (row-on) situation in the ollie maneuver.

	Static maneuver		Dynamic maneuver		*p* (Cohen's d)	
	Participant	Skateboard	Participant	Skateboard	Participant	Skateboard
h of COM (m)	0.18	0.24	0.18	0.24	0.98	0.82
	(±0.07)	(±0.01)	(±0.06)	(±0.01)	(0.00)	(0.00)
R Hip (°)	56.22	64.14	65.12	57.29	0.47	0.45
	(±53.73)	(±41.58)	(±46.66)	(±51.25)	(0.17)	(0.14)
L Hip (°)	52.64	54.97	61.73	64.53	0.07	0.14
	(±32.00)	(±34.38)	(±30.19	(±29.74)	(0.29)	(0.29)
R Knee (°)	-9.22	-1.58	58.27	71.31	0.29	0.25
	(±149.36)	(±80.24)	(±64.50)	(±87.14)	(0.63)	(0.87)
L Knee (°)	30.2	36.51	29.89	32.68	0.97	0.71
	(±111.50)	(±107.40)	(±115.41)	(±110.96)	(0.00)	(0.03)
R Ankle (°)	53.01	50.36	-7.45	-8.84	0.17	0.19
	(±76.51)	(±79.61)	(±71.29)	(±63.21)	(0.81)	(0.82)
L Ankle (°)	-0.77	-4.62	-2.49	-10.42	0.97	0.90
	(±84.28)	(±86.23)	(±92.18)	(±100.06)	(0.01)	(0.06)

Figure 3
Participant COM trajectory and skateboard during the dynamic ollie maneuver and joint angles (hip, knee and ankle) of the right and left limbs



Conclusions

The results show that there is no significant difference between performing the static and dynamic skateboard ollie maneuver. The maximum skateboard and skateboarder COM heights reached were close when compared to the maneuver conditions.

However, some angular variations were observed during the dynamic maneuver in the knee and ankle, indicating that these angular variations may influence the height of the center of mass reached by the skateboard during the maneuver.

Contribution

LUANA B. WOOD - Data collection and processing; text writing;

ANA CAROLINA P. de OLIVEIRA - Text writing and correction;

KARINI BORGES - Text correction and language proofing;

ANDRÉ L. F. RODACKI - Text correction and language proofing;

JERUSA P.R.LARA- Guidance on data collection and processing, text writing and correction.

References

Determan, J. J., Frederick, E. C., Cox, J. S., & Nevitt, M. N. (2010). High impact forces inskateboarding landings affected by landing outcome. *Footwear Science, 2*(3), 159–170. https://doi.org/10.1080/19424280.2010.525534

Jr Bridgman, S., & Collins, D. F. (1992). *Human body motion in an ollie. 498*. https://doi.org/10.1119/1.2343617

Kremnev, A. V, & Kuleshov, A. S. (n.d.). *Dynamics and Stability of the Simplest Skateboard Model*.

Lemos, L.F.C; Teixeira, C. M. C. (2009). Uma revisão sobre centro de gravidade e equilíbrio corporal A review about center of gravity and body balance. *Revista Brasileira de Ciencia e Movimento, 17*(4), 83–90.

Rodríguez-Rivadulla, A., Saavedra-García, M., & Arriaza-Loureda, R. (2019). Creation and Validation of a Questionnaire on Sport Habits and Injuries in Skateboarding. *Apunts. Educación Física y Deportes, 135,* 36-47. https://doi.org/10.5672/apunts.2014-0983.es.(2019/1).135.0303

SANTOS, M. M. . (2008). Efeitos do feedback extrinseco na performance da manobra ollie em skatistas do municipio de irati-pr.

SILVA, R. E. (2006). Contribuição da força e potência dos membros inferiores na performance da manobra “ollie” do skate.

Tesler, P. Asphalt acrobats. (2000) *Scientific American Presents,* 68-73.

Conflict of Interests: No conflict of interest was reported by the authors.

apunts EDUCACIÓN FÍSICA Y DEPORTES

Published 01 July 2020

ISSUE 141

OPEN ACCESS

Physical Education Textbooks in Primary Education: Analysis of Images and Stereotypes

Irene Moya Mata*
Lecturer at the University of Valencia. Faculty of Teacher Training, Spain.

Directors
Dr Petra Mª Pérez Alonso-Geta
University of Valencia, Spain.
Dr Concepción Ros Ros
Valencia Catholic University Saint Vincent Martyr, Spain.

Date read: 20 July 2017

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Irene Moya Mata
irene.moya@uv.es

Section:
Doctoral Dissertations

Original language:
Spanish

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

Previous research has shown that images in physical education (PE) textbooks in the third stage of primary education (PRE) reproduced stereotypes in terms of gender, age, body, race and disability in relation to physical activity. Consequently, the sample needs to be expanded and this curriculum material analysed to see whether stereotypes related to the body and physical activity have been removed or are still in textbooks. The general purpose of this doctoral thesis is therefore to examine the images related to body stereotypes in physical activity which appear in PE textbooks in PRE. A descriptive study was conducted using content analysis as the main research technique. The sample consisted of 3,836 images, including drawings and photographs, from 34 PE textbooks for PRE by six Spanish publishers. Specifically, the publishers were: Anaya, Bruño, Edelvives, Santillana, Serbal and Teide, which published the textbooks under the Education Act 2/2006 of 3 May, better known as the LOE (Official State Gazette No. 106, 4.5.2006). The SAIMEF online tool was used to analyse the images based on two category systems (SC-I and SC-II) developed ad hoc in order to examine the images in which a person was performing physical activity – which was an adaptation of an instrument used in previous research – and the "other" images that appeared in these textbooks. The pilot test, the panel of experts and the inter-coders test on both instruments endorsed the scientific criteria of this tool. SPSS 22.0 software was used to process the information. Univariate and bivariate analysis was performed and Pearson's chi-squared test was applied with a significance level of 5%. The results showed a predominance of male versus female figures, mainly white and without disabilities, who perform activities far from the sports elite and related to perceptual motor skills, representing mainly the "games and sports activities" content block in the PE subject area. This imbalance in the representation of the content blocks in the subject area does not comply with the minimum teaching requirements of Royal Decree 1513/2006 of 7 December (Official State Gazette No. 293, 8.12.2006) for the PRE stage in Spain.

Keywords: content analysis, image, stereotypes, physical education, primary education

apunts
EDUCACIÓN FÍSICA Y DEPORTES

Published 01 July 2020

ISSUE 141

OPEN ACCESS

Autonomic and cardiovascular responses in flight and their relationship with physical fitness

Iransé Oliveira-Silva*
University Center of Anápolis-UniEVANGÉLIC

Director
Dr Daniel Alexandre Boullosa Alvarez
Universidade Católica de Brasília, Brazil

Date read: 29 March 2016

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Iransé Oliveira-Silva
iranse.silva@unievangelica.edu.br

Section:
Doctoral Dissertations

Original language:
Portuguese

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

Flying is the most effective means of transportation available and is used by billions of people every year. However, the stressors present in air travel lead autonomic changes to occur, requiring the body to deal with them. Therefore, the preventive and/or mitigating strategies of these effects need to be understood. This study aims to evaluate the autonomic and cardiovascular responses that occur in flight and their relationship with physical fitness. The research was conducted through two studies in healthy men in whom the physical fitness components of aerobic capacity, muscular strength and body fat had previously been evaluated. Heart rate variability (HRV) was recorded on a control day and on a flight day. In the first study, HRV was recorded in 11 fighter pilots over a 3-h period and their level of dehydration during a test flight was measured through changes in hematocrit. The flight lasted 1 hour and they all underwent the same operating procedures. In the second study, HRV and blood pressure were recorded simultaneously over 24 h in 22 commercial airline passengers. The results of the study point to a reduction in most HRV parameters during supersonic flight compared to the control day. There is no autonomic anticipation. Entropy correlated with aerobic capacity and body fat. Flight-generated dehydration changed HRV (RMSSD and SD1). The second study demonstrates a reduction in most HRV parameters (RMSSD; SD1; SampEn; LnHF; α1) over 24 h in the commercial flight compared to the control day (FC; LnHF; α2). Autonomic anticipation took place. The blood pressure and Rate-Pressure Product were significantly higher in the flight, with the largest increases occurring two hours before the flight, and remaining elevated for up to two hours. The lower the body fat percentage and BMI, the greater the flight-day HRV (RMSSD; LF; HF; SD1). The higher the aerobic capacity, the greater the HRV during the flight (LnLF; LnHF). Conclusions: Flying, in both situations and groups, demanded autonomic responses of the body generating significant vagal withdrawal and an increase in heart rate. Body fat and aerobic capacity, indicators of physical fitness, correlated with HRV, albeit differently in both populations and situations: fighter pilots (SampEn) and commercial airline passengers (RMSSD; LF; HF; SD1). The dehydration generated by supersonic flight influences HRV. Blood pressure (SBP, DBP, MAP) is influenced by flight in the 24-h comparison. Autonomic changes correlate with aerobic capacity and body fat differently in supersonic jet pilots and commercial airline passengers during flight. Relative strength was not correlated with HRV parameters in either of the populations studied.

Keywords: physical fitness, flight, autonomic control

apunts
EDUCACIÓN FÍSICA Y DEPORTES

Published 01 July 2020

ISSUE 141

OPEN ACCESS

Serious Leisure and Recreation Specialisation in Sportspeople. Contrast in Sportspeople With and Without Disabilities

Sheila Romero da Cruz*
Institute of Leisure Studies, Faculty of Social and Human Sciences, University of Deusto, Bilbao, Spain

Directors
Dr Aurora Madariaga Ortuzar
Dr Ioseba Iraurgi Castillo
University of Deusto, Spain

Date read: 8 January 2016

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Sheila Romero da Cruz
sheila.romero@deusto.es

Section:
Doctoral Dissertations

Original language:
Spanish

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

The constant change in the population's sports demands has led to a decrease in sports licenses and an increase in more recreational sports practices. For this reason, it is essential to examine competitive sports practices via theories related to leisure and recreation. At this point, it is worth mentioning serious leisure and recreation specialisation, two theoretical constructs which have emerged to explain the new forms of leisure that emerged in the late 20th century and have been used in a host of studies to examine different sports practices. This decrease in sports licenses is worrying both sports federations and public administrations, so this type of practice must be studied from the sphere of leisure. This thesis aims to ascertain the relationship between these two constructs in federated sports through three fundamental objectives:

· To adapt to Spanish and verify the psychometric goodness of a measurement instrument related to serious leisure (SLIM, Serious Leisure Inventory and Measure) and an index classifying recreation specialisations (Specialization Recreation Index, SRI) in federated sportspeople without physical disabilities (*n*=232) and with physical disabilities (*n*=138) (Total= 370).
· To check whether the perceptions of serious leisure and recreation specialisation are different in these two types of sportspeople.
· To analyse the relationship between serious leisure and recreation specialisation in the two samples using the SLIM tool and the SRI index.

The main results are the following:

· Both tools show acceptable reliability and construct validity, although there is a debate as to the advisability of replicating validation studies with larger populations and a wider range of sports practices.
· Both groups have practically identical perceptions; having a disability or not does not influence the experience of sports practice.
· It is confirmed that sportspeople without a disability show higher degrees of specialisation and that there is a relationship between the concepts of serious leisure and recreation specialisation. This implies that within federated practices, which are viewed as serious leisure, there is a continuous specialisation among the sportspeople themselves.

It is concluded that despite the increase in the recreational component within the population's new sports habits, there is a continuous recreation specialisation in competitive sports. This kind of sport is viewed by its practitioners as their serious leisure. There are currently two instruments that enable both the specialisation profiles and the sportspeople's perception of serious leisure to be analysed.

Keywords: serious leisure, recreation specialisation, sportspeople, adaptation, psychometric assessment

apunts
EDUCACIÓN FÍSICA Y DEPORTES

ISSUE 141

Published 01 July 2020

OPEN ACCESS

Design of a Screening and Training Programme for Young People with High Abilities in U-14 Women's Volleyball

Mateo Rodríguez Quijada*
University of Santiago de Compostela, A Coruña, Spain

Directors
Dr José Ignacio Barbero González
Faculty of Educational Sciences, University of Santiago de Compostela, A Coruña, Spain
Dr Rafael Martín Acero
Faculty of Sports and Physical Education, University of A Coruña, A Coruña, Spain

Date read: 30 October 2017

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació
Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Mateo Rodríguez Quijada
mateo.rodriguez@rai.usc.es

Section:
Doctoral Dissertations

Original language:
Spanish

Cover:
New Olympic Sports
for Tokyo 2020. Surf.
Photo: Gabriel Medina (BRA)
riding a wave at Supertubes
beach 2018 WSL Champsionship
held in Peniche, Portugal.
REUTERS / Pedro Nunes.

Abstract

In recent years there have been numerous major advances in the sport of volleyball, and it is especially challenging and complex to determine who is part of what is considered the "sporting elite". The screening and training stage of young people with high sporting abilities in junior categories is crucial and one of the most significant and relevant parts of any programme geared towards their training and development on a personal, collective, human and technical level.

Accordingly, the main purpose of this thesis was to design a screening and training programme for young people with high abilities in volleyball in the U-14 women's category. In order to do this, the main performance factors of an elite volleyball sportswoman, including physiological, technical and tactical and psychological ones, were identified along with others directly associated with performance such as agility and hand-eye coordination. Many of the components of these factors can be evaluated in a U-14 women's player, although other circumstances or dimensions such as education in values for the athlete should also be considered.

The Screening and Training of High Abilities in Volleyball (DeFACaVo) programme was designed following the quoted references in which physiological factors were addressed using the Beunen-Malina-Freitas method to estimate the height which the adolescents will have in their adulthood; Lince software was used to analyse the technical and tactical elements during matches and/or competitions; and the relevant sections of the Questionnaire of Psychological Characteristics related to Sports Performance (CPRD) were used for psychological factors. Information was additionally included about whether the player had played other sports. As for the factors which show whether the player is appropriately educated in values, Lince software was used to analyse her behaviour in terms of fair play, justice and sportspersonship (both positive and negative) during matches and/or competitions.

A report was drawn up on the player using all the results derived and which also included her personal details (name and surname, date of birth, place of residence, etc.) and her sporting details (club, years of playing volleyball, sporting category to which the club belongs, etc.). This information was used to effectively gauge which players had high abilities to play volleyball in the U-14 women's category, taking into consideration for this purpose the assessments made by various experts (academics, researchers, athletes, coaches, etc.) to validate the programme and its instrumental developments.

Keywords: volleyball, high sporting abilities, U-14 women's category, sports training, sports screening, education in values

apunts
EDUCACIÓN FÍSICA Y DEPORTES

Published 01 July 2020

ISSUE 141

OPEN ACCESS

Gender as a Criterion for Analysing Verbal Exchanges between Teachers and Students in Physical Education Lessons

Ana Pérez Curiel*
Lower and Upper Secondary Physical Education Teacher at Ideo School

Director
Dr Clara López Crespo
Autonomous University of Madrid, Spain

Date read: 27 July 2017

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Ana Pérez Curiel
ana.perez@escuelaideo.edu.es

Section:
Doctoral Dissertations

Original language:
Spanish

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

Language, or more specifically linguistic uses and contents, express a way of seeing and understanding reality. Consequently, language is used whether consciously or not to convey and reproduce beliefs, values and ideologies which reveal how female and male roles are interpreted, acceptance or otherwise of contemporary stereotypes about what it means to be a man or a woman, and the value assigned to what is considered to be befitting of one or other gender.

Starting from this premise, this thesis studied the language used during physical education lessons from the gender perspective. It examined the characteristics of the verbal exchanges present in the communication processes in the classroom in terms of the frequency of verbal exchanges between teachers and students, the contexts in which they take place, the prominence of the role of the person conveying or receiving the message, etc. Likewise, it addressed study of the content of the exchanges in terms of the existence of male chauvinist features with respect both to the messages that female and male students receive and also those that they convey.

The research analysed verbal exchanges during physical education lessons teaching body expression and introduction to sport units of study, both of which are curricular contents that have traditionally had an unambiguous gender attribution. An interpretative methodology was used based on a case study, a teacher and their students. The data derived were analysed using Nvivo software (10 and 11 Pro).

The results concerning the features of the verbal exchanges reveal greater participation by female students as senders and receivers of messages. However, there are some nuances to this when analysed in terms of the aspects defined by the learning settings and units of study. The results derived with respect to the content of the teaching discourse include the fact that female students received more feedback in the introduction to sport classes while male students did so in the body expression classes, and moreover its type was also different. As for the analysis of the male chauvinist traits in the teaching discourse, the results show the presence of androcentric uses such as using the masculine gender as a purported generic, semantic leaps, erroneous male usage, etc. With regard to male chauvinist contents and uses, the analysis discloses expressions which imply contempt for the feminine, subordination of women to men, asymmetrical treatment for male and female students and heteronormativity.

Keywords: gender, physical education, language, androcentrism, male chauvinism

apunts
EDUCACIÓN FÍSICA Y DEPORTES

Published 01 July 2020

ISSUE 141

OPEN ACCESS

The Formation of Talent in the Sports Field: The Transfer of Formative Processes in the Field of Education to the Young Football Player

Alejandro Prieto-Ayuso*
University of Castilla-La Mancha, Albacete, Spain

Directors
Dr Onofre Contreras-Jordán
Dr Juan Carlos Pastor-Vicedo
University of Castilla-La Mancha, Albacete, Spain

Date read: 26 October 2017

Editor:
© Generalitat de Catalunya
Departament de la Presidència
Institut Nacional d'Educació Física de Catalunya (INEFC)

ISSN: 2014-0983

***Corresponding author:**
Alejandro Prieto-Ayuso
alejandro.Prieto@uclm.es

Section:
Doctoral Dissertations

Original language:
Spanish

Cover:
New Olympic Sports for Tokyo 2020. Surf. Photo: Gabriel Medina (BRA) riding a wave at Supertubes beach 2018 WSL Champsionship held in Peniche, Portugal. REUTERS / Pedro Nunes.

Abstract

The overall objective of this doctoral thesis was to improve the processes of identifying and developing gifted young football players, and the specific objectives were: 1) to determine the reliability of the evaluation of gifted football players; 2) to create a reliable detection instrument; and 3) to ascertain the technical-tactical differences between gifted and non-gifted football players.

The research had two phases. First, a study was conducted with 103 football players to analyse the differences shown in the following performance indicators: influence on the team, goals/shots, aerial duels, penalties, entries and short and long passes. Secondly, an instrument to detect gifted young football players (Nomination Scale for Identifying Football Talent) was validated within the academy of a professional football club that plays in Spain's second division. A total of 201 players and 11 coaches participated. The effective processes carried out in education to identify students with high intellectual capacity were adapted: inclusion of coaches, parents and peers in the evaluation process. Thirdly, the performance of the 33 players identified in technical-tactical play was analysed, comparing their performance with that of the non-gifted players. The instruments used were the Game Performance Evaluation Tool and the Tactical Evaluation System in Football.

The results showed that the performance indicators were not reliable as a measure to evaluate gifted players. The instrument designed and validated was valid and reliable to be used in detection processes. The teammates best discriminate the gifted players. Very strong performance was shown in the players considered gifted compared to the sample of players not chosen.

Finally, the importance of using validated tools when identifying and training football players is highlighted with the goal of avoiding biases in the selection of gifted young football players.

Keywords: sports initiation, physical education, giftedness, teaching, high capacities