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The effect of resilience on emotional intelligence and life satisfaction in mountain sports technicians

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Two alpinists climbing a snowy mountain in the Arctic under the northern lights. Adobestock ®Urdialex

Abstract

Mountain sports have their own characteristics, different from other outdoor sports modalities with similar characteristics. Emotional intelligence and resilience are likely to positively affect sport performance in extreme conditions. In this study, 788 athletes over 18 years of age (age of majority in Spain) from the Spanish Federation of Mountain Sports and Climbing (FEDME) participated, 593 men (75.3%), 193 women (24.5%), and 2 persons (0.3%) who considered themselves to belong to the category "other gender" (non-binary, etc.). The mean age was 49.8 years (± 12.8). The Resilience Scale (RS-14), Wong-Law Emotional Intelligence Scale (WLEIS-S), and Satisfaction With Life Scale (SWLS) were used as resources. The aim was to provide evidence on the potential for resilience between emotional intelligence and life satisfaction in mountain and climbing athletes. The results of structural equation modelling (SEM) showed high coefficients of determination for the resilience variables [(Q^2 = .553); (R^2 = .663)] and life satisfaction [(Q^2 = .301); (R^2 = .422)]. In the future, this research will require specific studies by sport modality for this area, with a large number of practitioners and disciplines, as well as its possible applications for the improvement of emotional factors.

Keywords: life satisfaction, mountain sports, perceived emotional intelligence, resilience, well-being.

Introduction

Mountain sports have experienced significant growth worldwide, especially in the last decade (Ayora-Hirsch, 2022). In Spain, the recent Estudio de Hábitos Deportivos de España 2022 ("Study on Sports Habits in Spain 2022", Ministry of Culture and Sports, 2022) reports that the sport discipline most practised by the Spanish population in 2021 was hiking-mountaineering, with 30.8% of the Spanish population practising it. Mountain sports have their own characteristics, different from other outdoor sports modalities with similar features, particularly the risk conditions in some cases, which can condition the profile of the athletes at a physical level, but, above all, at a psychological level (Gavín-Chocano et al., 2023). This study analyses the resilience, emotional intelligence, and life satisfaction of people linked to the Spanish Federation of Mountain and Climbing Sports (FEDME), the only Spanish sports federation that will participate in the Summer Olympics with climbing and in the Winter Olympics with ski mountaineering, which will debut as an Olympic discipline in Milan-Cortina d'Ampezzo 2026.

We consider it necessary to carry out this study because of its practical usefulness, both for the people who practise these sports and for those who are responsible for their management. The evidence obtained will be useful for decision-making in its management tasks, given its practical and social application (transfer), in addition to the knowledge that can be generated, based on the theoretical and scientific contributions that will be made.

There are still few studies that analyse emotional intelligence (EI), resilience, and its relationship with life satisfaction in mountain sports, due to the characteristics of the discipline. EI and resilience not only refer to the adaptive capacity that can be developed in the face of an adverse experience, but can also positively affect sport performance in extreme conditions. Resilience is defined as the ability to exhibit adaptive responses to adverse situations (Salmela-Aro et al., 2019). It is a factor related to emotions, which generates determination, self-control, self-efficacy, optimism, well-being, and the ability to solve problems in a positive way (Salanova, 2021). In this regard, Tabibnia (2020) considers that common techniques to increase resilience include exposure to nature by hiking in the mountains. Resilience of mountain athletes has been analysed in connection with behavioural addiction to extreme mountain sports (Méndez-Alonso et al., 2021; Niedermeier et al., 2022), and with the management of emotional regulation (Brooks & Goldstein, 2015) for better risk management (Habelt et al., 2022). In this sense, resilience in mountain and outdoor athletes should combine psychological aspects and emotional management processes (Jaramillo-Moreno & Rueda, 2021).

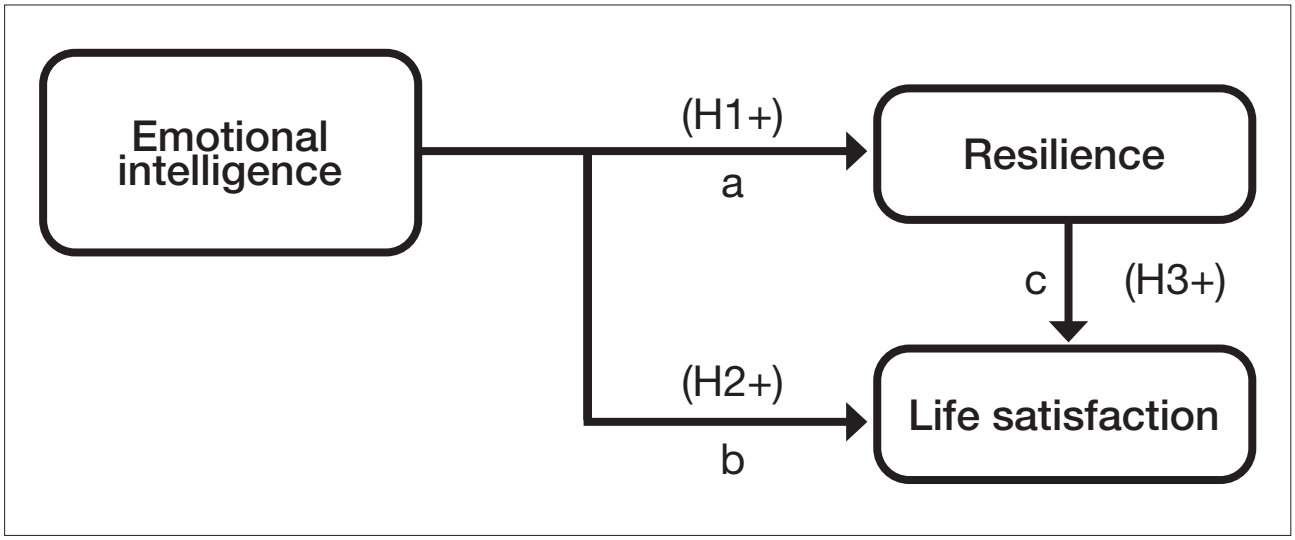
The conceptualisation of the EI construct is an issue that requires consensus among researchers. Petrides et al. (2004) distinguish 2 different constructs of EI: on the one hand, EI as a personality trait, and on the other, EI as an ability. EI as an ability should be measured through performance tests, while EI as a trait would refer to self-perceptions concerning one's ability to recognise, process, and use emotionally charged information. Among the studies of practitioners of outdoor sports activities, we highlight those that analyse the use of emotional regulation strategies by athletes (Castro-Sánchez et al., 2019; Nicolas et al., 2019), or the influence of EI on climbing performance (Garrido-Palomino & España-Romero, 2019; Laborde et al., 2015).

One of the most fruitful areas of EI research focuses primarily on providing evidence of the relationship with psychological well-being and life satisfaction, referring to the state of the individual in which both objective and subjective needs are satisfied (Biswas-Diener, 2022). In subjective well-being, people's emotional experiences, the satisfaction of different life domains, and the overall assessment of life are studied. Próchniak (2022) analysed the relationship between life satisfaction and optimism in mountain sports, personality, and emotional responses. It has been shown that the most life-satisfied resilient athletes are those in whom high EI values can be predicted (Baumsteiger et al., 2022).

The positive effects of EI and resilience, related to life satisfaction, can promote effective coping strategies in adverse situations (Cejudo et al., 2016).

The aim of this study is to provide evidence on the potential effect of resilience on EI and life satisfaction in mountain and climbing athletes in Spain. The following are considered as working hypotheses (see Figure 1): *(H1)* EI will be positively related to resilience; *(H2)* EI will be positively related to resilience; *(H3)* Resilience as EI potential will be related to life satisfaction.

Figure 1
Proposed theoretical model.



Method

Participants

A total of 788 people with a sports qualification participated in this study through the use of a non-probabilistic sampling of incidental or casual type. The participants had a sports licence with FEDME in the year 2022 and had taken some formal or federative training in mountain sports or climbing. Regarding gender distribution, 75.3% were men (593 cases), 24.5% were women (193 cases) and 2 persons (0.3%) considered that they belonged to the category "other gender" (non-binary, etc.). The mean age of the participants was 49.8 years (± 12.8), ranging from 18 to 78 years. The sample exceeded the minimum number of participants required when making an inference of sample size for a confidence level of 95% and an estimation error of 4% (estimated number of participants: 598).

Resources

It was considered necessary to use three data collection instruments to obtain evidence of the variables contemplated in the study (EI, resilience, and life satisfaction).

Wong-Law's Emotional Intelligence Scale –WLEIS-S, in its Spanish version (Extremera et al., 2019), consists of 16 items and 4 dimensions: intrapersonal perception (self emotional appraisal, or SEA), interpersonal perception (others' emotional appraisal, or OEA), assimilation (use of emotions, or UoE) and regulation of emotion (RoE). A 7-point Likert-type scale (1 to 7 points) was used. In our study (see Table 1) the reliability (Cronbach's α coefficient) for each dimension is .90, .90, .89 and .89, respectively; and .90 for all four factors for the McDonald's ω coefficient.

14-item Resilience Scale (RS-14), Spanish version by Sánchez-Teruel and Robles-Bello (2015), with 14 items that respond to a Likert-type rating (1 to 7 points), which are divided into two factors: Personal Competence (11 items), and Acceptance of Oneself and Life (3 items). The reliability of scores on both dimensions of this scale: Personal Competence α = .89 and ω coefficient = .90; and, for Acceptance of Oneself and Life, Cronbach's α = .88 and ω = .90.

Satisfaction With Life Scale. The SWLS was used to assess life satisfaction, in our case, the version of the Satisfaction with Life Scale of Vázquez et al. (2013), consisting of five items (1 to 7 points) where participants must indicate the degree of agreement or disagreement for each of the resource's response options. In our study, the reliability was α = .86 and .88 for the ω coefficient.

Procedure

The ethical guidelines promoted and encouraged by national and international regulations for conducting research with people were followed, through the completion of informed consent and the guarantee of confidentiality and anonymity of the data obtained. Participation in the study was voluntary in accordance with the Declaration of Helsinki (WMA, 2013). The resource was administered individually via the Google® platform (Google LLC). The sample participants received an email with the link to the forms for their response.

The approximate response time for each participant was 15 minutes, and the information was collected during the months of May to June 2022. This research has been approved by the Human Research Ethics Committee of the University of Jaén (Spain), with identification code OCT.22/2-LINE. Participants who requested to receive information on the results of the study will receive this article in electronic format when it is published.

Data analysis

First, it was determined whether the data assumed normality and it was found to follow a normal distribution. The assumptions of multicollinearity, homogeneity, and homoscedasticity were tested. Descriptive statistics were obtained, and validity and reliability (alpha and omega coefficients) were analysed *a priori* using Confirmatory Factor Analysis (CFA). The analyses were carried out using the program SPPS AMOS 25, Jamovi software version 1.2 and SmartPLS (version 3.3.6). For the coefficients considered in this study, the Chi-square test (χ^2), the degrees of freedom (*gl*), and the comparative fit indices (CFI), goodness-of-fit index (GFI), standardised root mean squared residual (SRMR) and root mean squared error of approximation (RMSEA) were used. A confidence level of 95% was used in all cases. The statistical power obtained is .948 for the predictors of life satisfaction used. A Bootstrapping procedure with 2,000 subsamples was used to calculate the structural equation model of the variables considered, reporting the predictive significance and the standardised regression coefficient (Q^2 and R^2).

Results

From the data obtained with each of the instruments, a Confirmatory Factor Analysis (CFA) was carried out to verify the validity and internal structure of each item. Critical *Z* score values (95% confidence level) determined a reduced *p* value that reflected statistically significant spatial structure in the data.

The factor loadings (see Table 1) for the items of the EI scale (WLEIS-S), presented an adequate fit (Hair et al., 2021), $\chi^2/df = 3.259$, with CFI = 0.973, SRMR = .0380, RMSEA = .067.

The overall reliability of the WLEIS-S scale was $\alpha = .906$ and $\omega = .909$ (see Table 4).

The factor loadings (see Table 1) for the items of the EI scale (WLEIS-S) presented an adequate fit (Hair et al., 2021), $\chi^2/df = 2.967$, with CFI = 0.911, SRMR = .046, RMSEA = .078. The reliability of this scale was Cronbach's $\alpha = .899$ and McDonald's $\omega = .906$ (see Table 2 and Table 4).

Table 1
Factor loadings (WLEIS-S).

Latent factor	Item	α	ω	Estimator	SE	Z	p	β	AVE	CR
Valuing one's own emotions	Item 1	.901	.904	0.731	.0306	23.9	<.001	.756	.653	.889
	Item 2	.897	.900	0.808	.0272	29.8	<.001	.879		
	Item 3	.898	.901	0.790	.0285	27.7	<.001	.839		
	Item 4	.903	.907	0.531	.0348	15.3	<.001	.533		
Valuing the emotions of others	Item 5	.904	.908	0.731	.0362	20.2	<.001	.690	.601	.854
	Item 6	.904	.908	0.895	.0358	25.0	<.001	.817		
	Item 7	.908	.911	0.589	.0375	15.7	<.001	.566		
	Item 8	.902	.907	0.792	.0323	24.5	<.001	.809		
Use of emotions	Item 9	.903	.907	0.740	.0408	18.1	<.001	.606	.644	.874
	Item 10	.901	.905	0.916	.0409	22.4	<.001	.715		
	Item 11	.897	.902	1.095	.0340	32.2	<.001	.910		
	Item 12	.897	.902	1.065	.0334	31.8	<.001	.904		
Emotional regulation	Item 13	.897	.901	0.803	.0328	24.5	<.001	.744	.621	.856
	Item 14	.896	.899	1.085	.0274	39.7	<.001	1.000		
	Item 15	.896	.899	1.079	.0273	39.6	<.001	.999		
	Item 16	.897	.901	0.731	.0306	23.9	<.001	.756		

Note: *SE*: standardised error; *Z*: value of *Z* in the estimation; *p*: value of *p* of the estimate *Z*; *β*: standardised estimate; *AVE*: average variance extracted; *CR*: critical ratio.

Table 2
Factor loadings (RS-14).

Latent factor	Item	α	ω	Estimator	SE	Z	p	β	AVE	CR
Personal competence	Item 1	.894	.901	0.522	.0300	17.4	<.001	.589	.613	.885
	Item 2	.892	.899	0.601	.0314	19.2	<.001	.635		
	Item 3	.891	.899	0.762	.0392	19.4	<.001	.642		
	Item 4	.886	.894	0.792	.0326	24.3	<.001	.759		
	Item 5	.897	.903	0.645	.0427	15.1	<.001	.523		
	Item 6	.893	.900	0.477	.0272	17.5	<.001	.591		
	Item 7	.895	.902	0.563	.0338	16.6	<.001	.566		
	Item 8	.886	.893	0.827	.0319	25.9	<.001	.792		
	Item 9	.892	.899	0.549	.0282	19.5	<.001	.642		
	Item 10	.890	.898	0.708	.0329	21.5	<.001	.694		
	Item 11	.889	.895	0.616	.0257	24.0	<.001	.751		
Acceptance of oneself	Item 12	.900	.905	0.656	.0450	14.6	<.001	.529	.545	.811
	Item 13	.888	.896	0.922	.0391	23.6	<.001	.813		
	Item 14	.898	.904	0.578	.0415	13.9	<.001	.505		

Note: *SE*: standardised error; *Z*: value of *Z* in the estimation; *p*: value of *p* of the estimate *Z*; *β*: standardised estimate; *AVE*: average variance extracted; *CR*: critical ratio.

Table 3
Factor loadings (SWLS).

Latent factor	Item	α	ω	Estimator	SE	Z	p	β	AVE	CR
Life satisfaction	Item 1	.835	.859	1.157	.0292	39.7	<.001	.901	.598	.862
	Item 2	.859	.894	0.796	.0355	22.4	<.001	.696		
	Item 3	.836	.860	1.146	.0290	39.5	<.001	.998		
	Item 4	.858	.896	0.753	.0354	21.3	<.001	.668		
	Item 5	.918	.922	0.839	.0547	15.3	<.001	.512		

Note: *SE*: standardised error; *Z*: value of *Z* in the estimation; *p*: value of *p* of the estimate *Z*; *β*: standardised estimate; *AVE*: average variance extracted; *CR*: critical ratio.

For the factor loadings (see Table 3) of the life satisfaction scale (SWLS) items, an adequate fit was also obtained, $\chi^2/df = 3.041$; with CFI = .963; SRMR = .034; RMSEA = .068. The overall reliability of this scale was Cronbach's $\alpha = .885$ and McDonald's $\omega = .907$ (see Table 4).

Structural model

To assess the robustness of the factor loadings and the significance between variables, the Bootstrapping procedure was used with 2,000 subsamples (Hair et al., 2021), resulting in the structural model (Figure 2) where the variables considered in this study are reported. Predictive relevance is obtained in the analysis in the estimation of the measurement model, with a good fit of the standardised regression coefficient model for resilience [($Q^2 = .553$); ($R^2 = .663$)] and life satisfaction [($Q^2 = .301$); ($R^2 = .422$)]. In this sense, R^2 values above .66 indicate a substantial fit of the model and above .33 a moderate fit following Chin's (1998) indications, and in our case it would be substantial for resilience and moderate for life satisfaction.

Table 4 presents the reliability (through alpha and omega coefficients), external loadings, and composite reliability index (CRI) scores obtained. The convergent validity or degree of certainty that the proposed indicators measure the same latent variable or factor, through the estimation of the average variance extracted (AVE), values must be greater than .5, according to the criteria of Becker et al. (2018).

Figure 2
Reliability and validity of the model.

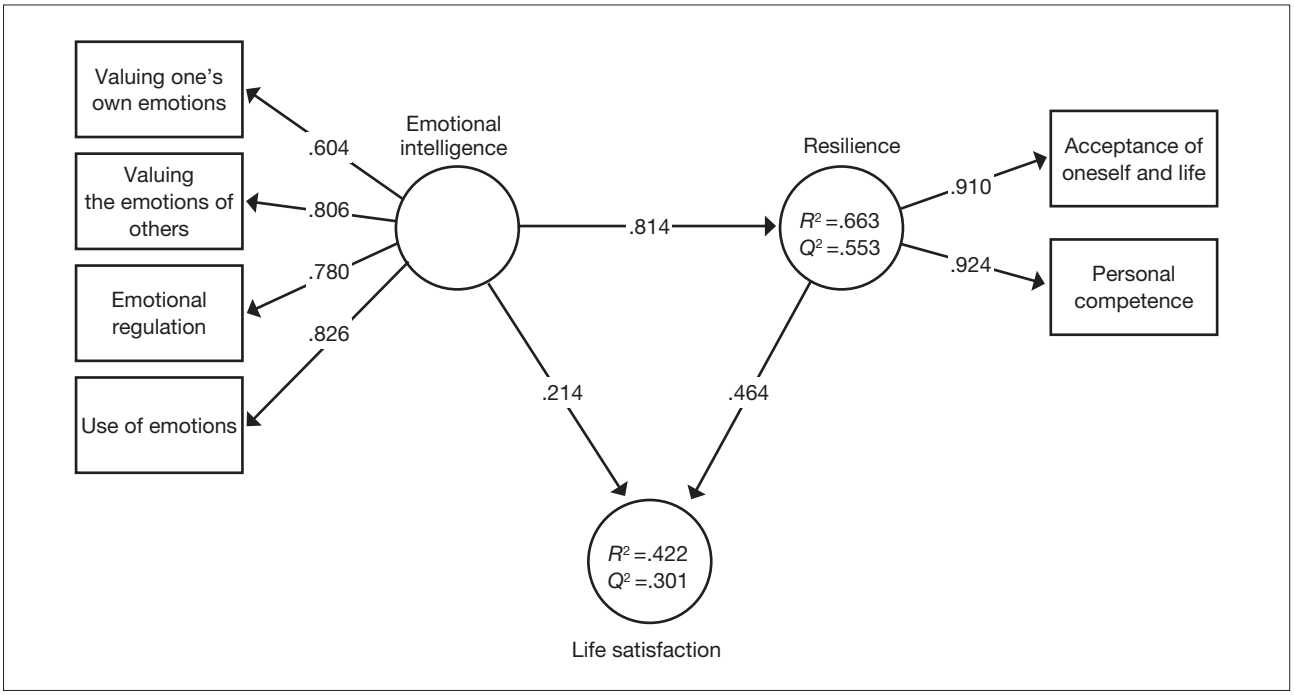


Table 4
Convergent validity.

Variable	α	ω	Composite reliability index (CRI)	Rho_A	Average variance extracted (AVE)
Emotional intelligence	.752	.909	.843	.777	.576
Resilience	.812	.906	.914	.815	.841
Life satisfaction	.901	.907	.928	.917	.722

Note: (1) Cronbach's alpha reliability coefficient = α, McDonald's omega reliability coefficient = ω.

Table 5
Cross-loadings (latent and observable variables).

Variable	Emotional intelligence	Resilience	Life satisfaction
Emotional intelligence			
Valuing one's own emotions	.826	.629	.482
Valuing the emotions of others	.604	.439	.306
Emotional regulation	.806	.714	.521
Use of emotions	.780	.650	.453
Resilience			
Personal competence	.769	.924	.617
Acceptance of oneself and life	.723	.910	.551
Life satisfaction	.565	.587	.929

A high value of AVE will have a better representation of the loading of the observable variable. All values obtained are above .5, fulfilling the established criteria.

The discriminant validity (Table 5) was examined through the analysis of the cross-loadings of each of the latent variables and their respective observed variables, with the loadings being higher than the rest of the variables.

Table 6
Path coefficient (standardised regression coefficient).

Relationship between variables	Path coefficient (β)	Standard deviation (σ)	Statistic *t*	Statistic *t*	Confidence intervals (95%) Lower / Upper	
Emotional intelligence → Resilience	.814	.014	19.979	***	.785	.840
Emotional intelligence → Life satisfaction	.214	.055	3.898	***	.104	.312
Resilience → Life satisfaction	.464	.056	8.254	***	.354	.570

Note: ***= $p < .001$.

Table 6 shows the results of the hypothesis testing following the criteria of Hair et al. (2021), where the causal relationship with the latent variables can be observed. The data of the t test (values above 1.96) indicate the consistency of the model. The results that showed a higher value were: emotional intelligence → resilience ($\beta = .814$, $t = 19.979$, $p < .001$); emotional intelligence → life satisfaction ($\beta = .214$, $t = 3.898$, $p < .001$); and resilience → life satisfaction ($\beta = .464$, $t = 8.254$, $p < .001$).

Discussion and conclusion

According to the first hypothesis (*H1*), we have obtained evidence confirming that EI is related to resilience. Resilience is a factor that directly affects the emotional area, providing organisation, determination, self-control, and the ability to solve problems in a positive way.

Our results coincide with those of studies that consider that resilience in mountain athletes as a psychosocial process should combine psychological and social aspects as processes of emotional management and use in high-level sports disciplines (Jaramillo-Moreno & Rueda, 2021). One of the keys to the relationship between EI and resilience lies in the fact that stressful events are highly emotionally charged. People's ability to regulate emotions is a key factor in their acceptance of oneself and life. Along these lines, the relationship between EI and resilience indicates the presence of increased well-being to cope with experiences of adversity and to develop personal competence (Brooks & Goldstein, 2015).

With regard to the second hypothesis (*H2*), we obtain a relationship between EI and life satisfaction, which confirms it. This is in line with Cejudo et al. (2016), finding positive effects of EI and adaptive responses or resilience, related to life satisfaction, favouring effective coping strategies in the face of adverse situations.

With regard to the third hypothesis (*H3*), it becomes evident that resilience acts as a variable that enhances EI and life satisfaction. Research corroborates these results, which show that resilient athletes who are more satisfied with life are significantly and positively predictive of higher EI (Baumsteiger et al., 2022). Relating these aspects, there are several elements that connect resilience to life satisfaction, such as: health, sport performance, context, as well as emotions experienced in personal activities and relationships (Castro et al., 2019; Molero et al., 2012; Nicolas et al., 2019). In this approach, athletes who exhibit higher personal competences also show higher life satisfaction, and resilience plays a mediating role with EI (Baumsteiger et al., 2022).

Sánchez-Álvarez et al. (2016) highlight that the appropriate use of certain emotional strategies could contribute to experiencing a higher rate of positive emotional states and the reduction of negative emotional states, thus having a positive impact on people's well-being and health. Frochot et al. (2017) analysed the satisfaction of the practitioners of these mountain sports disciplines and the self-perceived well-being that this activity produced in mountain tourism contexts, obtaining results along the same lines as those presented in our work. For Schebella et al. (2019), outdoor sporting activity in a natural environment improves self-esteem and is more restorative than in an urban environment. In this regard, the work of Engemann et al. (2019) found that the risk of psychological disorders from adolescence to adulthood decreases with an increase in the amount of green space near the place of residence.

If we globally approach the discussion of the results obtained and their relationship with the hypotheses considered, the positive effects of EI on resilience and its relationship with life satisfaction, which have been studied in other contexts, have been evidenced, obtaining similar results. It has been shown that people with high EI scores are more satisfied with life (Gavín-Chocano & Molero, 2020), and that there is a positive influence of EI on life satisfaction, both being related to resilience (Mérida-López et al., 2019).

In line with this, Quirante-Mañas et al. (2023) consider that satisfaction is also an emotional reaction, realised as a cognitive judgement following the choice of a sporting event, something that may provide incentives to engage in these activities. Finally, we would like to highlight that EI is a factor of psychological adjustment associated with well-being and a key variable in personal and social growth (Baumsteiger et al., 2022), key in the adaptive process and in social and emotional learning throughout our lives (Brackett et al., 2019).

Before concluding our proposal, it is necessary to reflect on the possible limitations of our study. These will be taken into account for future work that may have a longitudinal measurement character beyond the cross-sectional character of the present proposal. It will also be useful to analyse the variables considered in other contexts and in other sport disciplines. One of these constraints, which will have to become a future line of action, is related to participants. Our study includes people with a background of regulative and federative training, as long as they meet the condition of having a valid federative licence. Those who are not linked to the federation were not able to participate in the study and it would be advisable to include this profile in future studies. Another limitation is the lack of differentiated results by sport disciplines of mountaineering and climbing, so caution should be exercised in generalising results. In future work it will be interesting to analyse, in detail, the existence of significant differences according to gender and context in each of the disciplines.

Despite these limitations, this research makes a necessary contribution to the field of EI, resilience, and its influence on life satisfaction. On the other hand, the practical consequences of this work underline the need to strengthen emotional and resilience strategies in highly demanding athletes in order to improve personal well-being.

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Declaration of Conflict of Interest

The authors declare that there is no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

Ethical Clearance

This study is approved by the Human Research Ethics Committee of the University of Jaén, Spain (Code: OCT.22/2-LINE).

Informed consent

All participants gave their consent to participate voluntarily in the research.

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Physical Education in the pedagogical innovation projects in Catalonia for the academic year 2021-2022

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Two alpinists climbing a snowy mountain in the Arctic under the northern lights. Adobestock ®Urdialex

Abstract

The interest of the educational community in constantly improving teaching practices has led to the creation of pedagogical innovation projects in different educational fields. Unfortunately, the involvement of Physical Education (PE) in these new projects is unknown. In this study, the involvement of PE in the innovation projects of the 2021-2022 academic year was determined on the basis of a questionnaire and interviews with six experts in educational innovation and PE. The validation of the questionnaire was done following the Delphi method, with subsequent piloting and an expert panel, using Cronbach's alpha coefficient to determine its reliability. 232 PE specialists responded to the questionnaire thanks to the internal dissemination carried out by the Association of Physical Activity and Sport Professionals of Catalonia (COPLEFC). A considerable number of cross-curricular projects linked to PE were highlighted (62% of schools had at least one), although in 44.3% of these the field was of high importance in involvement. A significant correlation was detected ($p < .001$) between the number of projects in which PE was involved in the school and the weight of involvement within the projects, which was higher in schools with more projects. Among the conclusions, it is stressed that the scarce promotion in the school, the priorities of the Department of Education that are not linked to PE, and the creation of networks and spaces within the working day for the generation of new PE projects may be the causes and conditions for increasing the presence of PE in innovation projects.

Keywords: innovation, Physical Education, projects.

Introduction

The emergence of new problems and needs in the education community has called for going beyond pragmatism in order to develop more complex and innovation-based responses (Palamarchuk et al., 2020). One of the areas where more innovation has been demanded is Physical Education (PE), with the aim of abandoning the traditional mechanistic and uncritical vision (Gil Gómez & Maravé Vivas, 2018) focused on the purpose of enjoyment (Pastor et al., 2016). For this reason, a PE has been pursued aimed at the comprehensive development of students and addressing the emotional, intellectual, social, and physical dimensions (Gil Gómez & Maravé Vivas, 2018), all based on more meaningful physical activity practices (Prat et al., 2019). However, there is a divergent view that has called for reconsidering the need for innovation in PE, taking into account the unique and exclusive characteristics of the area that differentiate it from the rest (Pérez & Hortigüela, 2020). In this sense, it is claimed that innovation in the area should focus mainly on generating an improvement in educational quality (Pérez & Hortigüela, 2020; Sein-Echaluce et al., 2016).

Innovation in the area of PE has focused, among others, on the creation of educational innovation projects (Cañabate et al., 2019). According to Order ENS/303/2015 of the Department of Education, projects are a modality of pedagogical innovation consisting of articulated actions where the objectives of improvement derived from the educational needs detected are specified and which generate long-term changes based on previous research. In the area of PE, the forms that these projects have taken have been varied and have addressed different fields of innovation, from didactic proposals that combined martial arts and dance to develop social and civic competency (Moneo et al., 2017) to the creation of sports simulation games that sought to improve specific psychological abilities (Arribas-Galarraga et al., 2017). Some projects have focused on combining models, such as personal and social responsibility (TPSR) and gamification in PE, demonstrating a positive impact on student motivation, autonomy, and responsibility (Valero-Valenzuela et al., 2020). Although the focus of the projects is not always on improving student competencies, to the extent that the TPSR model has been used to improve teachers' own competencies (Camerino et al., 2019).

The impact on competencies that were not specific to the area of PE stands out among the above proposals. In this line, PE can become an ideal context for developing their specific competencies, as well as those of other areas, all based on the creation of cross-curricular projects (Fuentes, 2019). The latest contributions in the field of neuroscience suggest a close relationship between motor skills and other non-motor learning (Tomporowski & Qazi, 2020; Van der Fels et al., 2015), and that cross-curricular learning, which requires the involvement of more areas of the brain, becomes more effective and resilient over time (Bueno-Torrens & Forés-Miravalles, 2021).

In the absence of updated and contrasted data on the current situation of the area of PE in relation to educational innovation, the aim of the study was to determine the presence of PE in the pedagogical innovation projects carried out during the 2021-2022 academic year in Catalonia. The specific objectives were:

1. To determine the distribution of innovation projects according to the type of involvement of the area of PE.
2. To identify the conditions that favour the existence of innovation projects linked to the area of PE.
3. To identify the expectations of specialist PE teachers regarding the future of the area's presence in educational innovation projects.

Method

The study emerged at the initiative of the Official Association of Physical Activity and Sport Professionals of Catalonia (COPLEFC). A mixed methodology was followed and, for this reason, the procedure was divided into two phases. Firstly, a quantitative search was carried out in schools in Catalonia using a questionnaire specifically designed and validated to be applied to PE teachers. Subsequently, qualitative research was carried out by means of semi-structured interviews with representatives of selected schools with a proven level of expertise in the field of PE and educational innovation. In the following, each search will be divided into two phases and the methodological design will be made explicit.

Phase 1 - Questionnaires to schools on the role of PE in school innovation

Participants

A total of 232 PE specialists working in 232 different public, charter or private schools, covering primary, ESO (Mandatory Secondary School), baccalaureate and/or intermediate and higher vocational training levels, took part in this study. Participants were informed in advance about the purpose of the research and responded to the questionnaire that was distributed via social media and COPLEFC's weekly internal newsletter. All ethical

standards and guidelines in educational research and in the field of sport and exercise sciences were followed (BERA, 2018; Govil, 2013), as well as the criteria of the Declaration of Helsinki and the codes of research integrity at the University of Barcelona (University of Barcelona, 2020).

Procedure

A questionnaire was designed covering three dimensions: 1) the presence of PE in innovation projects, 2) the assessment of the involvement of PE in projects in which the area was involved, and 3) the role of educational agents with respect to the involvement of PE in innovation. A total of 13 questions (identification questions 1 to 3; questions 4, 6, 9 of dimension 1; questions 5, 7, 8, 10 of dimension 2; questions 11 to 13 of dimension 3) made up the questionnaire.

Validation of the resource

To ensure the validity of the questionnaire, a Delphi method was used (De Villiers et al., 2005) following a process similar to Monguillot et al. (2022):

- The people responsible for the research, 3 PE teachers with experience in school PE, generated the first version of the questionnaire (12 questions).
- Subsequently, based on a piloting phase, changes in the structure and wording of questions 8 and 10 were proposed and question 13 was created.
- 2 experts in qualitative methodology and with experience in PE determined the degree of understanding and appropriateness of the 12 initial questions on the basis of a 0-1 rating. An 83.3% agreement was obtained and the wording of questions 5 and 10 was modified.
- A panel of expert PE teachers from both primary and secondary schools was set up to check the coherence and relevance of the questions on a scale of 1 to 4. The mean rating of the questions was 3.36 ± 0.2 out of 4 and the mean rating of the questionnaire was 3.69 ± 0.3 out of 4. The wording of question 4 was changed as the lowest average score was 3 out of 4.
- Finally, Cronbach's alpha coefficient was calculated for the non-identifying and central questions of the study (questions 5, 7 to 13) to assess their appropriateness. A value of .751 was obtained and was considered acceptable as it was superior to alpha .700.

Analysis of results

Once Cronbach's alpha coefficient was determined, the descriptive statistics (mean and standard deviation), the frequencies of each variable, and the bivariate correlations of the variables were calculated (from Pearson for symmetrical quantitative variables and Spearman for ordered quantitative variables). Cross tables were then constructed between two variables for those that had shown significant correlations. Finally, a factorial dimension reduction was performed on the basis of a rotated component matrix to obtain new dimensions by combining variables and the frequencies of the new dimensions were calculated. The level of statistical significance was set at $p < .05$ for the correlations. All analyses were performed using the *SPSS 27.0* software.

Phase 2 - Interviews with experts in educational innovation and PE

Six individual interviews were conducted with experts in PE during the year 2022. The selection of the people was intentional because of their link to innovation in the area of PE. The people included had more than 8 years of experience in teaching in PE and were in active employment. It was ensured that 3 people had experience in secondary and post-compulsory education and 3 people in primary education. Four people were PhDs and taught at universities in the field of PE. One person from the Department of Education with expertise in innovation in the area of PE, two people in charge of coordinating innovation in schools, and the headmistress of a secondary school were involved. The resource used to collect information was the semi-structured interview. The five interview dimensions (and their categories) were validated by consulting three experts in qualitative research in PE. The procedure began with the agreement of the respondents and the subsequent setting of a date and place for the interview. Once the procedures had been explained and the doubts of the respondents had been resolved, the interviews were carried out. All conversations were recorded with a tape recorder with the consent of the respondents.

Analysis of results

Based on the research of Lobo-de-Diego et al. (2020), the content of the extracted information was analysed and identified, reduced and grouped on the basis of inductive categorisation (table 1) to establish relationships between the categories on the basis of networks. The analyses were carried out with Atlas.ti version 22.

Table 1
Dimensions and categories for data analysis

Dimension of analysis	Category
Actions to boost the creation of projects linked to the area	Timetable and presence of PE in the school
	Teacher training for innovation in PE
	Specialist networks
	Networking between the specialist and the rest of the teaching staff
	Role of movement in the school and promotion of the school
	Spaces for the creation of projects
Types of innovation in PE	Innovation in evaluation
	Innovation on the content area
	Methodological innovation
	Cross-curricularity and relationship with other areas
Agents involved	Role of the Department of Education and priorities
	Engagement and willingness of the PE specialist
	Role of the management team
	The specialist in the management team
	Role of non-specialist teachers

Table 2
Relationship between the number of cross-curricular projects in which PE is involved and the importance attributed to the area in these projects.

No. of projects in which PE is involved at school	Percentage of schools where the weight of PE in the cross-curricular innovation projects is:		
	Low or non-existent	Neutral	High
1	26.2	32.2	41.6
2	18.9	24.5	56.6
3	13.9	43.5	42.6
4 or more	7.4	63.9	28.7

Results

The questionnaire to the PE specialists

A total of 232 PE specialists responded to the questionnaire (166 teachers from public schools; 63 from charter schools; 7 from private schools). No significant relationships were found between the responses and origin by type of school. Of the 232 schools surveyed, 90.5% of the schools ($n = 210$) had an active innovation project.

The presence of PE in school innovation

62% of schools had an active cross-curricular educational innovation project in which the area of PE was jointly involved with other areas. Of these schools, 13.4% reported having three or more active cross-curricular projects linked to PE (see Table 3).

Beyond involvement in the project, the specialists were asked what weight and importance was given to PE in the cross-curricular innovation project. A significant correlation ($r_s = .222$; $p = .011$) was found between the number of projects in which PE was involved in the school and its weight of involvement within the projects. In schools where there were fewer cross-curricular projects involving PE, the importance of the area in the projects was lower than in schools where PE was involved in more projects (see Table 2). In 44.3% of cross-curricular projects, PE had a prominent involvement weight.

Table 3
Relationship between the number of cross-cutting projects in which PE is involved and specific projects in the area of PE.

Number of projects	Cross-curricular projects in which PE is involved		Specific PE projects	
	Frequency	Valid percentage	Frequency	Valid percentage
Unknown	11	5.2	9	4.3
No project	69	32.9	109	51.9
One project	65	31.0	56	26.7
Two projects	37	17.6	20	9.5
Three projects	14	6.7	5	2.4
Four or more projects	14	6.7	11	5.2
Total	210	100.0	210	100.0

Table 4
Frequency and percentage of the school's promotion and specialist engagement to create innovation projects linked to the area of PE.

	Promotion in the school		Specialist engagement	
	Frequency	Valid percentage	Frequency	Valid percentage
It is non-existent	51	22.0	23	9.9
It is insufficient	42	18.1	37	15.9
It is neutral	70	30.2	68	29.3
It is high	60	25.9	73	31.5
It is the maximum	9	3.9	31	13.4
Total	232	100.0	232	100.0

In addition to cross-curricular innovation projects, the specialist was asked about the number of specific projects in the area of PE. It should be noted that more than half (51.9%) of the schools had no project unique to the area, while 17.1% of centres had more than one.

A significant correlation was found between the number of innovation projects carried out by schools and the number of projects in which PE was involved, either cross-curricularly or specifically. The majority of projects linked to the area of PE (48.5%) were created in schools with four or more educational innovation projects ($r_p = .474$); $p < .001$).

Aspects that condition the engagement of PE in educational innovation projects

The role of both the school and the teachers' own engagement in the creation of new projects involving the area of PE was discussed with the PE specialists (see Table 4). Next, the relationship between school support and specialist engagement was analysed and a significant correlation between the two variables was found ($r_s = .537$; $p < .001$). In schools where the promotion of PE-related projects was the lowest, 54.5% of specialists were not sufficiently involved in the creation of these projects. On the other hand, in schools where promotion was at a maximum, 100% of specialists were highly involved.

In relation to the assessment of the projects, the PE specialists were asked about their relevance, usefulness, and educational quality. 77.2% of the respondents gave a positive rating of the projects in which PE was involved and a significant correlation was found between the rating and the number of projects linked to PE that the school had ($r_s = .183$; $p = .019$). In relation to the assessment of PE teachers, a new category was created on the basis of a rotated component matrix linked to the perceived success of the innovation process in the school in relation to PE. The results showed that 81.9% of specialists believed that the success of the innovation process linked to the area of PE was high.

Future scenarios for the presence of the PE in innovation projects

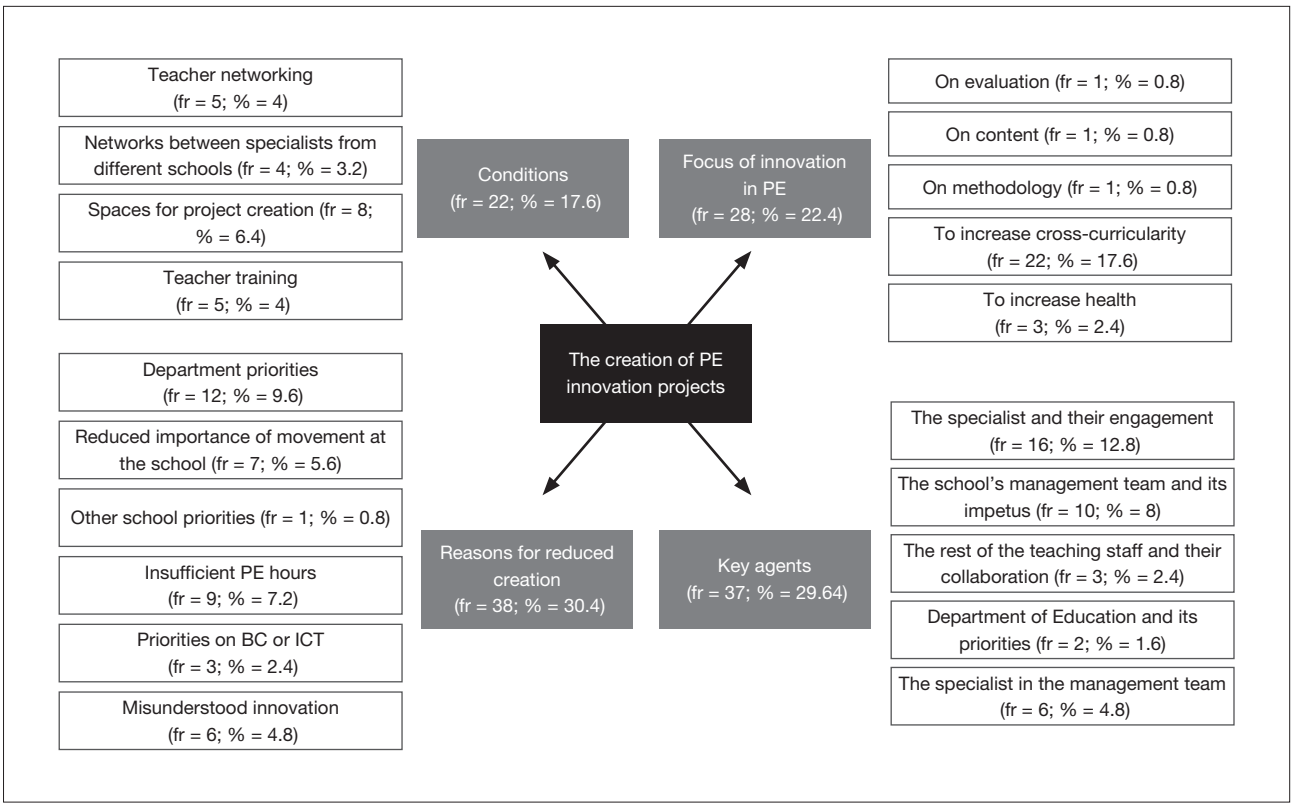
A new dimension was created from a rotated component matrix to calculate what PE involvement is claimed in the school innovation process, based on the current and future demands made by the specialist. It was noted that 91.2% of specialists demanded a high presence of PE in the innovation of the school of the future. In relation to the desired weight, a statistically significant correlation was found between the current weight of PE in the interdisciplinary innovation projects and the weight claimed by PE teachers for the future (r_s = .263; p = .002). In schools where the weight of PE in innovation projects was non-existent, 65.2% of specialists called for a more important or crucial weight of the area in these projects, while in schools where the weight of PE in the projects was high or the maximum, 100% of teachers argued that it should be kept high or increased as much as possible in the future.

Interviews with Physical Education experts

The analysis of the interviews using Atlas.ti generated a total of 19 codes, which were grouped into 4 different families (see Figure 1). The four families of codes were collected in all interviews. The family that appeared most frequently were the reasons for not creating more innovation projects linked to the area (fr = 38; % = 30.4), among which the following stood out: a) priorities of the Department of Education—unlinked to PE—(fr = 12; % = 9.6), and b) the hours of PE—which were considered insufficient according to all respondents—(f = 9; % = 7.2). In fact, the third most frequently mentioned word in all interviews was "hours", after "project" and "Physical Education". The greatest agreement among the respondents was the importance of the engagement and willingness of the PE specialists to create new projects (fr = 16; % = 12.8), as well as the high level of creation of cross-curricular projects linked to PE (fr = 22; % = 17.6).

With regard to the conditions favouring the creation of innovative projects with the involvement of PE, the creation of training spaces for innovation (fr = 5; % = 4), the existence of networks between specialists to share ideas (fr = 4; % = 3.2) and the creation of spaces within the working day for the design of innovation projects between specialists or between the specialist and teaching staff from other areas and schools (fr = 4; % = 3.2) were highlighted as indispensable. In this sense, the importance of the management team a) facilitating the occurrence of the conditions mentioned above, and b) promoting the creation of projects related to the area was stressed (fr = 10; % = 8). Respondents agreed that the presence of PE specialists in management teams facilitated the emergence of all these aspects (fr = 6; % = 4.8). Finally, most of the innovations linked to PE focused on involvement in cross-curricular projects.

Figure 1
Conceptual network of the codes and families extracted from the interviews.



Discussion

This study analysed the presence of PE in pedagogical innovation projects, identified the conditions that favour the creation of projects linked to the area, and highlighted the expectations of specialist PE teachers in relation to innovation of the field in the future.

Regarding the presence of PE in cross-curricular projects

The results of the study emphasised the involvement of PE in cross-curricular innovation projects. Experts highlighted the current trend to incorporate PE in cross-curricular innovation projects and, according to teachers, 62% of schools had innovation projects that included more than one interrelated curricular area (Fuentes, 2019) in which PE was involved. This result contrasted with those related to specific PE projects, where 43.8% of schools have at least one project. Similarly, and according to the experts interviewed in the study, the innovations being made in the area of PE focused on its inclusion in cross-curricular projects. One possible explanation is that PE has its own characteristics that generate an ideal framework for developing cross-curricular competencies such as social and citizenship skills (Moneo et al., 2017), emotional skills (Gil-Gómez & Maravé-Vivas, 2018), other curricular areas (Hraste et al., 2018; Norris et al., 2015), autonomy and responsibility (Valero-Valenzuela et al., 2020), and cognitive skills (Dalziell et al., 2019) that promote synergies with the rest of the areas in order to facilitate the comprehensive development of students (Pastor et al., 2016) based on the conscious improvement of their corporeality (Buscà, 2005). As highlighted by the experts, the construction of joint networks between teachers of various specialisations and roles in the school, all based on the creation of systematic spaces with time for the design and evaluation of projects, can enhance this synergy and favour the implementation of cross-curricular projects.

Beyond assessing the presence of the area of PE in school projects, our interest focuses on the extent to which it does so. In this respect, in less than half of the cross-curricular projects (44.3%) PE played a prominent role. In fact, a significant correlation was found between schools with fewer PE projects, where the importance of the area within the projects was also lower, and schools with more PE projects, where PE played a more important role. Experts suggest that the priorities of the school are a key aspect in determining not only the inclusion of PE in cross-curricular projects, but also its importance and quality within them. As the interviews showed, misunderstood innovation can directly affect the area of PE (Pérez & Hortigüela, 2020), in the sense that its involvement is reduced to the performance of physical activity as a resource for learning other content, ignoring the specific content of the area (Pastor et al., 2016).

Concerning the creation of specific projects in the area of PE

This research provided evidence on the engagement of the PE specialist in the creation of specific innovation projects and in innovation and improvement processes in the area (Pastor et al., 2016). In fact, only 26% of specialists stated that they had little engagement in setting up projects. However, more than half of the schools (55.7%) did not have any specific innovation project in the area of PE. Among other explanatory factors, only 29.8% of schools encouraged the creation of specific projects. In this sense, a significant correlation between the support of the school and the involvement of the specialist in the creation of projects was highlighted, so that when the former reached values close to the maximum, 100% of specialists stated that they were engaged in innovation in the area of PE.

The results showed, with a significant correlation, that schools with 4 or more innovation projects also had an innovative proposal in the area of PE. In the educational contexts where more innovations are developed, common characteristics are observed, such as the constant concern for educational quality and the proposal of educational policies and actions to improve the area (Barraza, 2005) as well as the support of educational agents towards the specialist in the introduction of new initiatives (Gil López et al., 2018). Beyond the willingness of each school to innovate, the interviews stressed the importance of the management team facilitating the conditions for promoting the creation of projects linked to the area and overcoming the demands and priorities of the Department of Education, which are totally unrelated to PE. The creation of networks between specialists to share ideas, as well as the creation of spaces within the working day for the design of projects (Van Waes et al., 2018), communities of practice (Jarrett & Harvey, 2014), or the increase of hours available for the implementation of projects in the area, were indispensable conditions upon which experts agreed. A condition that was also highlighted was teacher training for innovation. The results of empirical research demonstrate an insufficient level of innovation skills on the part of PE professionals (Palamarchuk et al., 2020).

Regarding the future of the area and its role in educational innovation

One of the remarkable results of the research was the claim for a more active role of the area of PE in innovation projects in schools (91.2% of specialists). This seems logical if one takes into account that the assessment of the projects was positive in 77.2% of the cases, but that more than half of the schools (55.7%) did not have any active projects linked to the area or that the importance attributed to PE in the overall projects is low or non-existent (21.4%). In fact, the results highlight a correlation between the teachers' assessment of innovation in the field and the number of PE projects available at the school. In this sense, the teachers' assessment was more positive in the schools that carried out more projects linked to PE.

Similarly, a relationship is found between the role of PE in the school's projects and the specialist's claim for the future, although fewer specialists (65.2%) claim more innovation when they are in schools where PE is not involved in innovative projects. On the other hand, in schools where PE is involved, and with a high or maximum weight, all the specialists agreed in calling for more involvement in the future. This result, coinciding with the interviews, placed the specialist at the centre of the process of change and innovation in the area. Further empowerment of the specialist to foster innovation linked to PE is based on strong institutional support, either from the Department of Education or from the school itself. Experts agreed that the Department does not foresee or carry out actions to promote the improvement of the area based on innovation. From the results of the present study, the key role of the school was also emphasised, although only 29.8% were highly supportive of the creation of innovation projects.

Conclusion

In relation to the first objective of the study, there is evidence of an elevated and superior involvement of PE in cross-curricular projects compared to that of area-specific projects. Despite the specialists' general satisfaction with this, a high number of schools are noted in which PE is only marginally involved in cross-curricular projects, or where there are no innovation projects linked to the area. In this sense, and in response to the second objective, a series of conditions are proposed that need to be met in order to promote the creation of projects linked to the field, including the role and support of the school, the engagement of the PE specialist, and the creation of spaces within the working day and networks for collaboration between teachers. With regard to the third objective, there was a majority of agreement among PE specialists in calling for higher and better-quality involvement of the area in educational innovation projects in the coming years.

Given the characteristics of this study, we consider it important to highlight its limitations. Firstly, the number of specialists who responded to the questionnaire is not significant for the population of Catalan PE teachers. Secondly, the panel of experts has been limited in terms of the number of people and variety of backgrounds. In the future, the latter limitations should be addressed by including more specialists and a wider and more varied panel of experts. Future research should also analyse how the latest innovation projects in PE are developed within the framework of the new curriculum. Derived from the results of the present study with regard to cross-curricularity and the changes that the new curriculum has brought about in this respect, it will be necessary to include educational agents from different fields, beyond specialists in PE.

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Exploring the relationships between motor creativity, lateral preference and sport in children

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Two alpinists climbing a snowy mountain in the Arctic under the northern lights. Adobestock ®Urdialex

Abstract

Laterality is a relevant construct because of its impact on motor development, learning processes and sport performance. A few studies have identified relationships between specific laterality profiles and more versatile motor actions. Such relationships have not been explored in the school setting or with people in the early stages of sports development. This study aimed to describe the percentage distribution of lateral preference types (eye, direction, turn, hand, foot, crossed) in a sample of school children (sportspeople vs. non-sportspeople) and to explore its possible relationships with motor creativity (fluency and originality). 500 children (220 females and 280 males) participated in the study (9.05 ± 1.86 years old). Dominant eye and rotational direction were identified by standardised tests. Lateral hand and foot preference were assessed by observation during participation in sports games. Two Game Test Situations (GTS) were used to assess motor creativity parameters (fluency and originality). The percentage of left-sidedness and crossed laterality was significantly higher in the group of children who performed sports. T-tests revealed superior creative performance (fluency and originality) in children with left-side rotational direction preference or with crossed laterality. Cohen's *d*-values show relationships when creativity is evaluated through game situations with direct player interaction. The results suggest relations between lateral preference and greater movement fluency and originality, which would be interesting in detecting talents and designing programmes.

Keywords: child, fluency, laterality, originality, sport.

Introduction

Creativity is the ability to detach oneself from the conventional way of thinking, create a new concept by combining two or more seemingly incompatible ideas, and abstract oneself from the concrete situation to see beyond mere representation. This way of thinking fosters more diverse and novel forms of behaviour and could favour better performance and the ability to adapt to different realms of human activity.

Sports scientists empirically examined this construct, and it has been associated with creating novel movement patterns, outstanding decision-making during gameplay, and training and competition adaptations. A widely-used tool for studying creativity is the Torrance Tests of Creative Thinking (Torrance, 1966), aligned with Guilford's (1967) approach. Guilford proposed four main components of creativity: fluency, or the number of adequate solutions given by a participant; flexibility, or a participant's diversely stated action alternatives; originality, or the ability to generate new and unique actions in a given context; and elaboration, or the ability to create pertinent details. This approach has guided the assessment of creativity in different areas of human activity, including the context of physical activity and sports (Hüttermann et al., 2018) or dance (Torrents et al., 2013).

Creative solutions are crucial to sporting success and talent development and selection, and it is essential to let creativity blossom during a child's early years (Cañabate et al., 2018; Santos et al., 2018). Therefore, we need to know its underlying factors and processes (Karaca et al., 2020) and how to stimulate or develop them from an early age (Domínguez et al., 2015).

A line of study almost unexplored in sports is the possible relationship between laterality and motor creativity. Castañer et al. (2016) analysed Lionel Messi's successful goal achievements, finding associations with his body hemidominance (laterality) and his versatility of actions (a characteristic trait of creative behaviours). To our knowledge, there are no other references in sports, although the relationship between laterality and creativity has been studied in other contexts with a broad diversity of methodologies and results (Shobe et al., 2009; Van der Feen et al., 2020).

Laterality is a complex and multidimensional construct that has been investigated in different ways and in various age groups. Its complexity has led to a wide variety of assessment methods, including preference identification tasks, performance tasks, self-report questionnaires (Faurie et al., 2016), or protocols, such as MOTORLAT (Castañer et al., 2018). It comprehensively identifies laterality profiles through 30 tasks providing information on the synergies between support and precision functions while performing complex motor skills. Although there is some controversy as to whether the different measures (preference-performance) are indicators of the same construct or independent dimensions, one of the most widely used measures in the literature on the subject is lateral preference (Utesch et al., 2016).

Lateral preference identifies the predominant use of one side of symmetric body parts to perform specific actions (Loffing et al., 2014). Handedness is the individual's preference to use one hand predominately for unimanual tasks and/or the ability to perform these tasks more efficiently with one hand (Porac, 2016). This human characteristic can be observed in the preferred use of one hand, foot, eye, ear, or even a preference for their rotation. If preference is not strongly unilateral or performance on both sides is qualitatively comparable, the term "mixed laterality" or "inconsistency" has often been used (Touwen, 2008). The degree of consistency seems to vary according to the directional preference. A recent study reported that left-handed children showed less lateralised behaviour for sport-specific tasks than right-handed children (Díaz-Pereira et al., 2022). Crossed laterality means that the preference is not ipsilateral across different body components. Right-sided dominance (both hand and foot) combined with left-eye dominance (Touwen, 2008) is the most frequent occurrence in the general population. A recent meta-analysis estimated that left-handed prevalence in the adult population is around 10% (Papadatou-Pastou et al., 2020), with equivalent findings for children (Prete et al., 2020).

In the context of physical activity and sports, the study of laterality is a relevant issue because of its impact on the processes of development and learning of motor skills and sports performance. In athletic populations, the right-side bias is notably reduced (Loffing & Hagemann, 2012). Loffing and Hagemann (2016) concluded that, compared with left-sided prevalence in the general population, left-sided (predominantly left-handed) athletes are found more frequently at the elite level of duel-like interactive individual sports or team sports. This greater prevalence seems especially significant in interactive sports, characterised by a high demand for perceptive and dynamic cognition, the anticipation of the opponent's intentions, and the need to adapt actions quickly in time-pressured situations.

Left-handers should have an advantage in duel-like contexts due to their relative infrequency, with their opponents being less familiar with the left-handers' fighting behaviour (Groothuis et al., 2013). Alternative explanations propose that other possible mechanisms associated with

left-handedness per se constitute a left-hander's advantage, such as less lateralised motor skills (Gorynia & Egenter, 2000) or more efficient neural processing (Holtzen, 2000).

A recent literature review (Moreno et al., 2022) analysed the prevalence of hand-eye laterality profiles in different sports modalities and their relationship with performance. Only two studies were conducted with children and adolescents (9-17 years). The authors conclude that in some sports (e.g., football, tennis, team sports), the percentage of individuals with crossed laterality (hand-eye) is higher in regular and high-level athletes than in the average population, suggesting some advantage associated with these laterality profiles. Castañer et al. (2016) concluded the relevant role played by laterality in Lionel Messi's scoring achievements, highlighting its possible association with exceptional versatility of movement (motor creativity) and ways of adapting in space.

Investigators from other domains of human performance have explored the possibility of a relationship between laterality, cognitive flexibility and creative performance (Sontam & Christman, 2012). The data indicate some relationship between lateral preference and creativity that may be presented as higher creativity scores among left-handers (Abbasi, 2011), those with mixed laterality or lower lateral specialisation (Badzakova-Trajkov et al., 2011; Shobe et al., 2009) or those with reduced right-sided orientation preferences (Mohr et al., 2003).

Given the importance of motor creativity in sports training and performance, this study aimed to explore the possible relationships between lateral preference and motor creativity in a sample of primary school children. A deeper understanding of laterality profiles and their relationship with tactical-sporting patterns can contribute to more effective development plans and complement talent detection (Laborde et al., 2009; Moreno et al., 2022). Specifically, we aimed to analyse:

- The percentage distribution of different types of lateral preference (eye, direction, turn, hand, foot, crossed) in a sample of schoolchildren according to sports practice (Objective 1).
- The relationship between motor creativity and sports activity (Objective 2).
- The relationship between motor creativity and lateral preference (Objective 3).
- The relationship between motor creativity and the interaction between lateral preference and sports activity (Objective 4).

Methodology

Participants

Research procedures followed ethical standards in sports and exercise science (Harris & Atkinson, 2015). They were approved by the Ethics Committee of the PhD Program in Education and Behavioral Sciences (CE-DCEC-UVIGO 2020-10-31-8449).

Five-hundred children (280 males and 220 females) participated in this study. The mean age was 9.05 years (*SD* = 1.86), ranging between 6 and 12 years. All participants attended state-run primary schools in Galicia (NW Spain), and 37% (*n* = 189) systematically participated in sports activities in affiliated sports clubs. The physical activities most commonly reported among the children were basketball (43.9%) and soccer (20.1%).

Materials and instruments

Two Game Test Situations (GTS) were used to measure motor creative performances: GTS1 and GTS2 (Memmert, 2006). The validity of these situations has been established in preliminary studies (Memmert et al., 2010).

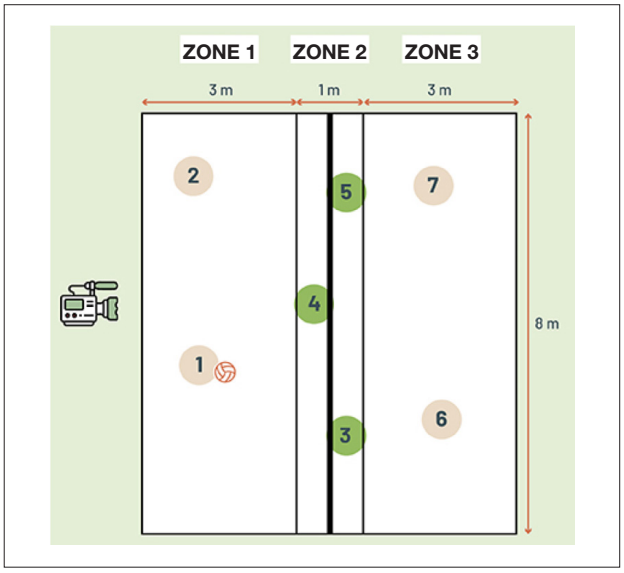
In both games, two teams of players (forwards and defenders) were matched against each other to prevent the team in possession of the ball from reaching their objective, that is, to pass the ball to their teammates. The game's instructions encouraged the individuals to vary and innovate their ways of passing the ball and their spatial movements.

Each game was played first with the hands (H) and then with the feet (F), resulting in four game situations: GTS1-H; GTS1-F; GTS2-H; GTS2-F. Each game lasted for 3 minutes.

In GTS1 (see Figure 1), a team of 4 players had to pass the ball from Zone 1 to Zone 3 and vice versa. The defending team (3 players), situated in the intermediate zone (Zone 2), tried to prevent this from happening. Players could not leave their designated zone.

The players in each zone could cooperate to open up gaps (free space) between the three defenders. After three minutes, the positions changed according to a specific sequence so that each child held an offensive position twice in the course of the GTS.

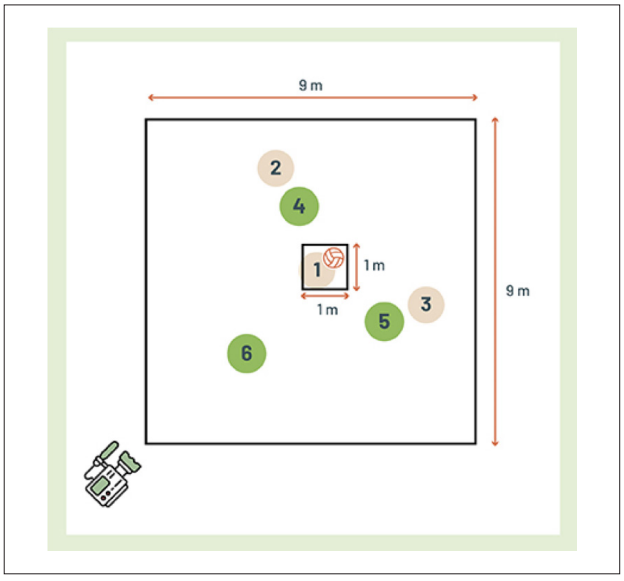
Figure 1
Game Test Situation 1.



Note. Adapted from D. Memmert (2006). Developing creative thinking in a gifted sport enrichment program and the crucial role of attention processes. *High Ability Studies, 17*(1), 101-115. https://doi.org/10.1080/13598130600947176

In GTS2 (see Figure 2), two teams of three players contested ball possession. The game was played in a 9 x 9 square metre space with a central 1 x 1 square metre zone from which the game was restarted every time an opponent intercepted the ball, or it went out of play. The players could move around to find free spaces or more favourable zones in which to receive the ball from their teammates.

Figure 2
Game Test Situation 2.



Note. Adapted from D. Memmert (2006). Developing creative thinking in a gifted sport enrichment program and the crucial role of attention processes. *High Ability Studies, 17*(1), 101-115. https://doi.org/10.1080/13598130600947176

The primary difference between the two games was the level of interaction (direct vs. indirect) between forwards and defenders.

The participants' behaviour was recorded on videotape. Two independent observers (Physical Activity and Sports Science graduates and national basketball and soccer coaches) then coded and evaluated it. The recorded actions and their subsequent evaluation were agreed upon by the consensus of the two experts.

The observers recorded the actions carried out for each game situation (GTS1-H, GTS1-F, GTS2-H, GTS2-F) and each individual (n = 500). The data were collected when the individual was acting in an offensive position. Given that each individual took on the role of attacker twice (3 minutes each time), the data were recorded in the second of the two trials, as the first trial aimed to ensure that the participants understood the task and its objectives.

The actions recorded were ball passes and players' spatial movements, either to open up spaces between defenders (GTS1) or to find favourable positions in which to receive the ball (GTS2). Repeated actions were excluded.

The criteria used to consider that a ball pass was different were the presence of changes in: the segment with which it was executed (right vs. left), the spatial level (upper, middle, lower), body orientation (front, side, back) and the ball's trajectory (parabolic, straight, chipped).

The criteria used to consider that players' spatial movements were different were the presence of variations in: the aim of the movement (closer to/farther away from) concerning the player with the ball, the side towards which the movement begins (left/right) and the player's trajectory during the movement.

The measures in motor creativity were calculated following indicators and procedures traditionally used and accepted in the literature: fluency and originality (Runco, 2007).

Fluency is defined as the number of different solutions to one given situation produced by an individual (Runco, 2007). The fluency score was calculated as the number of different actions (ball passes and spatial movements) produced by each participant in the four game situations (GTS1-H; GTS1-F; GTS2-H; GTS2-F). Total fluency GTS1 and total fluency GTS2 were calculated as the sum of the participants' fluency scores in the two situation tasks (hand and foot).

Originality has been defined as the statistical rareness or uniqueness of a motor response in comparison to the population sample (Johansson et al., 2015; Runco, 2007). It was calculated as follows: in each of the four game situations,

each movement was given an originality coefficient (see Table 1) according to the number of times it appeared in relation to the total sample (percentage of the sample that executes the action).

Table 1
Originality coefficient of each response based on the percentage of the sample that executes the action.

Percentage of the sample that executes the action	Originality Coefficient
More than 50.1%	0
20.1%-50%	1
10.1%-20%	2
5.1%-10%	3
2.1%-5%	4
0%-2%	5

Once the originality coefficient for each response was determined, the score for originality (∑ of the originality values linked to each action) was calculated for each individual in each of the four game situations (GTS1-H; GTS1-F; GTS2-H; GTS2-F). Total originality GTS1 and total originality GTS2 were calculated as the sum of the participant's originality scores in the two situation tasks (hand and foot).

Preference laterality measures

Different procedures identified the dominant eye, the preference in the direction of the turn, and the preferred hand and foot to pass the ball while participating in sports games (GTS1 and GTS2).

For the identification of eye dominance, we used the hole-in-the-card test (Johansson et al., 2015). To determine the preference in the rotational direction, we used test Number 4 of the Zazzo battery (Zazzo, 1984). With the child's back to the examiner (approximately 4 metres), in a static position, standing on both feet, they are instructed to turn their head as quickly as possible to look at the examiner on a signal. Three attempts were made for each of the tests. Children with mixed lateral preference (i.e., those who did not show a systematic preference for one of the sides) were eliminated from this study.

Lateral preference measurements of hand and foot were taken by observing the precision actions (passes) during the game situations (GTS1 and GTS2). In each game situation and for each action (hand passes, foot passes), the side used was recorded. The percentage of times that the right or left side was used in relation to the different extremities (hand, foot) was calculated.

To determine the direction of lateral preference (right vs. left) for each extremity, when the percentage use of each side (right-left) was equal to or higher than 80%, the individual was attributed that lateral preference. The children who showed a mixed (inconsistent) lateral preference were eliminated from this study. Specifically, for each extremity or action, when the percentage use of one side was lower than 80%, the individual was considered to show an inconsistent or mixed lateral preference and was excluded from the sample.

The following lateral preference measurements were established: dominant eye, rotational direction, handedness (the hand most frequently used during ball passes), and footedness (the foot most frequently used during ball passes).

When preferences of hand/foot/rotation or eye were not uniformly right- or left-sided, the individuals were attributed crossed laterality (the lack of concordance between two of the measurements considered, taking into account any combination of hand, eye, foot or rotational direction being sufficient).

Registration of sports activities

In the informed consent form given to parents or tutors, they were asked about their children's participation in extra-curricular sports activities to determine how regularly and in what type of activity their children participated.

The children who regularly participated in some planned sports activity (at least twice a week) were assigned to the group of "sportspeople".

Procedure

The researchers contacted the head teachers of the schools in the area, requesting their collaboration. Physical Education teachers received information on the study's aims and were in charge of collecting the written consent forms signed by parents/tutors enabling the children to participate and be filmed. The tasks were performed in a multiple-purpose hall and administered and scored by the same specifically trained evaluators.

The tasks were presented to the children in a way that motivated their performance. The children were repeatedly encouraged to change and innovate their way of passing the ball and moving as much as possible.

Data analysis

Chi-square tests were conducted to compare the percentage distribution of different types of lateral preference as a function of sports activity (Objective 1).

To analyse the relationship between motor creativity and sports activity (Objective 2), for all the analyses, the participants were placed in two subgroups (sportspeople vs. non-sportspeople). Tests of difference were computed using *t*-tests for all motor creativity measurements (total fluency and total originality). An alpha level of .05 was used for all statistical comparisons, and effect sizes were calculated using Cohen's *d* for *t*-tests.

To analyse the relationship between motor creativity and lateral preference (Objective 3), for all the analyses and in all the laterality measurements, participants were placed in two subgroups (left vs. right preference or no crossed vs. crossed).

The results obtained in relation to Objective 3 revealed that the relationships between motor creativity and lateral preference showed more cases of significant and more intense differences in GTS2 (with direct interaction between opponents) than in GTS1 (with no direct interaction between opponents). Likewise, Cohen's *d*-values revealed that the rotational direction and crossed laterality are the lateral preference measurements with a higher explanatory value. For this reason, the analyses made concerning Objective 4 were carried out exclusively with the data obtained in GTS2, related to rotational direction and crossed laterality. In order to analyse the relationship between motor creativity and the interaction between lateral preference per sports activity (Objective 4), two 2 x 2 ANOVAs were carried out: the 2 (rotational direction, left vs. right) x 2 (sportspeople vs. non-sportspeople), and the 2 (crossed laterality, crossed vs. non-crossed) x 2 (sportspeople vs. non-sportspeople).

Results

Percentage distribution of types of lateral preference according to sports practice (Objective 1)

The results concerning the prevalence of left-sided individuals and those with crossed laterality of the group of sportspeople compared with non-sportspeople showed that for all the body segments evaluated, the percentage of left-sided individuals was higher in the group of sportspeople than in the group of non-sportspeople (hand: 9.5% - 8.4%; foot: 12.2% - 9.6%; eye: 20.1% - 11.3%; rotation: 14.8% - 5.1%).

The χ^2-value obtained significant values in the eye preference side (χ^2 [1, 449] = 7.38. $p < .007$. w = 0.12, Odds ratio = 1.98) and the rotational direction side (χ^2 [1, 449] = 13.69. $p < .000$. w = 0.16, Odds ratio = 3.21). The group of individuals with crossed laterality also seems to be overrepresented in the group of sportspeople (30.7%) compared to its presence in the group of non-sportspeople (17%). Also, in this case, the χ^2-value obtained significant values (χ^2 [3, 449] = 12.67. $p < .000$. w = 0.16, Odds ratio = 2.15).

Relationship between motor creativity and sport activity (Objective 2)

Systematically and in all cases, the results (see Table 2 and Table 3) revealed the existence of significant differences in the two motor creativity measurements (total fluency and total originality) and in the two GTSs (GTS1 and GTS2) in terms of sports activity. In all cases, the sportspeople surpassed the non-sportspeople, obtaining effect sizes (Cohen's *d*) considered of a medium-high level, which range from *d* = -0.78 (Originality GTS2) to *d* = -1.03 (Fluency GTS1).

Table 2
Means (standard deviations) and t*-tests for total fluency per sports activity.*

Sport (*n*)	Total fluency GTS1				Total fluency GTS2			
	M (SD)	*t*-test (*p*)	*d*	CI	*M (SD)*	*t*-test (*p*)	*d*	95 CI *d*
YES (189)	8.73 (2.79)	-12.40 ($p < .001$)	-1.03	-1.19, -0.86	7.89 (2.72)	-8.85 ($p < .001$)	-0.79	-0.97, -0.61
NO (311)	5.70 (2.37)				5.82 (2.18)			

Note. GTS= Game Test Situation; *d* = Cohen's *d*; 95 CI *d* = 95% confidence interval for Cohen's *d*.

Table 3
Means (standard deviations) and t-test for total originality per sports activity.

Sport (*n*)	Originalidad total GTS1				Originalidad total GTS2			
	M (SD)	*t*-test (*p*)	*d*	CI	*M (SD)*	*t*-test (*p*)	*d*	95 CI *d*
YES (189)	15.64 (9.18)	-9.58 ($p < .001$)	-0.86	-1.03, -0.68	15.85 (10.89)	-8.46 ($p < .001$)	-0.78	-0.96, -0.60
NO (311)	8.22 (6.87)				8.16 (7.81)			

Note. GTS= Game Test Situation; *d* = Cohen's *d*; 95 CI *d* = 95% confidence interval for Cohen's *d*.

Table 4
Means (standard deviations) and t-test for total fluency and total originality per GTS1 and GTS2.

Total fluency

Lateral preference measurements		*N*	Game Test Situation 1				Game Test Situation 2			
			M (SD)	*t (p)*	*df/d*	95 CI *d*	*M (SD)*	*t (p)*	*df/d*	95 CI *d*
Handedness	Left-handed	44	7.22 (2.98)	-0.897 (.370)	498 -0.141	-0.451, 0.168	7.52 (2.99)	-2.145 (.037)	49.218 -0.384	-0.744, -0.024
	Right-handed	456	6.81 (2.93)				6.52 (2.55)			
Footedness	Left-sided	53	7.50 (2.85)	-1.739 (.083)	498 -0.252	-0.536, 0.032	7.49 (2.86)	-2.618, (.009)	498 -0.378	-0.661, -0.094
	Right-sided	447	6.76 (2.93)				6.50 (2.55)			
Eye Dominance	Left-sided	73	7.50 (3.27)	-1.895 (.061)	91.827 -0.262	-0.538, 0.126	7.52 (3.24)	-2.677 (.009)	86.518 -0.409	-0.713, -0.105
	Right-sided	427	6.73 (2.86)				6.45 (2.44)			
Rotational direction	Left-sided	44	8.11 (2.94)	-3.020 (.003)	498 -0.472	-0.780, -0.165	8.38 (2.97)	-4.843 (< .001)	498 -0.747	-1.051, -0.444
	Right-sided	456	6.72 (2.90)				6.43 (2.50)			
Crossed Laterality	Crossed	111	7.47 (3.04)	-2.576 (.01)	498 -0.275	-0.485, -0.065	7.63 (3.02)	-4.209 (< .001)	151.62 -0.503	-0.740, -0.267
	Not crossed	389	6.66 (2.88)				6.31 (2.39)			

Total originality

Lateral preference measurements		*N*	Game Test Situation 1				Game Test Situation 2			
			M (SD)	*t (p)*	*df/d*	95 CI *d*	*M (SD)*	*t (p)*	*df/d*	95 CI *d*
Handedness	Left-handed	44	11.15 (7.69)	-0.106 (p = .916)	498 -0.016	-0.327, 0.293	13.70 (11.53)	-1.867 (.063)	498 -0.293	-0.603, 0.015
	Right-handed	456	11.01 (8.69)				10.81 (9.62)			
Footedness	Left-sided	53	11.98 (8.03)	-0.852 (p = .394)	498 -0.123	-0.409 0.161	13.77 (11.30)	-1.869 (.066)	61.22 -0.307	-0.636, 0.021
	Right-sided	447	10.91 (8.67)				10.74 (9.60)			
Eye Dominance	Left-sided	73	11.73 (8.83)	-0.764 (p = .445)	498 -0.096	-0.345, 0.152	12.75 (10.86)	-1.586 (.113)	498 -0.200	-0.449, 0.047
	Right-sided	427	10.90 (8.57)				10.78 (9.62)			
Rotational direction	Left-sided	44	11.86 (8.32)	-0.674 (p = .501)	498 -0.106	-0.416, 0.203	15.41 (10.36)	-3.093 (.002)	498 -0.484	-0.791, -0.176
	Right-sided	456	10.94 (8.63)				10.65 (9.68)			
Crossed Laterality	Crossed	111	11.82 (8.69)	-1.112 (p = .267)	498 -0.119	-0.330, 0.091	13.23 (10.90)	-2.441 (.016)	159.85 -0.283	-0.512 -0.054
	Not crossed	389	10.79 (8.57)				10.45 (9.42)			

Note. df = degrees of freedom ; *d* = Cohen's *d*; 95 CI *d* = 95% confidence interval for Cohen's *d*.

Relationship between motor creativity and lateral preference (Objective 3)

In general, the relationships between lateral preference and motor creativity showed more cases of significant and, moreover, more intense differences in GTS2 than in GTS1 (see Table 4).

Therefore, the subsequent analyses aimed to study exclusively the motor creativity measurements obtained in GTS2.

Likewise, Cohen's *d*-values revealed that rotational direction and crossed laterality are the lateral preference measurements that obtained a higher explanatory value concerning motor creativity levels, both in the fluency and the originality of the actions performed by the players. For this reason, we used these lateral preference measurements exclusively in the subsequent analyses, whose results are shown below.

Table 5
Means (standard deviations) and ANOVA for total fluency and total originality per Lateral Preference x Sport Activity..

	Rotational direction				Crossed Laterality			
	Right-sided		Left-sided		Not crossed		Crossed	
	Sport *N* = 161	No-Sport *N* = 295	Sport *N* = 28	No-Sport *N* = 16	Sport *N* = 131	No-Sport *N* = 258	Sport *N* = 58	No-Sport *N* = 53
Total Fluency	7.62 (2.67)	5.78 (2.14)	9.46 (2.56)	6.50 (2.75)	7.48 (2.42)	5.72 (2.15)	8.82 (3.14)	6.32 (2.26)
$F_{(df)}$, *p*	$F_{(1.\ 496)} = 2.092$. $p = .149$				$F_{(1.\ 496)} = 2.060$. $p = .152$			
Total Originality	15.30 (11.04)	8.11 (7.77)	19.00 (9.59)	9.12 (8.70)	15.38 (10.67)	7.94 (7.59)	16.89 (11.40)	9.22 (8.80)
$F_{(df)}$, *p*	$F_{(1.\ 496)} = 0.809$. $p = .369$				$F_{(1.\ 496)} = 0.013$. $p = .909$			

Relationship between motor creativity and the interaction between sports activity and lateral preference (Objective 4)

The results of the ANOVAs revealed that motor creativity (total fluency and total originality) is not significantly linked to the interaction between sports activity per lateral preference. No significant values were obtained either in crossed laterality or rotational direction (see Table 5).

Discussion

The results show that for all the preference laterality measures, the percentage of left-sided individuals is higher in the group of sportspeople than in the group of non-sportspeople, with significant differences recorded in eye dominance and rotational direction (Objective 1). Furthermore, the group of individuals with crossed laterality also seem to be significantly overrepresented in the group of sportspeople. These results confirm that the overrepresentation of left-sided players at the top levels of certain sports, especially interactive sports (Loffing & Hagemann, 2012), is already present in the early stages of sports development. Regarding the higher percentage of children with crossed laterality, the results are in line with the results provided by Moreno et al. (2022), as they concluded a higher prevalence of athletes with hand-eye crossed laterality profiles in sports such as football (53%) or team sports (50.7%).

Concerning the relationships between motor creativity and sports activity (Objective 2), the results show that the group of children who regularly participate in some sports activity display a greater variety of creative solutions (fluency), as well as more novel and less stereotyped patterns of movement (originality).

The results confirm the potential value of early sports experiences as a scenario of interest to contribute to the development of child creativity. In keeping with other studies (Bowers et al., 2014), sports activity at an early age foments the exploration, discovery and creation of actions that will stimulate the development of motor creativity.

In line with the results of other studies (Badzakova-Trajkov et al., 2011; Shobe et al., 2009), the data reveal a tendency towards higher levels of fluency and originality in children with a left-sided preference or some type of crossed laterality (Objective 3). The data provide evidence of some connection between motor creativity and lateral preference. However, this relationship might involve differentiated distinctions as a function of the type of lateral preference measurement and the GTSs used to evaluate motor creativity.

The results allow us to conclude that lateral preference for rotating the body is the measurement with the highest predictive impact (Cohen's $d = -0.747$). The children who use the left side more frequently to begin rotations during movements perform better when varying and innovating ways of passing the ball or moving around the given space.

The results also revealed higher creative skills in individuals with some crossed laterality (Cohen's $d = -0.503$). We could not find any study analysing this type of relationship. Only Moreno et al. (2022) conclude that cross-laterality patterns could positively affect performance in certain sports (basketball, cricket or golf) due to biomechanical particularities in technical execution.

The type of game situation used to evaluate motor creativity also provides interesting data. Specifically, GTS2, characterised by one-on-one confrontations between participants, was shown to have greater sensitivity than GTS1. These results align with other studies (Loffing & Hagemann, 2012, 2016) showing that the competitive

advantages of left-sided individuals appear more significantly in sports involving direct interaction among participants.

Finally, the relationship between motor creativity and lateral preference did not show differentiated distinctions in terms of sports activity (Objective 4). Regardless of whether or not the children performed sports, in all cases, the children with a left-sided rotational direction or crossed laterality obtained higher average scores in fluidity and originality of movements.

Conclusions

This exploratory study is a first approach to the new factors associated with motor creativity in a large sample of primary school children. The results reveal the relationships of lateral preference with motor performance indicators that have not been studied to date, such as fluency of movements and motor innovation ability.

The results also show that children with a left-sided preference in the direction of the turn and those with some kind of crossed laterality present higher movement versatility and originality. These relationships seem to be mediated by the type of sports games, with more intense relationships observed in activities in which the participants share the action space and their actions are interactive.

Nevertheless, the interpretation of the current findings should consider the limits of the data collection undertaken. Laterality is a complex construct that goes beyond left-right preference, so we need alternative tools to obtain more accurate data on this variable. MOTORLAT (Castañer et al., 2018) could be an interesting instrument to achieve a more precise measure of laterality in the context of children and youth sports. This inventory detects accurate laterality profiles considering the contralateral distribution of postural support and the precision of the gesture for a wide range of motor skills. In addition, we should identify which specific cross-lateral profiles are related to movement creativity.

Furthermore, the results are also interesting for intervention programmes to promote motor creativity. Following the research carried out by Rasmussen et al. (2017), who propose the design of interventions in which creativity is fostered from varied situations, the results of this study suggest that rotational direction and the hemidominance profile in the use of body segments may constitute criteria to stimulate behavioural variability.

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A daily session of Physical Education: approach, organisation, and legislative viability through teacher perceptions

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Two alpinists climbing a snowy mountain in the Arctic under the northern lights. Adobestock ®Urdialex

Abstract

Physical Education (PE) is a subject of great pedagogical and educational value. However, the administration can be constrained by utilitarianism against physical inactivity and overweight. This might have been the main reason for the implementation by LOMLOE of three PE sessions per week. However, there are schools which attach great importance to this subject, with a large vision and a long tradition of teaching PE on a daily basis. This qualitative study explored the approach and legislative fit of PE in a private school institution in the Region of Madrid, from infant to high school, with a daily PE session in a case study through the perceptions and experiences of PE teachers and teachers of other materials. In this school they extended the duration of breaktimes and used them for daily PE teaching, leaving aside the usual concept of breaktime. The teachers interviewed agreed that PE is fundamental for students' all-round development: healthy habits, academic performance, well-being, satisfaction with PE, etc. However, they also pointed to the increased risk of injury and organisational, economic, and logistical challenges. It was nonetheless argued that the legislative fit of daily PE was highly feasible. Considering the current situation, schools and PE teachers have the opportunity to demonstrate the importance and relevance of PE beyond its usefulness against obesity and sedentary lifestyles.

Keywords: challenges, integral development, legislation, obesity, pedagogical value, sedentary lifestyle.

Introduction

In recent years, levels of inactivity, obesity, and excess weight at school age have increased, and this has been accompanied by Spain's rise in the European rankings (Pérez-Farinós et al., 2013). In order to curb the situation, and still under the Organic Law for the Improvement of Educational Quality (LOMCE), some autonomous communities proposed an increase of Physical Education (PE) hours in secondary education (e.g. Madrid). Currently, under the umbrella of the Organic Law amending the Organic Law of Education (LOMLOE), three sessions of PE are taught per week in the first three years of secondary education and two sessions in the fourth year and first year of baccalaureate.

Many studies show the contribution of PE to improving well-being, both physical (Committee of Experts on Physical Education of the COLEF Council, 2017; National Sports Council 2010) and mental and social (European Parliament, 2007). It is therefore clear, as Pérez-Pueyo et al. (2021) point out, that by extending PE hours, health problems could be solved and savings in public spending could be achieved. This fact may lead one to think that the administration's proposal to increase the number of hours of PE is utilitarian and not related to the pedagogical and formative value of PE (Pérez-Pueyo et al., 2021). However, even if the increase in hours is an administrative strategy, it does not negate the pedagogical value of PE and the two can be complementary. This simply reflects that, in order to achieve goals such as lowering the European obesity rankings or reducing health spending, the administration uses (physical) education as a tool. Thereby, two perspectives emerge:

The pedagogical, which reflects on teaching actions and their formative value with questions such as:

- How do the arguments justifying the increase in PE hours translate into teacher practice?
- What are the aims that PE would pursue after such an increase in hours?

The administrative, which questions:

- What are the difficulties that would arise from increasing the number of hours for PE?
- How would it affect other topics and their teachers?

In order to answer these questions, qualitative case study research was carried out in a school which from its beginnings in the 1940s gave great importance to PE, with more than one PE session per day for all its students. In this context, the reasons for this high number of PE hours, the educational aims pursued and, furthermore, how this school has achieved administrative viability under the different educational laws will be explored.

Arguments for increasing the number of hours of Physical Education and its pedagogical aims

As previously mentioned, the main driver for governments to increase PE hours is its influence on improving physical well-being and reducing sedentary lifestyles and obesity (e.g. Oliveira et al., 2022). Scientific evidence supports the link between PE and improved health. For example, in the Integral Plan for Physical Activity and Sport (Plan A+D), the National Sports Council (2010) highlighted the importance of PE in establishing healthy habits and overcoming sedentary lifestyles and childhood obesity in Spain. Similarly, in the *Proyecto para una educación física de calidad en España* (2017), the PE Committee of the Collegiate Organisation of Physical and Sports Education (COLEF Council) also concludes that PE provides a comprehensive education that improves the physical, mental, and social well-being of students, and the academic and cognitive performance of adolescents. There is arguably sufficient scientific evidence (e.g. McIntyre et al., 2015; Ruiz-Pérez et al., 2015) that this intervention is an adequate strategy to achieve its intended purpose. However, a number of issues arise in parallel to the increase in the number of hours of PE per week: (1) the aim of improving the status of the subject, (2) health turned into physical performance and measurement, and (3) the relationship between PE and academic performance.

Improving the status of the subject

To understand this factor, it is necessary to start from a traditional view that attributes fictitious features to the subjects. This traditional view of topics implies considering subjects such as Language, Mathematics, Biology, etc. as having a higher status than a subject such as Physical Education. In an attempt to increase the academic status of PE, grading tools such as fitness tests were incorporated, with the questionable argument that they endow the subject with greater scientific rigour (López-Pastor, 2006). However, as López-Pastor et al. (2013) show, these tests lack pedagogical value, are far removed from the guidelines of formative assessment, and have serious shortcomings precisely in terms of scientific rigour. In line with this, authors such as Lloyd et al. (2010) argue that while physical fitness is an important component of PE, it should not be the sole focus of assessment. They propose a more holistic approach, which places value on PE in the development of key motor skills, attitudes, physical activity behaviours and habits, positive body image, and self-esteem. This would reinforce the status of PE and links to the following issues.

Health turned into physical performance and measurement

The relationship between health promotion and PE is often taken for granted (Green, 2004). This excuse has been used to justify the application of physical fitness tests as a common teacher strategy, but it has also been criticised for its low validity and reliability, as well as for its illogical application in educational situations as a grading system for the subject (López-Pastor, 1999, 2000). This highlights two aspects. First, whether or not PE linked to physical fitness tests promotes healthy lifestyle habits, which does not seem to be close because it even breaks with basic training principles (López-Pastor et al., 2013). Second, students have repeatedly expressed disinterest and lack of motivation for these tests (e.g., Beltrán-Carrillo & Devís-Devís, 2019). Despite this, it is possible to combine a learning-based approach with a health-based approach (e.g. Devis Devís & Peiró Valert, 1992). One example is the proposal by Pérez-Pueyo et al. (2021), where they use high-intensity interval training. They propose the use of pedagogical models (Fernández et al., 2018) combined with formative assessment processes (López-Pastor & Pérez-Pueyo, 2017).

Improving academic performance and physical activity

This is another large piece of scientific evidence that can justify the increase of hours in PE. Numerous reviews and meta-analyses support that physical activity, and in particular school PE, improves not only academic performance—especially in mathematics and reading—but also behaviour (e.g. Álvarez-Bueno et al., 2017). This may convince even the most reluctant teachers who are interested in students' academic performance (Pérez-Pueyo et al., 2021). However, this argument diverts attention from the inherent aims of PE, in a similar way to what happened with the physical fitness tests, as if this subject was not capable in itself of justifying its pedagogical value or of justifying its presence as a subject.

The administrative dimension: the increase in hours and its feasibility under the current legislation

The administrative dimension is then addressed in order to explore the real feasibility of extending hours. The data for the present study were collected under the Organic Law for the Improvement of Educational Quality (LOMCE), although the Organic Law amending the Organic Law of Education (LOMLOE) follows the same line in terms of the procedure for a daily PE session.

With the LOMCE, prior to the 2022-23 academic year, article 3 of Royal Decree 1105/2014, of 26 December (BOE), on the distribution of competencies, establishes that each educational administration may determine the timetable to be given to each specific subject and subject of free autonomous configuration. This opened up the possibility to deliver more than two PE sessions throughout the country. In the case of the Region of Madrid, where the school at the centre of this research is located, it is stipulated in the Official Bulletin of the Region of Madrid (BOCM). Thus, in article 6 of Decree 48/2015, of 14 May (BOCM), PE is included in the block of specific subjects, setting a minimum of two hours per week. However, in paragraph 4 of the same article, it is stated that it is possible to increase this number of teaching hours because each school is free to increase the timetable of some specific subjects or free choice subjects. In this section it is indicated that the subject "Sport" could be offered with two sessions per week. That is to say, without making a request to the Regional Ministry, under LOMCE a school could have two sessions of PE plus the option of offering two more sessions of Sport as an optional subject. In addition, Article 22 of Decree 48/2015, on the autonomy of schools, establishes that each school may decide to increase the timetable of subjects, provided that the teaching hours corresponding to other subjects are not reduced. The school should prepare a proposal to be studied by the competent Regional Ministry and, with this option, a daily PE session could be incorporated into the timetable.

In the 2022-23 academic year, two education laws coexist: LOMCE and LOMLOE. The LOMLOE, in Royal Decree 217/2022 of 29 March (BOE), establishes that at least three sessions of PE per week will be taught in the first three years of secondary education and two sessions in the fourth year and first year of baccalaureate. A weekly session of a core subject is reduced, in line with the main proposal of the Committee of Experts in PE of the COLEF Council (2018), published in the handbook entitled *Proyecto para una Educación Física de calidad en España: aumento de horas de Educación Física* (Project for a quality Physical Education in Spain: increase in hours of Physical Education). As with the previous legislation, the Region of Madrid provides autonomy to schools to increase the timetable of subjects without reducing the teaching hours of other topics, in Article 16 of Decree 65/2022 of 20 July (BOCM). Hence, there is still the possibility of a daily PE session.

Up to this point, the benefits of increased hours on health, mental state, and academic performance have been outlined. In addition, specific proposals or interventions related to the increase of PE hours (COLEF Council, 2018; Heras et al., 2017; Pérez-Pueyo et al., 2021) and administrative placement. However, due to the small number of schools with more than two teaching hours per week, no further studies and none have been identified regarding teachers' perceptions and experiences.

Objective

Therefore, the aim of this research was to analyse the implementation of a daily PE session in a school from a legislative perspective, as well as to explore the perceptions and experiences of teachers of both PE and other topics with regard to this initiative.

Method

An exploratory qualitative study was conducted based on an interpretive framework (Creswell & Creswell, 2017). A qualitative case study methodology was used to examine the phenomenon in depth and within its real context (Yin, 2009). This approach made it possible to explore the implementation and fit of daily PE, in accordance with current legislation, through the input and perceptions of teachers. The study followed the American Psychological Association (APA) standards for qualitative research by Levitt et al. (2018).

Context and school

The research was carried out in a private (not subsidised) secular school in the Region of Madrid, located in a high income per capita area. Of line five or six, depending on the course, with around 2,000 students. This school was chosen for two reasons. Firstly, because it is one of the few schools in which all students, from nursery to baccalaureate, have at least one daily PE session. In secondary education, they have a daily PE session, adopted as breaktime (see appendix 1). Secondly, because, unlike other schools where under the LOMCE there was an optional subject taught to interested students, all students have a daily PE session, without distinction or optional subjects. It is a school founded under the philosophy of the Free Institution of Education (Institución Libre de Enseñanza, ILE), with a tradition of PE that goes back decades, which allows us to really see the culture of the school and the identity of PE in students and teachers. According to its pedagogical model, the ILE included PE as a fundamental and integral element of education, which was totally groundbreaking for its time—and it seems that it still is (Felipe, 2014).

Participants

Twelve secondary school teachers of PE, English, Mathematics, Language, and Social Studies took part in the project. One participant was a secondary school head teacher. The sample consisted of 9 women and 3 men with a mean age of 36.9 years (min. 27, max. 51, *SD* = 9.4), 11.25 years of average teaching experience (min. 3, max. 23, *SD* = 7.4) and, of those, 9.75 years on average (min. 1, max. 23, *SD* = 9.9) in the school used in this research. A quota sampling strategy was used to select participants (Coolican, 2014). That is to say, the opinions of teachers of different subjects and not only of PE were explored, with the aim of ascertaining their perception of how this number of hours of PE per week fits into the timetable and the consequent harm to teaching hours in other subjects in favour of PE. All secondary school teachers were contacted and 12 responses were obtained, which were considered appropriate due the variability of viewpoints provided, the quality of these, and the type of qualitative research (Hennink & Kaiser, 2022).

Research team

Six researchers participated in this study. Four of them had training and experience in qualitative designs and five had a background in physical education. None of them had any previous relationship with the participants.

Data collection

The second author facilitated the contact with the school when he started his internship as a physical education teacher there. Following a meeting with the secondary school head teacher, he was granted permission to proceed with the study. Given the limited availability of teachers, it was jointly decided that the best resource to meet the objective would be a qualitative questionnaire with open-ended questions, in order to obtain the greatest number of responses from teachers who freely agreed to participate, and that they could fill it in at times of their choice and convenience.

All participants completed an informed consent form, based on the principles set out in the Helsinki Declaration (World Medical Association, 2013), in which they were informed of the purpose of data collection, their confidentiality in the processing, and the possibility of withdrawing from the study at any time.

An *ad hoc* resource of 12 open-ended questions, created by the first and second authors, was used. A rigorous process was followed to ensure its validity and relevance to the research objectives, through a number of different processes (e.g. Creswell & Creswell, 2017): content development and validity from previous studies, review by two experts, pilot testing with two teachers not involved in this study, iteration with first responses, and continuous reflexivity by the research team. The resource collected personal data and included five sections of questions in relation to the increase in the number of hours of PE: the aim of the increase, the benefits and disadvantages of the increase, the perceived opinion of the students, how it fits into the school timetable, and the historical evolution of its implementation. The qualitative questionnaire was conducted via Google Forms and sent by email.

The second author contacted all secondary school teachers in person, individually requesting their participation and email address to send the link to the questionnaire.

Category coding and data analysis

In line with the open-ended nature of qualitative studies (Creswell & Creswell, 2017), an inductive thematic analysis was used to identify emerging themes and the data was analysed in three blocks of four participant responses. Microsoft Excel was used, as this tool allows for an efficient and systematic organisation of responses of the nature of this study, facilitating the identification of recurring themes and emerging patterns.

Initially, and separately, the first, second, and third authors read all the responses to get a general idea. Next, they carried out mixed coding using both theoretical codes (based on the literature in the field) and "live" codes (codes emerging from participants' responses). After analysis of the data from the first four participants, the coding done by each author was pooled and refined. Non-relevant codes were eliminated and others were merged or split according to their similarity or differentiation in order to improve the accuracy of the analysis. The first author then continued with the codification. Fourthly, a conceptual analysis was carried out based on a matrix with the main results and attributes (Bazeley, 2013), triangulating codes, and analysis in group reflections among four authors.

Results

Vision of Physical Education

All teachers stated that PE is of great importance in this school and agreed that there should be at least one session per day, and ideally between one and a half to two hours per day. Most teachers, including those who did not teach PE, made it clear that the main aim of placing so much importance on PE was the holistic development of pupils. Further elaborating on this idea, participant 12 (P12) links the school's pedagogical vision with its origins in the ILE. For this teacher, the ILE recovered "the Classical Greek idea of the human being as an indivisible whole", and this is what the school has done. This boils down, in other words, by P5, to the well-known Roman proverb *mens sana in corpore sano*. The teachers insisted that the integral development of pupils includes not only the physical component but also the social, emotional, affective, and mental aspects. Thus, teacher P1 stated that "it creates a bond between pupils and they feel much more identified with their school". With regard to integral development within PE, teacher P7 stated: "It is ultimately about developing people who will maintain these values and habits throughout their adult life". Beyond a physical or performance approach, the subject of PE was, according to the teachers, taught with a wide variety of content that provides students with a wide range of experiences along the common thread of an integrative PE.

High teaching load in physical education: benefits and drawbacks

Several teachers pointed out that there were virtually no obese pupils, associating this with the seven hours of PE lessons per week in primary school and five hours per week in secondary school. Beyond physical activity, they linked it to the development of healthy habits and to the emotional-affective dimension and self-esteem to which it also leads. In support of this thesis, P12 alluded to an anecdote: "A group of French exchange teachers came to the school and I was struck by something one of them said: "the children in this school seem happy, they are always laughing'. Is this the relationship between exercise and endorphins, or a coincidence?" Similarly, P6 commented that, in his previous experience, students in other schools "look less happy".

Teachers also alluded to the relationship between physical activity and increased academic performance as a benefit. Thus, P7 responded: "Recent studies in the field of neuroeducation seem to support these decisions, as they indicate that a high level of physical activity in children greatly facilitates the acquisition of other learning."

In addition, it is worth noting the perspective of some of the teachers who had worked in other schools with fewer hours of PE per week. These teachers explained that they perceived positive differences compared to these schools. For example, "lower obesity rate, lower disciplinary incidences, more physical development" (P7) or "physical, social, behavioural, metabolic, academic, medical differences... I would never finish" (P12). Finally, it is interesting to note that all the teachers surveyed perceived that students were delighted with the high number of hours of PE, adding that it was the favourite subject of a large portion.

As the only negative aspect, teachers agreed that the biggest drawback was the increase in injuries: "There is more risk of small injuries to pupils, crutches are common in our school" (P7).

Organisation of PE in schools and how it fits in with legislation

The strategy followed in order to provide a weekly PE session, while respecting legislation, has been to reduce break and lunch time. Breaktimes, as they are usually conceived, disappear in order to make room for PE sessions. This is how P2 and P3 respectively described this strategy: "We cut back

on other non-compulsory subjects and breaktime"; "we have less break and that's how we compensate it". There were two teachers who referred directly to legislation to support their answer: "The law stipulates a minimum number of hours per subject, not a maximum" (P12).

The vast majority of teachers acknowledged that coping with the high number of hours of PE involved difficulties. P7 encompassed the views of other teachers as well, setting out the range of factors involved:

> Economic (the more hours, the more teachers hired), material (adequate spaces and materials), logistical (organisation of timetables and spaces), pedagogical (increasing PE means taking time away from other subjects) and, perhaps, in some contexts, social (communities of parents who do not accept increasing PE at the expense of other more "cognitive" areas).

Among all teachers, the main concern was the reduction of time for other topics by increasing the number of hours of PE. In addition, the composition of timetables and space management are common problems to be resolved. However, despite these challenges and concerns, P12 stated that "fitting in the timetable is easy if everything revolves around PE and meal times and not around the other topics".

Discussion

This research aimed to explore how the enforcement of at least one hour of PE lessons per day has been implemented and maintained through the perceptions of teachers of PE and other materials. Using a qualitative case study design, the results showed a positive assessment by teachers, a holistic approach to PE, the organisational and logistical fit in the timetable and in accordance with legislation, and the benefits and difficulties derived.

Vision of Physical Education and its high teaching load

The results show that the approach to PE in this case study school, with at least one session per day, is linked to the holistic development of students, beyond just skills and physical fitness. This view is in line with the report of the Committee of Experts on Physical Education of the General Council of Physical Education and Sport (COLEF) (2018). From the perspective of physical well-being, PE pursues the acquisition and maintenance of healthy habits (Pérez-Pueyo et al., 2021). This function seems necessary in view of the alarming sedentary lifestyle of 73% of the Spanish child population (National Sports Council, 2011) and estimating that up to 80% of schoolchildren only engage in physical activity at school (European Commission, European Executive Agency for Education and Culture, Eurydice, 2013). However, as previously argued, tackling obesity should not be the sole purpose of PE (González-Calvo et al., 2022).

From a social perspective, as the participating teachers consider, it can improve coexistence in the school (Gil-Espinosa et al., 2016). In line with this, active breaks could also increase students' social and cognitive interaction, as well as their motor participation (Jiménez-Parra et al., 2022). In addition, some teachers considered the opportunities it provides for their adult life (e.g. for leisure) and for the creation of a physical-sport culture to be important (López-Pastor et al., 2016). Finally, from a psychological perspective, PE contributes to better cognitive ability and academic performance (e.g., Ardoy et al., 2014).

Teachers also stated that students are very satisfied with the high number of hours of PE and that it is one of their favourite subjects. Most likely caused by the holistic approach of this school away from performance-linked PE that would generate disinterest and demotivation (e.g., Hortigüela-Alcalá et al., 2021).

Organisation of PE in schools and how it fits in with legislation

In general, teachers reported that it is not easy to logistically organise such a high number of PE sessions. The solution is based on the use of the time usually allocated to breaks, extending their duration, in order to convert them into PE sessions. That is to say, it means the disappearance of breaktime as it is usually conceived, partly leaving aside situations that are generated autonomously by the pupils in these freer moments and which are also important (Chaves-Álvarez, 2013).

The teachers surveyed, who are used to making PE a central part of their pupils' daily lives, agree that the minimum number of hours per day allocated to this subject should be one. It must be considered that this school has a decades-long tradition of following this model and, although there may be some debate and opinions that partially deviate from this line, everyone assumes that it is a sign of identity and that it will be maintained.

As P12 pointed out, "the law sets a minimum number of hours per subject, not a maximum". The State cedes this competency to each community and opens up the possibility of a daily PE session. In the case of the school in this study, we took the BOCM (Decree 65/2022) as a reference. As stated in the introduction, no maximum is specified. Schools have the possibility to increase the timetable of some specific subjects or free choice subjects, or to decide to increase the timetable of subjects, as long as the teaching hours corresponding to the other topics are not reduced.

Practical applications

Both the aforementioned proposals (Committee of experts on PE of the COLEF Council, 2018; Heras et al., 2017; Pérez-Pueyo et al., 2021) and the strategies carried out by this school can be taken into account by any school when designing the structure that supports the increase in PE sessions. Regarding the possible transferability of this proposal to other schools, the main issues to be taken into account seem to be the following: it should be a collective and majority decision at school level with broad support both in the school staff and among families and the school council; modifying the school timetables so that breaktimes become PE sessions and their duration is extended; shortening the canteen timetable and not putting PE hours after lunch; slightly adjusting the timetables of other subjects; and, probably, hiring more PE teachers or looking for efficient forms of management depending on the university training and specialisation of the staff (easier in primary education than in secondary).

While the benefits of a high teaching load in PE are indisputable, it is vital that schools anticipate and prepare for the inherent challenges, such as the risk of injury and the readjustment of hours allocated to other subjects. Each institution should also carry out a detailed assessment of its context in order to establish the most relevant organisational and legislative strategies.

In the school under study, the prioritisation of PE has been a hallmark since its foundation in the 1940s, making it a decisive factor for many families in choosing this institution. However, for schools without such an established tradition, it is essential to involve and raise awareness among the whole educational community, from teachers and students to families, highlighting the importance and benefits of integrating PE into the school curriculum.

Limitations and future lines of research

The school chosen for the research was one of the few centres that had the ideal characteristics to contextualise the research and provide a view from a qualitative perspective that would enrich the state of the question. However, at the same time, contextualising the study in this school has implied inherent limitations. Firstly, the private management system makes it difficult to generalise the results to other, mainly publicly managed, institutions.

In future research endeavours, it would be interesting to extend the view of both the number of schools and their ownership, as well as the different management regimes in place. This would allow the views of other teachers and schools to be heard, and the perspective of pupils and families could also be explored.

Conclusion

In this school, teachers of PE and of other subjects consider a daily PE session to be a very appropriate measure for the pupils and it has been an important feature of the school for decades. Participants highlight the importance of PE for all-round development: physical, cognitive, emotional, social, etc. This organisation in the school is achieved by extending the duration of breaktimes and allocating them to PE, leaving aside the usual use of breaks. Despite some difficulties to be faced and decisions to be taken, the legislative fit is perfectly possible. In these times of the LOMLOE in which the third hour of PE has been introduced, PE teachers have the opportunity to demonstrate the importance of this subject (Pérez-Pueyo et al., 2021). There is much more to PE than tackling sedentary lifestyles and obesity and therefore this cannot be the justification—or at least the only justification—for extending the school PE timetable. Therefore, it is up to PE teachers to seize this moment to change the value and status of the subject and to make it resonate with their students, fellow teachers, families, politicians, and society at large. In line with this, the importance of this study lies in showing how to go even one step further to incorporate a daily PE session in the organisational structure of any school.

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Appendix 1

Timetable	Monday	Tuesday	Wednesday	Thursday	Friday
9:30-10:30	English	Laboratory	Arts and Crafts	Economics/Biology	English
10:30-11:30	Mathematics	ICT	Mathematics	Chemistry	Language
11:30-12:30	Physics and Chemistry	History	Biology	Language	Laboratory
12:30-13:30	PE	PE	PE	PE:	PE
13:30-14:15	Language	Language	History	Philosophy	History
14:15-14:45	Lunch	Lunch	Lunch	Lunch	Lunch
14:45-15:30	Chemistry	English	Ethical values	Consultancy	Mathematics
15:30-16:25	Philosophy	Physics and Chemistry	English	Mathematics	Economics

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Motivating teaching styles and directiveness in Physical Education

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Two alpinists climbing a snowy mountain in the Arctic under the northern lights. Adobestock ®Urdialex

Abstract

The PE teacher's intervention can be more effective if they use certain motivational styles, helping to create a positive learning environment and to promote active lifestyle habits. However, if it is perceived as a negative experience, it could demotivate the learner and provoke rejection of the practice, thus jeopardising the motor literacy process. Following a cross-sectional-correlational design, the main objective of this study was to analyse the relationships between teachers' motivational styles and directiveness in Physical Education. 500 secondary school students participated. The SIS scale was used to determine interpersonal teaching style and the PCT scale was used to assess directiveness. The results indicated that the scale dimensions correlate positively and significantly with each other, except for Chaos, which correlates negatively with Autonomy Support and Structure. The Control dimension did not show any correlation with the rest of the dimensions assessed. In addition, the cluster analysis showed two profiles of teacher motivational style perceptions: a more directive one, called "dominant", and a more autonomous profile, called "adaptive". The results reveal positive links between adaptive motivational style, which supports learner autonomy in a positive and structured learning climate, and negative links with inattention and dropout. These findings suggest that the adaptive motivational style in PE involves the learner more autonomously in tasks and can help to create positive learning situations that encourage adherence to practice.

Keywords: autonomous motivation, motivational profiles, motor skills, positive learning climate, practice adherence.

Introduction

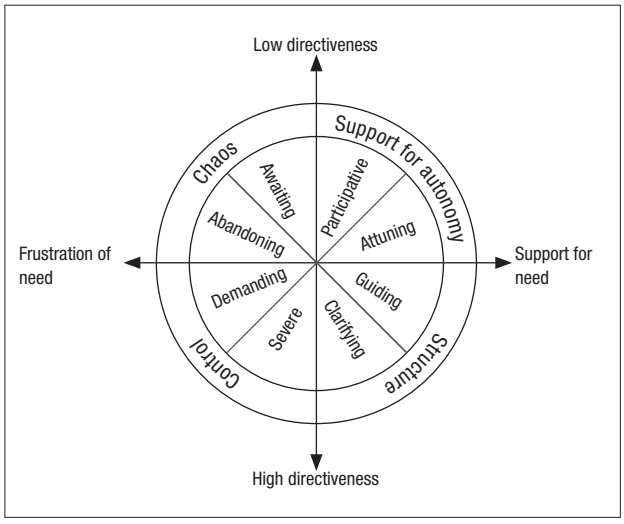
Society considers health as a fundamental right and a prime objective (World Health Organisation, 2022). However, current reports warn of the prevalence of a low rate of physical exercise in adolescents, drawing the attention of educators to the increased risk of chronic diseases associated with metabolic syndrome, which will limit the potential for improvement in the quality of life of those affected (Dallmeyer et al., 2020). Several studies point to the importance of generating healthy habits during childhood and adolescence, as these are crucial developmental stages for establishing routines and behaviours throughout adulthood (Jester et al., 2018; Knafel et al., 2023; Taylor et al., 2010).

Physical Education (PE), due to its presence in the basic education curriculum (6-16 years), with an appropriate pedagogical approach, can play a decisive role in promoting physical exercise and creating healthy habits, helping to increase levels of practice and adopting an active lifestyle (World Health Organization, 2022). Recent studies confirm that motivation in PE is of utmost importance for increasing the likelihood of remaining active and promoting healthy lifestyles (Bechter et al., 2019), especially when the practice is enjoyable (Fin et al., 2019). It has been shown that the perception of a positive classroom environment stimulates student participation in activities and that this involvement is increased when the teacher adopts a motivational facilitating style (Chacón Cuberos et al., 2018; Reeve et al, 2014), improving the results and quality of learning (Reeve & Shin, 2020) towards a more adaptive and functional direction (Vasconcellos et al., 2020), in line with competence-based learning, in which meaningfulness, autonomy, and reflection are the pillars for the development of key competencies.

Although student motivation depends on multiple factors, interpersonal interaction and the behaviour displayed by the teacher to motivate their students (motivational style) are fundamental in order to foster positive experiences (Diloy-Peña et al., 2021), proactivity, and engagement in practice. Self-Determination Theory (SDT) (Ryan & Deci, 2017, 2020) evidences that student motivation improves when the teacher's motivational style addresses basic psychological needs (BPNs) (competence, autonomy, and relatedness) (Franco et al., 2023; Moreno-Murcia & Huéscar, 2019; Vansteenkiste et al., 2020), uses supportive messages to the student, and is empathetic in class (Zhang, 2022), as it creates a positive learning climate (Reeve & Shin, 2020), in which students are more involved in tasks (Cents-Boonstra et al., 2022), improve their academic performance, and show greater vitality (Santana-Monagas et al., 2022).

Teacher motivational style has been interpreted on a continuum ranging from a controlling approach (CA) to autonomy support (AS) (Reeve, 2016). The CA is characterised by frustrating BPNs, as a cold or chaotic environment predominates, employing authoritarian language and pressuring the student to act according to their criteria, encouraging their participation with extrinsic incentives (Moreno-Murcia et al., 2018; Vasconcellos et al., 2020). The AS style is identified as meeting the BPNs, as a structured environment prevails, fostering student confidence and security, giving them greater responsibility for decision making. In this regard, Fin et al. (2019) showed that autonomy support in PE resulted in a positive motivational orientation in the learner, generated greater enjoyment, and promoted greater involvement in activities at the situational level. Consequently, according to the Hierarchical Model of Motivation (Vallerand, 1997), to the extent that such experiences are prolonged over time, they can have a stable impact on their personality at the contextual level (school environment), so that it will be easier to adopt an active and healthy lifestyle at the global level (living environment) (Vallerand & Lalande, 2011). In further study of teacher motivational style, Aelterman et al. (2019) proposed a model around a circumplex approach, which presents four major styles (Autonomy Support, Structure, Control, and Chaos) organised in a circular structure, across two dimensions (Figure 1). The vertical axis, which positions the styles according to the degree of directiveness and the horizontal axis, which confronts them according to the frustration or satisfaction of the BPNs.

Figure 1
Representation of the different interpersonal styles in the Circumflex Model (Aelterman et al., 2019).



This approach establishes a total of eight sub-dimensions, associated in pairs (adjacent) to each of the motivational styles, whose relationships are specified in Table 1.

Table 1
Description of the four styles and eight sub-dimensions based on Aelterman et al. (2019).

Style	Definition	Subdimension	Description
Support for autonomy	The teacher seeks to identify and promote the interests, opinions and feelings of the students, so that they can voluntarily become involved in the activities.	Participative	The teacher identifies students' personal interests through dialogue, inviting them to provide ideas and suggestions. In addition, where possible, the teacher tries to offer alternative ways of solving activities so that they can develop at an optimal pace.
		Attuning	The teacher tries to make the exercises more attractive and interesting for the students, trying to understand their perspective.
Structure	Taking into account the students' abilities, the teacher provides help and assistance so that they feel competent to master the skills.	Guiding	The teacher seeks the progress of students, providing help and assistance as and when needed. The teacher provides hints so that students can continue independently and complete the task, questioning the teacher if necessary.
		Clarifying	The teacher communicates their expectations of students in a clear and transparent way and assesses against said expectations.
Control	The teacher imposes their own rules, forcing the student to think and act in a certain way, regardless of what they think.	Severe	The teacher demands discipline through an imposing vocabulary, marks the students' obligations, does not tolerate contradictions and threatens sanctions if they do not comply with the rules.
		Dominant	The teacher exercises some power over the students to make them comply with the rules. They also repress students by making them feel ashamed, guilty and anxious.
Chaos	The teacher leaves the students to act on their own, making the teaching process confusing for them, in which they would not know what to do, how to behave or how to develop their skills.	Abandoning	The teacher lets the students off the hook by allowing them to do whatever they want.
		Awaiting	The teacher provides a motivational climate called *laissez-faire* where the initiative lies with the students. The teacher tends to wait and see how things unfold, not planning too much and letting things take their course.

The circumflex model proposes to shift the traditional categorisation between motivating and demotivating teachers towards a holistic approach, aimed at better understanding the styles deployed in a classroom situation, in order to more accurately interpret their consequences (Aelterman et al., 2019), establishing two main behavioural patterns, those of an adaptive nature, represented by styles that encourage participation and guide students during their learning, and those that are non-adaptive, represented by dominant, intransigent and chaotic styles, linked to passivity during instruction and student abandonment in the development of the activity (Escriva-Boulley, Haerens, et al., 2021; Burgueño et al., 2023).

The focus on the directiveness and satisfaction binomial of BPNs for the study of teacher motivational style is attracting interest in the literature and several studies have recently appeared in different contexts (Aelterman et al., 2019; Cohen et al., 2022; Delrue et al., 2019; Escriva-Boulley, Haerens, et al., 2021; Gordeva & Sychev, 2021; Franco et al., 2023; Moè et al., 2022; Vermote et al., 2020). However, to date there is little evidence linking the motivational styles of the PE teacher to the degree of student-perceived directiveness and confirming these patterns with student perceptions. Thus, this study had two main objectives. The first was to check whether there was a relationship between styles and substyles or subdimensions. The second was to test whether the theoretical relationship between the styles shown in the literature coincided with the students' perception in terms of directiveness. Based on the findings shown in previous studies, it was expected that there was a positive and significant relationship between AS motivational styles, because they satisfy BPNs, and a negative and significant relationship with Chaos and Control styles, because they frustrate them (Hypothesis 1). Directiveness was also predicted to be positively and significantly affected by the Control style and negatively by the AS style, while a Structure style was predicted to be more related to Directivity (Hypothesis 2). According to the approach, it was anticipated that Chaos would have no relationship with Directiveness, while the Control style would have a close relationship with Directivity (Hypothesis 3). Finally, the investigators expected to obtain a positive and significant relationship between each subdimension with the corresponding teaching styles and their adjacencies, the latter being smaller and even negative as they move along the axes of the model (Aelterman et al., 2019; Delrue et al., 2019; Vermote et al., 2020) (Hypothesis 4).

Method

Research design

This study responded to a correlational-causal, cross-sectional design, with a quantitative method of data collection. Thus, by means of self-reporting, the variables were measured on an *ad hoc* basis and their possible relationships were analysed, without manipulation or a differentiated methodological intervention.

Non-probability sampling was carried out by convenience and was conditional on access to the sample. The established inclusion criteria were: 1) being enrolled in the participating school during the academic year, and 2) currently studying PE as a subject. A total of 38 students were excluded as they fulfilled one of the following exclusion criteria: a) irregular attendance to PE class (< 80% of the sessions); b) failure to complete the questionnaires, and c) failure to sign the informed consent form. This research was approved by the Ethics Committee of the Miguel Hernández University of Elche (DPS.JMM.01.17).

Participants

The sample consisted of a total of 500 students (291 girls and 207 boys) from various secondary schools in different Spanish provinces, aged between 13 and 17 (M = 14.02; SD = 1.52). Of the total sample, 153 students belonged to 1st ESO (mandatory secondary education), 127 students to 2nd ESO, 154 students to 3rd ESO and 66 students to 4th ESO. In general, the socio-economic level of the participants was heterogeneous. Some schools were categorised as low or lower-middle class because of families who were unemployed or had limited financial resources, while other schools were medium or upper-middle because the families were employed workers, small-business self-employees, and civil servants.

Resources

Situations-in-School (SIS) Questionnaire (Aelterman et al., 2019). This 60-item questionnaire determines the interpersonal style used by the teacher, looking at how they act in 15 possible scenarios that occur in PE. In turn, four ways of behaving are presented for each of these situations (one for each teaching style: autonomy support, structure, control, and chaos), thus encompassing a total of 60 responses when completing the questionnaire (e.g., "When presenting the rules in class... AS - the teacher invites us students to have a say in the rules, so that they help us feel comfortable in class; ES - the teacher announces his expectations to start cooperating with us; CO - the teacher tells us students that we must follow them all as he says, even warning us that there will be sanctions if we break them; CA - the teacher does not care about the rules or our opinions at all"). Following Muñiz et al. (2013), the translation of the scale into Spanish was carried out by means of a reverse translation of the items of the SIS questionnaire, transcribed first into Spanish and then into

English by an independent translator. It was measured on a Likert-type scale ranging from 1 (does not describe me at all) to 7 (describes me extremely well). In this study, Cronbach's alpha coefficient ranged from.82 < α < .88 and .66 < α < .87 for the four teaching models and the eight sub-dimensions, respectively.

Directiveness. The Psychologically Controlling Teaching (PCT) scale (Soenens et al., 2012) was used. This questionnaire measures the degree of Directiveness employed by teachers in PE and consists of seven items (e.g. "The teacher always wants to influence the behaviour or thinking of the students, even before we give our opinion"). The previous sentence was "In our PE classes...". The questionnaire was translated from English into Spanish. It was measured on a Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). A Cronbach's alpha coefficient of .76 was obtained. Confirmatory factor analysis found that the seven items were grouped into a single dimension. The standardised factor loadings (between .44 and .89) were all statistically significant ($p < .001$), so it can be concluded that the model performed satisfactorily at the analytical level. In addition, the overall results of the model indicated a satisfactory overall fit (x2 = 345.123; $p < .001$; x2/g.l. = 2.311; CFI = .971; IFI = .978; RMSEA = .041).

Procedure

Firstly, the schools were contacted through the PE department and the general objective of the study was explained, as well as the procedure to be followed. Data confidentiality was emphasised and permissions were arranged. Once the procedure was detailed and permissions accepted, data collection was carried out by means of questionnaires using Google Docs Questionnaires.

Analysis of results

First, descriptive statistics were calculated for each of the variables: means and standard deviations, as well as bivariate correlations. Next, in order to obtain certainty about the validity of the questionnaires, an internal consistency analysis of each factor was carried out by calculating Cronbach's alpha coefficient and a confirmatory factor analysis to check the validity of the construct of the scales. In addition, an attempt was made to identify different profiles on the perception of the motivational style of teaching. A hierarchical cluster analysis with Ward's method was performed with sample 1, using all interpersonal styles from the SIS questionnaire. Then, with the same variables, the investigators tried to confirm the profile solution found, using a K-means cluster analysis with sample 2. In addition, an analysis of variance (ANOVA) was performed. A hierarchical cluster analysis using the Ward method was then carried out on the entire sample. The statistical package SPSS Statistics 25 and AMOS 25 were used for the analysis.

Results

Descriptive analysis and bivariate correlation

Table 2 shows that, of the four dimensions of motivational style, it was the Structure style that had the highest mean ($M = 4.70$, $SD = 1.06$), followed by the AS style ($M = 4.15$, $SD = 1.15$) and the Control style ($M = 3.89$, $SD = 0.97$), while the lowest mean was for the Chaos style ($M = 2.98$, $SD = 0.99$). Regarding the pairwise sub-dimensions, the highest mean was for the Clarifying subdimension ($M = 4.72$, $SD = 1.05$), followed by Guiding ($M = 4.67$, $SD = 1.21$) and Attuning ($M = 4.46$, $SD = 1.25$), while the lowest was for the Awaiting subdimension ($M = 2.71$, $SD = 1.17$) followed by Abandoning ($M = 3.12$, $SD = = 1.07$). The dimensions of the scale correlated positively and significantly with each other, except for Chaos, which correlated negatively with AS and Structure. Control was not correlated with any dimension. A positive and significant relationship was found between the AS dimension and the Structure dimension ($r = .817$; $p < .01$), whereas with the Chaos dimension it was negative and significant (r = -.173; $p < .01$). The Chaos dimension was positively and significantly related to the Control dimension ($r = .527$; $p < .01$). The Structure dimension was negatively and significantly related to Chaos ($r = -.302$; $p < .01$).

Regarding the relationship between the different motivational styles and their corresponding subdimensions, it was observed that the AS and Structure dimensions were positively and significantly related to the Participative, Attuning, Guiding, and Clarifying subdimensions. At the same time, the Structure style was negatively and significantly related to the Directiveness subdimension. In the case of the Control and Chaos dimensions, a positive and significant relationship was observed with the sub-dimensions Domineering, Demanding, Abandoning, Awaiting, and Directiveness (Table 2).

Table 2
Descriptive analysis and bivariate correlations.

	M	*SD*	α	1	2	3	4	5	6	7	8	9	10	11	12	13
Dimensions																
01. Support for autonomy	4.15	1.15	.888	–												
02. Structure	4.70	1.06	.878	.817**	–											
03. Control	3.89	0.97	.825	.027	.068	–										
04. Chaos	2.98	0.99	.838	-.173**	-.302**	.527**	–									
Sub-dimensions																
05. Participative	3.54	1.24	.665	.847**	.621**	.125**	.070	–								
06. Attuning	4.46	1.25	.875	.965**	.823**	-.025	-.274**	.677**	–							
07. Guiding	4.67	1.21	.840	.820**	.952**	-.003	-.318**	.610**	.834**	–						
08. Clarifying	4.72	1.05	.713	.691**	.915**	.151**	-.237**	.544**	.687**	.748**	–					
09. Severe	4.03	1.08	.727	.016	.102*	.929**	.404**	.105*	-.030	.029	.184**	–				
10. Demanding	3.74	1.05	.688	.036	.015	.900**	.573**	.126**	-.013	-.039	.084	.674**	–			
11. Abandoning	3.12	1.07	.793	-.198**	-.297**	.552**	.948**	.033	-.291**	-.332**	-.207**	.423**	.602**	–		
12. Awaiting	2.71	1.17	.684	-.077	-.225**	.330**	.811**	.118**	-.165**	-.201**	-.223**	.254**	.358**	.581**	–	
13. Directiveness	2.30	0.89	.758	-.204**	-.455**	.429**	.489**	-.170*	-.201**	-.404**	-.457**	.298**	.487**	.482**	.347**	–

Note: *M* = Mean; *SD* = Standard Deviation; *p <.05; **p < .01.

Table 3
Means and standard deviations of the variables in each cluster for samples 1, 2 and total.

	Sample 1				Sample 2				Total sample			
	Cluster 1 (*n* = 169)		Cluster 2 (*n* = 81)		Cluster 1 (*n* = 175)		Cluster 2 (*n* = 75)		Cluster 1 (*n* = 344)		Cluster 2 (*n* = 156)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Dimensions												
Support for autonomy	3.56	1.04	4.90	0.69	3.53	0.92	5.10	0.80	3.55	0.99	5.00	0.75
Structure	4.42	0.82	5.78	0.49	4.02	0.87	5.73	0.57	4.22	0.87	5.76	0.53
Control	4.11	1.02	3.51	1.01	3.91	0.89	3.67	0.85	4.01	0.96	3.59	0.94
Chaos	3.28	0.98	2.20	0.54	3.21	0.91	2.14	0.66	3.25	0.95	2.17	0.60
Sub-dimensions												
Participative	3.19	1.28	4.18	0.96	3.15	1.04	4.51	0.99	3.17	1.17	4.34	0.98
Attuning	3.92	1.02	5.62	0.71	3.91	1.05	5.68	0.78	3.92	1.04	5.65	0.74
Guiding	4.29	1.02	5.88	0.63	3.97	0.93	5.86	0.67	4.13	0.99	5.87	0.65
Clarifying	4.55	0.85	5.96	0.54	4.07	0.97	5.60	0.60	4.31	0.95	5.65	0.57
Severe	4.22	1.11	3.71	1.20	4.03	0.99	3.93	1.01	4.12	1.05	3.81	1.12
Demanding	4.00	1.10	3.31	1.04	3.80	0.96	3.42	0.89	3.91	1.04	3.36	0.97
Abandoning	3.50	1.06	2.36	0.64	3.45	0.93	2.28	0.83	3.48	1.00	2.32	0.74
Awaiting	3.06	1.21	2.03	0.79	2.98	1.13	2.00	0.79	3.02	1.18	2.02	0.79

Note: *M* = Mean; *SD* = Standard Deviation.

Cluster analysis

For the cluster analysis, the phases proposed by Hair et al. (1998) were followed. First, the total sample of 500 students was randomly divided into sample 1 (n = 250; 107 males and 140 females; M = 1.33; SD = 0.469) and sample 2 (n = 250; 99 males and 151 females; M = 1.30; SD = 0.459). Second, the univariate distribution of all pooled variables was examined for normality.

To determine the group profiles on the perception of teacher motivational style in sample 1, a hierarchical cluster analysis was performed using the Ward method. The obtained dendrogram suggested the existence of two groups (Table 3; Figure 2).

In order to confirm the adequacy of the groups that emerged, it was decided to take the increase in the agglomeration coefficients as a reference. According to Norusis (1992), small coefficients indicate high homogeneity among cluster members while, on the contrary, large coefficients show differences among cluster members. Two distinct profiles appeared (Figure 2): a dominant profile (cluster 1), with mean scores on the perception of the teacher's motivational style (between 3 and 4.55) in all sub-dimensions; and an adaptive profile (cluster 2), with high scores in the sub-dimensions belonging to the AS and Structure styles (4.90 and 5.78, respectively), and medium scores in the subdimensions Domineering and Demanding (3.71 and 3.31, respectively), characteristic of the Control style, and low scores in the subdimensions Abandoning and Awaiting (2.36 and 2.03, respectively), characteristic of the Chaos style.

Figure 2
Hierarchical cluster analysis with Ward method in sample 1.

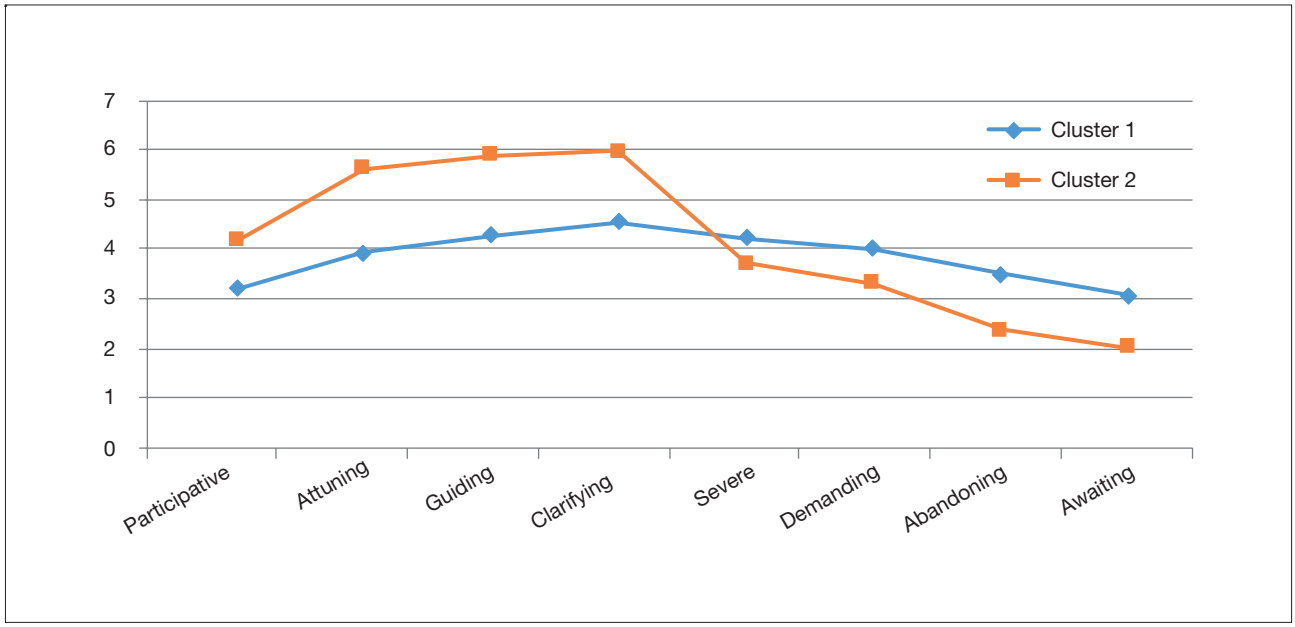
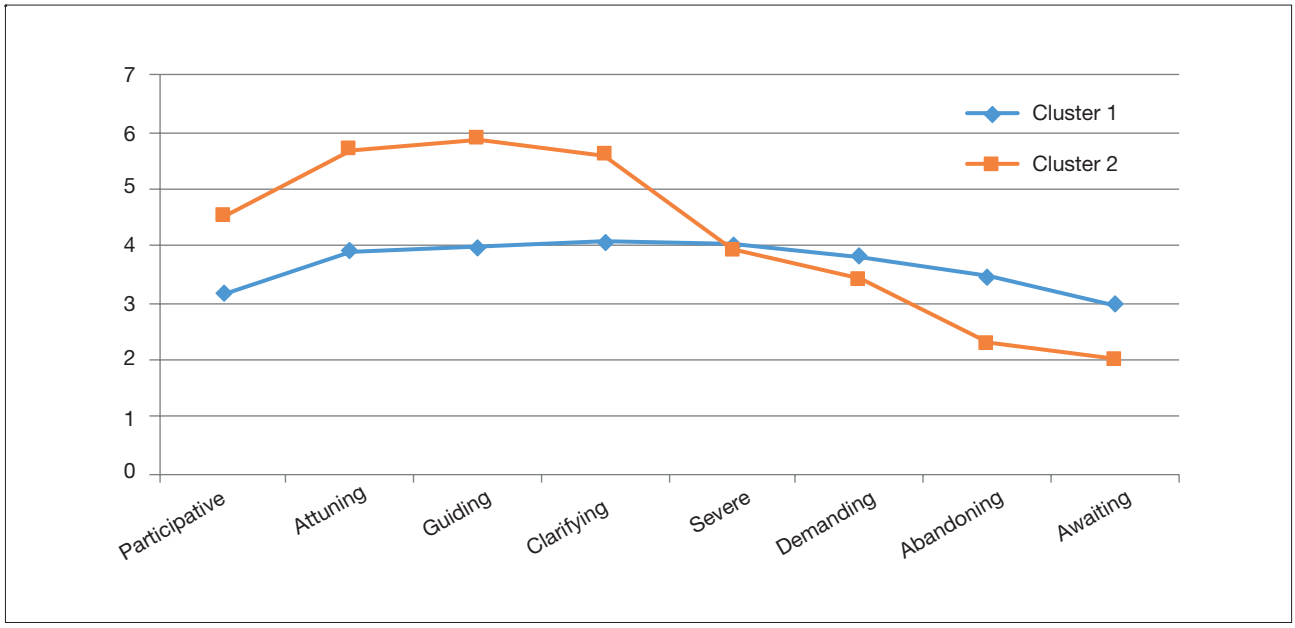
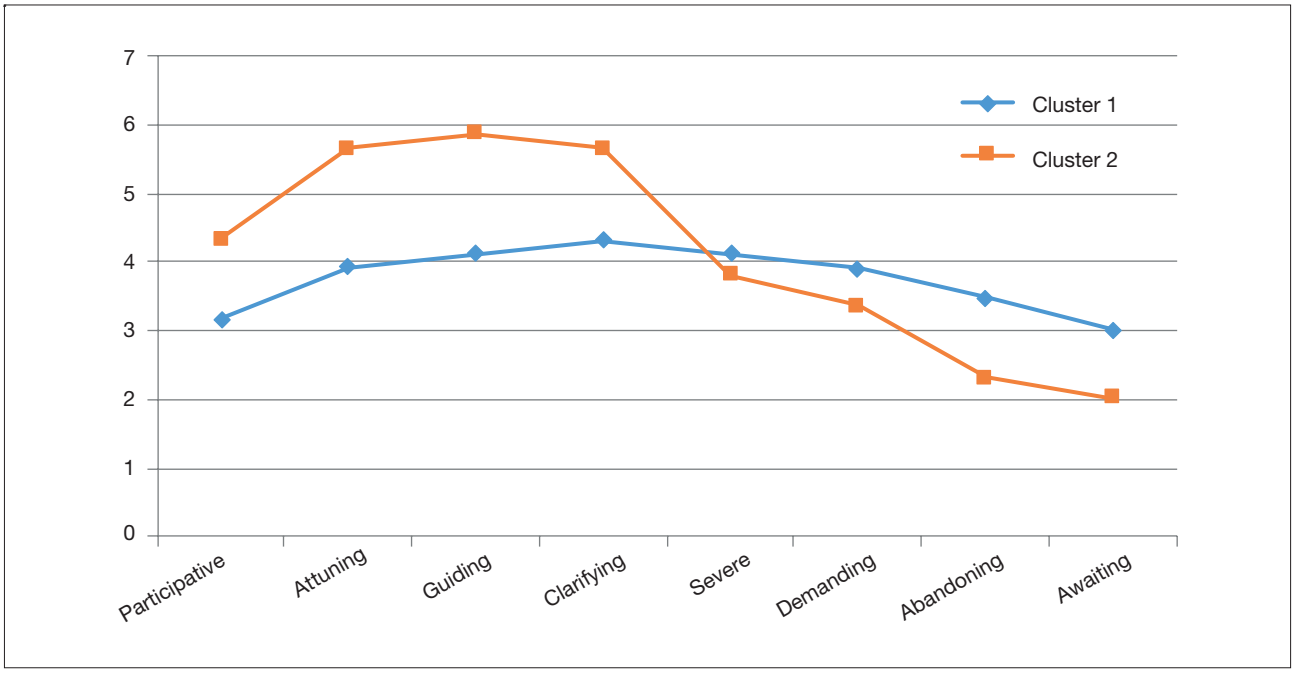


Figure 3
Cluster analysis of K-means in sample 2.



To determine the group profiles in sample 2, the k-means test was used, also determining two profiles on the perception of teacher motivational style (Table 3; Figure 3): a dominant profile (cluster 1), with average scores on the perception of teacher motivational style in all sub-dimensions (between 3.15 and 4.07); and an adaptive profile (cluster 2), with high scores on the perception of teacher motivational style in the sub-dimensions: Participative, Attuning, Guiding, and Clarifying (4.51, 5.68, 5.86 and 5.60, respectively), belonging to the AS and Structure styles, medium scores in the subdimensions Domineering and Demanding (3.93 and 3.42), belonging to Control, and low scores in the Abandoning and Awaiting subdimensions (2.28 and 2.00), included in the interpersonal style Chaos.

Figure 4
Hierarchical cluster analysis with Ward method on the total sample.



Next, a hierarchical cluster analysis using the Ward method was carried out with the whole sample, again obtaining two profiles (Table 3; Figure 4): a dominant profile (cluster 1) with mean scores on the perception of the teacher motivational style in all subdimensions (between 3.02 and 4.31); and an adaptive profile (cluster 2), with high scores on the subdimensions belonging to the AS and Structure interpersonal styles (5.00 and 5.76), and medium scores on the subdimensions Domineering and Demanding (3.81 and 3.36), belonging to the Control style, and low scores on the Abandoning and Awaiting subdimensions (2.32 and 2.02), belonging to the interpersonal style Chaos.

Multivariate analysis

To examine the characteristics of each profile in relation to Directiveness, an analysis of variance was performed on the total sample. For this purpose, clusters were used as the independent variable and Directiveness as the dependent variable. The results obtained showed differences (Wilk's $\Lambda = .80$, $F = 21.16$, $p < .001$) in favour of the dominant profile 1 ($M = 2.63$; $SD = 0.95$) versus the adaptive profile ($M = 1.83$; $SD = 0.51$), as shown by the data (F (1,500) = 42.30, $p < .001$, $\eta^2 = .19$).

Discussion

First, investigators hypothesised (H1) a positive and significant relationship between the motivational styles of AS and Structure, and a negative and significant relationship with the styles of Chaos and Control. AS and Structure style correlated highly, positively and significantly but only negatively with Chaos style (Control style did not correlate with either AS or Structured). H1 can therefore only be accepted in part.

Secondly, Directiveness was expected to be negatively predicted by the AS style and positively predicted by the Control style. Cluster analysis revealed the existence of two profiles of perceptions of teacher motivational style and Directiveness. On the one hand, a dominant profile, which showed consistent average scores on all sub-dimensions and was positively associated with Teacher Directiveness; and an adaptive profile, which showed high scores on the sub-dimensions pertaining to the motivational styles of AS and Structure. Medium scores were also observed in the sub-dimensions Domineering and Demanding, typical of the Control style, and low scores in the Abandoning and Awaiting subdimensions, typical of the Chaos style. Therefore, the study confirmed that students who experience teacher interaction from an adaptive profile and show high scores on the interpersonal style of AS perceived less Directiveness during lessons. Previous studies partly concur with these findings, as most of the controlling or structuring teaching strategies were at the high end of Directiveness, while AS and chaos strategies were at the low end (Escriva-Boulley, Guillet-Descas, et al., 2021). On the other hand, the results obtained show two well-differentiated profiles coinciding with the theoretical model on the vertical axis, where Directiveness has a negative relationship with AS and a positive relationship with Control. However, a negative

relationship with Structure and a positive relationship with Chaos is envisaged, so that the assumptions postulated by the model are not fully met. This may be due to the fact that students who perceive greater structuring in the sessions do not relate it to Directiveness, but rather it is perceived as an aid or facilitator to learning. They may also relate Chaos to Directivity due to some PE teachers not structuring their classes well, not giving AS to their learners, but improvising and perceived as Chaos where Directiveness and malpractice are used to regain classroom management (Haerens et al., 2016; Reeve, 2016). As in previous studies (Chacón Cubero et al., 2018), a high relationship was found between styles that tend towards BPN satisfaction and their adjacencies and a low relationship with those that tend towards frustration of BPNs, while a high relationship of each style with its adjacencies was also found. However, it was expected that the interpersonal style "Structure" would be positively related to Directiveness and this was not the case, leading to the partial rejection of H2.

Thirdly, a positive and significant relationship was expected between each subdimension and its corresponding teaching style, as well as with its adjacencies, the latter being smaller and even negative as the styles move along the axes of the model. The results showed that the AS style correlated most strongly with the Participative and Attuning subdimensions, the Structure style with Guiding and Clarifying, the Control style with Domineering and Demanding, and the Chaos style with Abandoning and Awaiting. Similarly, the relationship between the subdimensions and their adjacencies, as they moved along the axes (e.g., Participative-Awaiting or Clarifying-Domineering), was also true. However, although the relationship between the adjacent styles was intuited, as they are characterised by the same degree of Directiveness, low or high (AS-Chaos and Control-Structure), or by tending to satisfy or frustrate BPNs (AS-Structure and Chaos-Control) in the same intensity, the results were not so clear. This may be due to how the styles are perceived among students. That is, a learner might perceive that one style is both participative and dominant; or that, even if they are totally opposite styles, they share some characteristics that make them related, since at a theoretical level they interact throughout the model. This different perception could be mediated by other aspects that influence motivation towards PE (Taylor et al., 2010) such as gender, age and motor skills, preferences and perceived competence. Previous studies have shown that female students tend to have lower motivation in PE or different perceptions of motivational climate (Pérez-González et al., 2019), which could be related to differences in physical activity and sport preferences, as well as perceptions of competence (Corr et al., 2019; Smith et al., 2015). It has been found that younger students tend to be more motivated in PE classes than older students, which could be related to changes in the perception of the importance of physical activity and interest in other extracurricular activities, and that the higher the level of motor skills, the higher the motivation in PE classes, as they perceive greater competence in the proposed activities. Therefore, PE teachers should design activities that allow all students to experience success and develop their skills, regardless of their initial level of competence, thus accepting H3.

Fourthly and finally, an interpersonal AS style was expected to be less related to Directiveness, while a Structure style was expected to be more related to Directivity. Thus, it was anticipated that Chaos would have no relationship with Directiveness, while the Control style would have a close relationship. The results showed that the AS style correlated low and negatively with Directiveness, but to a lesser extent than the Structure style. Chaos was related to Directiveness to a greater extent than the Control style, which was also positively and significantly related to Directiveness. H4 was therefore rejected.

Conclusion

The present study has shown the relationship between the different motivational styles employed by PE teachers and the Directiveness perceived by students. Within the axis structure proposed by the circumflex model, there is a positive relationship between the styles closest to each other and between these and their sub-styles. In addition, according to the student's perception, two motivational profiles are obtained. The so-called adaptive one, far from the rigid and authoritarian behavioural pattern, and the dominant one, closer to it. Therefore, this work represents a starting point in the use of predictive scales on (de)motivational styles in the context of PE in Spain. The results provide information for a better understanding of the nature of factors related to quality motivation and support for BPNs in the PE classroom, allowing for a more accurate and effective readjustment of the teaching intervention. The findings of the study may help teachers to apply a positive motivational style more effectively and to understand more rigorously the effects that the use of a certain style can have on student motivation, so that they can gradually transform their intervention towards an adaptive and self-regulated behavioural pattern. At a practical level, the results allow us to link the use of specific strategies (Huéscar et al., 2022; Moreno-Murcia & Barrachina, 2023) to the development of a

quality motivational climate in the classroom (e.g, involving students in the design of tasks makes them more attractive and stimulating, giving them a degree of responsibility increases their involvement in learning, taking into account students' opinions and interests promotes greater engagement and stimulates social affiliation, setting tasks with different levels of difficulty fosters the perception of effectiveness and generates a greater intention to be physically active and thus encourages attitudes towards adherence to practice, explaining the objectives and usefulness of tasks gives functionality and meaningfulness to learning, and monitoring students' progress by giving them feedback ensures deep learning by helping them to reflect on their progress and better understand their actions. Consequently, applying the strategies of the adaptive profile will minimise the use and effects of the dominant controlling profile (imposing, closed, threatening and not empathising with the students' interests) and chaotic profile (disorganised, improvising, with imprecise, contradictory or decontextualised instructions, and teaching intervention will serve to reduce passivity and situational apathy (in class), by offering positive experiences associated with physical activity, which can reverse the premature abandonment of physical activity at a global level.

With this purpose on the part of teachers, on the one hand, it is expected that the interests of PE students will be identified in order to propose more attractive tasks and thus encourage participation, since taking into account the opinions of students leads to greater commitment (Cheon et al., 2012) and even the intention to be physically active (Moreno-Murcia & Sánchez-Latorre, 2016) as a fundamental objective of PE. On the other hand, the Structure style does not have to be related to Directiveness, so the teacher will seek to develop the task by providing help (when necessary) and will inform them of the objectives expected of them in the task, class or course. In order to avoid control or chaos styles on the part of the PE teacher, one should avoid imposing one's own incomprehensible rules on students, using arrogant or threatening vocabulary, avoiding an authoritarian and dominant climate (without tolerating contradictions and repressing students) and, finally, avoiding passive and idle attitudes that show the teacher's lack of interest in his/her profession and responsibility.

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How does a change of coach affect the physical performance of football players?

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Two alpinists climbing a snowy mountain in the Arctic under the northern lights. Adobestock ®Urdialex

Abstract

The present study analysed the conditional manifestation of a semi-professional football team when it underwent a change of coach. The results showed external load data extracted from global positioning devices (GPS) in two periods of the season—regular league and permanence phase—, where it could be observed that the change of coach affected the physical performance of the team, as it was significantly higher in HSR Rel Dist (m) ($t_{348.26}$ = 2.72; p =.007; d = .27), HSR Rel Count ($t_{352.85}$ = 2.72; p = .007; d = .27), Sprints REL ($t_{260.9}$ = 2.12; p = .003; d = .28), HMLD (m/min) ($t_{156.69}$ = 7.07; p < .001; d = .74) and > 24 m/min (t_{354} = 2.16; p = .031; d = .23) with the first coach's work methodology. However, in the variables Distance (m) ($t_{186.65}$ = 2.5; p = .013; d = .29) and Player Load ($t_{188.94}$ = 2.63; p = .015; d = .29), higher values were obtained with the new coach. There was, therefore, no relevant variation and improvement in the data with the new coach, indicating that a team's performance was due to multiple factors and that more running did not guarantee a higher collective performance in terms of scoring success.

Keywords: change of coach, conditional demands, GPS, physical performance.

Introduction

Achieving performance in team sports is a complex process that depends on different variables (Del Coso et al., 2020; Gómez et al., 2019). These factors can be intrinsic (technical-tactical aspects, physical, psychological, and social domains), contextual (playing at home), or extrinsic, such as contractual situations (Del Coso et al., 2020; Pappalardo & Cintia, 2018). This set of areas must be coordinated in order to achieve the highest possible performance and the coach is the figure responsible for the performance of the team (Grusky, 1963), being decisive and influential in the development of these areas (Flepp & Franck, 2021).

The role of the coach is crucial for good sport performance, but it presents high job insecurity (Bentzen et al., 2020; Tozetto et al., 2019). This is mainly due to the fact that their performance is constantly evaluated, both by the managers of the different clubs and by the fans themselves (Semmelroth, 2021). Moreover, it often depends on the achievement of victories, titles, or the ability to perform in line with the club's stated objectives, so that the result is one of the most influential factors in the evaluation of coaches and decision-making by club officials (Tozetto et al., 2019).

One of the most frequent decisions taken by managers when the expected results are not achieved is to change the coach (Flepp & Franck, 2021). This change is made with the aim of reversing the team's situation, seeking to achieve a greater number of points and improve performance in the short term (Lago-Peñas, 2011). This phenomenon could occur over the next 5 (Lago-Peñas, 2007) or 10 days (Gómez et al., 2021), decreasing the number of points obtained from these days onwards (Balduck et al., 2010; Hughes et al., 2010; Lago-Peñas, 2007).

According to Balduck and Buelens (2007), the new coach would need a period of more than one month to change, develop, implement, or rebuild the team's game, equivalent to more than 4 or 5 matches. This period of work would coincide with the increase in points obtained by the team (Lago-Peñas, 2011) and, from these weeks onwards, the ability of the new coach could be the most important variable for the improvement of these results (Lago-Peñas, 2007). Similarly, variables such as the coach's experience (Balduck & Buelens, 2007; Gómez et al., 2021), the team's budget (Gómez et al., 2021), whether the coach was an elite player or a rookie in the competition did not show a significant improvement in the teams' results, although an improvement in the points recorded by the teams after the change of coach was detected (Gómez et al., 2021).

Although changing coach is commonplace, there is a lot of controversy about whether or not this "winner effect" exists. Several authors have highlighted in their research that changing coaches did not show improvements in team performance afterwards (Anderson & Sally, 2013; Balduck & Buelens, 2007; De Paola & Scoppa, 2012; Heuer et al., 2011; Ter Weel, 2011; Van Ours & Van Tuijl, 2016). As can be seen, team performance in relation to points scored has been a concurrent and disparate theme in studies supporting both sides. Despite this, coaching changes continue to occur, influencing not only the psychological or social aspects of the players but also the style of play and the physical conditioning of the team, an area where fewer studies have been carried out.

We found studies that report that coaches have little influence on the physical aspect of the teams (Heuer et al., 2011). Guerrero-Calderón et al. (2021) concluded that players show more high intensity values with the previous coach than with the entry of the new coach in training, while the rest of the training values and match records showed no differences in relation to the change of coach. They indicated that the differences in training could be explained by the use of different tasks (wide vs. small spaces) or by the pursuit of a different style of play.

However, we also find authors highlighting significant differences in these coach changes. Castellano and Casamichana (2016) observed differences in team behaviour in different coaching changes with the same players. Radzimińskiet al. (2022) noted an increase in total distance, distance per minute, high speed distance (19.8-25.1$^{km \cdot h^{-1}}$) and sprint distance (> 25.2$^{km \cdot h^{-1}}$) with the addition of the new coach, noting that its duration was limited to around 5 matches, losing out in the comparison when 10 matches were used. Even in other team sports it has been pointed out that the change of coach could generate different external and internal load demands, as it is common that different strategies are adopted to achieve the expected performance (Salazar et al., 2020).

Due to the lack of information in the literature on the influence of a change of coach on the physical performance of a football team, the aim of this study was to analyse whether there were differences in the physical performance of a team when there was a change of coach, both at a general level and by playing positions, in order to provide new information on this fact, which has been little studied from the perspective of physical performance.

Materials and methods

Experimental approach to the problem

The work was carried out within the framework of the research project: "Factors that determine sports performance in high competition" by the Technical University of Madrid (UPM) and the National Institute of Sports, Physical Education and Recreation (INDER), Provincial Directorate of Sports "Pinar del Río", Republic of Cuba. Resolution 10012023-DPD-m-Pinar del Río. Centre for the Study of Sports Training in High Performance Sports (CEEDAR).

A descriptive analysis of the physical activities performed by semi-professional football players was carried out using physical performance data from a semi-professional football team. The team played in Spain's 2nd division B. Each participant gave their consent and the ethical committee was approved in the project "Psychological factors and physical activity in the resident population in Spain" of the Sports Laboratory, at the Faculty of Physical Activity and Sport Sciences - INEF, on 7 May 2020, and currently in force. The choice of the club was based on access to GPS data collection over a full season. In order to carry out the research, three phases of the 2020/2021 season were analysed, divided as follows: the first phase covered matchday 1 to 8, the second phase covered matchdays 9 to 17 and the third phase included the data corresponding to matchdays 19 to 26. The choice and division of these league matchdays was due to the lack of data corresponding to the 18th matchday, therefore, the rest of the matchdays were divided in such a way that they had the same number of matchdays played. The first phase and the second phase referred to matches played with the coach in the regular season, while the third phase were matches played with the incorporation of a new coach and coaching staff, after the dismissal of the previous coach for the relegation play-offs in accordance with the new RFEF regulations. Teams would form a new group based on their regular season standings against teams they had not faced before. The position in the group determined promotion and relegation. On the other hand, the data were taken according to the position of the players: centre backs (CB), full backs (FB), midfielders (MF), wingers (WG) and forwards (ST).

Data collection and analysis

The collection of the physical data related to the external load of the players in the official matches was carried out using an inertial device (wireless inertial measurement unit, WIMU) called WIMU^{PROTM} (RealTrack Systems, Almería, Spain), which integrates different sensors (four accelerometers, a gyroscope, a magnetometer, GNSS, UWB, among others) (Giménez et al., 2020). The device recorded data pertaining to the accelerometer, gyroscope, and magnetometer at a sampling rate of 100 Hz, while data pertaining to the location (GNSS) were recorded at 10 Hz. The reliability and validity of this device has been evaluated for the analysis of positioning variables by GNSS (Muñoz-Lopez et al., 2017) and UWB (Bastida Castillo et al., 2018), and good results were obtained at a sampling frequency of 5 Hz and 20 Hz, respectively. For the purposes of this study, data were recorded on the device's built-in eight GB internal memory. To attach the device to the players, the device was inserted into a specific harness designed to be attached to each player. The variables are shown in Table 1.

Table 1
Description of the variables analysed in the study.

Variables	Definition
Distance (m)	Total distance travelled in metres
Dist (m/min)	Total distance travelled per minute
Explosive Dist (m)	Total distance travelled with an acceleration of greater than 1.12$^{m/s2}$
Explosive Dist (m/min)	Explosive distance in metres per minute
HSR Rel Dist (m)	High speed running relative is the distance travelled at speeds above the player's threshold (at 75.5% of maximum speed)
HSR Rel (m/min)	High speed running relative in metres per minute
HSR Rel Count	Number of times (counter) that the player has run at a speed above his HSR Rel threshold.
HSR Abs Dist (m)	High speed running absolute is the distance travelled at speeds above 21 km/h.
HSR Abs (m/min)	High speed running absolute in metres per minute.
HSR Abs Count	Number of times (counter) that the player has run at a speed above their HSR threshold Abs
Diff ACC DEC	Difference between accelerations and decelerations with value higher than 3$^{m/s2}$

Caption: Dist: distance; HSR: high sprint running; rel: relative; abs: abdolute; Dif: difference; ACC: accelerations; DCC: decelerations; HMLD: HMLD: High metabolic load distance, DSL: Dynamic stress load

Table 1 (Continued)
Description of the variables analysed in the study.

Variables	Definition
Sprint Abs (m)	Distance travelled above the absolute sprint speed threshold (24 km/h)
ABS Sprints	Number of sprints above the absolute sprint speed threshold
SprintsREL	Number of sprints above the relative sprint speed threshold
MAX Speed (km/h)	Maximum speed achieved
Sprints (min)	Number of sprints per minute
Step Balance	Percentage of decompensation between right and left step intensity. A negative result indicates that the dominant leg is the right leg
Player Load	Displays the accumulation of motion in the accelerometers
Player Load (min)	Player load per minute rate value
HMLD (m)	High metabolic load distance is the distance travelled by a player when his metabolic power is above 25.5 W/kg
HMLD count	Number of times the player has been at a metabolic power higher than 25.5 W/kg
HMLD (m/min)	HMLD value per minute
DSL	Dynamic stress load, number of impacts weighted above 2G
DSL (min)	DSL value per minute
> 24 (m/min)	Running at a speed of more than 24 km/h in metres per minute

Caption: Dist: distance; HSR: high sprint running; rel: relative; abs: abdolute; Dif: difference; ACC: accelerations; DCC: decelerations; HMLD: HMLD: High metabolic load distance, DSL: Dynamic stress load

Analysis of results

Data analysis was performed with IBM SPSS version 25.0 for Windows (IBM Corporation, Armonk, NY, USA). The assumption of normality was tested using the Kolmogorov-Smirnov test and the assumption of equality of variances was tested using the Levene test. For the analysis of the effect of season phase and player position on each of the physical variables, 1-factor inter-subject ANOVAs were performed. Tukey was applied as a *post hoc* test. The Student's t-test for related samples was used to compare the change of coach and physical variables. The effect size was calculated using Cohen's *d* and was interpreted as: trivial 0.2; small = 0.01; moderate = 0.6-1.2; large = 1.2-2.0; very large = 2.0- 4.0; and extremely large 4.0 (Batterham & Hopkins, 2006; Hopkins et al., 2009). Results are expressed as mean ± standard deviation (M ± SD) and the level of statistical significance is set at $\alpha = 0.05$.

Results

The physical performance of the players with respect to the change of coach obtained significantly better data with the previous coach. Data were significantly higher in HSR Rel Dist (m) ($t_{348.26} = 2.72$; $p = .007$; $d = .27$), HSR Rel Count ($t_{352.85} = 2.72$; $p = .007$; $d = .27$), Sprints REL ($t_{260.9} = 2.12$; $p = .003$; $d = .28$), HMLD(m/min) ($t_{156.69} = 7.07$; $p < .001$; $d = .74$) and > 24 m/min ($t_{354} = 2.16$; $p = .031$; $d = .23$), as can be seen in Table 2. However, in the variables Distance (m) ($t_{186.65} = 2.5$; $p = .013$; $d = .29$) and Player Load ($t_{188.94} = 2.63$; $p = .015$; $d = .29$), higher values were obtained with the new coach.

In the analysis of the physical variables analysed as a function of the third of the season, significant differences were observed in variables such as Distance (m) ($F_{2,297} = 3.74$; $p = .25$), with these values being higher in the third third compared to the second ($p = .027$), and in Explosive Dist (m/min) ($F_{2,338} = 11.57$; $p < .001$), being the third period the one with the lowest number ($p <. 001$ in both comparisons), which can be seen in Table 3.

In the variables related to High Speed Running, significant differences were detected in HSR Rel Dist (m) ($F_{2,353} = 6.06$; $p = .003$), being favourable to the second period compared to the third ($p = .002$), and in HSR Rel Count ($F_{2,353} = 5.11$; $p = .006$), where a higher number of efforts were maintained in the second third relative to the third ($p = .004$).

Table 2
Comparison between coaches.

	Former coach			New coach				
	M		SD	M		SD	*p*	*d*
Distance (m)	7,169.55	±	3,270.49	8,255.89	±	4,070.13	.013	.29
Explosive Dist (m)	968.68	±	443.51	1,077.96	±	532.43	.580	.22
Explosive Dist (m/min)	14.96	±	2.11	14.7	±	8.68	.750	.04
HSR Rel Dist (m)	153.87	±	162.17	120.34	±	68.89	.007	.27
HSR Rel (m/min)	2.3	±	1.81	2.18	±	2.21	.568	.06
HSR Rel Count	8.29	±	9.04	6.4	±	4.04	.007	.27
HSR Abs Dist (m)	404.62	±	231.68	414.07	±	230.15	.719	.04
HSR Abs (m/min)	6.71	±	3.36	6.38	±	4.55	.439	.08
HSR Abs Count	21.93	±	12.42	22.27	±	12.81	.809	.03
Dist (m/min)	109.6	±	9.86	111.04	±	60.65	.800	.03
Diff ACC DEC	-13.1	±	12.54	-14.39	±	13.48	.376	.10
Sprint Abs (m)	172.87	±	121.34	176.57	±	117.73	.786	.03
ABS Sprints	9.04	±	6.02	9.32	±	6.47	.689	.04
REL Sprints	0.63	±	2.59	0.12	±	0.38	.003	.28
MAX Speed (km/h)	29.14	±	2.28	29.58	±	2.17	.088	.20
Sprints (min)	11.88	±	26.75	10.88	±	33.01	.770	.03
Step Balance	-0.0056	±	0.02	-0.0043	±	0.02	.615	.07
Player Load	95.8	±	44.45	110.1	±	54.47	.015	.29
Player Load (min)	1.46	±	0.17	1.41	±	0.49	.170	.14
HMLD (m)	1,511.55	±	687.56	1,576.57	±	764.55	.422	.10
HMLD count	173.49	±	79.76	188.37	±	95.82	.124	.17
HMLD (m/min)	23.91	±	5.39	18.57	±	8.74	<.001	.74
DSL	278.35	±	194.88	554.14	±	2,802.38	.294	.14
DSL (min)	4.14	±	2.04	19.28	±	165.37	.328	.13
> 24 (m/min)	2.84	±	1.82	2.34	±	2.43	.031	.23

Caption: Dist: distance; HSR: high sprint running; rel: relative; abs: abdolute; Dif: difference; ACC: accelerations; DCC: decelerations; HMLD: HMLD: High metabolic load distance, DSL: Dynamic stress load

Significant differences were also reported between Rel Sprints ($F_{2,353}$ = 3.46; p = .033) performed in the second and third third of the season, accumulating in the final one a lower value (p = .026); the number of metres per minute at more than 24 km/h also showed significant differences ($F_{2,353}$ = 3.11; p = .046), with higher values in the first period than in the third (p = .035), and the HMLD (m/min) ($F_{2,353}$ = 25.04; p < .001), where better results were obtained in the first and second third than in the third (p < .001 in both cases).

Finally, with respect to the Player Load presented by the players, significant differences were observed ($F_{2,353}$ = 3.76; p = .024) between the second and third periods, with these demands being higher in the third period (p = .021).

The analysis according to the position of the players on the pitch with the arrival of the new coach did not show significant results in any of the comparisons (p > .05). Descriptive data show differences between them (see Table 4).

The final result of the matches in the first third was draw, win, lose, draw, lose, win, draw, lose, win, draw, lose, scoring a total of 9 points. In the second third, lose, draw, win, lose, lose, lose, lose, win, draw, draw, draw, for a total of 9 points. In the third trimester (with the new coach), win, win, win, win, lose, lose, draw, win, win, win, win, with a total of 16 points.

Table 3
Comparison by thirds of the season.

	1st third (*n* = 113)			2nd third (*n* = 128)			3rd third (*n* = 115)			
	M		SD	M		SD	M		SD	*p*
Distance (m)	7,275.13	±	3.319	7,076.35	±	3,237.24	8,255.89 B*	±	4,070.14	.025
Explosive Dist (m)	977.49	±	448.05	960.9	±	441.08	1,077.96	±	532.43	.124
Explosive Dist (m/min)	14.92 C***	±	2.05	14.99 C***	±	2.16	13.59	±	2.95	<.001
HSR Rel Dist (m)	142.63	±	102.45	163.8 C**	±	200.57	102.19	±	69.95	.003
HSR Rel (m/min)	2.35	±	1.56	2.26	±	2.01	2.18	±	2.21	.800
HSR Rel Count	7.56	±	5.19	8.94 C**	±	11.38	5.76	±	3.86	.006
HSR Abs Dist (m)	420.38	±	231.27	390.7	±	232.05	414.07	±	230.15	.572
HSR Abs (m/min)	7.09	±	3.57	6.38	±	3.15	6.38	±	4.55	.264
HSR Abs Count	22.61	±	12.79	21.32	±	12.09	22.27	±	12.81	.707
Dist (m/min)	109.98	±	9.09	109.27	±	10.53	111.04	±	60.65	.926
Diff ACC DEC	-13.73	±	13.04	-12.55	±	12.11	-14.39	±	13.48	.525
Sprint Abs (m)	181.15	±	120.89	165.55	±	121.75	176.57	±	117.73	.582
ABS Sprints	9.47	±	6.32	8.66	±	5.74	9.32	±	6.47	.554
REL Sprints	0.41	±	0.88	0.84 C*	±	3.44	0.12	±	0.38	.033
MAX Speed (km/h)	29.39	±	2.3	28.92	±	2.25	29.58	±	2.17	.064
Sprints (min)	14.48	±	29.42	9.59	±	24.02	10.88	±	33.01	.401
Step Balance	-0.0073	±	0.02	-0.0041	±	0.02	-0.0043	±	0.03	.482
Player Load	98.3	±	45.68	93.58	±	43.39	110.1 B*	±	54.47	.024
Player Load (min)	1.49	±	0.17	1.44	±	0.18	1.41	±	0.49	.214
HMLD (m)	1,534.5	±	696.62	1491.29	±	681.56	1,576.57	±	764.55	.649
HMLD count	175.11	±	80.76	172.05	±	79.16	188.37	±	95.82	.296
HMLD (m/min)	24.09 C***	±	5.55	23.75 C***	±	5.26	18.57	±	8.74	<.001
DSL	295.95	±	214.54	262.81	±	175.1	554.14	±	2,802.38	.312
DSL (min)	4.4	±	2.23	3.9	±	1.84	19.28	±	165.37	.365
> 24 (m/min)	3.01 C*	±	1.82	2.68	±	1.82	2.34	±	2.43	.046

Caption: A = significant differences with the 1st third, B = significant differences with the 2nd third, C = significant differences with the 3rd third. *= $p < .05$, **= $p < .01$, ***= $p < .001$.

Table 4
Descriptive data by positions as a function of the coach.

	CB				FB				MF				WG				ST			
	PRE (*n* = 37)		POST (*n* = 18)		PRE (*n* = 40)		POST (*n* = 21)		PRE (*n* = 72)		POST (*n* = 21)		PRE (*n* = 58)		POST (*n* = 22)		PRE (*n* = 34)		POST (*n* = 21)	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Distance (m)	8,974.6	± 1,724.6	9,457.1	± 3,594.1	7,445.1	± 3,784.9	9,108.2	± 4,006.7	6,710.1	± 3,396.5	9,108.2	± 4,006.7	6,653	± 3,159.2	7,813.6	± 4,276.4	6,735	± 3,268.9	5,894.2	± 3,728
Explosive Dist (m)	1,219.9	± 244.4	1,294.7	± 472.9	998.2	± 509.7	1,248.4	± 543.3	843.3	± 418.4	1,248.4	± 543.3	934.3	± 436.6	1,073.4	± 586.6	984.9	± 494	868.8	± 594.7
Explosive Dist (m/min)	13.6	± 1	12.4	± 1	14.9	± 1.6	13.4	± 1.7	14.5	± 2.6	13.4	± 1.7	16.1	± 1.9	14.5	± 1.7	15.5	± 1.4	14.7	± 2.8
HSR Rel Dist (m)	208.8	± 257.1	123.8	± 62.5	135.7	± 89.1	125.5	± 60.9	91.2	± 80.8	125.5	± 60.9	173.9	± 120.6	155.4	± 90	214	± 232.1	116.8	± 60.2
HSR Rel (m/min)	1.7	± 0.8	1.7	± 1.4	2.1	± 1.3	2.2	± 3.4	1.8	± 1.6	2.2	± 3.4	3	± 2.4	3	± 2.4	2.9	± 1.9	2.7	± 2.1
HSR Rel Count	11.5	± 15	6.9	± 4	7	± 4.4	6.8	± 3.7	4.9	± 4.1	6.8	± 3.7	9	± 5.9	8	± 4.7	12.4	± 13.2	6.2	± 3.8
HSR Abs Dist (m)	354.1	± 123.3	318.5	± 123.8	478.7	± 268.7	506	± 229	281.9	± 174.2	506	± 229	504.3	± 256.8	543.5	± 274.1	462.3	± 214.4	437.5	± 249.9
HSR Abs (m/min)	4	± 1.3	3.5	± 1.7	7.4	± 3	6.2	± 3.5	5.5	± 3.4	6.2	± 3.5	8.8	± 3	8.6	± 4.1	7.9	± 2.8	8.6	± 3
HSR Abs Count	20.1	± 6.4	18.3	± 7.6	23.9	± 13.7	26.4	± 12.1	15.5	± 9.5	26.4	± 12.1	26.8	± 13.5	27.8	± 15.2	26.9	± 13.3	23.5	± 15.8
Dist (m/min)	99.8	± 4.1	93.2	± 4.6	110.4	± 6.4	103	± 7.6	112.4	± 11	103	± 7.6	113.4	± 10.2	108	± 9.9	106.9	± 6.7	104.4	± 12.3
Diff ACC DEC	-7.3	± 11.8	-7.5	± 8.3	-12.7	± 12.3	-21	± 16.2	-10	± 8.8	-21	± 16.2	-20.3	± 13.1	-17.9	± 17	-14.1	± 14.1	-14	± 13.1
Sprint Abs (m)	140.4	± 74.9	131.2	± 59.9	219.4	± 135.3	248.9	± 118.2	99.8	± 72.3	248.9	± 118.2	234.5	± 140.6	265.5	± 144	202.9	± 104.2	179.5	± 102.4
ABS Sprints	7.5	± 3.6	7.1	± 3.7	10.6	± 6.6	12.6	± 6.3	5.4	± 3.7	12.6	± 6.3	12	± 6.7	13.7	± 7.9	11.5	± 5.9	9.6	± 6.7
SprintsREL	1.7	± 5.1	0.4	± 0.6	0.1	± 0.4	0.1	± 0.1	0.2	± 0.8	0.1	± 0.1	0.5	± 0.8	0.1	± 0.3	1.3	± 3.9	0.2	± 0.5
MAX Speed (km/h)	29.5	± 2	30.2	± 2.1	29.4	± 2.4	30.4	± 1.9	27.7	± 2.1	30.4	± 1.9	30.2	± 2	30.7	± 1.9	29.7	± 1.8	29.8	± 1.8
Sprints (min)	12.2	± 14.7	11.4	± 13.7	4	± 15.3	3.8	± 12.1	4.9	± 17.6	3.8	± 12.1	15.3	± 27.3	10.5	± 32	8.2	± 15.5	11.1	± 30.4
Step Balance	-0.01	± 0.02	0	± 0.03	-0.01	± 0.03	0	± 0.02	-0.01	± 0.02	0	± 0.02	0	± 0.02	0.01	± 0.02	-0.01	± 0.02	-0.01	± 0.02
Player Load	119.1	± 24.9	131.7	± 48.4	92.6	± 47.6	123.3	± 53.8	94.2	± 49	123.3	± 53.8	86.7	± 41.2	103.2	± 54.8	93.3	± 46.1	84.4	± 53
Player Load (min)	1.3	± 0.1	1.3	± 0.1	1.4	± 0.1	1.3	± 0.2	1.6	± 0.2	1.3	± 0.2	1.5	± 0.1	1.4	± 0.1	1.5	± 0.1	1.5	± 0.2
HMLD (m)	1,704.4	± 364.9	1,656.5	± 601.4	1,611.8	± 819.2	1,802.7	± 754.5	1,342.2	± 673.9	1,802.7	± 754.5	1,521.5	± 698.6	1,638.8	± 834.6	1,525.5	± 750.2	1,345.8	± 862.8
HMLD count	225.4	± 44.5	232.3	± 85.3	177.5	± 89.5	211.9	± 92.7	166.6	± 84.3	211.9	± 92.7	154.4	± 70.9	172.3	± 95.9	159.5	± 81.5	140.2	± 96.7
HMLD (m/min)	19	± 2.1	16	± 1.6	24.4	± 3.3	20	± 2.3	23.7	± 6.9	20	± 2.3	26.6	± 4.9	23.2	± 4.4	24.4	± 3.1	23.8	± 3.9
DSL	288.9	± 140.6	331.3	± 168.8	209.9	± 131.8	260	± 125	344.3	± 261.4	260	± 125	264.5	± 170.2	252.3	± 146.9	252.3	± 180.8	212.1	± 144.4
DSL (min)	3.2	± 1.3	3.1	± 1.1	3.2	± 1.6	2.8	± 0.8	5.2	± 2.6	2.8	± 0.8	4.2	± 1.6	3.6	± 1.1	3.9	± 1.5	3.7	± 1.2
> 24 (m/min)	1.6	± 0.8	1.5	± 1.5	3.3	± 1.6	2.9	± 3.6	2	± 1.4	2.9	± 3.6	4	± 2.1	3.5	± 2.4	3.4	± 1.5	2.9	± 2.1

Caption: A = significant differences with the 1st third, B = significant differences with the 2nd third, C = significant differences with the 3rd third. *= $p < .05$, **= $p < .01$, ***= $p < .001$.

Discussion

The aim of the present study was to determine possible differences in physical performance after a change of coach. The data shows that the change of coach obtained a greater number of points without presenting an improvement in the physical variables, only had a greater distance (m), Explosive Distance (m), Max Speed (km/h) and Player Load in the matches, in line with the results found (Guerrero-Calderón et al., 2021). This result indicates that they ran more in the final third, which may show that the importance of the change of coach lies in a different style of play (Augusto et al., 2021) with which the new coach scored more points (Lago-Peñas, 2011; Lago-Peñas, 2007; Balduck & Buelens, 2007; Gómez et al., 2021). This fact can be explained by the coach's vision on the conditional aspects of the players, prioritising high-intensity actions in areas closer to the opposing team's goal.

On the other hand, with the previous coach, better results were obtained in running > 24 km/h (m/min) and HSR Rel Dist (m), two variables that show the intensity in the players' running and the influence that coaches have on the type of running that players perform in matches (Flepp & Franck, 2021, Guerrero-Calderón et al., 2021). This may be due to the freedom or limitation of players' movements and, consequently, players' decision-making. An example of this could be that with one coach they have very marked movements and limit themselves to doing what the coach says and with another they have more freedom in decision making and perhaps do not make runs that provoke these speeds, making a better decision for the game.

After the analysis of the results found, it has been observed that it is important where to run at a higher intensity and what distance, among other aspects, so that with the new coach, in the same number of matches—eight—almost twice as many points were obtained (16 vs. 9). This is determinant for the team's ranking in the table, avoiding relegation or achieving promotion, in line with studies that showed that the new coach has an influence on the points obtained in matchdays 5 to 10 since their arrival to the team (Balduck et al., 2010; Flepp & Franck, 2021; Gómez et al., 2021; Hughes et al., 2010; Lago-Peñas, 2007, 2011).

On the other hand, despite the fact that coaching change is common, there is a lot of controversy regarding whether or not this "winner effect" exists. Several authors have highlighted in their research that changing coaches did not show improvements in team performance afterwards (Anderson & Sally, 2013; Balduck & Buelens, 2007; De Paola & Scoppa, 2012; Heuer et al., 2011; Ter Weel, 2011; Van Ours & Van Tuijl, 2016). Furthermore, performance recovery was reported to be independent of coach continuity or lack thereof (Kattuman et al., 2019; Scelles & Llorca, 2021). In this way, they inferred that the potential for better performance may be due more to social factors such as leadership and group motivation and behaviour (Kattuman et al., 2019).

Therefore, the importance of the change of coach by the club's leaders must respond to objective data and not to "bad luck" (Flepp & Franck, 2021), seeking to achieve a greater number of points in the short term so that in the medium term they seek to change the team's style of play, and for the players to make effective efforts, without this entailing running a greater distance at greater intensity. In line with the results found in the study, Kleinknecht and Würtenberger (2021) pointed out that change could be beneficial for clubs experiencing a decline in performance and that the profile of the successor should be studied according to the objectives presented by the club, analysing whether the incorporation of the new coach should be done with an external or internal person to the organisation, highlighting that those from outside the club could get the players to show greater effort.

Conclusion

The change of coach is a situation that seeks to improve the team's performance. This must be done on the basis of objective data (number of points, position in the ranking, objectives not achieved, etc.). When choosing a replacement, the style of play of the new coach must be taken into account, which is more important than the physical variables.

This study shows that physical variables should not be studied in isolation but in conjunction with technical and tactical variables in order to be able to derive transferable results in practice. Therefore, the relationship between these variables should be further investigated in future studies in order to understand the overall influence.

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Profiling mountaineering in Protected Natural Areas of Spain

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Two alpinists climbing a snowy mountain in the Arctic under the northern lights. Adobestock ®Urdialex

Abstract

In recent years, there has been an increase in the pressure exerted by physical and sporting activities in the natural environment. In Spain, mountaineering, which usually takes place in Protected Natural Areas, is the first option in the order of preference of people who practice sport. Knowing the profile of visitors is a key aspect in managing public use of these environments. The objectives of the study focused on i) characterising the generic profile of mountaineers on Spain's emblematic summits and ii) identifying behavioural patterns with a view to contributing to a more sustainable management of these natural environments. The study was based on a survey of mountaineers who climbed one of the following summits during the summer of 2020: Mulhacén, Monte Perdido, Aneto, Pica d'Estats, and Pedraforca, with a sample of 578 participants. The main results obtained include the identification of an average profile characterised by being: male, between 26 and 35 years old, with a high level of education, with more than 10 years of seniority in mountaineering and a high degree of environmental sensitivity. Another of the results of this study was the observation of common patterns of behaviour when visiting the different summits. The results obtained were analysed in terms of their application to the overall management of mountaineering in this type of protected natural environment.

Keywords: management, mountain summit,mountaineering, practitioner profile, practitioners.

Introduction

At present, there is a large amount of data supporting the increase in the practice of physical-sports activities in the natural environment. Among these, the results obtained in the latest survey on sporting habits in Spain stand out, where it was found that the outdoor environment is the preferred place to practice sport (45.3%). In this sense, activities such as hiking/mountaineering are in the first position, with 30.8%, in the order of preference of people who practice sport (Ministry of Culture and Sport, 2022).

According to the Spanish Federation of Mountain Sports and Climbing (FEDME), mountaineering is a sporting activity that consists of climbing mountains or trekking in them, which requires specific technical knowledge to perform (FEDME, 2018). This activity mainly takes place in Protected Natural Areas (PNAs) that are home to particularly fragile environments. In recent years, several studies have shown that the pressure on these spaces is increasing, alerting us to the environmental consequences that this has on these environments (Balmford et al., 2015; Múgica et al., 2021).

It should be noted that the general objective of the PNAs, which in Spain represent 27% of the territory, is to conserve natural heritage and biodiversity, as well as to guarantee the right of people to enjoy it (Law 42/2007, of 13 December, on Natural Heritage and Biodiversity). In order to achieve these objectives, the PNAs are responsible for planning their management, taking care of the more social aspect, the public use area. According to EUROPARC-Spain (2005), the term "public use" can be defined as: a set of practices and infrastructures that must be provided by the administration of the protected area with the aim of bringing visitors closer to its natural and cultural values in an orderly and safe way, guaranteeing the conservation, understanding, and appreciation of these values through information, education, and interpretation of the heritage.

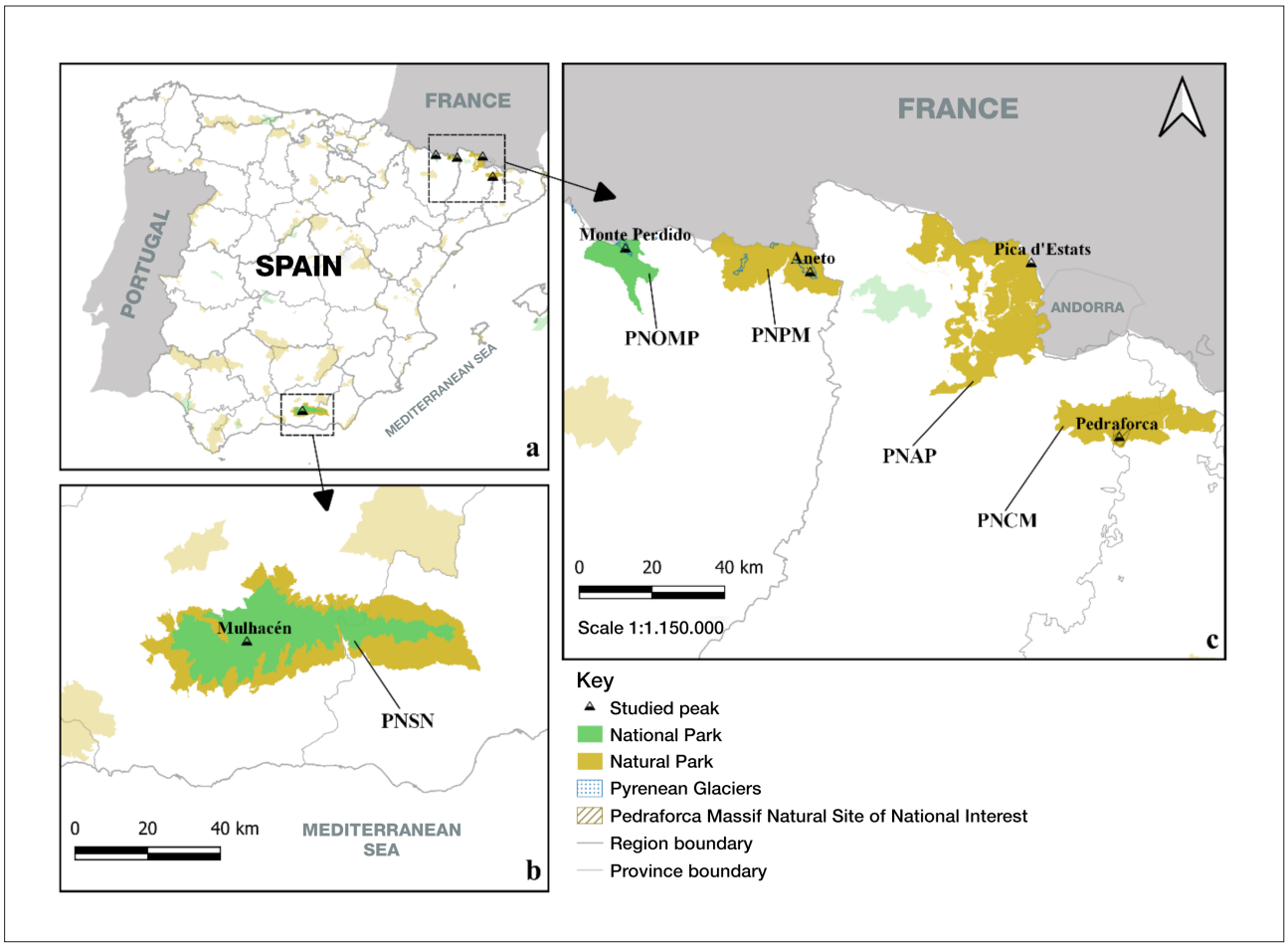
With regard to the planning of public use in PNAs, there are various tools available that are articulated in a hierarchical process, with the following plans being considered: (i) natural resource management plan (NRMP), equivalent to the plan for areas of natural interest in Catalonia or island plans in the Canary Islands; (ii) master plan for use and management (MPUM), responsible for setting future guidelines for public use, among others; and (iii) sectoral plans and programmes, which develop the public use model for the protected area, within which the public use plan is situated (EUROPARC-Spain, 2005).

According to the Action Plan for the PNAs of Spain (EUROPARC-Spain, 2002), the main recommendations to be taken into account when drawing up the public use plan include the consideration of at least two basic data sets: characterisation of visitors, as well as the number and frequency of their visits. The characterisation includes aspects such as visitor profile, visitor typology or segmentation, activities carried out during their visit, and demands for infrastructures or services, among other issues.

In relation to the above, several studies advocate segmentation based on visitor needs in order to develop management strategies which are adapted to each segment (Arnberger et al., 2012; Farías-Torbidoni & Monserrat, 2014; Jones & Nguyen, 2021; Jones & Yamamoto, 2016). Some authors have argued that physical-sports practice can be an element of segmentation, as it tends to differentiate themselves on the basis of a common pattern of behaviour derived from the activity carried out during the visit, with the level of intensity of this activity being a clear indicator of segmentation (Farías-Torbidoni & Barić, 2020; Mowen et al., 2012). It therefore seems appropriate to go beyond segmentation by activity, and to go into the analysis of the segment of a particular group of practitioners, similarly to the work carried out by Burns et al. (2020) and Esfahani et al. (2014), in order to achieve a strategy that is more focused on the needs of the segment. However, there are few studies that have gone into the characterisation of the mountaineering practitioner's profile in depth, and most of them are superficial or only partial. A good example of the existing studies in Spain is the one carried out intermittently since 2000 by Montaña Segura (2022) on the summits of the Aragonese Pyrenees which, while providing basic socio-demographic data, experience in mountaineering and safety behaviour in the practice of this activity over time, does not go into such relevant aspects as the characteristics and reasons for visiting. Furthermore, we should not overlook other studies that, without being specific to mountaineering, have made progress in the indirect characterisation of mountaineers (Farías-Torbidoni et al., 2018; Farías-Torbidoni & Monserrat, 2014).

Against this background, the objectives of this study were i) to characterise the generic profile of mountaineers on Spain's emblematic summits and ii) to identify behavioural patterns with a view to contributing to a more sustainable management of these natural environments.

Figure 1
Location of a) Spain and PNA. b) Penibaetic System: PNSN = Sierra Nevada National Park. c) Pyrenees and Pre-Pyrenees: PNOMP = Ordesa y Monte Perdido National Park; PNPM = Posets-Maladeta Natural Park; PNAP = Alt Pirineu Natural Park; PNCM = Cadí-Moixeró Natural Park; PNCM = Cadí-Moixeró Natural Park.



Context of the study

Study area: emblematic summits

The study was carried out on five summits in Spain, all of which are considered emblematic. Specifically on the summits of: Mulhacén, Monte Perdido, Aneto, Pica d'Estats, and Pedraforca (Figure 1).

The selection was based on the contemplation of six criteria: i) being included in the lists of main summits of Spain and Catalonia, as appropriate (published by the Institute of National Geography and the Cartographic and Geological Institute of Catalonia, in 2018 and 2015, respectively), ii) being considered an emblematic summit (based on the definition of Sánchez [2018]), iii) having the status of high mountain (> 2,500 m.a.s.l.), iv) being included within a PNA belonging to the Natura 2000 Protected Areas Network, v) representing different categories of protection, and vi) presenting different characteristics of accessibility and use.

Each of the summits studied is characterised by the following features: Mulhacén, located in the Penibaetic System within the Sierra Nevada National Park, as it is the highest point of the Iberian Peninsula and the most accessible; Monte Perdido, located in the Ordesa y Monte Perdido National Park, characterised by being the highest limestone massif in Europe; Aneto, located in the Posets-Maladeta Natural Park, as it is the highest peak in the Pyrenees and the least accessible; Pica d'Estats, the highest summit in Catalonia, within the Alt Pirineu Natural Park, and in the Pre-Pyrenees, we find the summit of Pedraforca, in the Serra del Cadí, one of the most emblematic mountains in Catalonia, declared a natural site of national interest, under the protection of the Cadí-Moixeró Natural Park. For more details on the different summits, see Table 1.

Table 1
Main characteristics of the summits.

	Mulhacén	Monte Perdido	Aneto	Pica d'Estats	Pedraforca
General characteristics					
Location[1]	30 N 472300 4100841	31 N 256998 4729051	31 N 307853 4722508	31 N 368712 4725071	31 N 392983 4677231
Autonomous Community	Andalusia	Aragon	Aragon	Catalonia	Catalonia
Province	Granada	Huesca	Huesca	Lleida	Barcelona- Lleida
Approximate distance and time to major population centres[2]	43 km from Granada (49')	87.1 km from Huesca (1 h 15')	152 km from Huesca (2 h 30')	265 km from Barcelona (3 h 50')	145 km from Barcelona (1 h 50')
	170 km from Málaga (2 h 12')	158 km from Zaragoza (2 h)	162 km from Lleida (2 h 35')	170 km from Lleida (2 h 50')	195 km from Lleida (2 h 10')
Management characteristics					
Management body	Government of Andalusia Department of Sustainability, Environment and Blue Economy. Autonomous Agency of National Parks	Government of Aragon. Department of Agriculture, Livestock and Environment Autonomous Agency of National Parks	Government of Aragon. Department of Agriculture, Livestock and Environment	Government of Catalonia Climate Action, Food and Rural Agenda Department	Government of Catalonia Climate Action, Food and Rural Agenda Department
Level of protection	Natura 2000 Sierra Nevada National Park	Natura 2000 Ordesa and Monte Perdido National Park	Natura 2000 Posets-Maladeta National Park	Natura 2000 Alt Pirineu Natural Park	Natura 2000 Cadí-Moixeró Natural Park Pedraforca Massif Natural Site of National Interest
Access regulation	Unregulated	Temporary parking regulation	Temporary parking regulation	Unregulated	Unregulated
Physical characteristics					
Altitude m a.s.l.	3,479	3,355	3,404	3,143	2,506
Number of access routes	5	3	2	3	3
Distance of the most popular route (km)	16.5	31.1	14.8	18.4	7.6
Positive difference in altitude (m)	1,255	2,889	1,499	1,582	1,059
Singularities of accessibility	Scree	Glacier - Loose rock cliff	Glacier	Scree	Clambering
Difficulty (Sendif method)[3]	1,894	4,629	2,076	2,336	1,435
Social characteristics					
Number of visitors to the Park in 2020	418,734	422,570	No data	367,713	363,370
Number of visitors peak year 2020	19,609	17,002	9,912	7,713	27,678

Note: (1) The ETRS89 / UTM coordinate reference system was used. (2) Google Maps was used for the calculation (distance and time). (3) Sendif is a method for determining the difficulty of walking routes, developed by the Institute for the Development and Promotion of the Alt Pirineu and Aran (IDAPA, 2018).

Table 2
Summary of distribution of surveys by case study.

Summit	Mulhacén	Monte Perdido	Aneto	Pica d'Estats	Pedraforca	Total
No. of surveys	119	116	112	113	118	578

The COVID-19 pandemic

The emergence of COVID-19, declared an international pandemic by the World Health Organisation (2020), led to a series of measures taken by the Spanish government to address the health emergency (Castillo-Esparcia et al., 2020). As a result, during the first months of lockdown and in later periods with mobility restrictions, visitation to the natural areas was reduced to minimum values, and in the case of the National Parks it was reduced by 51.7%. However, after the relaxation of the measures adopted, coupled with the difficulties for international tourism, visitation to PNAs increased, which meant a 7.9% increase in visitors to National Parks compared to the summer of 2019 (Gössling et al., 2020; Medina-Chavarría et al., 2022; Organismo Autónomo de Parques Nacionales, 2020; World Tourism Organization, 2022).

As a result, problems that had been occurring for some time in natural areas intensified, leading to the appearance of some of these problems in others where they had never occurred before, including: overcrowding of visitors, accumulation of waste, collapse of car parks, vandalism (graffiti, destruction of signage, etc.), among others (Dujisin, 2020; Hammitt et al, 2015; Medina-Chavarría et al., 2022; Miller-Rushing et al., 2021; Newsome et al., 2012; Pallathadka, 2020; Vagena, 2021). This triggered a series of responses by the management staff of the different PNAs through the implementation of actions aimed at resolving the situation (Medina-Chavarría et al., 2022).

Methodology

The present study was carried out by implementing a face-to-face questionnaire at the top of the five mountain summits between 3 July and 5 September 2020. The sampling system used in the selection of the sample was simple random, by alternately choosing the first or second person in the group (> 16 years), male or female, to reach the summit. The survey was written in Spanish and translated into 4 languages (Catalan, English, French, and German). Data collection was carried out through the KoboToolbox platform (offline). In total, 578 surveys were collected over 30 days of fieldwork (Table 2).

The survey

The survey was developed based on the consideration of five dimensions: (i) socio-demographic characteristics (gender, age, occupation, studies, environmental sensitivity, knowledge of environmental impact, place of residence), (ii) sporting habits (habitual practice, time of practice, and affiliation to the federation), (iii) visit characteristics (frequency of visit to the Park, access, group typology, duration of visit, frequency of visit to the summit, photography and dissemination on social networks, importance of COVID-19), logistical preparation of the activity and equipment), iv), reason for visiting (Likert scale 1-5), and v) opinion on the perceptual carrying capacity (number of people come across, perception of overcrowding). For more information, see Dorado et al. (2022b).

The survey model was validated at the qualitative level (AERA et al., 2014). Evidence was provided to support the validity of the scale. On the one hand, i) evidence related to content validity through the assessment of an expert judgement (composed of four people), which was carried out using a Likert scale (1 strongly disagree - 5 strongly agree) assessing the degree of univocity and relevance of each and every one of the questions included in the initial survey model and, on the other hand, ii) evidence of validity related to the response process, with the survey having been distributed among the target population to determine the comprehensibility of the questions in the questionnaire, as well as to identify possible practical aspects of its administration.

The survey and research project received the approval of the Clinical Research Ethics Committee (CEIC) of the Catalan Sports Administration, with the number. 16/CEICGC/2020, in addition to the authorisation of each of the managing bodies of the PNAs where the case studies are located. All the people who participated in the study did

so voluntarily, were informed and accepted the confidential treatment of their answers, subject to the guarantees of Organic Law 3/2018, of 5 December, on Personal Data Protection and guarantee of digital rights.

Analysis of results

The data obtained was transformed and coded using SPSS software, version 25.0. Firstly, data analysis was carried out based on the application of descriptive statistical tests according to the characteristics and distribution (normality test) of the different variables: frequencies, mean values, maximum, minimum, and standard deviation. Contingency tables were used for the observation of categorical data based on the summits studied. Secondly, inferential analysis was carried out to evaluate the data of the respondents according to the study summits and to check whether or not there were significant differences between them. In this step, the chi-square goodness-of-fit was used for qualitative variables. In the results where significant differences were found ($p \leq .05$), the 2 x 2 chi-square test was performed between summits; for this case, significance was adjusted to ≤. 005 (.05/10); in addition, the effect size index was calculated through the Phi test and *V* test (Φ), the interpretation of which was based on the following criteria: Φ < .30 = small effect, Φ ≈.50 = medium effect, and Φ > .80 high effect (Cárdenas & Arancibia, 2014; Cohen, 1988). Thirdly, for the quantitative variables, given that the data did not comply with a normal distribution, the Kruskal-Wallis one-factor ANOVA non-parametric test was applied to determine the presence or absence of significant differences between the different summits, and the Bonferroni Post Hoc test was applied in those cases where significant differences existed. The significance level for this procedure was set at $p \leq .05$.

At this point, two casuistries have to be taken into account in the data analysis. On the one hand, the Euclidean distance variable was calculated using ArcGIS Desktop 10.8 from the location extracted from the postcode provided by the respondents and the location created in the main car parks detected in each of the case studies.

On the other hand, in the case of the variables of logistical preparation of the activity (adequate or inadequate) and equipment (complete or incomplete), the Mountain Rescue and Intervention Section (SEREIM) of Granada, the Special Mountain Intervention Rescue Groups (GREIM) of Boltaña and the Special Actions Group (GRAE) of Catalonia were consulted on the minimum aspects necessary for logistical preparation: (i) checking weather conditions, (ii) planning the route and approximate timetable of the activity, (iii) forecasting sufficient food and water, (iv) informing third parties about the planned activity (route and timetables), and (v) suitable equipment to tackle the climb to the respective study summits during the summer season.

Results

Socio-demographic characteristics

The results obtained showed the presence of a profile of mountaineering practitioners characterised by being predominantly male (78.4%), aged between 26-35 years (35.6%), with an average age of 35.4 (11.8) years, working (77.9%) and with university education (58.8%). In terms of environmental sensitivity, 63.7% considered that their practice can generate some kind of impact on the natural environment, with an average score of 2.2 (1.0) out of 5. In relation to the usual place of residence, there was a predominance of local residents, i.e. from the same region as the summit visited (50.5%), with an average Euclidean distance of over 200 km (Table 3).

Five of the eight variables analysed in this dimension showed significant differences, these being gender ($p < .01$), age ($p < .001$), opinion on the generation of impacts ($p < .001$), place of residence ($p < .001$), and Euclidean distance to the summit ($p < .001$).

In this sense, in the analysis by summits, a predominance of the male gender was observed in the group of summits, with a greater representation of the female gender on the summits of Pedraforca (30.5%), Mulhacén (24.4%) and Pica d'Estats (23.9%), with a small effect size (Φ = .17). In relation to age, it was observed that on Mulhacén the majority age range was over 45 years, at 36.1%, while on the rest of the summits the most predominant age range was between 26-35 years (small effect size Φ = .15). With regard to environmental sensitivity, the results obtained showed the presence of a higher degree of sensitivity among mountaineers on the summits of Monte Perdido (71.6%) and Pedraforca (68.6%), obtaining for the latter a rating of 2.6 (1.1) on a scale of 1 to 5. Finally, in relation to place of origin, the results showed a higher percentage of mountaineers residing outside the summit region on the summits of Monte Perdido (94.0%) and Aneto (93.8%). In contrast, Pedraforca (94.1%) and Pica d'Estats (83.2%) stood out for receiving more mountaineers belonging to the same region, the effect size for this variable being medium (Φ = .75).

Table 3
Socio-demographic characteristics of mountaineering practitioners.

Variables	Mulhacén (*n* = 119)	Monte Perdido (*n* = 116)	Aneto (*n* = 112)	Pica d'Estats (*n* = 113)	Pedraforca (*n* = 118)	Total (*n* = 578)
Gender			$\chi^2 = 16.06$, $p < .01$, $\Phi = .17$			
Male (%)	75.6	81.0	90.2	76.1	69.5	78.4
Female (%)	24.4 A	19.0	9.8 M PE P	23.9 A	30.5 A	21.6
Age			$\chi^2 = 38.34$, $p < .001$, $\Phi = .15$			
16-25 (%)	11.8	25.9	16.1	23.9	31.4	21.8
26-35 (%)	28.6	38.8	35.7	38.9	36.4	35.6
36-45 (%)	23.5	21.6	24.1	23.0	16.9	21.8
45+ (%)	36.1 MP PE P	13.8 M PE	24.1	14.2 M MP P	15.3 M MP	20.8
Age (years). Average (SD)	40.6 (12.7)	33.4 (11.0)	37.2 (11.4).	33.8 (11.3)	32.1 (11.8)	35.4 (11.8)
Occupation			$\chi^2 = 7.43$, $p = .115$, $\Phi = .11$			
Unemployed (%)	17.6	25.0	16.1	23.0	28.8	22.1
Employed (%)	82.4	75.0	83.9	77.0	71.2	77.9
Studies			$\chi^2 = 3.17$, $p = .530$, $\Phi = .07$			
Non-university students (%)	45.4	35.3	42.0	38.9	44.1	41.2
University students (%)	54.6	64.7	58.0	61.1	55.9	58.8
Environmental sensitivity			$\chi^2 = 8.29$, $p = .082$, $\Phi = .12$			
Considers that it has no impact (%)	41.2	28.4	43.8	37.2	31.4	36.3
Considers that it does have an impact (%)	58.8	71.6	56.3	62.8	68.6	63.7
Environmental impact			$H(4)=26.64$, $p < .001$			
Impact (Likert scale 1-5). Average (SD)[1]	1.8 (1.0) P	2.2 (0.9)	2.0 (1.1) P	2.1 (1.0) P	2.6 (1.1) M A PE	2.2 (1.0)
Place of residence			$\chi^2 = 322.98$, $p < .001$, $\Phi = .75$			
Does not belong to the autonomous community of the summit (%)	38.7	94.0	93.8	16.8	5.9	49.5
Belongs to the autonomous community of the summit (%)	61.3 MP A PE P	6.0 M P	6.3 M PE P	83.2 M A	94.1 M MP A	50.5
Euclidean distance			$H(4)=187.84$, $p < .001$			
Euclidean distance (km). Average (SD)	224.7 (248.1) MP A P	269.5 (224.7) M PE P	278.2 (157.1) M PE P	141.4 (64.2) MP A P	99.9 (82.5) M MP A PE	200.7 (186.8)

Note: SD = standard deviation; χ^2 = chi-square; Φ = effect size; H = Kruskal-Wallis. M = Bonferroni *post hoc* is statistically significant with Mulhacén. MP = Bonferroni *post hoc* is statistically significant with Monte Perdido. A = Bonferroni *post hoc* is statistically significant with Aneto. PE = Bonferroni *post hoc* is statistically significant with Pica d'Estats. P = Bonferroni *post hoc* is statistically significant with Pedraforca. (1) These data were calculated for a *n* = 368.

Table 4
Sports habits of participants.

Variables	Mulhacén (*n* = 119)	Monte Perdido (*n* = 116)	Aneto (*n* = 112)	Pica d'Estats (*n* = 113)	Pedraforca (*n* = 118)	Total (*n* = 578)
Regular practitioner			$\chi^2 = 8.66$, $p < .070$, $\Phi = .12$			
No (%)	18.5	20.7	8.0	18.6	20.3	17.3
Yes (%)	81.5	79.3	92.0	81.4	79.7	82.7
Practice time[1]			$\chi^2 = 15.21$, $p = .231$, $\Phi = .11$			
Less than 1 year (%)	3.1	4.3	1.9	5.4	5.4	4.0
Between 1 and 5 years (%)	15.5	26.1	13.6	27.2	19.4	24.1
Between 6 and 10 years (%)	18.6	16.3	23.3	21.7	24.7	21.0
More than 10 years (%)	62.9	53.3	61.2	45.7	50.5	54.9
Seniority (years). Average (SD)	19.07 (14.09)	15.81 (12.44)	18.43 (12.79)	14.15 (12.57)	14.55 (11.06)	16.48 (12.75)
Affiliation to the federation			$\chi^2 = 18.35$, $p < .01$, $\Phi = .18$			
No (%)	58.8	62.9	54.5	69.0	78.8	64.9
Yes (%)	41.2 P	37.1	45.5	31.0	21.2 M	35.1

Note: SD = standard deviation; χ^2= chi-square; Φ = effect size. M = Bonferroni *post hoc* is statistically significant with Mulhacén. MP = Bonferroni *post hoc* is statistically significant with Monte Perdido. A = Bonferroni *post hoc* is statistically significant with Aneto. PE = Bonferroni *post hoc* is statistically significant with Pica d'Estats. P = Bonferroni *post hoc* is statistically significant with Pedraforca. (1) These data were calculated for a *n* = 477.

Sporting habits

In relation to the sporting habits of the visitors surveyed, it is worth highlighting the identification of a profile characterised by a long history of mountaineering. More than 82% declared to be regular mountaineers, to have some kind of affiliation to the federation (35.1%), and to have more than 10 years of mountaineering experience (54.9%), with an average value of 16.48 (12.75) years (Table 4).

In this case, one of the three variables analysed showed significant differences: affiliation to the federation ($p < .01$).

In particular, visitors to Aneto had a higher percentage of regular mountaineers (92%). With regard to the length of time spent mountaineering, visitors to Mulhacén and Aneto stood out as those with the most years of mountaineering experience, with an average of 19.07 (14.09) and 18.43 (12.79) years, respectively, and these two summits were the ones with the highest rate of affiliation to the federation among the visitors who frequented them: Aneto (45.5%) and Mulhacén (41.2%), representing a small effect size($\Phi = .18$).

Characteristics of the visit

Among the main characteristics of the visit, a high frequency of first visits to the PNA was observed (40.1%), with private transport (63.1%) being the most frequently used means of access. The majority of the visiting group format consisted of more than two people (57.8%), with an average of 3.8 (4.2) people per group, and a duration of visit in the area of more than one day (60%), with an average stay of 2 days (Table 5).

In terms of summit behaviour, it was noted that 55% of respondents stated that it was their first ascent, with the average number of climbs to the summit being 4.1 (9.9) and the average time spent on the summit being 25.7 (16.4) minutes. 96.5% of visitors surveyed reported taking photographs during their visit, of which 67.2% stated that they intended to post them on social media. Regarding the importance that COVID-19 had on the fact of having visited the summit (cancellation of other plans, mobility restrictions, etc.), the results obtained showed a low influence on the choice of visit destination, as an average of 2.02 (1.46) was obtained, on a scale of 1 to 5.

Of the total number of visitors surveyed, 69.7% made adequate logistical preparation for the activity. However, in terms of equipment for the activity (taking into account the needs of each of the summits to determine this variable), it was observed that only 26% carried the complete equipment based on the recommendations provided by the rescue groups (SEREIM, GREIM and GRAE).

Of the eleven variables analysed in this dimension, six showed significant differences: frequency of visit to the Park ($p < .001$), access to the Park ($p < .001$), duration of visit ($p < .001$), frequency of visit to the summit ($p < .001$), time at the summit ($p < .001$), and equipment ($p < .001$).

Regarding the analysis by summits, a higher frequency of first visit was observed in the PNAs where the summits of Monte Perdido (52.6%) and Aneto (46.4%) are located, the effect size being small ($\Phi = .18$). Regarding access to the park, the results obtained showed a predominance of private transport use over public transport at the summits of Pedraforca (95.8%), Pica d'Estats (94.7%) and Mulhacén (80.7%), showing a medium effect size ($\Phi = .71$). In relation to the duration of the visit, there was a predominance of one-day visits to the Pedraforca summit (79.7%), establishing a medium effect size ($\Phi = .43$). With regard to the frequency of visit to the summit, higher percentages of first climb were observed on the summits of Monte Perdido (69.8%), Pedraforca (64.6%) and Aneto (57.1%), with a small effect size ($\Phi = .23$). Finally, the mountaineers on the summit of Mulhacén and Monte Perdido were the ones who stayed the longest on the summit once the climb was completed, with an average time of 33.9 (24.0) and 28.7 (12.9) minutes, respectively. Regarding the importance of COVID-19 for the choice of destination, the results were very similar between the different summits.

Finally, in relation to the logistical preparation of the activity, it was the visitors to Aneto who reported a higher percentage of preparation (75.9%) compared to the rest of the summits. On the other hand, the Pica d'Estats mountaineers were positioned as the best equipped with 44.2% of the needs for summit climbing, resulting in a small-medium effect size ($\Phi = .34$).

Table 5
Characteristics of visit by mountaineering practitioners.

Variables	Mulhacén (n = 119)	Monte Perdido (n = 116)	Aneto (n = 112)	Pica d'Estats (n = 113)	Pedraforca (n = 118)	Total (n = 578)
Frequency of visits to the Park (≤ 2 years)			$\chi^2 = 18.38$, $p < .001$, $\Phi = .18$			
First visit (%)	27.7	52.6	46.4	39.8	34.7	40.1
Two or more visits (%)	72.3 MP A	47.4 M	53.6 M	60.2	65.3	59.9
Access to the Park			$\chi^2 = 288.03$, $p < .001$, $\Phi = .71$			
Private transport (%)	80.7	20.7	22.3	94.7	95.8	63.1
Public transport or walking (%)	19.3 MP A PE P	79.3 M PE P	77.7 M PE P	5.3 M MP A	4.2 M MP A	36.9
Visiting group			$\chi^2 = 3.94$, $p = .414$, $\Phi = .08$			
Equal to or less than 2 people (%)	47.9	44.0	43.8	38.9	36.4	42.2
More than 2 people (%)	52.1	56.0	56.3	61.1	63.6	57.8
Visitors (people). Average (SD)[1]	3.9 (3.6)	3.6 (2.5)	3.2 (1.7)	4.3 (7.7)	3.9 (2.7)	3.8 (4.2)
Duration of the visit			$\chi^2 = 104.41$, $p < .001$, $\Phi = .43$			
One day (%)	39.5	23.3	27.7	28.3	79.7	40.0
More than one day (%)	60.5 P	76.7 P	72.3 P	71.7 P	20.3 M MP A PE	60.0
Duration of visit (days). Average (SD)	1.8 (1.4)	2.1 (1.0)	2.6 (3.2)	2.3 (2.4)	1.2 (0.5)	2.0 (2.0)

Note: SD = standard deviation; χ^2= chi-square; Φ = effect size; H = Kruskal-Wallis. M = Bonferroni *post hoc* is statistically significant with Mulhacén. MP = Bonferroni *post hoc* is statistically significant with Monte Perdido. A = Bonferroni *post hoc* is statistically significant with Aneto. PE = Bonferroni *post hoc* is statistically significant with Pica d'Estats. P = Bonferroni *post hoc* is statistically significant with Pedraforca. (1) The Pedraforca data were calculated for a n = 116 (2) These data were calculated for an n = 558.

Table 5 (Continued)
Characteristics of the visit of mountaineering practitioners.

Variables	Mulhacén (*n* = 119)	Monte Perdido (*n* = 116)	Aneto (*n* = 112)	Pica d'Estats (*n* = 113)	Pedraforca (*n* = 118)	Total (*n* = 578)
Summit frequency			$\chi^2 = 30.53$, $p < .001$, $\Phi = .23$			
First climb (%)	41.2	69.8	57.1	64.6	43.2	55.0
Two or more climbs (%)	58.8 MP PE	30.2 M P	42.9	35.4 M P	56.8 MP PE	45.0
Climbs to the summit (no.). Average (SD)	7.0 (13.8)	2.4 (6.4)	3.8 (11.2)	2.9 (9.4)	4.1 (5.4)	4.1 (9.9)
Time at the summit			$H(4) = 43.23$, $p < .001$			
Time at the summit (minutes). Average (SD)	33.9 (24.0) A PE P	28.7 (12.9) A PE P	21.4 (14.4) M MP	23.0 (10.6) M MP	21.3 (13.4) M MP	25.7 (16.4)
Photography/filming at the summit			$\chi^2 = 7.75$, $p = .101$, $\Phi = .12$			
No (%)	5.0	4.3	0.9	0.9	5.9	3.5
Yes (%)	95.0	95.7	99.1	99.1	94.1	96.5
Share on social media[2]			$\chi^2 = 7.55$, $p = .109$, $\Phi = .12$			
No (%)	31.9	36.0	41.4	25.9	28.8	32.8
Yes (%)	68.1	64.0	58.6	74.1	71.2	67.2
Importance of COVID-19 in visiting the summit			$H(4) = 5.50$, $p = .239$			
COVID-19 (Likert scale 1-5). Average (SD)	2.31 (1.66)	2.00 (1.54)	1.87 (1.42)	2.01 (1.37)	1.92 (1.26)	2.02 (1.46)
Logistical preparation of the activity			$\chi^2 = 7.56$, $p = .109$, $\Phi = .11$			
Inadequate (%)	29.4	27.6	24.1	30.1	39.8	30.3
Adequate (%)	70.6	72.4	75.9	69.9	60.2	69.7
Equipment			$\chi^2 = 65.75$, $p < .001$, $\Phi = .34$			
Incomplete (%)	60.5	73.3	85.7	55.8	94.9	74.0
Complete (%)	39.5 A P	26.7 P	14.3 M PE P	44.2 A P	5.1 M MP A PE	26.0

Note: SD = standard deviation; χ^2= chi-square; Φ = effect size; H = Kruskal-Wallis. M = Bonferroni *post hoc* is statistically significant with Mulhacén. MP = Bonferroni *post hoc* is statistically significant with Monte Perdido. A = Bonferroni *post hoc* is statistically significant with Aneto. PE = Bonferroni *post hoc* is statistically significant with Pica d'Estats. P = Bonferroni *post hoc* is statistically significant with Pedraforca. (1) The Pedraforca data were calculated for a *n* = 116 (2) These data were calculated for an *n* = 558.

Reasons for visiting

The most valued reasons of the total sample were: firstly, enjoying the landscape, with an average of 4.7 (0.6), followed by observing the scenic beauty of the surroundings, with 4.6 (0.7) (Table 6).

Fourteen of the eighteen variables analysed showed marked differences of varying significance. Significance .001: skills ($p < .001$), physical exercise ($p < .001$), releasing tension ($p < .001$), being away from crowds of people ($p < .001$), improving health ($p < .001$) and releasing anxiety ($p < .001$). Significance .01: learning more about oneself ($p < .01$), thinking about personal values ($p < .01$), showing others that I could do it ($p < .01$). Significance .05: increasing self-esteem ($p < .05$), developing skills, doing something impressive ($p < .05$), proving to myself that I could do it ($p < .05$), experiencing the outdoors ($p < .05$), and observing the beauty of the environment ($p < .05$).

As shown in Table 6, the most valued reasons among the different summits coincide in the first two motivations: enjoying the landscape and observing the scenic beauty of the surroundings. In this respect, it is worth noting the presence of also high scores in the case of Mulhacén for the reasons to experience the outdoors 4.5 (0.8) and to do physical exercise 4.5 (0.9); Monte Perdido, to experience the outdoors 4.2 (1.0) and to live a stimulating and exciting experience 4.2 (1.1); Aneto, to live a stimulating and exciting experience 4.3 (1.1) and do physical exercise 4.2 (1.0); Pica d'Estats, to live a stimulating and exciting experience 4.5 (0.8), do physical exercise 4.4 (0.9) and experience the outdoors 4.4 (0.9) and in Pedraforca, to do physical exercise 4.4 (0.8) and experience the outdoors 4.4 (0.8).

Table 6
Reasons for visit.

Variables	Mulhacén (*n* = 119)	Monte Perdido (*n* = 116)	Aneto (*n* = 112)	Pica d'Estats (*n* = 113)	Pedraforca (*n* = 118)	Total (*n* = 578)	
	Average (SD)	Average (SD)	Average (SD)	Average (SD)	Average (SD)	Average (SD)	Kruskal-Wallis
To increase the feeling of self-esteem	3.5 (1.3) A P	3.0 (1.4)	2.9 (1.4) M	3.3 (1.4)	2.9 (1.4) M	3.1 (1.4)	$H(4)=17.17$, $p < .05$
To develop skills and abilities	3.7 (1.2) MP A	3.2 (1.3) M PE P	3.2 (1.3) M PE P	3.8 (1.1) MP A	3.7 (1.1) MP A	3.5 (1.2)	$H(4)=28.53$, $p < .001$
To learn more about myself	3.5 (1.4) MP A	3.0 (1.4) M PE	2.9 (1.4) M PE	3.5 (1.4) MP A	3.3 (1.3)	3.2 (1.4)	$H(4)=18.53$, $p < .01$
To challenge/push me	3.8 (1.3)	3.6 (1.4)	3.5 (1.4)	3.9 (1.2)	3.6 (1.3)	3.7 (1.3)	$H(4)=4.44$, $p = .350$
For physical exercise	4.5 (0.9) MP	3.9 (1.1) M PE P	4.2 (1.0)	4.4 (0.9) MP	4.4 (0.8) MP	4.3 (1.0)	$H(4)=27.17$, $p < .001$
For an exhilarating and exciting experience	4.4 (0.9)	4.2 (1.1)	4.3 (1.1)	4.5 (0.8)	4.2 (1.0)	4.3 (1.0)	$H(4)=8.98$, $p = .062$
To release or reduce tension	3.7 (1.4) MP A	2.9 (1.4) MPE P	3.1 (1.5) MP	3.5 (1.3) MP	3.8 (1.1) MP A	3.4 (1.4)	$H(4)=31.64$, $p < .001$
To do something impressive	3.3 (1.4)	2.9 (1.4)	3.1 (1.3)	3.3 (1.3)	3.0 (1.3)	3.1 (1.4)	$H(4)=10.71$, $p < .05$
To be away from the crowds	3.8 (1.3) MP	2.9 (1.5) M P	3.3 (1.5)	3.3 (1.4)	3.5 (1.4) MP	3.4 (1.5)	$H(4)=21.62$, $p < .001$
To enjoy the scenery	4.7 (0.6)	4.7 (0.6)	4.6 (0.8)	4.7 (0.6)	4.6 (0.7)	4.7 (0.6)	$H(4)=2.28$, $p = .684$
To think about my personal values	3.6 (1.2) MP A	3.0 (1.5) M	3.0 (1.4) M PE	3.5 (1.3) MP A	3.4 (1.3)	3.3 (1.4)	$H(4)=19.43$, $p < .01$
To experience emotion	3.9 (1.1)	3.6 (1.2)	3.8 (1.2)	4.0 (1.0)	3.8 (1.1)	3.8 (1.1)	$H(4)=7.24$, $p = .124$
To prove to myself that I could do it	3.6 (1.4)	3.2 (1.4)	3.1 (1.5)	3.5 (1.5)	3.4 (1.4)	3.4 (1.4)	$H(4)=10.52$, $p < .05$
To experience the outdoors	4.5 (0.8) MP	4.2 (1.0) M	4.2 (1.1)	4.4 (0.9)	4.4 (0.8)	4.3 (0.9)	$H(4)=12.36$, $p < .05$
To prove to others that I could do it	1.7 (1.2) PE	1.6 (1.0) PE	1.7 (1.1) PE	2.2 (1.4) M MP A	1.9 (1.2)	1.8 (1.2)	$H(4)=16.12$, $p < .01$
To observe the scenic beauty of the surroundings	4.7 (0.5) A	4.6 (0.6)	4.4 (0.8) M	4.6 (0.8)	4.6 (0.7)	4.6 (0.7)	$H(4)=10.32$, $p < .05$
To maintain/improve overall health	4.2 (1.0) MP A	3.6 (1.1) M PE P	3.7 (1.3) M P	4.2 (1.0) MP	4.3 (0.9) MP A	4.0 (1.1)	$H(4)=41.32$, $p < .001$
To help me get rid of anxiety	3.3 (1.5) MP	2.6 (1.4) M P	2.8 (1.5)	2.8 (1.4)	3.2 (1.4) MP	2.9 (1.5)	$H(4)=21.09$, $p < .001$

Note: SD = standard deviation; H = Kruskal-Wallis. M = Bonferroni *post hoc* is statistically significant with Mulhacén. MP = Bonferroni *post hoc* is statistically significant with Monte Perdido. A = Bonferroni *post hoc* is statistically significant with Aneto. PE = Bonferroni *post hoc* is statistically significant with Pica d'Estats. P = Bonferroni *post hoc* is statistically significant with Pedraforca.

Perceptual carrying capacity of visitors

The results showed that the number of people come across during the summit climb was more than 50 visitors (31%), and 33% of the respondents described the number of people observed during their visit as excessive, with a high degree of satisfaction with the visit, with an average score of 4.78 (0.51), on a scale of 1 to 5 (Table 7).

The results showed significant differences between the study summits in relation to the number of people come across ($p < .001$) and in the perception of overcrowding ($p < .01$).

In the analysis by summit, it was observed that the mountaineers on the summit of Mulhacén mostly came across groups of up to 25 people (81.6). On the other hand, 47.5% of the visitors to the summit of Monte Perdido claimed to have met more than 50 people, which meant a small effect size ($\Phi = .23$). With regard to the perception of overcrowding, Pedraforca mountaineers stood out with 40.7% for having declared the number of people observed to be excessive, followed by Monte Perdido and Aneto mountaineers, with 38.8% and 35.7%, respectively. On the other hand, on Mulhacén they recorded the lowest levels of perception of overcrowding, with 18.5%. In terms of satisfaction with the visit, the results were very similar between the different summits.

Discussion

This study is a first approximation of the characterisation of mountaineering practitioners at a national level. The objectives of this study were i) to characterise the generic profile of mountaineers on Spain's emblematic summits, and ii) to identify patterns of behaviour according to the different summits. The results obtained are discussed below.

Generic profile of mountaineers

The article helps to identify characteristics of mountaineering practitioners in a global way thanks to the consideration of five substantially different summits ranging from very accessible peaks, close to large population centres such as Mulhacén (Sierra Nevada National Park) and Pedraforca (Cadí-Moixeró Natural Park) to the peaks of Pica d'Estats, Monte Perdido and Aneto, with different physical-technical requirements.

Among the main results obtained at the socio-demographic level, in line with previous studies such as those carried out by Babí et al. (2018); Habelt et al. (2022); Montaña Segura (2022); Martín and Mediavilla (2020), which characterise the practitioners of this or other similar sports modalities, there was a clear predominance of males over females and, in our case, a higher degree of environmental sensitivity.

Table 7
Perceptual Carrying Capacity.

Indicators	Mulhacén (n = 119)	Monte Perdido (n = 116)	Aneto (n = 112)	Pica d'Estats (n = 113)	Pedraforca (n = 118)	Total (n = 578)
Number of people come across			$\chi^2 = 93.28$, $p < .001$, $\Phi = .23$			
Less than 10 people (%)	42.9	7.8	17.0	12.4	24.6	21.1
Between 10 and 25 people (%)	38.7	19.8	29.5	32.7	20.3	28.2
Between 26 and 50 people (%)	6.7	25.0	23.2	25.7	18.6	19.7
More than 50 people (%)	11.8 MP A PE P	47.4 M P	30.4 M	29.2 M	36.4 M MP	31.0
Perception of overcrowding			$\chi^2 = 22{,}74$, $p < .01$, $\Phi = .14$			
Scarce (%)	7.6	1.7	2.7	1.8	4.2	3.6
Acceptable (%)	73.9	59.5	61.6	66.4	55.1	63.3
Excessive (%)	18.5 MP A P	38.8 M	35.7 M	31.9	40.7 M	33.0
Satisfaction of visit to the summit			$H(4)=4.57$, $p = .334$			
Satisfaction (Likert scale 1-5). Average (SD)	4.75 (0.59)	4.84 (0.39)	4.76 (0.52)	4.84 (0.41)	4.71 (0.59)	4.78 (0.51)

Note: SD = standard deviation; χ^2= chi-square; Φ = effect size. M = Bonferroni *post hoc* is statistically significant with Mulhacén. MP = Bonferroni *post hoc* is statistically significant with Monte Perdido. A = Bonferroni *post hoc* is statistically significant with Aneto. PE = Bonferroni *post hoc* is statistically significant with Pica d'Estats. P = Bonferroni *post hoc* is statistically significant with Pedraforca.

In relation to gender, it is worth noting that this gender gap increased on those summits with more technical climbs, such as Aneto. Taking into account Piedra (2019), this could be explained by the fact that, despite the changing trend in Spanish society in terms of equal rights and opportunities for men and women, stereotypes still persist, mainly promoted by family, schools, and the media, which subliminally influence the choice of physical-sports activities historically rooted in the male role. This circumstance is aggravated, as López and Monreal (2018) point out, by the biased information provided by many media outlets that extol the achievements of male athletes and make some of the female achievements in mountain sports invisible, which does not help in reducing stereotypes.

With regard to the degree of environmental sensitivity, the results showed the presence of a higher level of environmental sensitivity when compared with those obtained in the characterisation of participants in other sports. In this case, 11.6% above mountain runners and 30.8% above mountain bikers (Dorado et al., 2022a; Farías-Torbidoni, 2015). These results support Eterović's (2019) hypothesis that, due to the idiosyncrasies of mountaineering, it is a philosophy of life between sport and bioethics.

With regard to the characteristics of visits, and focusing on those most relevant to the management of public use of this type of space, the following stand out: the identification in the set of data analysed of an occasional visitor profile visiting the summit for the first time, little influenced by the context of the pandemic, who prioritises sharing their experience on social networks and does not adequately prepare the climb to the summit in terms of equipment and planning. All this data is clearly interconnected if we base ourselves on works such as those carried out by Bhatt and Pickering (2022) and Kim and Stepchenkova (2015), which point to popularity as one of the main factors that contribute to the selection of destinations to visit, and with these, the frivolisation of some key aspects in the same, such as safety, environmental consequences, or social repercussions.

In this regard, it is worth noting that the following are key aspects for a safe visit to these environments: i) checking weather conditions, ii) verifying the route, distance and approximate time of the activity, iii) having sufficient provisions, and iv) having informed a third person of the location and approximate duration of the activity. Aspects which, if they had not been foreseen and added to the lack of the necessary equipment, according to García et al. (2019), are the main precursors of increased accident rates in the mountains.

Patterns of behaviour

On a specific level, the results obtained in relation to the characterisation of the visitors allowed us to observe common trends in the profiles of the mountaineers among the different summits analysed, especially those related to the characteristics and reason for the visit.

In terms of visit characteristics and reasons, similarities were observed in the pattern of behaviour, on the one hand, between the mountaineers who summit Aneto, Monte Perdido and Pica d'Estats and, on the other, between those who climb Mulhacén and Pedraforca; this grouping is not maintained in the case of socio-demographic characteristics and perceptual carrying capacity: Monte Perdido and Aneto versus Pica d'Estats and Pedraforca in the case of the former (in this Mulhacén is unbalanced) and Mulhacén versus the rest of the summits in the case of the latter (perceptual carrying capacity). In the case of visit satisfaction, the results show no differences between summits.

Among the main behavioural patterns identified in relation to visit characteristics, two clearly differentiated behavioural patterns could be identified. On the one hand, in the case of Monte Perdido, Aneto and Pica d'Estats, the identification of a longer duration and frequency of first-time visits than the rest of the summits. That is, a two-day visit and a first-time visit frequency of more than 57%. On the other hand, in the case of Mulhacén and Pedraforca, the characterisation of a more frequent visit, shorter and with a larger group size. The latter data, which if we compare them with the results obtained in previous studies such as the one carried out in the Pedraforca massif area during 2019 (Farías-Torbidoni & Morera, 2019), show the presence of a certain change in trend both in relation to the frequency of visits to the Park (more recurrent visits, increase of almost 5%) and in the duration of the visit (shorter visit, increase of more than 27% of the one-day visit), which indicate a change towards a more local visitor profile, which may be explained by the situation of deconfinement experienced in Catalonia (Dot et al., 2022).

In relation to the reasons most highly rated by the visitors surveyed, the motivations related to enjoying the landscape (1st), observing the scenic beauty of the surroundings (2nd), practising an outdoor activity (3rd), and doing physical activity (4th) were most highly rated by the visitors who climbed Mulhacén and Pedraforca, unlike the mountaineers who climbed the summits of Monte Perdido, Aneto and Pica d'Estats, relegated the third and

fourth motivations in favour of motivations related to the possibility of having a stimulating and exciting experience (3rd). These results are in line with the data obtained by Farías-Torbidoni et al. (2020) and Luque-Gil et al. (2018) in previous non-summit-specific studies.

At this point, it is worth noting that no pattern was identified in relation to sporting habits and perceptual load capacity, with the results obtained in these dimensions being quite similar between summits. For example, in the case of sporting habits, in all the summits, with the exception of the Pedraforca summit, the group of people surveyed showed the same profile: regular practitioners of this sport, mostly non-federated, with an average seniority of more than 16 years. The latter data, if we compare them with those obtained in studies of the profile of practitioners of other sports modalities such as mountain running and mountain biking, show greater seniority, exceeding by 10 and 6 years, respectively, the average value obtained in these profiles (Dorado et al., 2022a; Farías-Torbidoni et al., 2021; Guiu & Leyton, 2019). These results could undoubtedly be explained by the long tradition of mountaineering in Spain which, after its institutionalisation in 1922 (creation of the Spanish Mountaineering Federation), has become one of the most popular sports in Spanish society (Ministerio de Cultura y Deporte, 2022; Moscoso, 2004).

Finally, in relation to the results obtained with regard to perceptual carrying capacity and satisfaction with the visit, a high degree of satisfaction was observed despite a high perceptual sensation of overcrowding. In this sense, it is worth pointing out that this apparent contradiction is not exceptional, given that the results obtained in previous studies such as those carried out by Berrocal et al. (2013) and Luque-Gil et al. (2018) showed the same result. In the words of Luque-Gil et al. (2018), this could be explained by a high tolerance of visitors to the degree of overcrowding present in this type of environment.

Conclusions

Previous studies have characterised the profile of visitors to mountain sports at national level, but none have focused in depth on mountaineering. This is the main contribution of this study, which focused on identifying the generic profile of mountaineers on emblematic summits.

Firstly, the results obtained in relation to the generic profile constitute a good knowledge base, not only in relation to other mountain sports disciplines but also in decision-making for a more sustainable management of this practice. Knowing the characteristics of mountaineers can favour the implementation of certain environmental awareness campaigns, safer practices, among others.

Secondly, although the study of these characteristics and the comparison between summits showed somewhat different patterns of behaviour, they do not justify specific and differentiated management in the different environments. This is a much debated topic in different forums, especially in the first post-pandemic months, where different administrations advanced in the implementation of isolated regulations, very disconnected at the regional level and not always coherent with the needs or characteristics of the different environments (Gómez-Varela et al., 2020; González et al., 2021; Medina-Chavarría et al., 2022; Navarrete & Gómez-Limón, 2022). The results obtained in this study support the possibility of a more global approach to the design of joint actions, favouring efficiency in their design and a better understanding of them by the recipients, i.e. mountaineers and visitors in general. The results obtained in this respect support this, as there are no excessive differences between the different summits, despite the idiosyncrasies of each one of them. However, always taking into account the particularities of the different environments.

Limitations and future prospects

Finally, the main limitation of this study in relation to its implementation is that it was carried out during a pandemic, with all the implications that this may have had on the results obtained. In this sense, it would be interesting to replicate the study again in order to be able to contrast the effect that the pandemic may have had on the data obtained.

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Winter, climbing and mountaineering sports instructor qualifications in Spain: an instructors' and employers' perception

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Two alpinists climbing a snowy mountain in the Arctic under the northern lights. Adobestock ®Urdialex

Abstract

Physical and sporting activities in the natural environment have experienced a boom and have taken on a touristic, environmental, economic, and political dimension of great relevance. Previous research points to the need for the training of qualified personnel for the exercise of the related professional activity, in order to preserve the well-being, health, and safety of its practitioners and the general population. This article aims to evaluate the adequacy of the curricula of sports technician and advanced sports technician qualifications in winter, mountaineering and climbing sports to the needs of the professional activity, through the perception of key actors: technical staff and employers. A quantitative methodology has been used by means of a questionnaire designed *ad hoc* validated by expert judgement. The total number of valid questionnaires was 405, of which 372 were answered by technicians and 33 by employers. The results show data that become the basis for the optimisation of these degrees, seeking a better connection between education and the needs of professional activity and taking into account the agents involved. The comprehensive analysis provides information for decision-making in possible future curriculum developments.

Keywords: curricular adaptation, curriculum, physical-sport activities in nature, professional practice, qualifications, required competencies.

Introduction

Physical-sports activities in the natural environment (hereinafter PSANE) are increasingly diversified and changing, more numerous throughout the year, and have entered a cycle of constant creation that has led to a significant boom (Mulero & Rivera, 2018). The 21st century has seen an increase in the number of practitioners and professionals involved, as well as the growth of a large market (Izenstark & Middaugh, 2022; Kong & Sun, 2022; Mulero & Rivera, 2018). The offer of the PSANE in Spain has become an economic attraction for active tourism companies, professionals, sports clubs, regions, and other agents, going from being leisure activities to taking on a tourist, environmental, economic, and political dimension (Molina et al., 2017). Active tourism has seen a spectacular development in supply, demand, and the number of existing companies (ANETAE, 2014, 2020; Carrasco-Jiménez, 2020; Mulero & Rivera, 2018; SET, 2018).

There is a wide range of training and a multiplicity of qualifications related to physical activity and sport (hereinafter PA&S) and PSANE. This article focuses on special regime sports teaching (hereinafter SRSE), specifically the qualifications of sports technician and advanced sports technician (hereinafter ST and SST) in the specialities of winter sports (hereinafter WS) established by Royal Decree 319/2000 and the mountaineering and climbing sports (hereinafter MCS), established by Royal Decree 318/2000. Relatively recent legislative changes (Royal Decrees 701/2019 and 702/2019) established the new MCS, ST, and SST curricula. The specialisations under study are relevant within the group of SRSE in Spain since, of the total number of students enrolled in intermediate level vocational training (academic year 2019-2020), 11.4% were in WS specialisations and 12.3% were in MCS. In terms of superior level vocational training education, of the total number of students enrolled, 8.3% were from WS and 3.7% from MCS. Nevertheless, for the same academic year, the number of enrolments is far from the number of students who complete their studies, the latter being much lower: 28.9% of MCS ST students, 18.4% of WS students, 39.4% of WS SST students and only 3.7% of MCS SST students complete their studies (Ministry of Culture and Sport, 2022).

Although official qualifications are becoming more and more solidified in Spain, they coexist with other courses; as an example, see the case of canyoners in Martínez Cerón et al. (2022). According to recent data from guides associated to the Spanish Association of Mountain Guides (hereinafter AEGM), 89.5% have official training, 6.8% have a recognised qualification and 3.2% have a recognised qualification (Spanish Association of Mountain Guides, 2022). The number of people currently working as STs differs from the number of graduates. In Spain, there are a total of 1,290 registered guides: 323 canyoning technicians, 201 climbing technicians, 888 medium mountain guides, 222 high mountain technicians and 159 high mountain technicians (Spanish Association of Mountain Guides, 2022); although, for example, only 35.4% of canyoning STs belong to this association (Martínez Cerón et al., 2022). Given that not all people practising as guides are associated with the AEGM and that similar data is not available for WS, there is currently no database that accurately records the number of STs and SSTs who are practising or have practised in Spain.

There are studies in various fields (physical education, *fitness*, social education, administration, nursing, etc.) dedicated to curriculum adaptation or alignment, curriculum design, the relationship of the professional profile with professional practice, and competencies (Caballero et al. 2017; Freire et al., 2013; Gil et al., 2009; Harris & Metzler, 2018; Jiménez et al., 2019; Jornet et al., 2001; López-Gil et al., 2019; Meroño et al., 2018; among others) and, although it is true that there is more and more research on PSANE, more journals involved in the subject and more articles available (Baena et al., 2019), the situation of ST and SST degrees does not stand out in the literature. Studies are needed to address the educational curricula, content, and competencies of these degrees.

Thus, given the above context, we can justify the need to assess the adequacy of the curriculum of the ST and SST degrees of WS and MCS to the needs of the exercise of the professional activity, through the perception of key actors (Freire et al., 2013; Mirabelle & Wish, 2000): employers and graduate technicians (Jornet et al., 2001).

This article aims to provide relevant information for the optimisation of the existing connection between ST and SST training and the needs in the exercise of professional activity in WS and MCS in Spain.

Method

Methodological approach and variables

The design of this study, from a quantitative perspective, was non-experimental and cross-sectional (Latorre et al., 2003). Descriptive (Delicado et al., 2018) and relational elements were combined.

The analysis was approached on the basis of the structure and content of the State regulations establishing qualifications. Following the types of evaluation plans based on units of analysis (Jornet et al., 2001), the proposed analysis was divided into two broad dimensions that grouped the different variables into sub-dimensions: 1) The teaching, sub-dimensions referring to the general perception of the teaching (variables: general quality, students' expectations of the training and employers' expectations of the people recruited, suitability of the syllabus for subsequent professional activity and general satisfaction with the teaching) and to the curriculum (variables: modules and training gaps); and 2) Scope of professional activity (variables: fields of action, main occupations and relevant jobs, suitability of the studies for subsequent professional activity, and responsibility in the job).

Samples and sampling

The sampling was non-probabilistic and casual (Latorre et al., 2003) and the inclusion criteria were: 1) Sports technician: trained and qualified in Spain in one of the specialities of winter, mountain and climbing sports and who has practised or is practising the profession; and 2) Employer: registered in Spain and who hires or has hired technicians in winter sports and/or mountain and climbing specialities. There is no complete sampling base of such populations to facilitate drawing a sample; the final sample included people from various regions, levels and specialities, and is considered reasonably representative of the researched population.

The total number of participants was 350, of whom 328 were technicians (see Table 1 for demographic characteristics) and 22 were employers (see Table 2 for demographic characteristics). Due to the objective of the study, the design of the questionnaire allowed the same person to answer for more than one speciality and training level (a technician can be qualified in two different specialities and/or levels; an employer can have technicians hired in different specialities and/or levels); for this reason, the number of participants was lower than the number of valid cases, so that, out of 405 valid cases, 372 were answered as a sports technician and 33 as an employer. There were 629 responses to the questionnaire, of which 405 were complete responses and were considered valid cases; the remaining 224 responses were not considered valid cases because they were incomplete questionnaires.

The characteristics of the teaching taken by technicians in reference to the training centres are detailed in Table 3.

Table 1
Demographic characteristics of technicians; n = *328.*

Age (years)		42.63 ± 10.79
Experience (years)		10.29 ± 14.13
Gender	Woman	61 (18.6 %)
	Man	265 (80.8 %)
	Non-binary	2 (0.6 %)
Studies	ESO (mandatory secondary education)	39 (11.9 %)
	Baccalaureate	106 (32.3 %)
	Degree	112 (34.1 %)
	Postgraduate studies	15 (4.6 %)
	Master's degree	47 (14.3 %)
	PhD	9 (2.7 %)
Employment status	Employed, full-time	78 (23.8 %)
	Employed, part-time	56 (17.1 %)
	Cooperativist	4 (1.2 %)
	Self-employed	137 (41.8 %)
	Unemployed, looking for work	31 (9.5 %)
	Unemployed, not looking for work	2 (0.6 %)
	Retired	5 (1.5 %)
	Other	15 (4.6 %)

Table 2
Demographic characteristics of employers; n = *22*

Age (years)		46.09 ± 9.32
Gender	Woman	3 (13.6 %)
	Man	19 (86.4 %)
	Non-binary	0 (0.0 %)
Experience (years)		11.43 ± 7.29
Studies	ESO (mandatory secondary education)	2 (9.1 %)
	Baccalaureate	7 (31.8 %)
	Degree	6 (27.3 %)
	Postgraduate studies	1 (4.5 %)
	Master's degree	6 (27.3 %)
	PhD	0 (0.0 %)
Peak employees		13.05 ± 9.6

Table 3
Characteristics of the teaching attended by technicians in reference to training centres; valid cases n = *372.*

Type of training centre where the education was received	Public	201 (54.03 %)
	State-funded private	38 (10.22 %)
	Fully private	133 (35.75 %)
Region of training where the education has taken place	Andalusia	21 (5.65 %)
	Aragon	71 (19.09 %)
	Asturias	8 (2.15 %)
	Balearic Islands	3 (0.81 %)
	Canary Islands	4 (1.08 %)
	Cantabria	11 (2.96 %)
	Castile and León	2 (0.54 %)
	Castile-La Mancha	0 (0.00 %)
	Catalonia	172 (46.24 %)
	Community of Madrid	42 (11.29 %)
	Navarra	3 (0.81 %)
	Valencian Community	5 (1.34 %)
	Extremadura	1 (0.27 %)
	Galicia	6 (1.61 %)
	Murcia	3 (0.81 %)
	Basque Country	20 (5.38 %)

Resources

An online questionnaire was administered, both autonomously and directly, and designed *ad hoc* based on existing literature (Barbera, 2014; Freire et al., 2013; Gil et al., 2009; Misener & Danylchuk, 2009; Santos et al., 2010; Tejada, 2001). Similar studies have used online questionnaires and *ad hoc* design (Damián et al., 2010; Harris & Metzler, 2018; Iranzo et al., 2018). The questionnaire was reviewed and validated by experts, who assessed the degree of clarity and relevance of all the questions; their professional profile was that of a university lecturer with expertise in PSANE, with an extensive research background, as well as Senior Researcher in European competitive projects related to the subject, in addition to having ST degrees and professional experience in PSANE. The research protocol received a positive evaluation (no. 22/CEICGC/2020) from the Clinical Research Ethics Committee of the Catalan Sports Administration.

The final version was structured in blocks: 1) Welcome to the questionnaire; 2) Inclusion criteria; 3) Socio-demographic data; and 4) Questions according to modality and educational level. The response format was: ordinal Likert rating scale (1-5), multiple choice, and checkbox.

Procedure

Participants were informed of the purpose of the study, the voluntary participation, and the anonymity of the data. They had the opportunity to ask the research team about the characteristics of the study, freely agreed to participate, and signed the informed consent form. They were provided with a web link to the SurveyMonkey® platform. Although the questionnaire was administered en masse, it was answered individually.

Analysis of results

Quantitative data analysis was performed using IBM-SPSS-Statistics (v. 23). First, a descriptive analysis was developed, using frequencies and percentages. Secondly, the Wilcoxon's W test for related samples was used to compare usefulness and module mastery scores, separately for the technician data and the employer data. Thirdly, the Mann-Whitney U test for independent samples was used to compare the technicians' and employers' perceptions of the usefulness and mastery of the teaching modules. Finally, the data from technicians and employers were also compared in terms of the need to incorporate other competencies and in terms of the training gaps identified. For this purpose, the Chi-square test was used for nominal variables, incorporating Fisher's exact test where necessary. Comparisons between technicians and employers were only made when the sample of employers contained a minimum of ten cases. In addition, it is important to note that in all statistical comparisons, cases were grouped by educational level where possible. In all analyses, the *p* values of less than .05 were considered statistically significant.

Results

The teaching. General perception

a. General quality

The perception of the overall quality of the training received was higher in MCS than in WS, both by technicians and employers (see Figure 1).

Figure 1
The technical staff consider that the training they received was of high quality; the employers consider that the training received by the technicians was of high quality; from 1 (strongly disagree) to 5 (strongly agree).

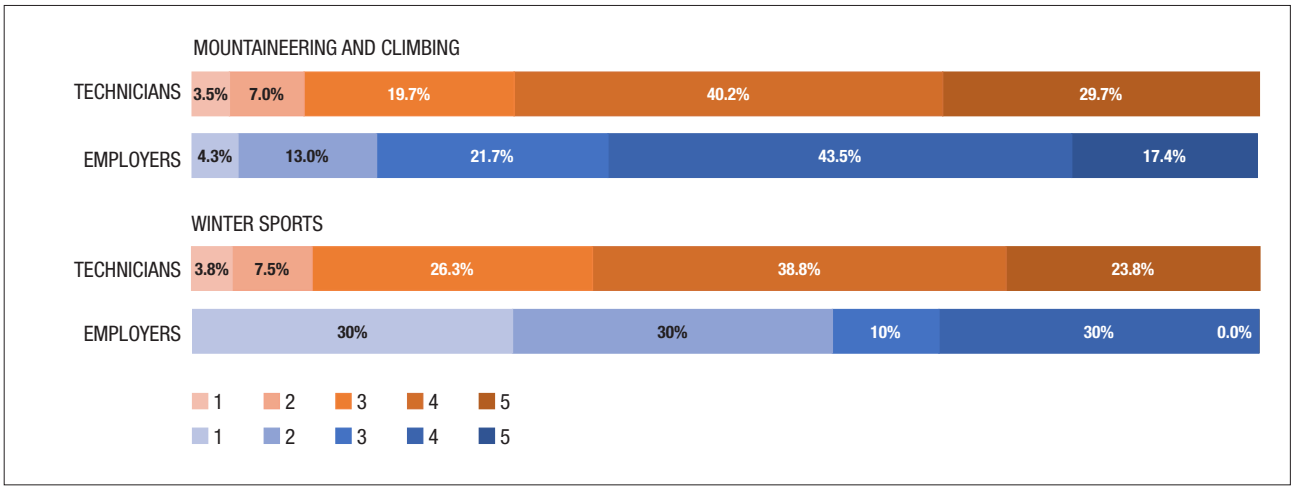


Figure 2
The teaching contents met the expectations of the technical staff; the training of the recruited technical staff met the expectations of the employers in terms of professional practice; from 1 (strongly disagree) to 5 (strongly agree).

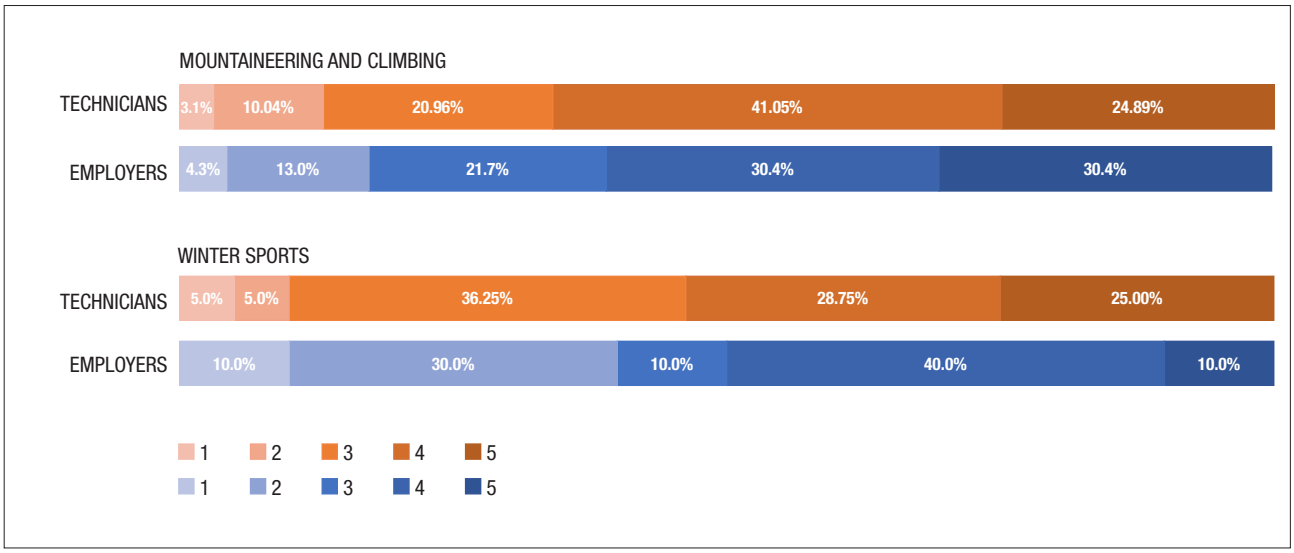
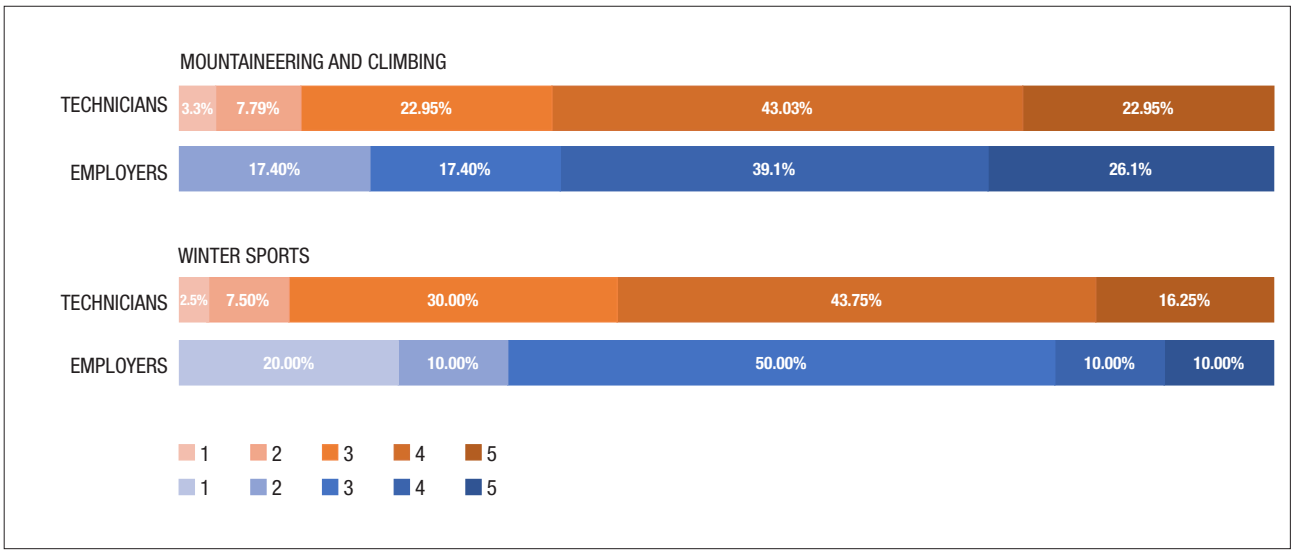


Figure 3
The technical staff assessed the adequacy of the training curriculum with the subsequent professional practice; from 1 (very poor) to 5 (very good). Employers think that the training prepared the technical staff to do their job successfully; from 1 (strongly disagree) to 5 (strongly agree).



b. Expectations

Employers' expectations of the training of the technical staff recruited were more satisfied in MCS than in WS; the same is true for the expectations of the technical staff's teaching (see Figure 2).

39% of MCS and 50% of WS employers were not satisfied with their expectations of the technical staff recruited (scores between 1 and 3).

c. Adequacy of the curriculum for subsequent professional practice

The matching of the curriculum with the subsequent exercise of the professional activity followed a similar dynamic; it was better valued in MCS than in WS, both by technical staff and employers.

d. Overall satisfaction

90% of WS technicians and 84.3% of MCS technicians would study the teaching contents again. The reasons of

the participants were collected. In the reasons for "yes", it stands out that the degree enables access to the labour market (see Figure 4). Among the reasons for "no", the poor quality of teaching and the fact that all participants would change study centres, as well as the high financial cost in the case of WS, stand out (see Figure 5).

Figure 4
For what reasons would participants study the same again? Multiple choice.

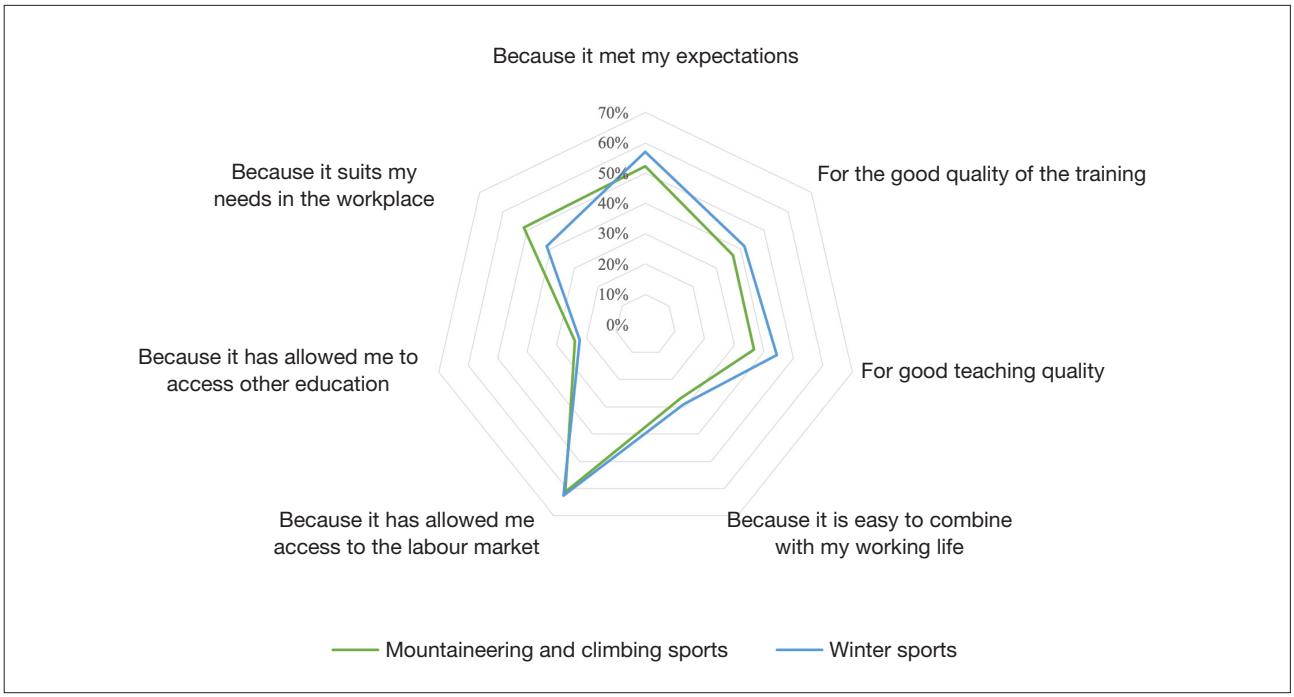
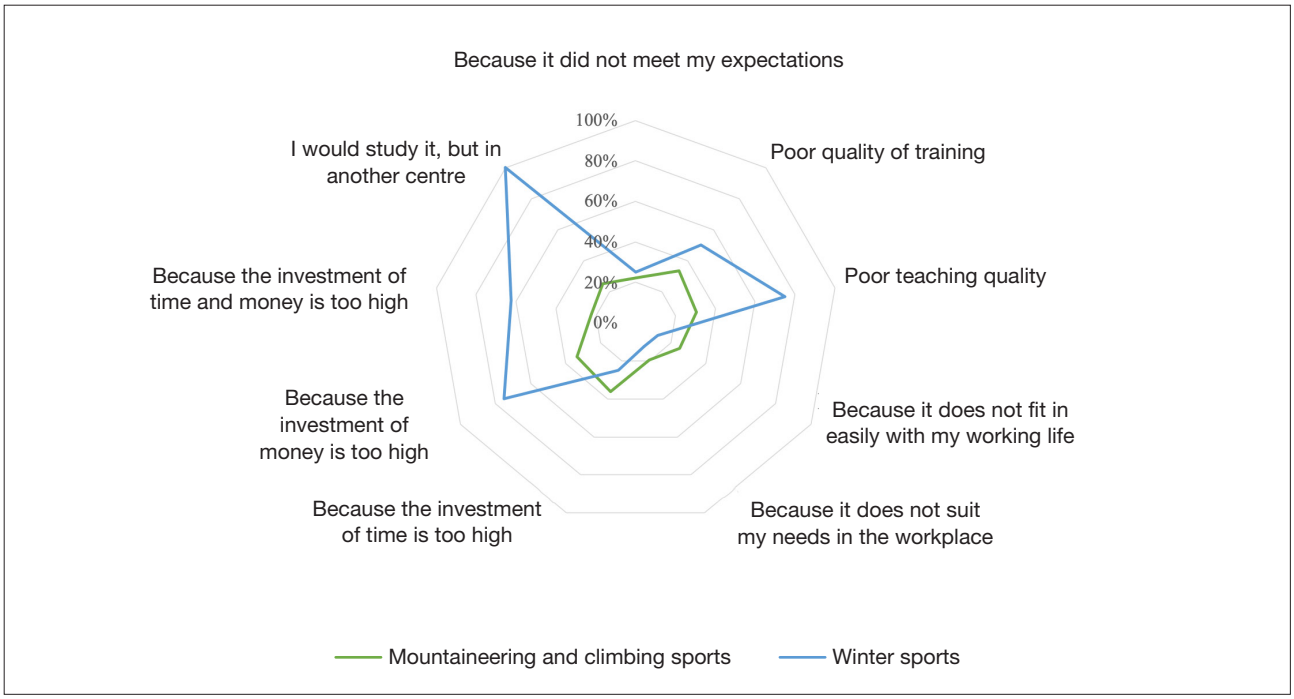


Figure 5
For what reasons would participants not study the same again? Multiple choice.



Contents. Modules

Technical staff and employers were asked how useful each module is for the technician's work; from 1 (not useful at all) to 5 (maximum usefulness). We asked whether at the end of the degree they felt mastery or demonstrated mastery of the content associated with the module; from 1 (strongly disagree) to 5 (strongly agree).

a. Common modules

Generally speaking, the technical staff considered that the modules taken were useful for their professional activity; this contrasted with a lack of a feeling of mastery of them. In this respect, there were significant differences in the modules Psychopedagogical bases of teaching and training, First aid, Sport theory and sociology, Sport biomechanics, High performance coaching, Physiology, Sport management, and High performance psychology.

According to the employers themselves, in the comparison between usefulness and mastery of the modules taken by the technical staff, there were no significant differences. Employers found some modules relatively unhelpful and the technical staff showed little mastery. This was the case, for example, with the module Organisation and Legislation of Sport (MCS). The technical staff, in contrast, did find the module useful and felt mastery, with statistically significant differences between the assessment of technicians and employers.

There were significant differences between the comparisons made by technicians and employers with regard to the usefulness of all the modules of the 2nd level of MCS. In contrast, this was not the case in WS.

In terms of mastery, it contrasted the perceived mastery of the technical staff with the employers' assessment of the mastery shown by the hired technicians. Significant differences existed in Coaching (2nd level MCS); Sport Organisation and Legislation (2nd level MCS, 1st and 2nd level WS), and Sport Theory and Sociology (2nd level MCS and WS). For detailed results, see Table 4 and Table 5.

Table 4
Common modules by WS level. Response rates and comparisons are shown. Only the comparisons that could be made due to the specific sample size for each speciality and level are shown.

Technicians. Level 1 WS											Comparison of usefulness and mastery
	USEFULNESS					MASTERY					Wilcoxon W (*p*)
	1	2	3	4	5	1	2	3	4	5	
Anatomical and physiological bases of sport	0	7.1	39.3	35.7	17.9	3.6	21.4	42.9	10.7	21.4	51,500 (.128)
Psycho-pedagogical bases of teaching and coaching	3.6	7.1	14.3	39.3	35.7	3.6	21.4	32.1	17.9	25.0	**58.000 (.040)***
Sports coaching	10.7	7.1	28.6	28.6	25.0	7.1	21.4	32.1	21.4	17.9	60,500 (.265)
Sociological foundations of sport	7.1	25.0	32.1	28.6	7.1	7.1	10.7	28.6	28.6	25.0	113.000 (.079)
Organisation and legislation of sport	7.1	25.0	32.1	25.0	10.7	3.6	14.3	35.7	21.4	25.0	92,500 (.198)
First aid and hygiene in sport	0.0	3.6	17.9	25.0	53.6	10.7	17.9	28.6	25.0	17.9	**21,500 (.002)***
Employers. Level 1 WS											Comparison of technicians and employers
	USEFULNESS					MASTERY					USEFULNESS / MASTERY
	1	2	3	4	5	1	2	3	4	5	U Mann Whitney U (*p*)
Anatomical and physiological bases of sport	0	40	0	20	40	20	0	20	40	20	71.000 (1.000) / 79,500 (.643)
Psycho-pedagogical bases of teaching and coaching	0	0	0	0	100	20	0	60	20	0	**115.000 (.022)*** / 53,500 (.419)
Sports coaching	0	0	40	20	40	20	20	40	20	0	84.000 (.509) / 51.000 (.364)
Sociological foundations of sport	0	0	60	20	20	20	20	40	20	0	89,500 (.338) / 39,500 (.129)
Organisation and legislation of sport	0	40	20	20	20	20	40	40	0	0	72,500 (.903) / **26,500 (.026)***
First aid and hygiene in sport	0	0	0	40	60	20	0	20	40	20	80,500 (.609) / 78.000 (.715)

Note: * Statistically significant differences

Table 4 (Continued)
Common modules by WS level. Response rates and comparisons are shown. Only the comparisons that could be made due to the specific sample size for each speciality and level are shown.

Technicians. Level 2 WS											Comparison of usefulness and mastery
	USEFULNESS					MASTERY					Wilcoxon W (*p*)
	1	2	3	4	5	1	2	3	4	5	
Anatomical and physiological bases of sport	0.0	14.3	25.7	40.0	20.0	2.9	14.3	42.9	11.4	28.6	122.000 (.402)
Psycho-pedagogical bases of teaching and coaching	0.0	8.6	14.3	37.1	40.0	2.9	17.1	40.0	20.0	20.0	**62,500 (.006)***
Sports coaching	0.0	11.4	17.1	37.1	34.3	5.7	17.1	22.9	37.1	17.1	56.000 (.031)
Organisation and legislation of sport	8.6	25.7	25.7	17.1	22.9	5.7	14.3	25.7	28.6	25.7	235,500 (.251)
Theory and sociology of sport	5.7	25.7	25.7	25.7	17.1	2.9	11.4	28.6	25.7	31.4	**198.000 (.062)***
Employers. Level 1 WS											Comparison of technicians and employers
	USEFULNESS					MASTERY					USEFULNESS / MASTERY
	1	2	3	4	5	1	2	3	4	5	U Mann Whitney U (*p*)
Anatomical and physiological bases of sport	0	0	20	20	60	20	40	20	20	0	125.000 (.133) / 44.000 (.078)
Psycho-pedagogical bases of teaching and coaching	0	0	20	0	80	20	40	20	20	0	117,500 (.228) / 47.000 (.103)
Sports coaching	0	0	20	40	40	20	20	60	0	0	98.000 (.691) / 42.000 (.065)
Organisation and legislation of sport	0	20	40	0	40	20	40	40	0	0	102,500 (.551) / **33,000 (.024)***
Theory and sociology of sport	20	0	20	0	60	20	40	40	0	0	112,500 (.317) / **26,500 (.009)***
Technicians. Higher Level WS											Comparison of usefulness and mastery
	USEFULNESS					MASTERY					Wilcoxon W (*p*)
	1	2	3	4	5	1	2	3	4	5	
Sports biomechanics	11.8	0.0	11.8	17.6	58.8	23.5	17.6	23.5	11.8	23.5	**12,500 (.020)***
High-performance sports coaching	5.9	0.0	11.8	23.5	58.8	11.8	41.2	0.0	23.5	23.5	**0.000 (.002)***
Exercise physiology	11.8	0.0	11.8	11.8	64.7	11.8	23.5	11.8	23.5	29.4	**11,500 (.027)***
Sport management	11.8	0.0	5.9	29.4	52.9	17.6	23.5	17.6	23.5	17.6	**12,500 (.020)***
Psychology of high performance in sport	5.9	5.9	17.6	11.8	58.8	23.5	11.8	17.6	23.5	23.5	**11,500 (.028)***
Sociology of high performance sport	11.8	5.9	17.6	23.5	41.2	23.5	5.9	17.6	29.4	23.5	26,500 (.322)

Note: * Statistically significant differences

Table 5
Common modules by MCS levels. Response rates and comparisons are shown. Only the comparisons that could be made due to the specific sample size for each speciality and level are shown.

Technicians. Level 2 MCS											Comparison of usefulness and mastery
	USEFULNESS					MASTERY					Wilcoxon W (*p*)
	1	2	3	4	5	1	2	3	4	5	
Anatomical and physiological bases of sport	2.8	12.5	21.6	34.7	28.4	7.4	9.1	22.7	26.7	34.1	3,053.000 (.869)
Psycho-pedagogical bases of education	2.8	13.6	20.5	27.3	35.8	9.1	14.8	23.9	19.9	32.4	**2,376.500 (.029)***
Sports coaching	9.1	10.8	17.6	32.4	30.1	9.7	9.7	25.6	25.6	29.5	2,812.000 (.463)
Organisation and legislation of sport	5.7	12.5	25.6	26.1	30.1	9.7	13.1	24.4	22.7	30.1	3,040.000 (.323)
Theory and sociology of sport	9.1	19.9	34.1	20.5	16.5	9.1	10.8	25.0	21.6	33.5	**5,204.000 (< .001)***

Employers. Level 2 MCS											Comparison of usefulness and mastery
	USEFULNESS					MASTERY					Wilcoxon W (*p*)
	1	2	3	4	5	1	2	3	4	5	
Anatomical and physiological bases of sport	0.0	33.3	38.9	11.1	16.7	0.0	27.8	27.8	33.3	11.1	28,500 (.454)
Psycho-pedagogical bases of teaching and coaching	11.1	22.2	33.3	22.2	11.1	5.6	22.2	33.3	33.3	5.6	38,500 (.593)
Sports coaching	5.6	33.3	44.4	5.6	11.1	11.1	22.2	33.3	33.3	0.0	42.000 (.796)
Organisation and legislation of sport	44.4	27.8	16.7	11.1	0.0	16.7	16.7	44.4	22.2	0.0	28,500 (.680)
Theory and sociology of sport	22.2	27.8	33.3	11.1	5.6	11.1	22.2	44.4	22.2	0.0	31,500 (.273)

	USEFULNESS	MASTERY
	U Mann Whitney U (*p*)	
Anatomical and physiological bases of sport	**1,062.000 (.017)***	1,197.000 (.077)
Psycho-pedagogical bases of teaching and coaching	**1,000.000 (.008)***	1,258.500 (.140)
Sports coaching	**958,500 (.004)***	**1,067.000 (.019)***
Organisation and legislation of sport	**1,039.500 (.013)***	**1,015.000 (.010)***
Theory and sociology of sport	**1,105.000 (.029)***	**966.000 (.005)***

Technicians. Higher Level MCS											Comparison of usefulness and mastery
	USEFULNESS					MASTERY					Wilcoxon W (*p*)
	1	2	3	4	5	1	2	3	4	5	
Sports biomechanics	7.4	18.5	29.6	29.6	14.8	11.1	33.3	14.8	22.2	18.5	91,500 (.395)
High-performance sports coaching	14.8	18.5	22.2	22.2	22.2	18.5	33.3	18.5	11.1	18.5	81,500 (.373)
Exercise physiology	0.0	11.1	37.0	25.9	25.9	11.1	18.5	37.0	14.8	18.5	49.000 (.058)
Sport management	3.7	14.8	25.9	40.7	14.8	11.1	22.2	29.6	22.2	14.8	75,000 (.254)
Psychology of high performance in sport	0.0	11.1	33.3	33.3	22.2	11.1	18.5	37.0	14.8	18.5	45,500 (.075)
Sociology of high performance sport	3.7	29.6	33.3	18.5	14.8	18.5	7.4	37.0	18.5	18.5	94,500 (.984)

Note: * Statistically significant differences

Table 6
New common modules of 2nd level MCS. Percentages and comparisons are shown

	Technicians					Employers					Comparison
	USEFULNESS					MASTERY					
	1	2	3	4	5	1	2	3	4	5	U Mann Whitney U (*p*)
Basis of sports learning	6.2	14.3	36.6	26.1	16.8	0.0	29.4	29.4	35.3	5.9	1,245,500 (.527)
Bases of sports coaching	7.5	13.0	24.2	34.2	21.1	0.0	23.5	47.1	23.5	5.9	1,052.000 (.105)
Adapted sport and disability	1.9	12.4	21.7	29.2	34.8	11.8	0.0	35.3	41.2	11.8	1,082.500 (.141)
Sports organisation and legislation	4.3	13.7	28.6	30.4	23.0	0.0	23.5	41.2	23.5	11.8	1,119,000 (.201)
Gender and sport	10.6	20.5	19.3	23.6	26.1	5.9	29.4	29.4	23.5	11.8	1,183,500 (.348)
Hiking school	6.2	13.7	21.1	23.0	36.0	0.0	0.0	41.2	41.2	17.6	1,330.500 (.845)
Technical training in mid-mountain in summer	2.5	4.3	13.7	18.6	60.9	0.0	5.9	11.8	47.1	35.3	1,107.500 (.146)
Guidance and orientation in mid-mountain	1.2	1.9	7.5	10.6	78.9	0.0	0.0	11.8	23.5	64.7	1,196.500 (.243)

Table 7
MCS, training gaps: response rates and comparison.

Technicians		Employers		Comparison of technicians and employers
Yes	No	Yes	No	Pearson's Chi-square (*p*)
68.6	31.4	73.9	26.1	.647

Table 8
WS, training gaps: response rates and comparison.

Technicians		Employers		Comparison of technicians and employers
Yes	No	Yes	No	Fisher's Exact Test (*p*)
65	35	100	0	**.028***

Note: * Statistically significant differences

b. Modules of the new curriculum: usefulness

With regard to the assessment of the new modules (2nd level LOE of MCS), those considered most useful are Guidance and orientation in mid-mountain, Technical improvement in mid-mountain in summer and Hiking School; there are no significant differences between the assessment made by technical staff and employers of the usefulness of these new modules. For detailed results, see Table 6.

Contents. Training gaps

In MCS, 68.6% of the technical staff stated that they would have needed more training, and 73.9% of the employing staff have identified shortcomings in the training of the technical staff hired. There were no statistically significant differences in the comparison between technical staff and employer (Pearson's chi-square $p = .647$) (see Table 7).

In WS, 65% of the technical staff stated that they would have needed more training and 100% of the employing staff identified gaps in the training of the technical staff recruited. Analyses pointed to statistically significant differences between technical staff and employers (see Table 8).

Furthermore, 69.6% of employers in MCS and 80% in WS thought it was necessary to provide additional technical training related to the competencies needed in the workplace for technical staff.

Figure 6
The technical staff assessed whether at the end of the degree they clearly knew about the main occupations they could develop in the labour market; from 1 (strongly disagree) to 5 (strongly agree).

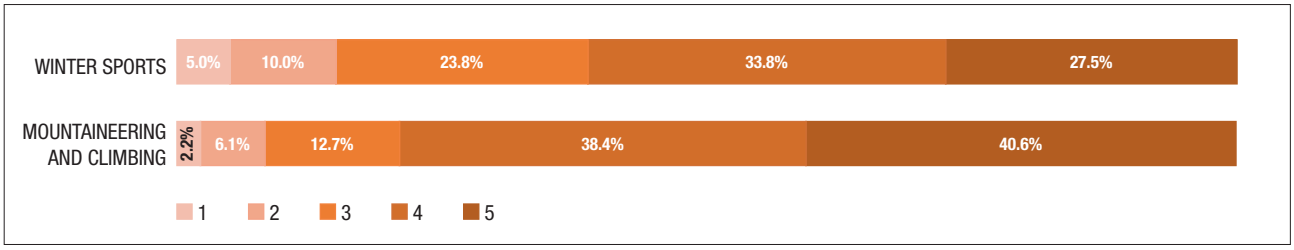


Table 9
Preparation for professional activity: response rates and comparison between technicians and employers.

	Technicians					Employers					Comparison
	1	2	3	4	5	1	2	3	4	5	U Mann Whitney U (*p*)
MCS	1.1	6.3	18.7	45.9	28	4.3	13	26.1	43.5	13	**2,312.500 (.034)***
WS	5	6.9	23.8	44.6	19.8	30	20	20	30	0	**248.000 (.005)***

Note: * Statistically significant differences

Scope of professional activity

a. Areas of action

It was found that 69% of MCS and 67% of WS technicians do not know all the fields of action (established in the Royal Decree) in which they can work with their degree.

b. Main occupations

27.5% in WS and 40.6% in MCS rated that they strongly agreed that they were clear about the occupations they could develop in the labour market (see Figure 6).

c. Preparation for the exercise of the professional activity

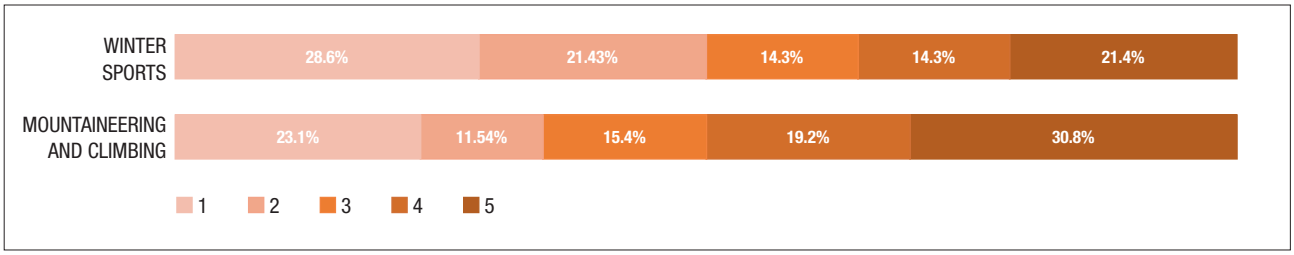
Technical staff assessed whether at the end of the qualification they felt fully prepared for immediate professional practice; employers assessed whether, at the end of the training, the recruited technical staff were prepared for immediate professional practice. From 1 (strongly disagree) to 5 (strongly agree).

Especially in WS, technicians in general perceived themselves as more prepared than employers perceived technicians. There are significant differences (see Table 9).

d. Responsibility in the workplace

Royal Decree 319/2000 (in force for WS) stipulates that qualified people at the first level of teaching must always act under the supervision of professionals at a higher level. In contrast, the current LOE curriculum for MCS no longer establishes such a limitation for the first level of MCS, and they can act without supervision. Technicians were asked whether they felt the need to always act under the supervision of senior professionals. Some heterogeneity appeared in the ratings, with 50% in MCS and 35.7% in WS scoring between 4 and 5 (see Figure 7).

Figure 7
With the training they received, they felt they always needed to act under the supervision of senior professionals; from 1 (strongly disagree) to 5 (strongly agree).



Discussion

The results of the present study highlight that there are weaknesses in the ST and SST curricula of WS and MCS that should be remedied in future curricular updates, such as training gaps, the need for additional technical training, common modules, fields of action, main occupations, preparation for professional activity, and responsibility in the workplace. In this sense, previous studies of various kinds also highlight that the design of sports training in Spain, and specifically of the SRSE, needs to be supervised and become homogeneous (Feito, 2016; López, 2013; Madrera, 2016) and for that it is necessary, for example, to amend the lack of publication of LOGSE curricula adapted to the LOE (organic law of education) system, as in the case of winter sports (Feito, 2016; Sans & Inglés, 2020).

In accordance with the results of the present study, it is also necessary to homogenise some aspects of training in the field of the PA&S since, in general, the levels and professional profiles are not clearly differentiated, with overlaps in competencies even between non-academic training; this also happens with the SRSE, in important aspects such as competences, modules, time distribution by modules, duration of the teaching, among others (Madrera, 2016; Sans & Inglés, 2020, 2021). The diversity of teaching facilitates access to the majority of the population, but causes confusion in reference to competencies in the exercise of professional activity and this prevents a clear and direct relationship between the qualification obtained and the position that will be occupied in the professional space (Espartero, 2021; Feito, 2016; Javaloyes, 2019; Madrera, 2016; Madrera et al., 2015).

The curricular context generated by the Spanish government is flexible; for example, in the field of physical education, the regions and schools can modify it (López-Gil et al., 2019); in the case of SRSE, each region implemented SRSE in its own way in different training centre models (López, 2013; Madrera, 2016; Madrera et al., 2015) and, as confirmed in the present work at various points, the current scenario is assimilated and can have two conceptions: 1) curricular flexibility, adaptation to the needs of each region, school, and area; and 2) loss of stability and educational coherence in the country as a whole (López-Gil et al., 2019; Madrera et al., 2015; Nasarre, 2016). Previous work suggests that the State should have basic regulations that homogenise and unify training and access to professional practice regardless of the region (Espartero, 2021; Madrera, 2016) and studies in other countries suggest the need to align curricula with state standards (Harris & Metzler, 2018).

The results of the present work could be used for future curriculum change; study plans and educational programmes, in order to be considered quality, need to be reviewed and updated on a regular basis (Harris & Metzler, 2018). For such a review, it is recommended that an assessment be made of various sources or stakeholders to ensure that it meets the needs and expectations of interested parties, which may be former students and employers, among others (Mirabelle & Wish, 2000), as has been done in the present study. Strategic plans to improve curricula and syllabus designs are needed in PA&S technical degrees (Madrera et al., 2015). Any implementation of curricular change is notoriously complex, but in order to optimise the adaptation of qualifications to the changing reality of professional practice it is necessary for the Spanish education system to implement systematic studies that take into account acquired and required competencies (Freire et al., 2013), as well as the vision of the various agents involved.

Conclusions

The following conclusions emerge from this research:

In terms of overall quality of training, fulfilment of expectations, suitability of the curriculum to the subsequent exercise of professional activity, and general satisfaction, there is substantial room for improvement in WS and MCS, with the need to accentuate attention to the former, according to the view of technicians and employers. On the other hand, the majority of qualified technical staff stated that they would study the teaching again, mainly for access to the labour market. The technical staff who would not study again highlighted a bad teaching centre, poor teaching quality, and high financial cost in winter sports.

The analysis of the modules contrasts the evaluation of the usefulness for professional practice with the technicians' lack of feeling of mastery. This perception also contrasts with the employers' assessment in this respect. The concrete analysis in the results section shows which modules suggest the greatest scope for improvement.

Employers highlight the need for additional training for qualified technical staff and, in the same vein, technical staff report significant training gaps for their professional performance.

Technical staff are not aware of the areas of professional activity, nor are they clear about the main occupations that they can carry out with their qualifications at the end of their training, with particular emphasis on WS.

MCS technicians feel more prepared for the profession when they finish their training than WS technicians.

This feeling on the part of technicians contrasts with a lower perception of such preparation on the part of employers, especially in WS.

As far as the job responsibility of 1st level technical staff is concerned, the fact that they can work without supervision of higher level professionals should be reviewed with the new LOE, or training should be adjusted so that 1st level technicians feel secure and autonomous in the exercise of their professional activity.

On the one hand, the present work is a pioneer in analysing specific aspects of the curriculum of ST and SST degrees, and it confirms data that become the basis for an optimisation of these degrees, seeking greater connection between teaching and needs in the exercise of professional activity, taking into account the agents involved. The comprehensive analysis provides information for decision-making in future curriculum development. On the other hand, a questionnaire has been designed that can be replicated periodically for the analysis of the degrees under study and to add the vision of new graduates entering the labour market, as well as being replicated in other technical degrees.

The sample, especially of employers, would be a limitation of the study, as well as the use of mostly closed questions in the questionnaire, which limits the extensive expression of opinions and experiences.

These limitations suggest that a prospective study is needed: 1) to extend the sample of the present study; 2) to take qualitative data to ascertain the in-depth vision of other key agents involved (guides, coaches, employers, teachers, ST and SST teaching coordination, federations, professional associations and companies in the sector) in order to go deeper into the subject; and 3) to replicate the questionnaire to expand the study to other sports technician qualifications.

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