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# Attentional Capacity, Weight Status and Diet Quality in Schoolchildren

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## Abstract

The scientific literature suggests that following a healthy diet and maintaining an optimal weight status is associated with multiple benefits across dimensions of health. This study examines the relationship between weight status and diet quality with attentional capacity in primary school children. For this purpose, an empirical, quantitative, cross-sectional study was carried out on a sample of 209 Spanish schoolchildren with a mean age of 10.79 years (SD = 1.18). Two questionnaires were used: Perception of Similarities and Differences Test for attentional capacity and the KIDMED questionnaire to assess diet quality. Weight status was assessed by body mass index (kg/m<sup>2</sup>) adjusted for sex and age. Statistical analysis showed no significant differences according to sex, diet quality or weight status ( $p > .05$ , for all), except for the number of errors ( $p < .05$ ) and inhibitory control ( $p < .05$ ), in favour of normal-weight schoolchildren. In conclusion, having an optimal weight status may be related to better inhibitory control and fewer attentional errors than their overweight peers. Therefore, health promotion professionals in school settings should consider the positive role that optimal weight status can play in care; and initiate programmes to promote healthy eating among school children.

**Keywords:** childhood, cognition, health, nutrition.

## Introduction

Basic education is a host of stages (nursery, primary and secondary) that are critical for cognitive development, as the brain's neuroplasticity is greater at this age (Rueda et al., 2015). The brain is the organ of thought, defined as the faculty of conceiving, judging or inferring, or considering something, an opinion or a set of ideas on a given subject, and includes learning processes (Bueno-Torrens, 2020). Cognitive function is important due to the fact that this metacognitive process is necessary for performing schoolchildren's complex and goal-oriented learning operations (Akubuilu et al., 2020). Cognitive skills are those that involve the processing of information and the ability to use it later (Caamaño-Navarrete et al., 2021). According to this study, these include various capacities such as perception, comprehension, memory, language and attention, among others.

Both brain formation and function and neuronal plasticity are influenced by the activity of a set of genes and also by epigenetic modifications, which contribute to the regulation of gene expression, adapting it to environmental conditions (Bueno-Torrens & Forés-Miravalles, 2018), which in turn can lead to structural and functional brain changes early in life (Polverino et al., 2021). Therefore, understanding the weight of environmental factors in the modulation of cognitive functioning is relevant for possible interventions in the educational context.

In this regard, lifestyle may be associated with cognitive functions (González-Calvo et al., 2022; Tapia-Serrano et al., 2021). For example, high rates of obesity indicate that food intake is not limited to eating in response to the biological need for energy, but has cognitive and socio-emotional triggers, such as eating due to anxiety, boredom or other emotions (Carrillo-López & García, 2020). Diet has also been identified as one of the main nutritional factors contributing to the prevalence of non-communicable diseases, including neurodegenerative disorders (Godos et al., 2020). Dietary polyphenols, antioxidant components and anti-inflammatory agents in plant-rich diets have been shown to modulate neuroinflammation, adult neurogenesis and brain signalling, all of which are related to cognitive function (Nyaradi et al., 2013). The Mediterranean diet is internationally recognised as healthy, characterised by an intake of a large amount of vegetables, fruits, bread or other forms of grains, rice and includes virgin olive oil as the main source of fat, moderate amounts of dairy products (essentially cheese and yoghurt), as well as moderate amounts of fish and red meat (García-Cantó et al., 2019). This Mediterranean dietary pattern is presented not only as a cultural model but also as a healthy and environmentally friendly one (Serra-Majem & Ortiz-Andrellucchi, 2018). This study shows that recognition by

UNESCO, with consequent greater visibility and acceptance of the Mediterranean diet worldwide, together with better and more scientific evidence on its benefits and effectiveness in longevity, quality of life and disease prevention, have led to this dietary pattern being fully recommended at all stages of life.

While there is extensive research in animals to describe the relationship between individual nutrients and brain development and function, there is limited evidence on the effect of diet on cognitive function in humans (Jirout et al., 2019). This study shows that total diet quality intake patterns may be unfavourable for cognitive function in ageing (e.g. Western diet has been linked to accelerated brain ageing). For their part, Caamaño-Navarrete et al. (2021) have highlighted that there are moderate correlations for dietary intake characterised by regular breakfast consumption, lower intake of energy-rich and nutrient-poor foods and overall diet quality with respect to cognitive ability. Furthermore, a cluster analysis study showed that schoolchildren with better lifestyles have better cognitive ability (Dumuid et al., 2017).

Within education, attentional capacity has been identified as one of the top variables with the highest rate of impairment (around 15%) (Llanos-Lizcano et al., 2019). Attention serves to capture information and has been defined as a basic cognitive mechanism responsible for selecting, processing and prioritising the information necessary to perform any task, as well as focusing mental processes towards any stimulus that occurs in the environment, in addition to excluding information that is irrelevant for the development of the task (Rueda et al., 2015). Thus, according to this study, attention is the ability to generate, direct and maintain a state of activation adequate for the correct processing of information.

Jirout et al. (2019) indicate that current knowledge about indicators of cognition and optimal attention is incomplete and probably lacks understanding of many critical facts and relationships, their interactions and the nature of their interrelationships, such as the existence of differentiating factors that could provide broader knowledge to increase the effectiveness of educational interventions focused on improving attention.

Based on these precedents, it is important to analyse the association between healthy lifestyle indicators, such as diet quality and weight status, with attentional capacity. Furthermore, according to the scientific literature consulted, no other research has analysed the association of attentional capacity with these indicators in Spanish schoolchildren in the early stages of schooling. Therefore, the aim of this study was to analyse the relationship between weight status and diet quality with attentional capacity in primary school children.

## Methodology

### Design and Participants

A total of 209 schoolchildren (125 boys and 84 girls) from the Autonomous Community of the Canary Islands (south of Tenerife), aged between 10 and 12 years (SD = 1.18) participated in this descriptive, cross-sectional, empirical *ex post facto* study (see Table 1). Sampling was non-probabilistic, non-random, convenience sampling (access to the sample).

**Table 1**  
Distribution of frequencies (and percentages) considering sex and academic year.

Sex	Year 5 n (%)	Year 6 n (%)	Total
Boys	56 (56.6)	69 (62.7)	125 (59.8)
Girls	43 (43.3)	41 (37.3)	84 (41.2)
Total	99 (47.3)	110 (52.6)	209 (100)

Source: Authors' own creation.

Two public schools were selected in the Adeje and Arona districts. These schools have a medium-high socio-economic level. In previous meetings held with the school leadership teams and legal guardians of the schoolchildren, they were informed of the study protocol and informed consent was requested for the schoolchildren to participate. Inclusion criteria were: being between 10-12 years of age and regular school attendance (90% of classes during the months of the current academic year). The following exclusion criterion was also considered: I) Failure to provide informed consent to participate in the research. It should be noted that, after jointly estimating the relevant statistics (units of variables and effect size) for the calculation of the sample size (population = 921), it was determined that the minimum sample should be a total of 198 participants to ensure that the results of the study would be consistent (Quispe et al., 2020); and this was achieved, as there was a total sample of 209 students.

### Procedure

The study was carried out during May and June of the 2020/21 academic year. The team consisted of a main researcher and two collaborating doctors (professors specialising in primary education and physical education). A theoretical session was held with each study group prior

to the completion of the questionnaires in order to ensure that all participants understood them. The researchers administered the tests in their normal classroom groups. The questionnaires were administered during the first school period in order to avoid possible fatigue from the school day and to interrupt the school dynamics as little as possible.

The research was conducted in accordance with the ethical standards recognised by the Declaration of Helsinki (2013 revision). This work has been assessed and approved by the Bioethics Committee of the University of Murcia (Murcia, Spain) from the ethical point of view of research (Code: RUxFMqw2-WMQUy9wq-vYPTQUIM-xg/kY-4cF).

## Resources

### Causal or Independent Variable

The quality of the Mediterranean diet was measured using the KIDMED questionnaire (Serra-Majem et al., 2004), which has been widely used in education (Henriksson et al., 2017; Tapia-Serrano et al., 2021). In its original version, a reliability coefficient of .93 was found. This instrument is composed of 16 items representing standards of the traditional Mediterranean diet. Four of them are scored negatively (-1 point) if answered positively (items 6, 12, 14 and 16), while the remaining twelve items are scored positively (+1) if answered positively. After calculation an overall score of between -4 and 12 is obtained, which indicates a better or worse diet quality. Following the recommendation of the original study, in this study diet quality was categorised into *improvable*  $\leq 7$  and *optimal*  $\geq 8$  diet quality, as has been done in other previous studies (Carrillo-López & García, 2020; García-Cantó et al., 2019). Weight and height were determined using an electronic balance (TANITA TBF 300A, USA) and measuring rod (SECAA800, USA) with an accuracy of 100g and 1mm, respectively, following the protocol of the International Society for the Advancement of Kynanthropometry (ISAK) with level I certified personnel. From these anthropometric variables, body mass index ( $\text{kg}/\text{m}^2$ ) was calculated and age and sex-adjusted nutritional status was determined (Cole & Lobstein, 2012). Participants were categorised into two groups: normal weight and overweight (*overweight + obesity*), as has been done in previous studies (Carrillo-López & García, 2020; Tapia-Serrano et al., 2021).

### Criterion or Dependent Variables

Selective attention was estimated using the thirteenth version of Thurstone & Yela's (2012) Perception of Similarities and

Differences Test (Faces-R). This test measures the ability to perceive, with the quickest processing speed, similarities, differences and partially ordered stimulus patterns. It is used for participants aged 6 to 18 years. It consists of 60 graphic elements, each of which is made up of three schematic drawings of faces with the mouth, eyebrows and hair represented with elementary strokes. In each set of three faces, two are the same, and the task is to determine which is different and cross it out. The participant has a total of three minutes. The score is obtained directly from the total number of correct answers, with a maximum score of 60 points.

Test-retest reliability studies by Crespo-Eguílaz et al. (2006) with individuals aged six years and older showed a reliability coefficient of .89. Taking these aspects into account, the following variables were considered in this research: (1) *Correct Answers (A)*: total number of correct answers; (2) *Errors (E)*: number of incorrect answers; (3) *Omissions (O)*: figures not indicated in the task; (4) *Inhibitory control (IC)*: ratio of the difference between correct and incorrect responses, divided by the sum of correct and incorrect x 100  $((A-E / A+E) \times 100)$ ; (5) *Attentional efficacy (AE)*: is the number of correct answers divided by the number of correct answers plus errors plus omissions x 100  $((A / A+E+O) \times 100)$ .

## Statistical Analysis

Normality and homogeneity of variances were obtained using the Kolmogorov Smirnov and Levene statistics, respectively. As a normal distribution of the recorded values was observed, a parametric analysis was chosen. Differences in the different study variables according to sex (*males vs. females*), weight status (*normal weight vs. overweight*) and diet quality (*improvable vs. optimal*) was carried out using the *t*-Student test. Effect size was calculated using Cohen's *d* (.20 = small; .50 = medium, and .80 = large effect). The differential analysis of the combined weight status/diet quality variable, which resulted in 4 groups (*normal weight/optimal DQ, normal weight/improvable DQ, overweight/optimal DQ, and overweight/improvable DQ*), was studied using a simple analysis of variance (*one-way ANOVA*; Bonferroni's *post hoc* test). It should be noted that Bonferroni correction was applied to reduce the risk of a Type 1 error in multiple testing; the *p* value was  $p < .01$ . Effect size was calculated using  $\eta^2$  (.01 = small; .06 = medium, and .14 = large effect) (Cumming & Calin, 2016). A bivariate correlation analysis was performed between attention, body mass index and diet quality (Pearson's test). Data analysis was performed using IBM SPSS 25.0 statistical software and the significance level was set at 5% ( $p \leq .05$ ).

**Table 2**  
Scores obtained in the different variables of the study according to gender.

	Boys M $\pm$ SD (n = 125)	Girls M $\pm$ SD (n = 84)	F	p	d
Number of Correct Answers (0-60)	37.54 $\pm$ 9.51	39.66 $\pm$ 9.22	1.222	.223	.09
Number of Errors (0-60)	2.87 $\pm$ 1.60	2.18 $\pm$ 0.34	3.622	.297	.12
Number of Omissions (0-60)	19.34 $\pm$ 6.54	18.14 $\pm$ 6.11	1.021	.489	.11
Inhibitory Control (1-100)	85.79 $\pm$ 10.84	89.31 $\pm$ 10.64	6.447	.241	.12
Attentional Efficiency (1-100)	62.81 $\pm$ 7.70	66.10 $\pm$ 8.21	1.932	.251	.12
Overall Attention Index (1-9) <sup>a</sup>	5.66 $\pm$ 1.02	5.93 $\pm$ 1.80	1.322	.443	.11
Age (years)	10.89 $\pm$ 0.75	10.75 $\pm$ 0.79	1.619	.365	.10
Height (cm)	150.06 $\pm$ 8.47	150.57 $\pm$ 8.48	1.570	.758	.09
Weight (kg)	50.09 $\pm$ 13.26	47.12 $\pm$ 12.09	1.036	.218	.12
BMI (kg/m <sup>2</sup> ) <sup>b</sup>	21.84 $\pm$ 4.22	20.28 $\pm$ 4.09	1.968	.044	.16
DQ <sup>c</sup>	7.53 $\pm$ 2.07	7.46 $\pm$ 2.62	2.935	.877	.07

M  $\pm$  SD = mean  $\pm$  standard deviation. <sup>a</sup> Global Attention Index calculated from the enneatypes score. <sup>b</sup> BMI = Body mass index. <sup>c</sup> Quality of diet as expressed by the mean score of the KIDMED scale.

**Table 3***Bivariate correlation between body mass index, diet quality and attention.*

Variables	Correct Answers <i>r</i> ( <i>p</i> )	Errors <i>r</i> ( <i>p</i> )	Omissions <i>r</i> ( <i>p</i> )	Inhibitory Control <i>r</i> ( <i>p</i> )	Attentional Efficiency <i>r</i> ( <i>p</i> )	Overall Attention Index <sup>a</sup> <i>r</i> ( <i>p</i> )
Body Mass Index	-.039 (.677)	-.178 (.054)	-.058 (.530)	-.194 (.035*)	-.023 (.809)	-.200 (.830)
Diet Quality <sup>b</sup>	.101 (.271)	-.048 (.607)	-.073 (.432)	.031 (.705)	.096 (.302)	.081 (.386)

Note: (\*)  $p < .05$ .  $M \pm SD$  = mean  $\pm$  standard deviation. <sup>a</sup> Global Attention Index calculated from the enneatypes score. <sup>b</sup> Quality of diet as expressed by the mean score of the KIDMED scale.

**Table 4***Differences in attention according to weight status.*

	Normal-weight $M \pm SD$ ( <i>n</i> = 111)	Overweight $M \pm SD$ ( <i>n</i> = 98)	F	<i>p</i>	<i>d</i>
Number of Correct Answers (0-60)	41.28 $\pm$ 9.20	39.81 $\pm$ 9.49	1.078	.135	.12
Number of Errors (0-60)	1.78 $\pm$ 0.76	3.33 $\pm$ 0.09	5.637	.023*	.19
Number of Omissions (0-60)	19.13 $\pm$ 6.99	18.45 $\pm$ 6.71	1.133	.695	.10
Inhibitory Control (1-100)	91.71 $\pm$ 11.50	83.09 $\pm$ 7.04	10.670	.005*	.21
Attentional Efficiency (1-100)	66.36 $\pm$ 7.24	62.27 $\pm$ 15.64	1.109	.171	.12
Overall Attention Index <sup>a</sup> (1-9)	5.97 $\pm$ 1.85	5.24 $\pm$ 1.95	1.369	.291	.11

Note: (\*)  $p < .05$ .  $M \pm SD$  = mean  $\pm$  standard deviation. <sup>a</sup> Global Attention Index calculated from the enneatypes score.

**Table 5***Differences in attention according to diet quality.*

	Improvable DQ $M \pm SD$ ( <i>n</i> = 91)	Optimal DQ $M \pm SD$ ( <i>n</i> = 118)	F	<i>p</i>	<i>d</i>
Number of Correct Answers (0-60)	38.23 $\pm$ 8.06	38.76 $\pm$ 10.48	3.886	.763	.09
Number of Errors (0-60)	2.40 $\pm$ 0.80	2.67 $\pm$ 0.43	1.930	.766	.09
Number of Omissions (0-60)	19.18 $\pm$ 6.35	18.46 $\pm$ 7.15	1.785	.677	.10
Inhibitory Control (1-100)	87.05 $\pm$ 7.16	87.71 $\pm$ 9.38	1.782	.860	.08
Attentional Efficiency (1-100)	63.62 $\pm$ 8.29	64.91 $\pm$ 11.28	3.908	.657	.10
Overall Attention Index <sup>a</sup> (1-9)	5.18 $\pm$ 0.79	5.78 $\pm$ 1.05	2.626	.997	.07

Note: (\*)  $p < .05$ .  $M \pm SD$  = mean  $\pm$  standard deviation. <sup>a</sup> Global Attention Index calculated from the enneatypes score.

## Results

Table 2 shows the scores obtained in the different variables of the study according to sex. It should be noted that no significant differences were found for any variable according to sex ( $p > .05$ ).

Table 3 shows the different bivariate correlations observed according to body mass index, diet quality and factors and global index of attention. No statistically significant positive or negative correlation was found between the factors and the overall index of attention and diet quality ( $p > .05$  for all). However, a significant negative correlation was found

between inhibitory control and body mass index ( $p < .05$ ).

When analysing the differences in the responses of the dimensions of attention considering weight status (see Table 4), significant differences were only found in the number of errors ( $p < .05$ ) and in the inhibitory control ( $p < .05$ ), in favour of those at normal weight.

On the other hand, when analysing the differences in detail considering the quality of the diet classified as *improvable* vs. *optimal* (see Table 5), it is worth noting that no significant differences were obtained for any variable of attention ( $p > .05$ ).

**Table 6**  
Differences in attention according to weight status and diet quality.

	Normal-weight/ Optimal DQ M ± SD (n = 69)	Normal-weight/ Improvable DQ M ± SD (n = 42)	Overweight/ Optimal DQ M ± SD (n = 48)	Overweight/ Improvable DQ M ± SD (n = 50)	F	p	η²	Post hoc <sup>1</sup>					
								1-2	1-3	1-4	2-3	2-4	3-4
Number of Correct Answers (0-60)	40.57 ± 6.92	35.25 ± 7.84	32.00 ± 8.22	31.54 ± 7.41	1.492	.220	.02	NS	NS	NS	NS	NS	NS
Number of Errors (0-60)	1.32 ± 0.55	1.59 ± 0.12	1.37 ± 0.49	2.55 ± 0.74	2.022	.115	.02	NS	NS	NS	NS	NS	NS
Number of Omissions (0-60)	20.77 ± 9.90	20.12 ± 7.20	20.32 ± 9.57	17.67 ± 6.97	1.814	.489	.01	NS	NS	NS	NS	NS	NS
Inhibitory Control (1-100)	93.40 ± 12.70	90.00 ± 13.77	81.16 ± 7.84	83.19 ± 9.88	2.834	.041*	.06	NS	<	NS	NS	NS	NS
Attentional Efficiency (1-100)	67.58 ± 17.13	67.12 ± 11.55	55.33 ± 17.18	57.13 ± 13.66	1.292	.281	.02	NS	NS	NS	NS	NS	NS
Overall Attention Index <sup>a</sup> (1-9)	6.19 ± 0.96	5.71 ± 0.67	5.25 ± 0.20	5.05 ± 1.07	1.124	.342	.02	NS	NS	NS	NS	NS	NS

Note: (\*) p < .05. M ± SD = mean ± standard deviation. <sup>a</sup> Global Attention Index calculated from the enneatypes score. NS: denotes lack of statistical significance. <sup>1</sup> Pairwise comparisons using Bonferroni correction.

In table 6, the joint relationship between weight status and diet quality with attentional capacity is shown. ANOVA analysis showed significant differences in the inhibitory control dimension (p < .05), in favour of those in normal weight/optimal QD relative to those who are overweight/optimal QD. Despite the non-significance, it is observed that those schoolchildren with better weight status and optimal diet quality obtain, for all dimensions, better levels of attention than their overweight peers and those with poor diet quality.

### Discussion

The aim of this study was to analyse the relationship between weight status and diet quality with attentional capacity in primary school children. The main findings show that schoolchildren with a normal weight status have better inhibitory control and fewer attentional errors than their overweight peers. However, the absence of a statistically significant relationship between diet quality and attentional capacity is surprising, since weight status is obtained from the energy balance of nutrients ingested in the diet minus caloric expenditure and is measured by indicators such as body mass index for age and sex, which allows for the diagnosis of being overweight or obese (Cole & Lobstein, 2012).

Since no studies in primary school children have been found among the scientific literature that analyse

the association between weight status and attention, this prevents us from making direct comparisons. Furthermore, studies analysing the relationship between diet quality and attention are very scarce in primary school children, hence the original focus of our study. Scientific literature found on primary school children (Henriksson et al., 2017; Caamaño-Navarrete et al., 2021) suggests that healthier dietary patterns, as indicated by a higher diet quality index, are associated with attention span. In turn, similar studies in terms of methodology show a lack of relationship between weight status and cognitive variables such as intelligence level (Akubuilu et al., 2020) or other variables such as academic performance, where no significant relationship between eating habits and academic performance or nutritional status has been found (Iglesias et al., 2019).

These results can be explained on the basis of Information Processing Theory and human physiology, as it has been hypothesised that the potential role of the "gut-brain axis" in the human body is of critical importance for the proper functioning of the human body (Jirout et al., 2019). That is, physiological conditions, such as the nutrients and energy provided by meals and snacks, as well as the resulting feelings of hunger or tiredness, can directly influence the capacity for cognitive processes. This study reflects that the learning process is a complex construct that can be described as a series of engagements in information/memory processing and storage systems that ultimately result in knowledge. One of the most basic

conditions for a schoolchild to be able to pay attention to a task is to have the necessary energy and no discomfort inhibiting factors (e.g. hunger or fatigue). If conditions are not optimal, the schoolchild experiences lower levels of alertness or vigilance, thus decreasing attention to any input from the environment. Therefore, attention span will be restricted, limiting the information that is eventually encoded and retained in long-term memory, from where it can be retrieved later (Nyaradi et al., 2013).

Further hypothesising the potential role of the "gut-brain axis" and its effect on modulating systemic inflammation and oxidative stress, there are molecular mechanisms underlying the putative beneficial effects on brain health of different dietary factors, such as I) micro- and macronutrient intake and habits, such as meal timing and circadian rhythm; II) the role of hormone homeostasis in the context of glucose metabolism and adiponectin regulation and its impact on systemic and neuroinflammatory inflammation, and III) individual bioactive molecules that exert antioxidant activities and act as anti-inflammatory agents, such as omega-3 fatty acids and polyphenols, considered beneficial to the central nervous system through modulation of neurogenesis, synaptic and neuronal plasticity and microglia activation (Godos et al., 2020).

For example, lutein, one of the three main types of dietary carotenoids, has been reported to be present in the brain, and metabolomic analyses indicate that it has "functional significance" in cognition and development in the infant brain (Jia et al., 2017). Lutein concentration correlates with homocarnosine, a neuroprotective antioxidant found in the hippocampus and frontal cortex. Interestingly, the concentration of lutein is higher in schoolchildren than in adults, suggesting a possible role in development. In particular, lutein has been specifically linked to cognitive function measures of executive function, language, learning and memory, and improves temporal processing speed (Reichelt & Rank, 2017). In turn, the study by Godos et al. (2020) hypothesised that flavonoids affect the production, bioavailability and biological activity of metabolites related to the gut-microbiome-brain axis. An imbalance of the gut microbiota is associated with a local and systemic inflammatory state, which in turn can affect immune and nervous system related diseases. Specifically, a higher inflammatory state triggers vascular damage and neuroinflammation, which in turn can cause alterations in brain structure and function, including ionic homeostasis, regulation of metabolic functions, production of antioxidant species, synaptic glutamate levels, modulation of synaptic plasticity and, ultimately, maintenance of the blood-brain barrier, systemic inflammation and oxidative stress and cognitive impairment (Ceppa et al., 2019). In this regard,

higher dietary intake of flavonoids (fruits and vegetables are rich in flavonoids) and certain subclasses are associated with better cognitive health (Bleiweiss-Sande et al., 2019). In particular, according to this study, higher dietary intakes of catechins, flavonols, anthocyanins and, among individual molecules, quercetin, are positively associated with cognitive status.

In turn, it has been suggested that the effects of various nutrients on diet-dependent epigenetic processes, in particular DNA methylation and histone post-translational modifications, and their potential role as a therapeutic target, may describe how some forms of cognitive decline could be prevented or modulated from early life onwards (Polverino et al., 2021). In this respect, diet may lead to alterations in dopamine-mediated reward signalling and controlled inhibitory neurotransmission by  $\gamma$ -aminobutyric acid (GABA), two major neurotransmitter systems that are built up during the infantile-adolescent period. In this sense, poor dietary choices can derail the normal maturation process and influence neurodevelopmental trajectories, which may predispose schoolchildren to dysregulated eating and impulsive behaviours that affect attention (Reichelt & Rank, 2017).

This is evidenced in a study with schoolchildren where they found that eating breakfast just before a cognitive demand, and having a regular high quality breakfast, is associated with increased attentional capacity (Peña-Jorquera et al., 2021). Similarly, it has been observed that those who report greater adherence to the Mediterranean diet have higher scores in elaboration and organisation strategies; critical thinking and study habits; greater effort capacity; self-regulation and intrinsically oriented goal setting (Dumuid et al., 2017).

Future studies should shed further light on the findings, as the difference in results across the body of research on these relationships may be a consequence of how attention, diet quality or weight status are measured or quantified (Carrillo-López & García, 2020). Therefore, these findings should be interpreted with caution due to the fact that this study was not interventionist, but based on self-reported data, with unknown quality and quantity of food consumed daily by schoolchildren. Similarly, no cause and effect relationship between attention and weight status or diet quality can be inferred in this study. In addition, there are confounding factors not considered in this study that are likely to influence these relationships (such as physical condition, screen time or hours of sleep) (Jiménez-Parra et al., 2022; Sebastiani, 2019). Therefore, these differential effects might be related to environmental aspects and deserve to be further investigated in future studies.

## Conclusions

In conclusion, the present study contributes to the scientific literature investigating the relationship between healthy lifestyle habits, such as diet quality or weight status, and the outcomes of cognitive processes, such as attention. Based on these results, it is concluded that having a healthy weight status may be related to better inhibitory control and fewer attentional errors than their overweight peers. In the meantime, health promotion professionals in school settings should consider the positive role that optimal weight status can play in care; and initiate programmes to promote healthy eating among schoolchildren.

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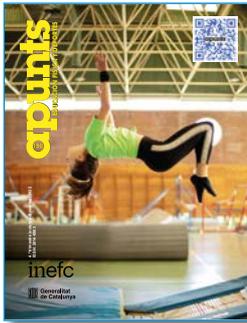
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# Effects of Multicomponent Training and Subsequent Lockdown (COVID-19) in Older People

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## Abstract

Multi-component training has proven to be the best non-pharmacological strategy to reverse or delay the effects associated with ageing and frailty, which have both become a health emergency. The aim of this study was to analyse the impact of a period of lockdown following a multicomponent training programme on functional capacity, physical fitness and quality of life in older people. A total of 54 participants over the age of 65 were randomly divided into two groups. The intervention group performed 3 weekly sessions of 1 hour of multicomponent training, and the control group, 1 hour of light aerobic activity per week. The Short Physical Performance Battery (SPPB), Senior Fitness Test (SFT), Handgrip and EUROQOL-5D were used: Visual Analogue Scale (EQ-5D: VAS). At the end of lockdown, both groups became worse in SPPB, although the intervention group to a lesser extent (Control, -10.34%,  $p = .015$ ,  $ES = .758$ ; Intervention, -6.48%,  $p = .018$ ,  $ES = .470$ ). In addition, this group improved strength (*Chair Stand*, +11.12%,  $p = .002$ ,  $ES = .632$ ), and flexibility (*Sit & Reach*, -48.88%,  $p = .001$ ,  $ES = .698$ ) of the lower limb as well as agility and dynamic balance (*Up & Go*, -10.68%,  $p < .001$ ,  $ES = .667$ ), due to possible residual effects of training. Only the control group reduced their manual grip strength (-5.57%,  $p = .033$ ,  $ES = .665$ ). Conclusion: 9 weeks of multicomponent training in older people could mitigate the effects of a 15-week lockdown, but it is not possible to know with certainty due to the lack of a post-training measurement, which could not be performed because of the outbreak of the pandemic.

**Keywords:** elderly, exercise, functional physical performance, physical condition, quality of life.

## Introduction

The United Nations stated that in recent years the world's population of people over 65 years of age has tripled and, between 2025 and 2030, it is expected to increase 3.5 times faster than the total population (Lutz et al., 1997). This increasing ageing of the world's population and the corresponding challenges of caring for the growing number of older people have become a "silent" emergency for all health services (Casas-Herrero et al., 2019). However, ageing is a natural physiological process, which is affected by lifestyle factors that include frequent physical activity, which has numerous benefits during ageing: improved cardiorespiratory fitness, maintenance of muscle mass, reduced risk of type II diabetes, improved cognitive function, among others (Harridge & Lazarus, 2017). On the other hand, unhealthy ageing, mainly characterised by a sedentary lifestyle, can lead to further deterioration of physiological systems.

Some of the systems most directly affected by these changes are the cardiorespiratory and neuromuscular systems, which are increasingly impaired (Hurst et al., 2019), leading to a reduction in functional capacity and physical fitness and contributing to the onset of frailty. This age-associated clinical syndrome is characterised by a decline in biological reserves, and is defined by vulnerability and increased risk of developing negative outcomes such as disability, dependence or death (Rodríguez-Mañas et al., 2013). Therefore, and because of its high prevalence (7.0% -16.3%) in the elderly population, the prevention and treatment of frailty is a major concern in the field of geriatrics (Rodríguez-Mañas & Fried, 2015) and the field of health in different countries.

There is no doubt that this progressive deterioration of physical condition and functional capacity, as well as its consequences mentioned above (frailty, disability and dependence), leads to an inevitable loss of quality of life. Therefore, it is urgent and important to study and find solutions to reverse, or at least delay, the aforementioned negative outcomes associated with ageing and frailty. One of the most promising and effective proposals within non-pharmacological therapies is multicomponent adapted physical exercise (Casas-Herrero et al., 2019). In recent years, multicomponent training has shown improvements in physical fitness (Viladrosa et al., 2017), functional performance and quality of life (Bouaziz et al., 2016) in older people.

However, the COVID-19 pandemic has created an unprecedented situation in which the population, and more specifically the older population, was forced into

lockdown, which drastically reduced their physical activity levels and made it impossible to follow any physical exercise programme. Especially in a highly vulnerable population such as the elderly, for whom inactivity is known to have serious negative effects on their health (Harridge & Lazarus, 2017). On the other hand, this context has made it possible to study and evaluate the possible preventive effect of a multicomponent training programme in elderly people who were subjected to subsequent lockdown.

Therefore, the aim of this study was to analyse the combined effect of 9 weeks of multicomponent training and a subsequent 15-week lockdown period on functional capacity, physical fitness and quality of life in older people.

## Methodology

This study is part of the EXERNET-Elder 3.0 project, a multicentre study registered in ClinicalTrials.gov (NCT03831841), which was carried out in two cities (Zaragoza and Huesca). The aim of this project was to evaluate the effects of a 24-week multicomponent training programme on frailty, physical fitness, body composition and quality of life, as well as to analyse a potential role of dietary intake, in more than 100 older people (Fernández-García et al., 2020). However, the health crisis caused by COVID-19 did not allow the study to be carried out as originally designed.

## Participants

Participants were non-institutionalised elderly people from the city of Huesca, and were recruited by health personnel through health centres in the city. The inclusion criteria, therefore, were: being over 65 years of age, not living in a nursing home and having no medical contraindications for physical exercise.

Using the software G\*Power 3.1.9.6 an initial sample size of 28 participants for the intervention group and 14 for the control group was calculated, allowing for a between-group difference of 2 points on the SPPB scale (SD = 2.1), a statistical significance of  $p \leq .05$  and a statistical power of 80%. Based on a previous study by Tarazona-Santabalbina et al. (2016), in which they found a post-intervention difference between groups of 2.4 points for this variable. The initial calculated sample of 42 participants was increased by 15% for possible loss to follow-up, and a further 15% for mortality. This resulted in an initial study sample of 54 participants,

divided between the intervention group ( $n = 34$ ) and the control group ( $n = 20$ ). To ensure that there were no significant differences between groups at the start of the study for any variable, an independent samples analysis was performed on each variable.

## Materials and Resources

The first measurement was taken in December 2019, before the exercise intervention. The training programme started in January 2020 and was interrupted in March due to lockdown. The second measurement was carried out when possible, in June 2020, at the end of lockdown. This measurement included a COVID-19 safety protocol, which included personal distancing measures, hand hygiene, use of masks and disinfection of all equipment used. Participants were tested in groups of 3-4 people.

Height was measured with a stadiometer accurate to 0.1 cm (SECA 225, SECA, Hamburg, Germany) and weight was measured with an electronic scale accurate to 0.1 kg (SECA 861, SECA, Hamburg, Germany), without shoes and with as little clothing attire as possible.

This was followed by the Short Physical Performance Battery (SPPB; Guralnik et al., 1994), and the Senior Fitness Test (SFT; Rikli & Jones, 2001). The 6-Minute Walk test proved impossible to carry out, as the nature of the test meant that protocols against COVID-19 could not be assured. In addition, maximum isometric handgrip force was measured on both arms and legs with a handheld digital dynamometer accurate to 0.1 kg<sub>f</sub> (Takei TKK 5401, Takei Scientific Instruments, Tokyo, Japan). The validated EUROQOL-5D - Visual Analogue Scale (EQ-5D) was used to assess the quality of life of the participants: VAS; Devlin and Brooks, 2017).

## Procedure

The project was conducted in accordance with the ethical principles of the 1961 Declaration of Helsinki, as revised in Fortaleza (World Medical Association, 2013), and obtained the evaluation and approval of the Clinical Research Ethics Committee of the Hospital Universitario Fundación Alcorcón. All participants who formed the initial sample of the study completed and signed an informed consent form. Then, participants were randomly divided into two groups: an intervention group, which performed a multicomponent training programme, and a control group, which performed light-intensity aerobic activity.

The complete and detailed training protocol has been described by Fernández-García et al. (2020). In summary,

the intervention group undertook 3 weekly multicomponent training sessions of one hour's duration. All sessions included:

1. 10 minutes of warm-up, in which mobility exercises, cardiopulmonary activation, coordination and dynamic balance games were carried out.
2. 40 minutes of the main part (2 types):
  - a. Circuit of muscular strength exercises, lower and upper limb with light-moderate weights, and static balance exercises (2 sessions per week).
  - b. Circuit of aerobic resistance exercises, at a light-moderate intensity, and dynamic balance and coordination exercises (1 session per week).
3. 10 minutes of cool down, including light intensity games and static stretching of the lower and upper limbs.

During the 9 weeks of intervention, the principles of individualisation and progression of the training load were followed to ensure an adequate stimulus for each participant. On the other hand, the control group performed a weekly one-hour session of walking and light-intensity tasks. All sessions were designed and supervised by a graduate in Physical Activity and Sport Sciences (CCAFD).

After 9 weeks of intervention, on the 11th of March 2020, the World Health Organisation declared COVID-19 a pandemic. Consequently, on the 14th of March, the Spanish government decreed a state of alarm which was extended until the 21st of June 2020 as a measure to deal with the spread of COVID-19. The intervention was inevitably interrupted. Consequently, the remaining 15 weeks corresponded to a period of lockdown at home in which no physical activity guidelines were provided. The results expected in this study (Table 2) were therefore inevitably affected by this situation.

## Statistical Analysis

For the statistical analysis, the software SPSS version 23.0 was used. For descriptive analysis, the data are presented with the mean, as a measure of central tendency, and standard deviation, as a measure of dispersion. In addition, the normal distribution of the variables was determined using the Shapiro-Wilk test.

For the inferential analysis, in order to establish whether there were differences between groups before the intervention, an independent samples Student's *t* test was performed for the descriptive variables, of a numerical nature and with a normal distribution, and a Chi-Square test in the case of the "sex" variable, as it is a nominal variable.

For the variables of interest, a Student's test for related samples  $t$  was used for those with a normal distribution. Its non-parametric counterpart, the Wilcoxon signed-rank test, was also used for variables that did not have a normal distribution. Both tests were used to determine whether there were differences before and after the intervention, within each group. An independent samples analysis, Student's  $t$  test or Mann-Whitney U-test, was also included, based on the normality of the variables, to determine whether there were differences between groups before and after the intervention. In all tests, statistical significance was established for a  $p < .05$ .

The calculation of effect sizes was performed with the software G\*Power 3.1.9.6, considering a large effect size  $ES \geq .8$ , a medium one around  $ES \approx .5$ , and a small one around  $ES \approx .2$ .

## Results

### Descriptive Variables

A total of 30 participants from the intervention group and 16 from the control group were assessed after the intervention. No significant differences ( $p > .05$ ) were found between groups for any of the starting descriptive variables (Table 1), so both groups had similar characteristics at the beginning of the intervention.

### Variables of Interest

The total score on the SPPB was significantly reduced between assessments in both groups (Table 2), although with greater percentage change and effect size in the control group (-10.34%,  $p = .015$ ,  $ES = .758$ ) than in the intervention group (-6.48%,  $p = .018$ ,  $ES = .470$ ).

On the other hand, in the SFT the control group did not show statistically significant differences ( $p > .05$ ) for any of the tests that make up the set. On the other hand, the intervention group did, as detailed below. Firstly, this improved its performance in *Chair Stand* (11.12%,  $p = .002$ ,  $ES = .632$ ), reduced the distance in *Sit & Reach* (-48.88%,  $p = .001$ ,  $ES = .698$ ), and improved time in *Up & Go* (-10.68%,  $p < .001$ ,  $ES = .667$ ). No significant changes were found for the *Arm Curl* test. Regarding isometric grip strength (*Handgrip*), significant reductions were found only in the control group (-5.57%,  $p = .033$ ,  $ES = .665$ ) and no changes were detected in the intervention group. Quality of life assessed, using EQ-5D: VAS (from 1 to 100), showed no significant differences ( $p > .05$ ) for either group. Finally, independent samples analysis reported no differences between groups pre-intervention, and only reported differences post-intervention in the *Up & Go* ( $p = .034$ ) in favour of the intervention group.

**Table 1**  
Descriptive variables and group differences before the intervention.

	Intervention ( $n = 30$ )		Control ( $n = 16$ )		$p$
	Average	Standard deviation	Average	Standard deviation	
Age (years)	74.07	4.84	74.13	7.48	.978
Sex, $n$ (%)					
Men		11 (36.67%)		8 (50.00%)	.382
Women		19 (63.33%)		8 (50.00%)	
Weight (kg)	74.30	12.56	71.13	9.92	.387
Height (cm)	158.27	8.64	156.95	7.56	.609
BMI (kg/m <sup>2</sup> )	29.68	4.74	28.90	3.83	.573

Note. Body Mass Index (BMI).

**Table 2**  
Changes in functional capacity, physical fitness and quality of life after 9 weeks of training and 15 weeks of lockdown.

	Intervention Group (n = 30)						Control Group (n = 16)					
	PRE		POST		%Change	SE	PRE		POST		%Change	SE
	Average	SD	Average	SD			Average	SD	Average	SD		
<u>Functional Capacity</u>												
SPPB Total (0-12 pts.)	10.80	1.63	10.10	1.93*	-6.48%	.470	10.25	1.92	9.19	2.66*	-10.34%	.758
<u>Physical Condition</u>												
<i>Senior Fitness Test</i>												
Chair Stand (No. rep.)	14.18	2.86	15.76	3.35**	11.12%	.632	12.63	5.45	14.37	3.78	13.80%	.489
Arm Curl (No. rep.)	18.82	4.21	17.67	3.15	-6.11%	.354	16.34	3.97	15.97	3.22	-2.29%	.141
Sit & Reach (cm)	-15.65	10.15	-8.00	11.29***	-48.88%	.698	-12.69	12.41	-10.97	12.68	-13.55%	.271
Back Scratch (cm)	-17.85	8.14	-16.90	9.69	-5.32%	.167	-14.91	8.19	-16.84	10.18	13.00%	.335
Up & Go (s)	6.78	2.04	6.06	1.63***†	-10.68%	.667	6.76	1.64	7.31	2.44	8.23%	.380
Handgrip total (kg <sub>r</sub> )	51.11	17.39	49.55	16.22	-3.05%	.335	54.19	16.01	51.17	13.85*	-5.57%	.665
<u>Quality of Life</u>												
EQ-5D: VAS (0-100)	69.17	16.97	72.00	15.40	4.09%	.158	67.50	16.53	71.88	14.36	6.49%	.252

Note. SD, standard deviation, ES, effect size; SPPB, Short Physical Performance Battery; EQ-5D: VAS, EuroQoL-5D: visual analogue scale; pts., points; rep., repetitions; cm, centimetres; s, seconds; kg<sub>r</sub>, kilogram-force. ES calculated for changes between measurements. Significant changes between measurements for each group: \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . Significant differences between groups: †  $p < .05$

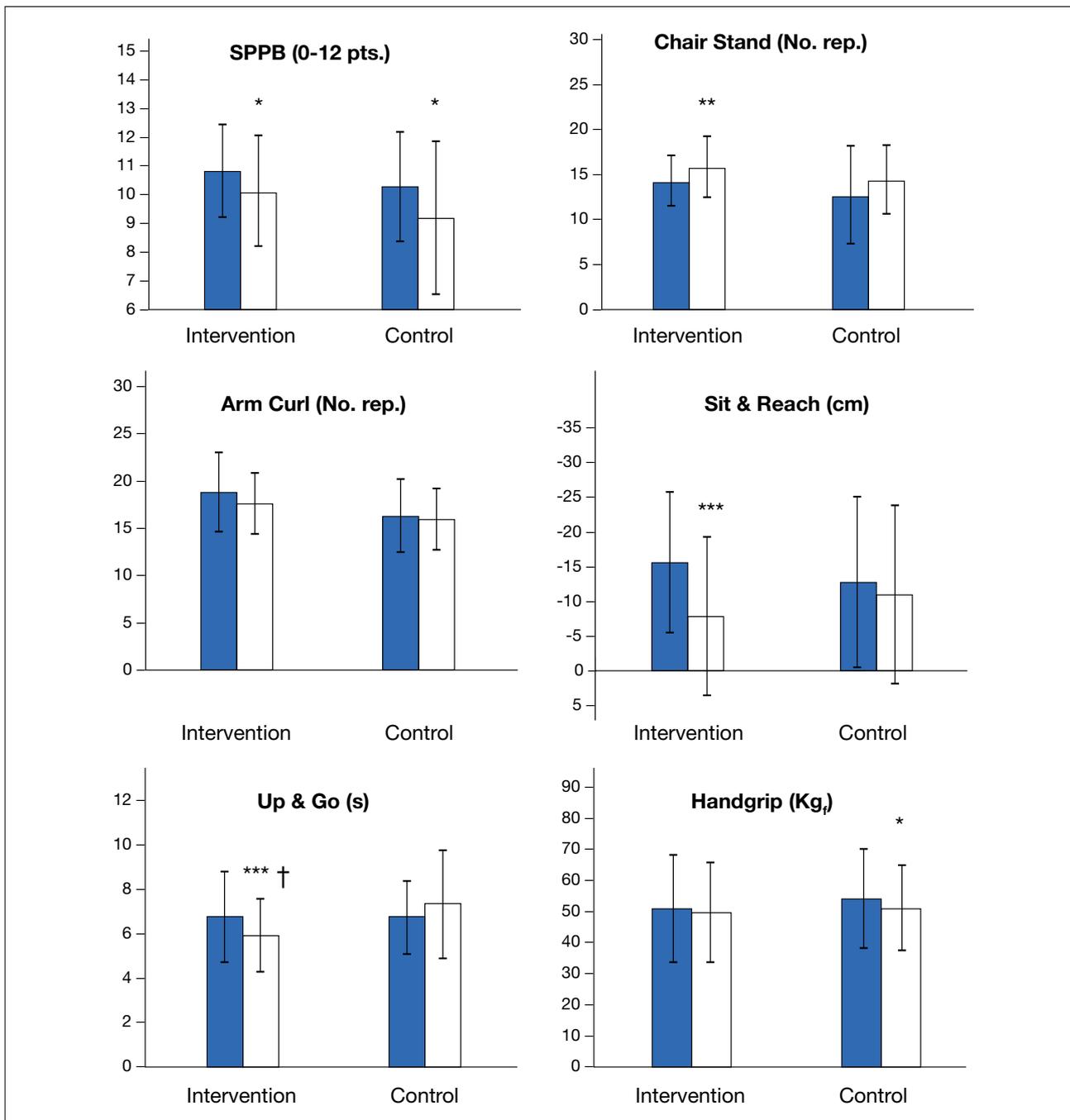
## Discussion

Following the outbreak of COVID-19, the purpose of this study was to analyse how the physical condition, functional capacity and quality of life of people over 65 years of age had changed after 9 weeks of multicomponent training and 15 weeks of lockdown. The results of this study should be discussed with prudence, during the analysis, interpretation, and comparison with other studies; taking into account that it was not possible to have a measurement prior to lockdown that would have allowed differentiating the changes due to training and lockdown. This is perhaps one of the few works of this nature that has been conducted: exercise intervention time interrupted by a total cessation of activity due to lockdown. The findings of this work point to a significant reduction in functional capacity in both groups, as assessed by the SPPB scale (Figure 1). Although with caution, it is important to emphasise that this reduction occurred at a higher percentage change and effect size in the control group than in the intervention group. However, there were no statistically significant differences between groups. This could imply that, despite these reductions, the difference was still not so considerable from a statistical point of view, but from a functional point of view. Not forgetting that the control group has almost half as many participants as the intervention group, it is worth noting that a 1-point reduction in the SPPB scale in the control group can lead to a clinically significant decrease in the functional capacity of older people (Montero-Odasso et al., 2019). Furthermore, these results support the need to avoid lockdown and to allow physical activity in order to preserve the health of older people. Exercise is essential for maintaining health and, in fact, this is stated in several previous studies that completed a multicomponent training programme, and found improvements in functional capacity and/or significant differences between groups favourable to the intervention group (Arrieta et al., 2018; Martínez-Velilla et al., 2019; Rezola-Pardo et al., 2019; Tarazona-Santabalbina et al., 2016). Although it is not possible to know with certainty due to the lack of a post-training measurement, based on the aforementioned studies that performed similar interventions ( $\geq 9$  weeks multicomponent training), the training period prior to lockdown may have provided a stimulus and improvements that acted as a protective factor against the decrease in activity and reductions due to lockdown. It is likely that if the intervention had been implemented as planned, statistically significant improvements in SPPB would

have been found, rather than reductions in the intervention group, as in these studies.

While overall functional capacity was reduced in both groups, although apparently more so in the control group, significant improvements were observed in the intervention group in selected fitness tests of the SFT. Firstly, this group improved their lower limb strength, as measured by the *Chair Stand* test (Figure 1), while there was no significant change in the control group. Several multicomponent training interventions have shown significant improvements in this test for the intervention group (Cadore et al., 2014; Carvalho et al., 2009; Rubenstein et al., 2000; Toraman & Şahin, 2004), as well as significant differences between groups in favour of the same group (Arrieta et al., 2018; Rezola-Pardo et al., 2019; Toraman et al., 2004). Some of these interventions had very similar training characteristics and training periods to the one finally carried out in this study, although they did not have a detraining period as in this study. Some that did evaluate periods of cessation of training (Carvalho et al., 2009; Martínez-Aldao et al., 2020; Toraman, 2005; Toraman & Ayceman, 2005) found significant reductions in performance on this test relative to a post-training measurement, after periods of 6, 12, 20 and up to 52 weeks. It is worth noting that Carvalho et al. (2009) reported significant reductions from pre-training values only in the control group of their study, who did not perform any training for 12 weeks. The period of lockdown in this study was 15 weeks, so it might be expected that there was a reduction in lower limb strength in the intervention group compared to post-training (which could not be assessed) and that the positive results obtained after this period were residual effects of the 9 weeks of training.

In contrast, upper limb strength, assessed with the *Arm Curl* test, showed reductions in both groups, although not statistically significant (Figure 1). Other interventions without a period of lockdown have found significant improvements in intervention group upper limb strength, and/or between-group differences, using this test (Arrieta et al., 2018; Carvalho et al., 2009; Rezola-Pardo et al., 2019; Toraman and Şahin, 2004; Toraman et al., 2004). After detraining periods of 6, 12, 20 and 52 weeks, significant reductions have been observed with respect to a post-training measurement (Carvalho et al., 2009; Martínez-Aldao et al., 2020; Toraman, 2005; Toraman & Ayceman, 2005). Furthermore, after 12 weeks of cessation of training, Carvalho et al. (2009) observed



**Figure 1**

Changes and differences between groups in functional capacity and physical condition after 9 weeks of multicomponent training and 15 weeks of lockdown.

Note. Significant changes between measurements: \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . Significant differences between groups: †  $p < .05$ .

that participants who underwent multicomponent training saw a reduction in upper limb strength levels to below baseline (pre-training) levels, which was not the case for lower limb strength, where the reduction was not as pronounced. Furthermore, Toraman (2005), after a long period of detraining (52 weeks), reported significant reductions from pre-training values in a group of 74-86

year olds, which also did not occur in lower limb strength. This suggests that upper limb strength may be lost faster than lower limb strength. This may explain why in this study improvements in upper limb strength and losses (although not significant) in upper limb strength were seen.

In terms of lower limb flexibility, specifically of the hamstring muscles, the *Sit & Reach* test obtained

improvements (decrease in distance reached) in the intervention group, while in the control group there were no significant changes (Figure 1). Given the magnitude of the percentage change, effect size and statistical significance, the improvements in the intervention group could be due to an improvement in the mobility and contractility of the hamstring muscles. On the other hand, upper limb flexibility, assessed with the *Back Scratch* test, showed no significant changes for either group. Some studies that assessed flexibility using both tests did not find significant results after a period of multicomponent training (Arrieta et al., 2018; Toraman et al., 2004), while others did observe positive results for the *Sit & Reach* (Taguchi et al., 2010; Toraman & Şahin, 2004) and *Back Scratch* (Toraman & Şahin, 2004). Significant reductions in both tests have also been reported after 6, 12 and 52 weeks of detraining (Carvalho et al., 2009; Toraman, 2005; Toraman & Ayceman, 2005) with respect to post-training. However, Martínez-Aldao et al. (2020) observed reductions in the upper limb only after 20 weeks. Again, it is possible that the improvements found in this work for the *Sit & Reach* test were the residual effects of the 9 weeks of training, and that there is a different rate of maladaptation between lower and upper limb flexibility that would explain the difference in results in this study.

As a last parameter of the SFT, agility and dynamic balance assessed by the *Up & Go* test showed an improvement in execution time in the intervention group, while no significant changes were obtained for the control group (Figure 1). However, the improvements in the intervention group did not reach the clinical significance established at 2 seconds by Montero-Odasso et al. (2019). It should also be noted that this test was the only one that reported significant differences between groups, post-lockdown, in favour of the intervention group. It is not possible to know whether this difference is due to the intervention or to learning in the execution of the test. It should be noted, however, that participants in both groups performed the test the same number of times. So, if there was a learning effect of this test, it was not more favourable in one group than the other. Several studies have reported improvements between assessments and/or significant differences between groups in favour of the intervention group for this parameter (Cadore et al., 2014; Carvalho et al., 2009; Freiburger et al., 2012; Toraman et al., 2004; Toraman & Şahin, 2004). In terms of detraining periods, significant increases in the running time of this test have been reported after 6, 20 and 52 weeks (Martínez-Aldao et al., 2020; Toraman, 2005; Toraman & Ayceman, 2005), which would indicate a reduction in agility and dynamic balance in their respective samples. However, Carvalho et al. (2009) reported no significant changes in this test after

12 weeks of detraining of the intervention group, compared to a post-training measurement. Furthermore, Freiburger et al. (2012) continued to find differences between groups in favour of the group that combined aerobic, strength and balance (multicomponent) training, even after 12 months of detraining. It was not until 24 months that these statistically significant differences were no longer present. The findings of the latter two studies, together with those of this study, could indicate that multicomponent training would provide greater durability of effects on agility and dynamic balance, assessed through the *Up & Go* test, with respect to other tests and components of physical fitness.

Maximum isometric handgrip strength, as a predictor of mortality and a biomarker of ageing, was significantly reduced only in the control group (Figure 1). Taguchi et al. (2010) found no significant improvements in their intervention group, but did find reductions in their control group for this parameter. Again, some protective effect of prior multicomponent training on grip strength could be suggested, although it is not possible to establish with certainty whether this was the case in this study. Other studies did observe improvements in Handgrip in the intervention group, as well as reductions in the control group (Cadore et al., 2014; Martínez-Velilla et al., 2019). It is possible that, had the 24 weeks of training been completed or had measurements been available after 9 weeks, improvements would have been found for the intervention group.

As for quality of life, assessed by EQ-5D: VAS was not modified after 9 weeks of training and 15 weeks of lockdown in any group. Other studies have reported positive results in the EQ-5D: VAS, in favour of the intervention group (Martínez-Velilla et al., 2019; Tarazona-Santabalbina et al., 2016). It is possible that, after the 9 weeks of training, there were improvements in the participants' quality of life, but that after 15 weeks of lockdown they were reversed. It should also be noted that the post-lockdown situation itself, and the emergence of a new pandemic crisis, had a negative impact on the subjective perception of quality of life, due to the participants' state of mind as a result of this novel situation. No studies have been found that have observed reductions in quality of life after a period of detraining, as assessed by this scale. This is why future studies on this matter are required.

Finally, the main limitation of this work has been the interruption of the training programme, without the possibility to perform measurements before lockdown, which would have allowed a clear differentiation between training and detraining effects. The time between the two measurements and the period of physical inactivity would require another phase of continuous work, which unfortunately could not be achieved. In terms of strengths,

it is worth highlighting the well-defined and well-founded study design and training protocol, with planning and direct supervision by a CCAFD graduate. Future research should remedy the main limitation of this work and, in the event of another pandemic, have a protocol for action that allows intervention to continue in a population group in which the use of technology is not straightforward. Even so, it seems that the existing evidence positions multicomponent training as one of the best strategies to improve functional capacity, physical fitness and quality of life in older people.

## Conclusions

The 24-week multicomponent training intervention could not be completed. Instead, 9 weeks of multicomponent training and 15 weeks of lockdown were performed, without the possibility of a pre-lockdown measurement. However, participants over 65 years of age who underwent 9 weeks of intervention had a smaller reduction in functional capacity and grip strength after lockdown. Furthermore, in this group, even after 15 weeks of detraining, improvements were observed in lower limb strength and flexibility, as well as in agility and dynamic balance compared to pre-training levels. However, perceived quality of life did not show significant changes in either group. Future studies should strive to include a measurement prior to the detraining period as other studies have included, which could not be included in this one due to a lockdown as a result of the pandemic. Other avenues that could be opened up from this study would be to compare a lockdown in which certain levels of training have been maintained at home versus a more sedentary lockdown. In addition, the time needed to reverse the negative effects of lockdown could also be investigated. Nonetheless, the results of this study show the need to promote physical exercise in elderly people and to avoid lockdown in order to preserve the health of the older population and to prevent/treat frailty, disability or dependency.

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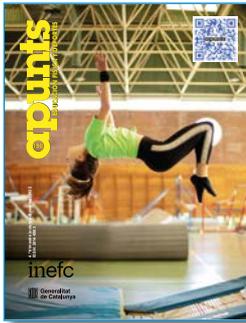
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# Influence of Practice Motives, Physical Activity and Resistant Personality in Primary and Early Childhood Teachers

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## Abstract

The aim of this research was to analyse the relationships between motives for physical activity, physical activity level and variables that encourage resistance at work, as well as the relationship between the most self-determined motives for physical activity and the components of a resistant personality in Spanish pre-school and primary school teachers. Using a descriptive, comparative and cross-sectional design, a questionnaire was administered to a sample of 649 practising teachers. Specifically, the MPAM-R (*Motives for Physical Activity Measure-Revised*) Questionnaire, the Work Resilience Questionnaire and the PACE (*Physician-based Assessment and Counselling for Exercise*) Questionnaire. The validity and reliability of the scales and the correlations between the factors were analysed. Finally, several hypotheses were studied through structural equation modelling. The results indicated that leisure ( $\beta = .29$ ), competition ( $\beta = .25$ ) and fitness ( $\beta = .14$ ) are predictors of physical-sporting activity performed ( $R^2 = .37$ ). Motives and level of physical activity together predict 15% of the *challenge* variable ( $R^2 = .15$ ). Physical-sport activity is positively related to the *challenge* dimension ( $\beta = .36$ ) is positively related to *engagement* ( $\beta = .66$ ) and *control* ( $\beta = .45$ ). Physical activity can improve resistant personality in the *challenge* dimension.

**Keywords:** motivation, psychology of education, resistance to change, sport, teacher.

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## Introduction

Exploring resistant personality has been of great interest in recent years in the educational context, given that the work of teachers can be considered to be one of the most stress-prone professions (Arís, 2009). It refers to an individual's ability to understand external conditions accurately and make the best decisions for oneself (Khaledian et al., 2013). The result of this process is defined as coping and is expressed in behaviours such as focusing on controlling or changing the stressful situation, changing the perception of the stressful situation to reduce emotional discomfort or distancing, focusing on other less relevant stimuli.

In fact, high values of resistant personality have been found to induce a *transformational coping* style, that is, the ability to "interpret potentially stressful events as opportunities for learning and personal growth" (Godoy-Izquierdo & Godoy, 2002, p. 143).

This construct is composed of three factors: *challenge*, *engagement* and *control*, all of which must be understood together to be considered resistant and they explain 33% of the variance of *burnout* (Oliver, 1993).

The *challenge* factor provides participants with a vision in which life changes are interpreted as a possibility to improve their own skills (Moreno-Jiménez et al., 2014), i.e. a predisposition to search for alternative situations and solutions (Garrosa & Carmona, 2011). This factor is particularly important in the field of sport given that competition, as a stressful situation, is inherent to its core logic and involves facing individual and/or group challenges. This is illustrated by authors such as Weinberg & Gould (1995), who point out that "highly competitive people tend to seek out competitive situations and are more motivated to succeed in them, compared to people with low levels of competitiveness" (p. 107).

The *engagement* factor refers to the tendency to identify with what is being done and therefore entails active involvement (De la Vega et al., 2011). It would be a quality that, in addition to self-esteem and personal competence, involves a sense of community and corporation. According to Godoy-Izquierdo & Godoy (2002), this attitude minimises the perceived threat of a life event through the ability to turn to others at such times. Other authors such as Moreno-Jiménez et al. (2012) found that this *engagement* factor has direct, significant and moderating effects on vigour and burnout.

The *control* factor urges one to seek explanations for events by emphasising one's own responsibility over the actions of others or fate (Eschleman et al., 2010). Authors such as Godoy-Izquierdo & Godoy (2002) point

out that this attitude of control over ones' experiences intensifies resistance to stress, since the individuals identify themselves as active protagonists, influencing the course of actions through their skills and decisions.

Perhaps a more clarifying definition of these three factors of resistant personality is how an individual views the same stressful event differently and how s/he would buffer its effects. Thus, from the engagement approach, such events would be perceived as situations with emotional significance; from the control approach, they would be considered a modifiable situation under the sphere of our control; and from the challenge approach, a normal life situation that offers an opportunity for growth (Godoy-Izquierdo & Godoy, 2002).

It should be noted, therefore, that a resistant personality presents a more optimistic perception of events and the that ther wil disposition of coping strategies focused on the search for a solution to the problem and the reformulation of events and their consequences (Garrosa & Carmona, 2011).

Some studies suggest that it is the *control* and *engagement* factors, or only the *control* factor, that truly make up the concept of resistant personality (Florian et al., 1995). In the case of firefighters, the *challenge* factor has been found to act in the relationship between *burnout* and organisational stressors, with *engagement* being the factor that regulates the associated symptomatology (Moreno et al., 2006). In this sense, relationships have been found between the *engagement* and *challenge* factors with social support but not with the *control* dimension (Ganellen & Blaney, 1984). Other authors, like Diloy-Peña et al. (2021), in their study with secondary school students, showed the importance of avoiding a controlling style on the part of PE teachers in order to generate more rewarding experiences for their students.

The importance of the study of resistant personality in physical-sporting activity lies in investigating how potentially stressful stimuli inherent to sporting activity are perceived and the behavioural response to them, modulating performance or injuries (De la Vega et al., 2011).

The relationship between resistant personality and sport performance has been found in different sport disciplines: in elite athletes with and without disabilities (Penna et al. 2004) or Spanish middle and long-distance runners (De la Vega et al., 2011), among others. While it is true that interest in this relationship between resistant personality and physical-sporting activity has evolved mainly in the field of sport, it is starting to occur in the other direction, as the practice of physical activity also helps to develop a healthier resistant personality, reducing the perception of stress (Garrosa & Carmona, 2011).

If we go a step further in the study of this relationship between resistant personality and physical-sporting activity, we find the motives for practising. It is well known that people engage in physical activity for different reasons (Moreno-Murcia et al., 2016).

In this regard, active participants have a greater intention to practice in the future (Blázquez et al., 2015). Authors such as Pavón-Lores et al. (2004) found that competition, social interaction and adventure are more highly valued by male university students, while physical fitness, body image and health are more highly valued by female students.

Given the importance of a resistant personality for better coping in the profession of teaching, and taking into account the possibilities offered by the sporting context as a scenario in which to discover how to perceive stressful situations and improve their development, it is particularly important to investigate the relationships between teachers' level of physical activity, their resistant personality and their motivation for sport. Thus, authors such as Jaenes et al. (2009), with reference to marathon runners, highlight that one of the characteristics of the act of sport is the challenge, as they perceive the uncertainty of competition or training as a challenge to be faced. Therefore, the importance of this sub-construct in the teaching context characterised by the stressful scenario mentioned above is evident.

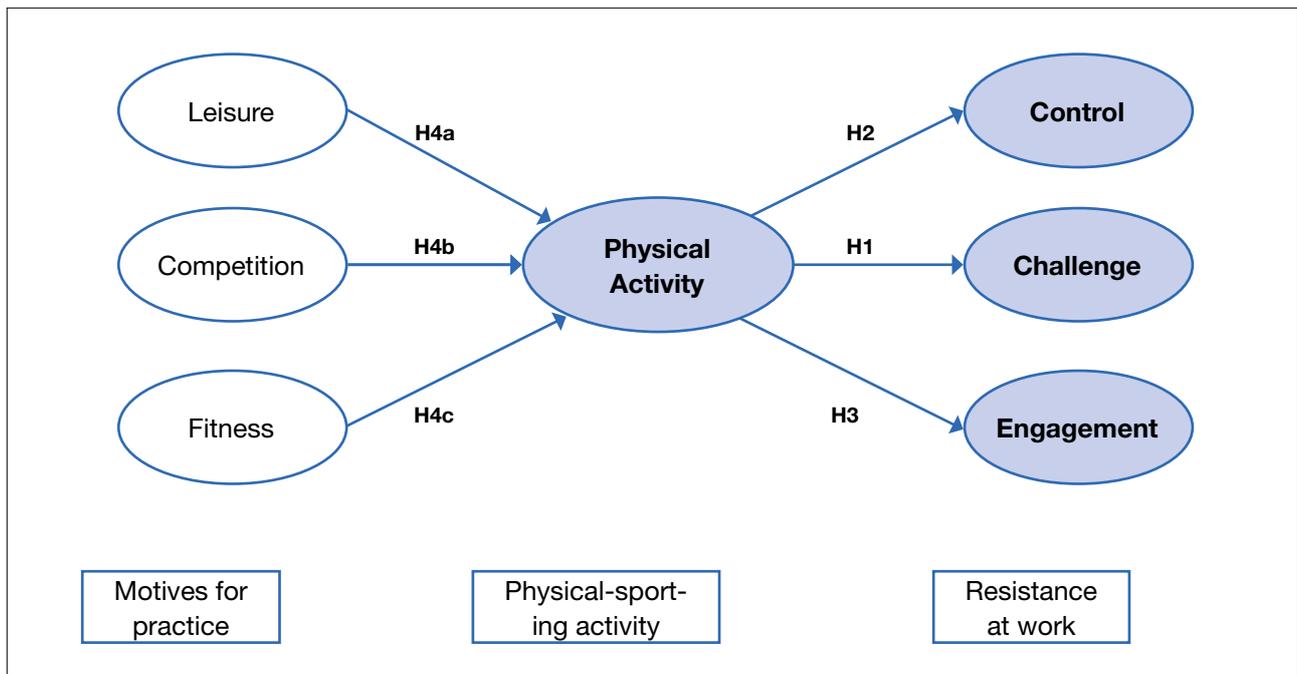
It could be argued that people who engage in more physical activity for leisure, health and competition would

be more resistant as they have a greater capacity to face challenges that improve their lives.

For all these reasons, the first objective was to analyse the relationships between the reasons for physical activity, the level of physical activity and the variables that favour endurance at the workplace. In addition, the second objective was to analyse the most self-determined set of relationships: leisure, competition and fitness/health, with each of the components of the resistant personality: control, challenge and engagement. To this end, it has been proposed, as a global hypothesis, that there will be a positive relationship between the motives for practising for leisure, fitness and competition, with the amount of physical activity performed, and in turn that there will be a positive relationship between the intention to be physically active and the *challenge* component within a resistant personality as the variable that most influences endurance at work and satisfaction with life, Figure 1.

On the basis of the above model, the following hypotheses are put forward:

H1: the practice of PA has a direct positive effect on the *challenge* variable greater than *engagement* and *control*. H2 and H3: the practice of PA has a positive and direct influence on the variables *control* and *engagement* of resistance at the workplace. H4 a, b and c: the most self-determined motives for PA, leisure, competition and fitness, have a positive effect on the physical activity variable.



**Figure 1**  
Hypothetical model of the relationships between the motives for doing physical-sports activities and their relationship with the capacity for work endurance.

## Methodology

### Design

The present study followed an associative strategy with a predictive, cross-sectional study (Ato et al., 2013). Structural equation modelling was used to test several hypotheses at the same time (Ruiz et al., 2010).

### Participants

The sample consisted of 649 active pre-school and primary school teachers, 76.64% of whom were female and 23.36% male; the majority profile was of teachers aged 26-40 years (62.90%). The sample was accessed through an online questionnaire which was distributed during March and April through resources and teachers' centres and teachers' associations. This work was positively assessed by the Bioethics and Biosafety Commission of the University of Extremadura, with registration number 244/2019.

### Resources

#### Revised Scale of Motives for Physical Activity.

One of the tools used is the Scale of Motives for Physical Activity adapted to the Spanish context and validated (Moreno-Murcia et al., 2007). In this work, 28 items were used, grouped into five factors: *enjoyment*, *appearance*, *social*, *competition* and *fitness*, on a five-point Likert scale, with 1 being "strongly disagree" and 5 "strongly agree".

#### Physical Activity

The PACE Questionnaire, *Physician-based Assessment and Counselling for Exercise* (Martínez-Gómez et al., 2009), was used to measure teachers' weekly physical activity. This questionnaire analyses how many days 60 minutes of physical activity was performed in the last week and in a typical week. This questionnaire has been used in other work with adults (Blázquez et al., 2015).

#### Study of Resistant Personality

The Occupational Resilience Questionnaire was used to measure resilient personality in its three dimensions (Moreno-Jiménez et al., 2014): *engagement*, *control* and *challenge*, through a series of statements about various situations on a four-choice Likert-type scale (1 = Completely disagree, to 4 = Completely agree).

### Statistical Analysis

Descriptive data were calculated for the variables used and a correlational analysis was carried out using Pearson's correlation coefficient for variables with a normal distribution and Spearman's correlation coefficient for those with a non-normal distribution. The reliability of the questionnaires was also calculated by means of Cronbach's Alpha, with the factors considered to be appropriate being  $> .70$  (Nunnally & Bernstein, 1994).

A structural equation model (SEM) was then applied to test the initial hypotheses set out in Figure 1. The estimation method used was adapted to the univariate and multivariate normality of the items used; therefore, as univariate normality was not met for some items and multivariate normality was not met, it was decided to use the unweighted least squares (ULS) method.

Similarly, several best-fit indices were studied to accept or reject a model (Hu & Bentler, 1999). These goodness of fit statistics are: the chi-square ratio / degrees of freedom ( $X^2/df$ ), where values below 5 are acceptable and below 2 are indicators of very good fit (Hu & Bentler, 1999). Additionally the normed fit index (NFI), the goodness of fit index (GFI), and the adjusted goodness of fit index (AGFI), where values  $\geq .95$  are adequate. Finally, the square root of the residual (RMR) and the standardised square root of the residual (SRMR) were also analysed, where values  $< .05$  are adequate and between .05 and .08 were considered reasonable (Ruiz et al., 2010).

## Results

The results of descriptive analyses indicated that the mean of the highest scoring resilient personality variables were *engagement* and *challenge* (Table 1). In terms of reasons for doing sport, leisure and fitness were the highest rated by teachers. Finally, teachers' physical activity practice could be considered low and with a high dispersion ( $M = 2.67 \pm T.D. = 1.72$ ). All variables used in the study had good reliability (Table 1). When the skewness and kurtosis values were checked, it was found that the *engagement* variables with respect to skewness had values greater than 1.961 and therefore did not follow a normal distribution (Finney & DiStefano, 2006).

As the hypothesis of normality was not met in the *engagement* variable, a correlation analysis was carried out with this variable using Spearman's correlation coefficient, Table 2, while Pearson's correlation coefficient was used for the rest of the variables.

**Table 1**  
Reliability of the variables in the study.

	M	T.D.	Asymmetry	E.T.	Kurtosis	E.T.	$\alpha$
Control	3.241	0.516	-0.556	.096	0.297	.192	.85
Challenge	3.509	0.4606	-1.102	.096	1.741	.192	.82
Engagement	3.682	0.400	-2.599	.096	11.114	.192	.72
Leisure	3.768	1.104	-0.836	.096	-0.112	.192	.94
Competition	3.147	1.112	-0.119	.096	-0.779	.192	.94
Fitness	4.025	0.918	-1.182	.096	-0.543	.192	.95
Physical Activity	2.669	1.718	0.180	.096	-0.579	.192	.87

**Table 2**  
Correlations between work-related resistance, practice motives and physical activity.

	M	Control	Challenge	Engagement	Leisure	Competition	Fitness	Physical activity
Control	<i>r</i>	1	.32**	.42**	.06	.13**	.13**	.04
Challenge	<i>r</i>		1	.47**	.20**	.25**	.21**	.14**
Engagement	<i>r<sub>s</sub></i>			1	.13**	.13**	.17**	.09*
Leisure	<i>r</i>				1	.733**	.62**	.54**
Competition	<i>r</i>					1	.59**	.50**
Fitness	<i>r</i>						1	.43**
Physical Activity	<i>r</i>							1

\*\*  $p < .01$

The results indicated positive correlations between the variables determining resistant personality, reasons for practising sport and physical activity and the practice of physical activity. The highest correlations were found between the *challenge* variable and the motives for *competition* ( $r = .25$ ;  $p < .05$ ) and *fitness* ( $r = .21$ ;  $p < .05$ ), Table 3. There was a correlation, albeit low, between the amount of physical activity carried out and the *challenge* variable ( $r_s = .14$ ;  $p < .05$ ). The motives for practising for *leisure*, *competition* and *fitness* correlated strongly with the level of physical activity.

The hypothetical model proposed, Figure 1, indicated that physical activity practice and motives for practice would have the ability to predict higher values for some of the occupational endurance variables. The model was tested using structural equation modelling, where in a first model it was observed that there were items with saturations below .50 in *control* and *challenge* factors.

Finally, the model consisted of fifty-seven variables: twenty-four observed variables or indicators and thirty-three unobserved variables. It should also be noted that 27 variables were endogenous and 30 exogenous.

The model's skewness and kurtosis data indicated that three items showed values greater than |1.96| and that the multivariate kurtosis was high ( $km = 174.49$ ; C.R. = 58.28) (Byrne, 2010). The indices indicate a good fit:  $X^2 = 524.37$ ;  $DF = 267$ ;  $X^2/DF = 1.96$ ;  $GFI = .989$ ;  $AGFI = .987$ ;  $NFI = .986$ ;  $RFI = .984$ ;  $RMR = .050$ ;  $SRMR = .10$ . All the saturations of the latent indicators obtained in the model are between .52 and .93.

The motives for leisurely physical activity ( $\beta = .25$ ), competition ( $\beta = .25$ ) and fitness ( $\beta = .14$ ) were predictor variables for physical activity performed, with a coefficient of completion  $R^2 = .37$ .

The results of the coefficient of determination ( $R^2$ ), which explained the variance of the model, were above the minimum ( $R^2 > .01$ ). In addition, the predictive ability of the motives for sport and physical activity was 15% for the variable *challenge* ( $R^2 = .15$ ). However, the model did not predict the *engagement* variables ( $R^2 = .06$ ) and *control* ( $R^2 = .04$ ). Physical activity was positively correlated with the following variables *challenge* ( $\beta = .39$ ), *engagement* ( $\beta = .25$ ) and *control* ( $\beta = .19$ ), Figure 2.

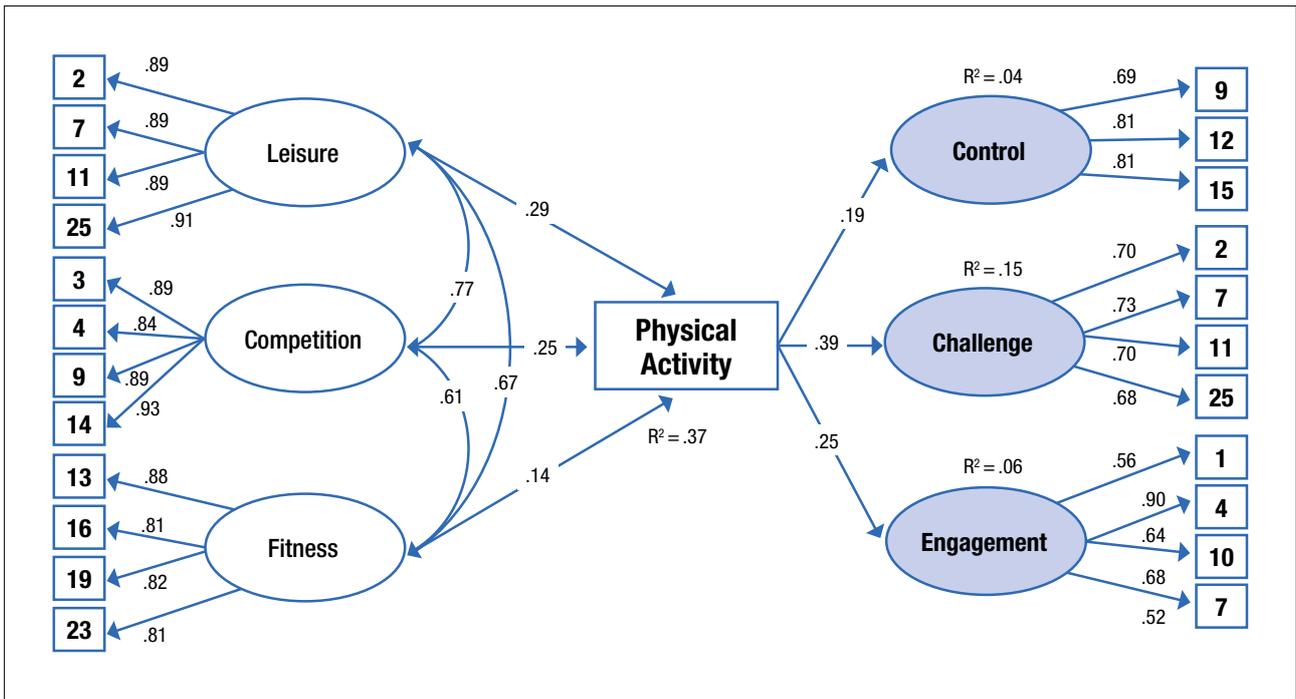


Figure 2  
Model 1 of structural equations.

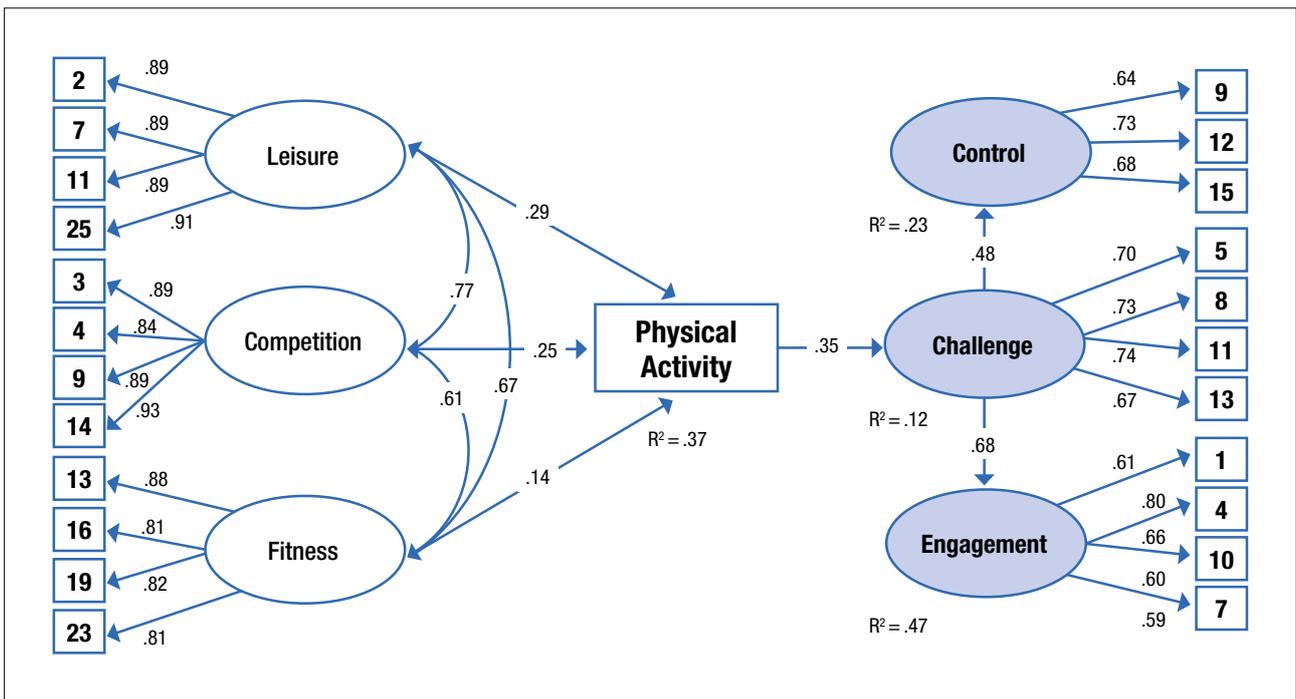


Figure 3  
Model 2 of structural equations.

Given that the coefficients of determination of the *engagement* and *control* variables were low, and hypotheses H1 and H2 could not be verified, it was decided to implement a new model to determine the influence of *challenge* on these two variables. The results of the second

model indicated that the *challenge* had a direct positive relationship on *engagement* ( $\beta = .47$ ) and *control* ( $\beta = .48$ ), and that physical activity had a direct relationship with the *challenge* variable ( $\beta = .35$ ), which explained 12% of the variance ( $R^2 = .12$ ), Figure 3.

## Discussion

This work has analysed the relationships between practice motives and level of sport practice with the variables that shape a resistant personality: *control*, *engagement* and *challenge*. The idea for this study emerged from the lack of studies that have focused on the influence of physical and sporting activity carried out by teachers, specifically in primary and infant education, with respect to a resistant personality in the workplace.

Analysis of the correlations between variables indicated that *challenge* is the only one of the resistant personality variables that is positively related to physical activity performed by teachers.

In the literature we found studies that conclude, in the case of athletes, that a more resistant personality is related to the practice of sport, and that this is due to the fact that they need to face more frequently stressful situations inherent to the activity where new challenges are presented (De la Vega et al., 2011). In the case of teachers, this relationship has only been found with the *challenge* variable of resistant personality. According to Godoy-Izquierdo & Godoy's (2002) explanation, this could be explained from the perspective of the *challenge* variable of a resistant personality, that physical-sporting activity could symbolise a moment in life that offers an opportunity for improvement.

There could be logic to these findings, given that if we consider the importance of cognitive evaluation in making the most of moments of *flow* in stressful situations experienced by athletes (Williams & Andersen, 1997), the *challenge* could be explained, as it is considered a characteristic of the sporting act (Jaenes et al., 2009).

It was decided to study the relationship between more self-determined motivations and resistant personality variables. It is noteworthy that the highest correlations in the resistant personality were found in the sub-construct *challenge* with the motives for physical activity: competition, fitness and leisure. A possible explanation could be that those people with motives for physical-sport activity based on competition, fitness and leisure might understand these elements of physical activity as those that define it as a life action with an opportunity for improvement (Godoy-Izquierdo & Godoy, 2002), feeling more able to face it as a way to improve their own capabilities (Moreno-Jiménez et al., 2014).

As a second aim, we set out to analyse the set of relationships between the motives of leisure, competition and fitness to be physically active and their relationship with the *challenge* variable. For this purpose, a global model was conducted in which a positive relationship was found between the motives of leisure, fitness and competition with the physical activity performed, and in turn there was a stronger positive relationship between physical activity

and challenge compared to the other variables that made up the construct of *resistant personality*. The model showed that physical activity only had an impact on the *challenge* variable and that fun and competition, excluding the fitness variable, were the most related motivations for doing more physical activity. The model demonstrates that intrinsic motivations, i.e. the most self-determined ones, favour the practice of physical-sporting activity, in line with Moreno-Murcia & Martínez (2006).

The results obtained were in line with another work (Moreno et al., 2006) where it was found that the *challenge* factor is the one that plays a role in shaping the relationship between burnout and organisational stressors, i.e. in the perception of environmental stimuli. It is therefore not surprising that those teachers who interpreted the environment as a challenge or opportunity for growth were the ones who practised physical activity as an enhancement of their skills or for leisure. Some studies have found high levels of resistant personality in athletes (De la Vega et al., 2011).

It should be noted that one of the characteristics of the athletes was the quality of *engagement*, which allowed them to minimise the perceived threat of long-term goals (Jaenes et al., 2009). It should be reiterated that, although physical activity reduced the perception of stress (Garrosa & Carmona, 2011), it was the *engagement* variable together with optimism that played a role in shaping burnout in primary school teachers (Moreno et al., 2006).

In a second model studied, it was found that the *challenge* variable is positively related to *engagement* ( $\beta = .66$ ) and the *control* ( $\beta = .45$ ), although resistant personality must be understood in conjunction with all three factors in order to be considered resistant. Note, in this regard, the results of Ganellen & Blaney (1984), who found relationships between the *engagement* and *challenge* factors with social support but not with the *control* dimension.

## Conclusions

In this study conducted with teachers in Spain, in which the type of physical activity and participation in competition, whether *amateur* or professional, were not analysed, the highest scores in relation to resistant personality were for the variable *engagement* followed by *challenge*.

*Challenge* was the only one of the resistant personality variables that was positively related to the physical activity performed by the teachers studied.

The motives of leisure, competition and fitness were strongly correlated with the level of physical activity.

Applying structural equation modelling, it was found that leisure, competition and fitness motives for physical activity could be predictor variables for physical activity (model 1).

Similarly, challenge had a direct positive relationship on engagement and control and physical activity had a direct relationship with the *challenge* variable, explaining 13% of the variance.

In the future, it would be necessary to investigate which conditions of weekly practice or type of physical activity would be the most appropriate to improve resistant personality, as well as the inclusion of other constructs such as life satisfaction or social support.

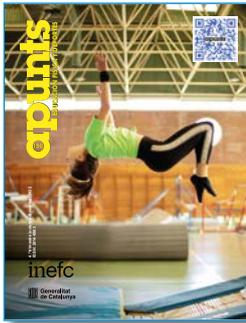
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## Perceived Educational Quality of a Municipal School Sports Programme

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### Abstract

This study analysed the educational quality of an extracurricular municipal school sport programme based on the perception of the people involved in its development and its participating schoolchildren. For this purpose, qualitative research was carried out in which in-depth interviews were conducted after the question guides had been approved by experts in the field of school sport. Interviews were conducted with 83 informants, including schoolchildren and their family members, instructors and programme coordinators. The information obtained was used to carry out a content analysis based on three dimensions of analysis: 1) Participation, social relations and attitudes of the participants, 2) Sport learning and promotion of healthy habits and active lifestyles, and 3) Transfer to other contexts, by means of the software Atlas.ti. The results demonstrated that participation and equality of participants was promoted; education in values was developed; schoolchildren were integrated and social interactions were positive; habits of regular physical activity were promoted; learning was developed; and what was acquired in the programme was transferable to other contexts. It was concluded that the educational quality of the programme is underpinned by the satisfaction of its participants in line with the achievement of its aims and its coherence with school physical education.

**Keywords:** educational sport, extra-curricular activities, integral development, quality.

## Introduction

The structure, scheduling and implementation of extracurricular school sport programmes with an emphasis on physical education (PE) can directly influence participation and the benefits of physical activity (Bean et al., 2021a; González-Calvo et al., 2018). Despite the educational potential of such programmes, both the positive and negative effects that an extracurricular sports programme can generate are conditioned by the degree of educational quality they offer. That is, the potential of the activity or programme to generate learning and contribute to comprehensive training in its cognitive, motor, emotional and social elements, allowing for education in values and enabling people to exercise active and democratic citizenship (Lobo, 2017). Therefore, the characteristics of the programme, as well as those that are in charge of its development, are a fundamental part of ensuring the success of the expected actions (Manrique et al., 2011).

In recent decades, research on this topic has focused on the educational outcomes obtained by people who participate in physical-sports programmes or interventions (Kirk, 2013). These have focused on models that develop life skills and positive development (Hemphill et al., 2019; Holt et al., 2017; Jacobs & Wright, 2021), on the promotion of healthy habits and increased levels of physical activity (De Meester et al., 2016), on the development of values (Koh et al., 2017) or on the development of emotional and/or social benefits (Gordon et al., 2016; Wright et al., 2020), but few studies have looked at the educational quality of the programmes developed. Specifically, the study by Lobo (2017) investigated the educational value of an educational school sport programme based on comprehensive and global models that put tactics before technique in sports learning, with a multi-sport character, in which students learn a multitude of sports during the academic year, and in line with the pedagogical principles that govern PE, and found that the learning, values and health habits transmitted contribute to the integral development of the individuals who participate in it. In the same study, they concluded that there is no difference between a school sport model focused on participatory discourse and one with a federated sport model. On the other hand, Lobo et al. (2020) examined the perception of the educational quality of the same programme from the point of view of the sports instructors, and found that the programme encourages respectful attitudes; promotes healthy habits and an active lifestyle; seeks maximum participation and equal opportunities for participants; has a positive relationship to studies; and the learning has a transferability to other contexts.

Zhang et al. (2016) found that sports programmes with an educational and training-oriented curriculum and service influence participants' perceived experience and quality, and directly influence programme satisfaction and loyalty to the programme. In the same vein, Lara et al. (2021) showed that the application of pedagogical models, such as sports education, has a great educational potential to contribute to the integral development of the participants, but that the success in its development depends on the teaching action. Meanwhile, Bean et al. (2020) found that those young athletes who had the perception of having high quality experiences in their sport practice and appreciated that the programme responded to their basic psychological needs (autonomy, competence and relationship with others) had high satisfaction with it and a high perception of its quality, while in the work of Bean et al. (2021b) found that there are usually no differences in the quality of programmes with a more competitive or recreational orientation, but they did find differences in the quality of the programme based on the sports instructors' number of years of experience, as well as on the degree of ethnicity in the participants' group composition.

Wilson & Millar's (2021) study found that the outcomes (health benefits, learning and emotional well-being) obtained by participants and the quality of the programme are related to lower dropout and higher satisfaction with the programme. In this vein, Côté & Hancock (2016) proposed an inclusive structure of sport programmes in order to pursue performance, participation and personal development, thus avoiding early dropout, favouring intrinsic motivation of participants and maximising participation in various sport activities.

The purpose of this study was to analyse the perception of the educational quality of an extracurricular municipal school sport programme through the perspective of the people involved and participating in it. More specifically, we studied the participation, social relations and attitudes of the schoolchildren involved in the programme; their ability to acquire sporting knowledge; the way they promote healthy habits and active lifestyles; and the transferability of what they have learnt and acquired in the programme to other practice contexts.

## Methodology

A qualitative study was conducted through a retrospective design of a phenomenological nature with the intention of describing, explaining and interpreting a phenomenon based on the discourse of the participants and the meanings they attribute to it (Marshall & Rossman, 2016).

## Context

The Integral School Sports Programme of the Municipality of Segovia (PIDEMSG) was an alternative school sport project to the exigent and traditional model that had been practised. It was implemented between 2011 and 2018 in a city of about 50,000 inhabitants. It is a programme that has been extensively studied and for which more detailed information can be found in the work of Jiménez et al. (2019), Lobo (2017), Lobo et al. (2020), Manrique et al. (2011) and Pérez-Brunicardi et al. (2018). Its main characteristics were: 1) It was based on the use of comprehensive and global models for teaching sport, 2) It was considered a complement to PE and pursued the integral development of participants, 3) It was multi-sport and mixed, 4) There were no results or rankings, and 5) It was oriented towards a participatory discourse (Pérez-Brunicardi et al., 2018).

## Participants

For this study, interviews were conducted with 83 key respondents, of which 20 were conducted in the 2016/17 academic year and seven during the 2017/18 school year. Nine interviews with schoolchildren were group interviews and the other 18 were individual interviews. Three programme coordinators with more than three years of experience in the programme were interviewed; four contracted sports instructors with three or more years of experience in the programme; four other instructors with a scholarship with between one and five years of

experience in the programme; 35 primary school children aged between 6 and 12 from low-middle and middle socio-economic levels, and from urban and rural public schools; 28 secondary schoolchildren aged between 13 and 15 from public and public secondary schools and with a medium-high socio-economic level; three relatives of infant schoolchildren and another 6 primary school children (Table 1) with medium socio-economic levels. The selection of these participants was done by means of a non-intentional probability sampling by convenience and accessibility, seeking to select those who were able to provide relevant and meaningful information on the basis of the following inclusion and exclusion criteria.

For the schoolchildren group, the inclusion criteria were: 1) Be a participant in the Programme during the academic year, 2) Be a primary or secondary school student, and 3) Have regular attendance at the Programme sessions and/or meetings. The exclusion criteria were: 1) Not attending the Programme on a regular basis, and 2) Not being a primary or secondary school student. For the family members group, the inclusion criterion was: 1) Having children enrolled in the Programme in the academic year, while the exclusion criteria were: 1) Not having children enrolled in the Programme. For Programme professionals, the inclusion criteria were: 1) Knowledge of the Programme, 2) Being an active Programme professional during the academic year, 3) Years of experience as a coordinator or instructor in the Programme. The exclusion criteria were: 1) Not being an active professional of the Programme.

**Table 1**  
*Distribution of informants.*

Representatives	Type of Participant	Number of Participants	
		Men	Women
PIDEMSG Professionals	PIDEMSG Coordinators	1	2
	Contracted Sports Instructors	2	2
	Sports Instructors with Scholarships	3	1
Schoolchildren	Primary School	22	13
	Secondary School	0	28
Family Members	Family Members of Infant Schoolchildren	0	3
	Family Members of Primary School Children	3	3
Total by Sex		31	52
TOTAL		83	

## Materials

The tool used for the collection of information was the interview. According to Kvale (2011), interviews allow exploration of people's interpretations and understanding of their world, providing unique access to participants' views of their situations and experiences. In this study, semi-structured, in-depth interviews were conducted following the script developed and validated by Lobo (2017) to study the educational value of PIDEMSG. The composition of the dimensions and questions was made *a priori* by the researchers on the basis of the Programme's documentation and scientific literature. They were then validated through consultation with school sport experts to filter and discard questions according to the purpose of the study. The final script was composed of questions adapted to each group on eight dimensions (respect for rules, participation and equal opportunities, healthy habits, multi-sport character, integration, motor self-perception, relationship with studies and transfer for life) that referred to the intentions of the Programme and are in line with the aims of PE.

## Procedure

For the interviews, access to the field was requested and carried out through the Programme coordinators. Once permission to access the field was obtained, the coordinators facilitated contact with the monitors and groups of schoolchildren, as well as the Friday training and match schedules. For the interviews with coordinators, instructors and pupils, one of the researchers initially contacted them to find out if they were willing to participate. This was followed by an informed consent form explaining the purpose of the research, assuring anonymity and confidentiality, as well as the intention to use and publish the information collected

in academic and scientific papers, and providing the right to leave or stop the interview at any time. After receiving the informants' consent, a date and place for the meeting was agreed upon. The researcher in charge of the project would contact them two days before the agreed date to remind them and confirm their participation. At the outset, the objectives of the research were explained and any possible questions from the interviewees were answered. To ensure the reliability of the study, the conversation was then recorded with a tape recorder and a mobile phone so as not to lose any of the information provided by the interviewees. The interviews were carried out in the sports facilities where the Friday training sessions or matches took place, ensuring that the context was familiar and not too hostile. Once the interviews were completed, they were transcribed into a word processor (Rapley, 2014). Some interviews with schoolchildren were group interviews, with the aim of facilitating everyone's participation. Interviews with family members were conducted during the Friday meetings, following the same protocol as above. In all interviews the researcher adopted a friendly attitude and it was emphasised that anonymity and confidentiality were guaranteed as outlined in the informed consent.

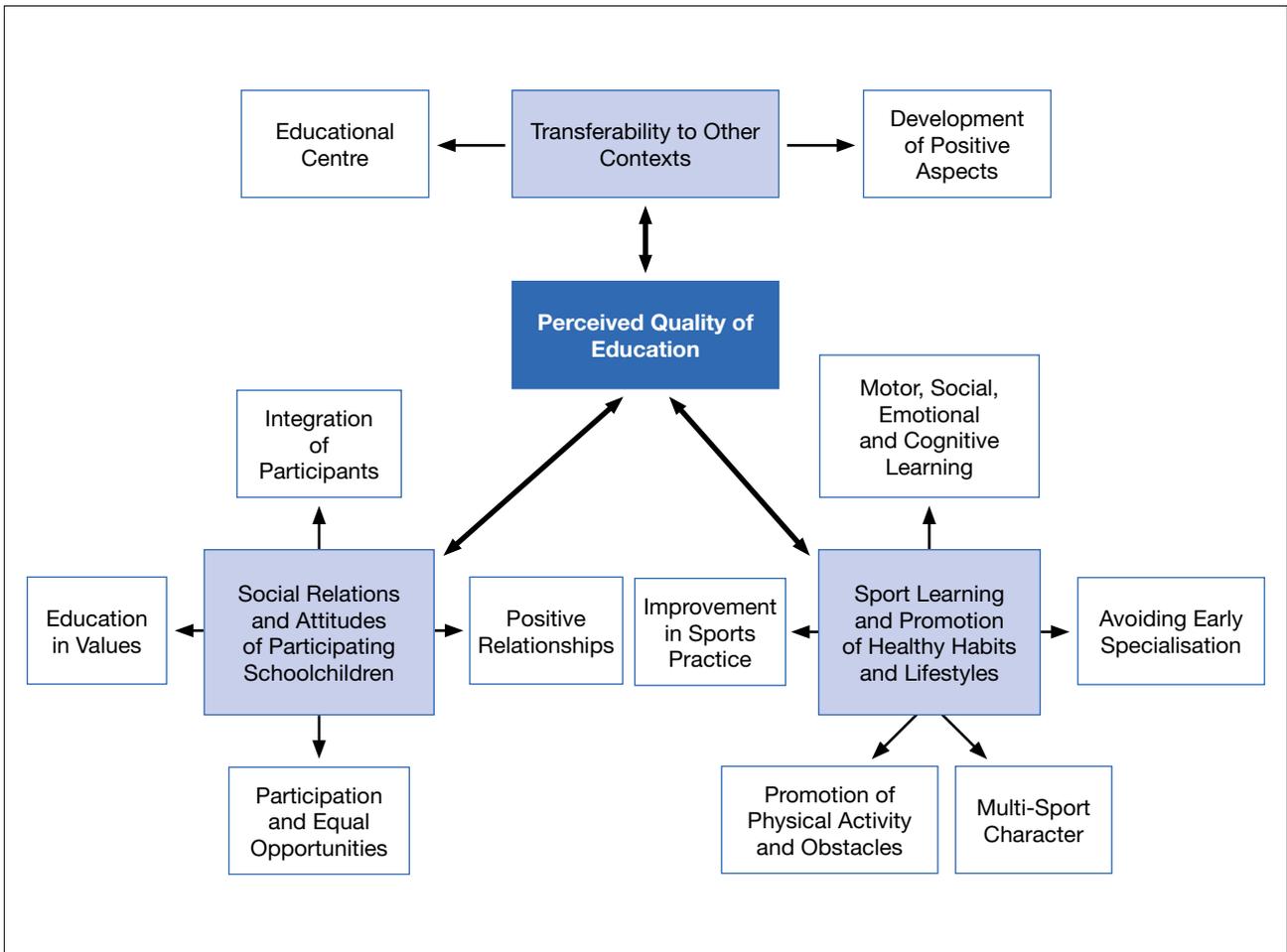
## Analysis of Data

The information collected was subjected to content analysis (Marshall & Rossman, 2016). Through this type of analysis, information was identified, reduced and grouped around inductive coding and categorisation (Table 2). This process was carried out with the qualitative analysis software Atlas.ti version 7.5.4., which enabled the establishment of networks between the different categories in order to carry out a convenient discourse analysis.

**Table 2**

*Dimensions of analysis and categories for the analysis of information.*

Dimension of Analysis	Category
Participation, Social Relations and Participants' Attitudes	Equal Opportunities
	Respect for the Rules
	Integration
Sport Learning and Promotion of Healthy Habits and Active Lifestyles	Improvement in Sports Practice
	Multi-sport Character of PIDEMSG
	Physical Activity Outside School Sport
Transferability to Other Contexts	Usefulness of Learning Acquired in Other Contexts



**Figure 1**  
Educational quality perceived by the participants of the school sport programme.

### Results and Discussion

The purpose of this study was to analyse the educational quality of an extracurricular school sport programme based on the perception of the people involved and participating in it. The analysis of the interviews yielded a total of 11 codes resulting from three main categories (Figure 1).

#### Social Relations and Attitudes of Participating Schoolchildren

One of the key objectives of the programme was to achieve participation and equal opportunities for schoolchildren. In this variable, a great diversity of opinions was found among the interviewees. Six informants from PIDEMSG professionals stated that schoolchildren in PIDEMSG did not participate equally and that there was greater participation of boys than girls, as one interviewee stated: "the intention is that but [...] what I have experienced in different schools is that boys tend to take up a lot of space, sometimes

monopolise a lot of space or be very protagonist in the activities" (ENIMO27, p. 3). On the other hand, five of the family members and seven of the pupils felt that they all participated equally and, if this was not the case, the instructors were usually the ones in charge of dealing with it in order to prevent some pupils from participating more than others. Specifically, one of the measures to encourage schoolchildren's participation was that "we play fairly because what we do is take turns serving, one player serves and when they score, the one who was playing comes off for the player who was not playing, and we all play equally" (ENGES11, p. 3). These findings are consistent with Lobo et al. (2020), as maximum participation is promoted in this programme, although it was found that some schoolchildren participate more than others. It also corresponds with Côté & Hancock (2016) in terms of quality, given that in this case one of the ways of facilitating participation is by having all the schoolchildren play in attacking and defensive positions for their tactical and participatory enrichment. For this reason,

it follows that it is important that maximum participation in such approaches is sought in order to avoid early dropout due to lack of involvement and opportunities.

All the interviewees agreed on the need to develop rules agreed between the pupils and the instructors. They expressed the importance of giving schoolchildren a space to intervene in the elaboration and consensus of rules and thus generate a positive environment of coexistence. However, the instructors, coordinators and family members pointed out that these rules did not need to be agreed with the infant schoolchildren and that they should be elaborated and facilitated by the instructors: "Obviously, depending on the age of the children, they are given a more guided orientation to establish these rules" (ENICO13, p. 2). These findings are consistent with Lobo et al. (2020) and stresses the importance of giving a voice to schoolchildren to develop rules that promote respectful attitudes and values towards schoolchildren and instructors, facilities and sports equipment. In this sense, it is worth noting the importance of the role, experience and training that the instructors of this type of programme have and receive so that their actions can achieve the educational goals pursued (Manrique et al., 2011), in a positive atmosphere and environment of coexistence in which the instructors are aware of the values they transmit (Koh et al., 2017). In addition, it should be noted that the sports instructors are an essential element that influences the educational quality of the Programme.

Interviewees agreed that schoolchildren tended to be accepted, respected and integrated into their groups. In order to achieve this, the instructors usually emphasised respect for the established rules, the work on positive relationships between participants and the development of an education in values that would enable a positive atmosphere in the training sessions and Friday matches. However, they also noted that there were often isolated cases of students who were not integrated or who excluded themselves for reasons unrelated to the programme, such as ethnicity:

They are the ones who segregate themselves, who set themselves apart. For example, there are groups of Moroccan students, and there are groups of Dominican students. They are the ones who decide to distance themselves, but specifically that happens in one school, in the rest of the schools they are integrated. (ENICO12, p. 5)

This apparent segregation may have been more along friendship lines. These results seem to be in line with Bean et al. (2021b), as most of the school groups were composed of people of different ethnic backgrounds, which had an impact on the interaction and development experience of the participants, and thus on the educational quality of the

programme. Furthermore, these results seem to support the findings of Gordon et al. (2016) and Wright et al. (2020), highlighting the ideal context that extra-curricular sports programmes form for participants' social and emotional learning. In turn, this idea is related to that expressed by Bean et al. (2021b), as in this programme there was a safe and supportive environment where opportunities for interaction with people from other schools or ethnicities were rich, especially in the Friday sports matches, thus satisfying the possible basic psychological needs for positive affection and relationship with other people. Therefore, teaching actions must be coherent and formative in extracurricular sport programmes in order to ensure a high quality of education (Lara et al., 2021).

### Sports Learning and Promotion of Healthy Habits and Active Lifestyles

The interviewees expressed that this Programme helped to improve sport practice, especially tactically, due to the use of comprehensive and global approaches. In addition, it helped them to improve the development of their basic motor skills, helping them to become more aware of their possibilities and limits. Likewise, the interviewees were of the opinion that in PIDEMSG special emphasis was placed on the development of values, given that "obviously what is practical helps, but it is two days a week and what I think is most encouraged is participation and the values that we have said" (ENIFA18, p. 2). The acquisition and improvement of sport learning is likely due to the progression and schedule followed by the programme to provide a high quality educational service, as pointed out by Zhang et al. (2016). In this sense, Wilson & Millar (2021) expressed that learning, health benefits or emotional well-being are directly related to programme quality, participant satisfaction and lower dropout rates. In this regard, the motor, social and cognitive learning that participants acquired in this programme is part of the positive development that is pursued in these types of extracurricular projects (Holt et al., 2017).

Although the multi-sport nature of this Programme did not allow for the deepening of specific motor skills of a particular sport, working on them in a general way contributed to the transferability of their knowledge to the large number of sports that they practised in the PIDEMSG. Thus, the multi-sport character was highly valued by the interviewees, as they preferred to learn and practice a multitude of sporting specialities rather than focusing on just one. The multi-sport nature of this programme is an indicator of high programme quality, according to Côté & Hancock (2016), and prevents early specialisation.

Pérez-Brunnicardi et al. (2018) explained that, although each sport was worked on for a short time, the horizontal teaching approach allowed for the connection and transfer of learning in sports that have a similar learning logic. Therefore, after-school sports programmes should focus on playing a variety of sports, not aiming for selection and therefore avoiding early specialisation, employing healthy competition but not emphasising results, understanding children's needs, encouraging all schoolchildren to play in all attacking and defensive positions, promoting meaningful play, and designing activities that focus on fun and short-term rewards (Côté & Hancock, 2016).

On the other hand, the interviewees considered that the Programme achieved the promotion of healthy habits and an active lifestyle, since the schoolchildren carried out physical activity in their free time without it being organised by any institution or company: "in some cases I know the children who then go out to the neighbourhood, I see them play, and I see them on occasion doing activities that are not usual, such as football, for example" (ENIMO27, p. 3). Moreover, informants felt that they put into practice the sports they learnt in this Programme, adapting them to their materials and available sports facilities. As in De Meester et al. (2016), these results corroborate that extracurricular sports programmes can contribute to increase levels of physical activity and promote healthy habits and active lifestyles in participants. It is therefore necessary that the programmes have the necessary material equipment and adequate sports areas, which affect the quality of the programme. In this sense, the study by Jiménez et al. (2019) found that the PIDEMSG's sports facilities and equipment were suitable for sports practice.

However, some interviewees expressed some of the obstacles that prevented schoolchildren from doing physical activity in their free time, such as the lack of sports infrastructures, given that "right now in the street there are no facilities prepared to encourage these types of games or work" (ENIFA18, p. 2) or the overload of other extracurricular activities (remedial classes, English classes). As such, the responsibility that extracurricular programmes must assume in facilitating access to opportunities to improve and increase the practice of sport among young people became evident (González-Calvo et al., 2018).

### Transferability to Other Contexts

The interviewees expressed that the sport learning, cognitive learning, social relations and interactions, or values acquired in this Programme were transferred to other contexts, with the place of transfer par excellence being the PE class, given

that "the content that we are developing in the Programme is totally aligned and closely linked in the way we work with the area of Physical Education" (ENIMO27, p. 6). Moreover, the interviewees were of the opinion that what was acquired in this Programme was mostly positive, as a family member pointed out: "so I don't know if there are negative things such as excessive competition, there may be discrimination among the kids, but as far as I can see there are not, and those who are participating all play happily" (ENIFA18, p. 3). The educational context turned out to be the main place of transfer of knowledge, learning and values acquired in this programme, a result that coincides with the findings of Hemphill et al. (2019) and Lobo et al. (2020). In this sense, Jacobs & Wright (2018) pointed out that for transfer to occur, a cognitive bridge connecting learning to its application is necessary.

### Conclusions

The educational quality of an extracurricular sports programme is an element to be taken into consideration for the appropriate development of the Programme. This quality is corroborated through the satisfaction of its participants in line with the achievement of the aims of the Programme, in coherence with the aims of the PE. These aims are oriented towards the positive learning and values acquired by the participants; the usefulness and transferability of what they have learnt; the promotion of a positive social interaction environment; the promotion of healthy habits; and the facilitation of access to physical-sports practice with equal opportunities, regardless of their motor skills. It is a programme that has improved because it has been evaluated on an annual basis, and as a result, approaches that were not proving successful have been redirected. It is therefore important that those responsible for the design and implementation of educational programmes have a clear training and educational approach to achieve the objectives.

Based on the findings of this work, the lines of future work are the collection of information on the Programme from external agents: PE teachers, technicians from the Municipal Sports Institute, politicians, etc. on the implementation, development and educational quality achieved by this model of school sport.

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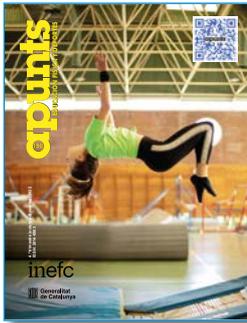
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# The Barometer of Physical Education in the COVID-19 Pandemic in Catalonia

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## Abstract

COVID-19 has had a significant impact on the functioning of many professional fields, including education. The aim of the study was to analyse what has happened in physical education in primary and secondary schools in Catalonia (Spain) during the COVID-19 pandemic. To this end, after a thorough review of the existing literature, a questionnaire was designed and implemented to identify the impact of COVID-19 in relation to changes in curricular decisions, attention to diversity and compliance with protocols, safety and hygiene standards generated by the pandemic in the classroom. To determine validity, the Delphi method was used, conducting a pilot test in the first phase and the analysis of two panels of experts in the following two phases, using Cronbach's alpha coefficient to delimit reliability. The questionnaire was answered by 629 primary and secondary physical education teachers, and the results showed that they made significant changes in the typology of teaching and learning activities and in the specification of curricular content, ensured physical distance between pupils, and ensured the application of health and safety protocols. There was an increased use of technology, both to facilitate communication with learners and to increase autonomy and self-regulation of learning. The methodological changes brought about by the pandemic are evident and envisage a hybrid model of physical education with a greater presence of technology.

**Keywords:** education, pandemic, questionnaire, teachers.

## Introduction

COVID-19 has had a global socio-economic impact that has disrupted the functioning of many professional fields, with the education sector being one of the most affected: closed schools, transition from face-to-face to digital education and uncertainty in educational processes (Trujillo et al., 2020). The pandemic and the lockdown measures meant that, as of 12 March 2020, teaching was virtual, including physical education (hereafter, PE) (Posso-Pacheco et al., 2020).

Changes in the forms of assessment generated controversy and challenges (Baena-Morales et al., 2021). Education bodies proposed to facilitate the grading of participants with flexible criteria taking into account the exceptionality of the situation.

In relation to physical education, lockdown led to the prioritisation of content linked to physical fitness and health, to the exclusion of physical activity, games and sports (Baena-Morales et al., 2021).

The start of the 2020-2021 academic year was not easy. Although the Spanish health authorities allowed attendance in schools, the Ministries of Education of the different autonomous communities only provided schools with generic guidelines and recommendations in relation to preventive hygiene measures, disinfection and protocols for action, which were specified by the leadership teams in their contingency plans. Preventive measures were the teachers' main concern, given the potential risk of contagion and the enormous social sensitivity at the time. PE had to adapt to the so-called "new normal" by obeying health recommendations, but without losing its essence. Teachers and leadership teams relied on recommendations published by different institutions - national and international - on procedures in relation to learning, safety, health and security measures. In Catalonia, the document "L'Educació Física en la 'nova normalitat'" ("Physical Education in the 'new normality'", COPLEFC, 2020) was published, which emphasised the flexibility of curricular content in the face of the pandemic situation and the use of materials that maintained a safe distance. The Association for Physical Education (2020) proposed to ensure safe PE by cleaning contact surfaces, frequent hand washing, minimising contact and ensuring proper respiratory hygiene. The COLEF Council (2020a, 2020b) created two documents in which they suggested avoiding activities that do not comply with the social distancing guidance and that, due to their requirements, cannot be done without a mask. It was urged to prioritise outdoor activities, without physical contact, ensuring a distance of 1.5 metres and avoiding the use of changing rooms.

The aim of the study was to identify the impact of COVID-19 in Catalan PE classes during the first four-

month period of the 2020/21 academic year. The specific objectives of the study were as follows:

1. Determine the level of changes introduced in the different educational processes and procedures.
2. To identify whether there were differences according to the level of education (primary vs. secondary) and the ownership of the school (state vs. public and private).
3. To determine teachers' perceptions of the institutional support received in their teaching during the pandemic.

## Methodology

### Participants

The sample population for this study was Catalan PE teachers, who were invited by COPLEFC to participate through its weekly newsletter and its social networks. A total of 629 PE teachers from Catalan schools participated, 309 from primary and 320 from secondary schools, of which 75.7% were from state schools and institutes and 24.3% from private or public. The representativeness of the sample was ensured, given that the population of PE teachers in Catalonia is 3,363 teachers in primary and 1,413 in secondary (Observatori Català de l'Esport, 2021), with the required sample size being 290 teachers in primary and 263 in secondary, according to the criteria of García-García et al. (2013).

### Materials, Resources and Procedures

The development of the instruments and the methodological procedures used followed the ethical standards in sport and exercise science research and the ethical guidelines for education (BERA, 2018). The participants, previously informed about the purposes of the research, responded anonymously to a questionnaire provided by the Professional Association of Physical Activity and Sport Professionals of Catalonia (COPLEFC).

After a thorough review of the existing literature to date, the "PE Barometer in times of COVID-19" questionnaire was designed, which included 21 items divided into 4 sections: questions 1 and 2 corresponded to the categorisation of the sample (it was asked whether they worked in primary or secondary education, and whether they worked in a state, private or public school); questions 3 to 8 dealt with changes in the teaching task; questions 9 to 14 described the safety measures implemented; and finally, questions 15 to 21 answered the teachers' perception of the teaching task performed and the support received by educational institutions or professional associations.

## Validity of Resources

In order to determine the validity of the questionnaire, the Delphi methodology was followed, using three sequential phases.

In phase 1, according to the criteria of Delbecq et al. (1975), four experts, graduates in PE and with more than 15 years of experience as secondary school teachers, developed a first draft of the questionnaire (questions 1 to 16). A pilot test was carried out with the participation of 37 PE teachers. At the end of this pilot, the experts considered the questionnaire to be of interest, but proposed a qualitative improvement by adding five questions (17 to 21) that could be used to analyse the impact of institutional support for teachers in the face of the emergence of COVID-19.

In phase 2, in accordance with Rowe & Wright (2001), two experts in qualitative methodology were incorporated into the study. In order to determine the degree of understanding and appropriateness of the questionnaire's 21 questions, they validated the questions by expressing their total agreement (Yes) or (No) with each question. Content validity was checked by calculating the percentage of positive matches using "R" software (© 2019 The R Foundation for Statistical Computing) version 3.5.3. A positive match rate of 93.7% with a 95.0% confidence interval (CI) of .904 to .961 was obtained.

In phase 3, following the criteria of Worrell et al. (2013), the expert panel was expanded to 10 people, all current secondary school PE teachers with more than 10 years of employment, who were asked about the appropriateness of the questions using a Likert scale format (1 = Strongly Disagree; 2 = Somewhat Disagree; 3 = Somewhat Agree; 4 = Strongly Agree). The criterion used to keep an item in the questionnaire was that the average of expert responses exceeded 75% of the average, which on a scale of 1 to 4 represents a rating of 3 points (George & Trujillo, 2018). The experts' responses showed a mean value of  $3.8 \pm 0.2$ , in a range of mean values between 3.3 and 4 for the different questions, confirming content validation for all items of the questionnaire.

In order to assess the suitability of the questionnaire items, Cronbach's alpha coefficient was calculated and applied to the group of questions corresponding to the central object of the study (questions 3 to 8; tables 1 and 2), resulting in a value of .737, which was considered an acceptable criterion of reliability as it was higher than

an alpha value of .70. The elimination of the question corresponding to the changes in attention to diversity would have strengthened the alpha value to .771 but, given its interest, it was decided that it should be kept in the analysis of the whole group of questions, and that the main group of questions in the study had a good internal consistency.

The incorporation of Likert-type scale questions from other content blocks was discouraged as they reduced alpha values below .70.

## Results

The questionnaire was completed by 629 teachers, 309 in primary education and 320 in secondary education. Of the total number of participants, 476 teachers belonged to state schools (244 in secondary education) and 153 to private or public schools (76 in secondary education).

In the teachers' responses and in the items analysed, no significant associations were detected in the distribution of responses according to the fact of belonging to a state school or to a private or public school.

### Changes in the Teaching Task

Table 1 shows the results reported by teachers in response to the changes made to the teaching task. It can be observed that there was a significant association between the level of education (primary and secondary) and the changes introduced in teaching and learning activities ( $p = .002$ ). There were no significant differences in the changes made to teaching units, content and objectives.

The differences observed in teaching and learning activities were only significant among teachers in state schools ( $p = .015$ ), and there were no significant relationships in the case of private or public schools.

### Changes in Attention to Diversity and Communication

Table 2 shows that there is a significant relationship between educational level (primary and secondary) and changes in communication with pupils ( $p = .001$ ), however, this was not observed in the changes introduced in relation to attention to diversity. Differences in communication with students were only significant among teachers in state schools ( $p = .002$ ).

**Table 1***Changes made in the teaching task of PE teachers in the face of the COVID-19 pandemic in Catalonia.*

Education Level	n	Few	Quite a few	Many	Other	Chi P-value
		%	%	%	%	
Question 3: How many changes have you made to the teaching units?						n.s.
Primary	309	18.1	47.6	31.1	3.2	
Secondary	320	16.6	45.6	34.7	3.1	
Total	629	17.3	46.6	32.9	3.2	
Question 4: How many changes have you made to the content?						n.s.
Primary	309	19.4	64.1	15.2	1.3	
Secondary	320	19.1	59.1	20.9	0.9	
Total	629	19.2	61.5	18.1	1.1	
Question 5: How many changes have you made to the learning objectives?						n.s.
Primary	309	31.4	55.3	12.3	1.0	
Secondary	320	25.6	58.1	15.3	0.9	
Total	629	28.5	56.8	13.8	1.0	
Question 6: How many changes have you made to teaching and learning activities?						.002
Primary	309	9.7	59.5	30.4	0.3	
Secondary	320	10.3	45.3	43.1	1.3	
Total	629	10.0	52.3	36.9	0.8	

**Table 2***Attention to diversity and communicative relations with students in the teaching task of PE teachers in the face of the COVID-19 pandemic in Catalonia.*

Education Level	n	Few	Quite a few	Many	Other	Chi P-value
		%	%	%	%	
Question 7: How many changes have you made relating to attention to diversity?						n.s.
Primary	309	90.6	2.9	4.5	1.9	
Secondary	320	87.5	3.1	3.8	5.6	
Total	629	89.0	3.0	4.1	3.8	
Question 8: How many changes have you made relating to communication with students?						.001
Primary	309		92.6	2.9	4.5	
Secondary	320		83.8	9.1	7.2	
Total	629		88.1	6.0	5.9	

### Measures Relating to Hygiene and Safety

As can be seen in table 3, there was a significant relationship between educational level (primary and secondary) and changes in social distancing ( $p < .001$ ), mask use ( $p < .001$ ) and when equipment was disinfected ( $p = .29$ ). With regard to changing rooms; disinfection of equipment; and hand hygiene, no significant differences were found.

Significant differences were found in the distribution of changing rooms ( $p = .003$ ), the use of masks ( $p = .002$ ), who disinfected ( $p < .001$ ) and the social distancing ( $p < .001$ )

only among teachers in public schools, with no significant associations in private schools.

As to who disinfected the equipment, 89.2% of the teaching staff participated in the disinfection tasks, 42.4% exclusively, 40.9% with the help of students and the rest with staff from the school. Primary school teachers had a higher exclusivity in disinfection tasks (46.0%) than secondary school teachers (39.1%). Student involvement in this task was higher at secondary level (49.1%) than at primary level (32.4%).

**Table 3**

*Actions linked to hygiene and safety criteria in PE classes in the face of the COVID-19 pandemic in Catalonia.*

Education Level	<i>n</i>	%	%	%	%	Chi P-value
Question 9: Did the student body wear a mask during physical activity?						.000
		Never	Sometimes	Always	Other	
Primary	309	18.8	49.8	28.5	2.9	
Secondary	320	10.6	67.5	18.4	3.4	
Total	629	14.6	58.8	23.4	3.2	
Question 10: Has the equipment been disinfected?						n.s.
		No	It has not been used	Yes	Other	
Primary	309	1.6	2.6	93.5	2.3	
Secondary	320	1.3	2.5	94.7	1.6	
Total	629	1.4	2.5	94.1	1.9	
Question 11: When was the disinfection of equipment carried out?						.029
		Before use	After	Before and after	Other	
Primary	309	3.2	61.8	9.7	25.2	
Secondary	320	1.9	65.3	15.0	17.8	
Total	629	2.5	63.6	12.4	21.5	
Question 13: How often have pupils maintained a physical safe distance?						.000
		Almost never	Sometimes	Usually	Other	
Primary	309	11.3	70.2	17.8	0.6	
Secondary	320	4.7	64.1	31.3		
Total	629	7.9	67.1	24.6	0.3	
Question 14: What is the student body's use of the changing rooms compared to its use before COVID-19?						n.s.
		It has not been used	The same	There have been changes	Other	
Primary	309	68.6	2.3	29.1		
Secondary	320	59.4	2.2	38.1	0.3	
Total	629	63.9	2.2	33.7	0.2	

**Table 4**

Assessment of personal satisfaction with the work carried out in the PE classes and the support received in the face of the COVID-19 pandemic in Catalonia.

Education Level	<i>n</i>	0 %	1 %	2 %	3 %	4 %	5 %	6 %	7 %	8 %	9 %	10 %	Chi P-value
Question 16: Satisfaction with your own work?													n.s.
Primary	309	1.3		1.0	2.6	2.6	10.4	19.1	25.6	25.2	9.4	2.9	
Secondary	320	0.6	0.3	1.6	3.1	4.4	10.9	17.8	26.3	26.9	6.9	1.3	
Total	629	1.0	0.2	1.3	2.9	3.5	10.7	18.4	25.9	26.1	8.1	2.1	
Question 17: Support from the education administration?													n.s.
Primary	309	18.8	8.7	12.3	11.3	12.6	17.5	10.4	6.5	1.3	0.6	0.3	
Secondary	320	19.1	12.5	12.5	16.6	10.0	13.8	6.9	5.6	1.9	0.6	0.6	
Total	629	18.9	10.7	12.4	13.8	11.3	15.6	8.6	6.0	1.6	0.6	0.5	
Question 18: Support from school leadership?													.000
Primary	309	1.0	0.6	2.9	1.6	3.2	5.8	4.5	14.6	17.5	23.0	25.2	
Secondary	320	3.1	2.2	3.1	2.8	3.4	11.3	7.8	12.5	24.4	13.1	16.3	
Total	629	2.1	1.4	3.1	2.2	3.3	8.6	6.2	13.5	21.1	18.0	20.7	
Question 19: Support from COPLEFC?													n.s.
Primary	309	4.2	0.6	1.6	2.9	4.2	18.1	11.0	21.4	22.3	9.7	3.9	
Secondary	320	4.7	1.6	2.8	3.1	4.1	13.4	10.3	23.8	18.8	12.8	4.7	
Total	629	4.5	1.1	2.2	3.0	4.1	15.7	10.7	22.6	20.5	11.3	4.3	

## Perceived Institutional Support

With regard to knowledge of the document "L'Educació Física en la 'nova normalitat'" (COPLEFC, 2020), 66.6% of teachers said they were familiar with it, with no differences depending on the level of education. As for the COLEF Council document (2020a), although more teachers (70.4%) said they were familiar with it, there were significant differences ( $p < .001$ ) in the knowledge of secondary school teachers (82.2%) compared to primary school teachers (58.3%), both in state and public schools ( $p < .001$ ).

Table 4 shows the rating (on a scale from 1 to 10) of the perception of the support received by the educational administration, the professional school and the leadership teams, as well as the personal satisfaction with the work done in the PE lesson. There was only a significant correlation between the level of education and the perception of support received from school leadership ( $p < .001$ ). These

differences were only observed among teachers in state schools ( $p < .001$ ).

The perception of the support received by the educational administration was significantly different ( $p < .001$ ) according to the existing knowledge of the document "L'Educació Física en la 'nova normalitat'" (COPLEFC, 2020). Of the teachers who were aware of the document, 3.6% rated their level of satisfaction from 0 to 3 and 45.6% rated it from 8 to 10.

In relation to the difficulty teachers had experienced with the adaptations made as a result of the pandemic, 67.7% of teachers reported not having experienced too many difficulties, with a higher percentage of difficulties or other circumstances ( $p = .042$ ) for secondary school teachers (33.1% and 3.8%) compared to primary school teachers (24.6% and 2.9%). Only in state schools were there significant differences in the distribution of teacher-perceived difficulties ( $p = .014$ ).

## Discussion

The unexpected outbreak of the COVID-19 pandemic triggered a radical change in teaching. At the start of the 2020/21 academic year, face-to-face teaching was enabled in Spanish classrooms; however, the official bodies that regulate education in the different autonomous communities did not specify entirely clear and specific measures that would allow teachers to carry out their role without undue uncertainty.

In relation to the group analysed, the COPLEFC and the General Council of Physical and Sports Education produced documents with recommendations for teachers (COLEF Council, 2020a, 2020b; COPLEFC, 2020), which were the only aid in the novel situation, which radically changed the teaching and learning processes at school.

The impact of the pandemic on the teaching profession has been extraordinary, but given that it is still recent and that educational realities and policies in different countries have varied, there is not much literature on the impact of COVID-19 in our classrooms. We therefore developed our aim to identify the impact of the pandemic on PE classrooms in Catalonia during the first four-month period of the 2020/21 academic year.

## Teaching and Learning Activities

The data in table 1 confirms that the widespread perception that the pandemic has led to a rethink in the type of teaching and learning activities is a reality (89.2% of the teachers surveyed said they had made some or many changes). The COLEF Council documents (2020a, 2020b) pointed out the need to prioritise non-contact activities, outdoor activities, the maintenance of a safety distance of 1.5 metres, the preparation and disinfection of equipment at each session and the distribution of students in bubble groups. More individual activities (Varea & González-Calvo, 2020) such as games and implement sports made it easier to keep a safe distance and to disinfect afterwards. On the other hand, in collective games and sports, rules had to be adapted to control the physical proximity (COLEF Council, 2020a).

One possible explanation for the higher number of changes made by secondary school teachers found in this study could be that the document produced by COPLEFC (2020) was specifically targeted at secondary school teachers.

## Content

The type of content worked on in PE classes was conditioned by the pandemic situation, as corroborated by 79.6% of teachers who stated that they had made a lot or many changes (table 1). COPLEFC (2020) advised teachers to be flexible in the selection of curricular content, choosing those that best fit the health recommendations on hygiene and distancing. By understanding curricular contents as tools at the service of the aims (González-Arévalo, 2005) and urging the curriculum itself to be flexible in terms of its

prioritisation, the post-lockdown situation has amplified this flexibility, despite the conditioning factors imposed by health regulations. In the face of a hybrid PE model combining virtual and face-to-face, SHAPE America (2020) advised doing activities at home that had been previously learned at school, linked to basic motor skills, and that could be done individually or with another family member, while at school doing physical fitness, dance, yoga or athletics activities, that met the physical distances and required little material.

## Teaching Units

79.5% of teachers reported having made a lot or quite a lot of changes in the teaching units (table 1). This is not surprising, as COVID-19 meant that space occupation had to be scheduled in a coordinated and disinfection-friendly manner (PHE-EPS Canada, 2020), as well as accelerating digitisation and the integration of technology in schools and teacher training (Donitsa-Schmidt & Ramot, 2020). This has made it possible to rethink methodological strategies to adapt them to hybrid environments that combine face-to-face and virtuality, and a more technological PE that explores new forms of expression of movement is beginning to be observed (Varea & González-Calvo, 2020). Along these lines, Koehler & Mishra's (2009) TPACK model is a conceptual framework of reference for online teaching (Murray et al., 2020) to be taken into account in post-pandemic PE.

The pandemic has opened the door to methodological change, moving from a more directive teaching model to one that promotes self-regulation, decision-making and learner autonomy (SHAPE America, 2020).

## Learning Objectives

Only 13.8% of teachers reported having incorporated many changes in the objectives (table 1), probably due to the fact that, once the course had started, most teachers decided to maintain the planned objectives and adapt contents and methodologies based on the evolution of the pandemic. However, the pandemic situation opens the door to a rethinking of the objectives of the participant (Hortigüela-Alcalá et al., 2021).

## Attention to Diversity

89.0% of the teachers stated that they were unable to attend to the specificity of the students who required more personalised attention (table 2).

## Communication with Students

92.6% of primary school teachers and 83.8% of secondary school teachers indicated that they had made few changes in communication with students. However, the changes that have occurred are probably the result of online teaching in lockdown.

The pandemic has generated social distancing and peer-to-peer rapprochement at the virtual level that has highlighted the need to find novel methodologies to engage online learners and generate meaningful learning in as yet unexplored environments (O'Brien et al., 2020).

The pandemic led to the sudden and forced use of different virtual tools with which to communicate with families, as well as the personalisation and attention of students (Varea & González-Calvo, 2020). Along these lines, teachers expressed a need for ICT training in order to integrate ICT in the classroom (Baena-Morales et al., 2021), an aspect that coincides with the need to develop and improve the digital competence of PE teachers today (Menescardi et al., 2021).

### Social Distancing

One of the most significant impacts of COVID-19 on PE has been physical distancing measures, which have led to a reduction in experiential practices (Association for Physical Education, 2020; O'Brien et al., 2020). Outdoor PE classes (PHE-EPS Canada, 2020) and individual and non-contact physical practices (Varea & González-Calvo, 2020) have been encouraged.

In classroom explanations and activities, teachers frequently (24.6%) or sometimes (67.1%) recalled the importance of keeping safe distances, with a higher percentage in primary education, probably due to the younger age and greater immaturity of the pupils.

### Use of Face Mask

Having found no other studies in the literature on the use of masks or distancing at different educational stages, this study found that 18.8% of primary school teachers and 10.6% of secondary school teachers did not use a mask. The recent study by Hortigüela-Alcalá et al. (2021) points out the perception of PE teachers of the loss of the pedagogical character of the participant due to the influence of distance, not being able to share material and the use of the mask. Emotional transmission is reduced by limiting teacher-student bonding and group cohesion and learning (COLEF Council, 2020b).

### Disinfection of Equipment

The use of materials that do not pose a risk of contagion and that can be easily disinfected, the availability of individual equipment and the disinfection of equipment before and after each use were measures promoted by the PE protocols in the new normal (COLEF Council 2020a; PHE-EPS Canada, 2020), and this is shown in table 3, where 94.1% of teachers stated that the equipment was subjected to a disinfection process, with the most common time to do so being after use (63.6%). Pupils' involvement in the task of disinfecting equipment was higher in secondary school (49.1%) than in primary school (3.4%), probably due to their older age and maturity.

COPLEFC (2020) proposed to establish a place to accommodate students with sufficient water-alcohol dispensers, and space to leave clothes and backpacks with sufficient distance to avoid overcrowding.

### Support Received

Table 4 shows that 25.2% of primary school teachers rated the help received from their school's management team as the highest, compared to 16.3% of secondary school teachers. We sense that this result reflects the more collegial work done in primary schools. However, secondary school teachers valued the document produced by COPLEFC (2020) more positively, which was focused on this educational stage, and which probably helped them to incorporate more changes in teaching and learning activities.

### Conclusions

In relation to the first objective of the study, to determine the level of changes introduced in the different educational processes, the PE Barometer has shown that the main modifications have been linked to teaching and learning activities and the specification of curricular content for compliance with the protocols of physical distancing, sanitation and use of the material. In this context, the prioritisation of curricular content has been a challenge for teachers. With regard to the second objective, to detect differences in the changes introduced according to educational level and type of school, the EF Barometer showed that there were no significant differences between teachers in public schools and those in private and subsidised schools, but there were significant differences between teachers in primary and secondary education, specifically in relation to changes made in teaching and learning activities and in interaction and communication with pupils through the use of technology.

With regard to the third objective of the study, that of perceived institutional support for the teaching task, it should be noted that the teaching staff reported having received little support from the education administration, but significant support from the management team of their respective schools, especially in primary education.

Finally, the methodological changes in post-pandemic teaching envisage a model of hybrid PE with greater technological presence (O'Brien et al., 2020; SHAPE America, 2020), where the TPACKPEC model fits perfectly as a reference framework (Monguillot et al., 2018), which relates technological, curricular and pedagogical knowledge in the classroom, as well as personal knowledge (emotions and motivations), given that the pandemic has led to the need to also address the emotional dimension of teachers and students (Román et al., 2020), opening the door to new lines of research.

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# Autism Spectrum Disorder in Physical Education in Primary School: a Systematic Review

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## Abstract

Autism spectrum disorder (ASD) is diagnosed daily in children all over the world. Although the effects of physical exercise in this population have been extensively studied, there is still little research analysing the benefits of physical activity as part of Physical Education in schools. Therefore, this article aims to analyse the effects of physical exercise carried out in the area of Physical Education as a curricular subject on primary school pupils diagnosed with ASD, as well as the methodological strategies applied by teachers in this area. For this purpose, a systematic review was carried out in accordance with PRISMA standards, by searching for scientific articles in the databases: Web of Science, Scopus, PubMed and SportDiscus. After applying the established inclusion and exclusion criteria, a total of 11 articles were selected, in which the following variables were analysed: participation, stereotyped behaviour, general behaviour and emotional control, social and communication skills, and motor skills. The results obtained suggest the application of cooperative learning strategies to improve their participation; the introduction of psychomotor activities and team games to reduce stereotyped behaviour, improve conduct and emotional control, and foster social and communicative skills; and the inclusion of tasks and games aimed at developing basic motor skills and coordination abilities to improve motor skills.

**Keywords:** ASD, autism, methodology, physical exercise.

## Introduction

In recent decades there has been a large increase in members of the population diagnosed with autism spectrum disorder (ASD) (Chiarotti & Venerosi, 2020), especially among primary school pupils. In fact, in Spain, it is estimated that the rate of children with ASD aged 0-14 could be close to 13 per 10,000 (Bejarano et al., 2017). An international inclusion-oriented approach has been successful in increasing the intake of students with ASD in mainstream schools (Hodges et al., 2020). However, there is still widespread ignorance about this disorder (Terrazas Acedo et al., 2016).

Pérez-Pichardo et al. (2018) consider ASD as a neurodevelopmental disorder in which persistent deficits in communication and social interaction in multiple contexts, repetitive behaviours and limited interests are displayed. However, although there are numerous conceptualisations, it is particularly difficult to provide an exact definition of ASD, as each individual presents different symptoms (Baena Beato et al., 2010).

People with ASD often show difficulties when planning tasks and altering their thinking, tending to self-isolate in environments that require high cognitive flexibility and extensive socialisation, such as those found in Physical Education classes; and they tend to perform repetitive, routine and stereotyped movements and actions (Talero-Gutiérrez et al., 2015). With regard to learning, they are also considerably affected in terms of language, socialisation and communication skills; and their executive functions, specifically the planning of complex behaviours, due to a deficit in their working memory (Pérez-Rivero & Martínez, 2014; Pérez-Pichardo et al., 2018). In addition, children and adolescents with ASD often show limited levels of physical activity, as well as delayed acquisition and development of motor skills and physical fitness, which can lead to a higher incidence of becoming overweight and obesity, and even health complications (Toscano et al., 2017).

According to Moscatelli et al. (2020), the practice of physical activity in people with ASD has a remarkable influence on the improvement of stereotyped behaviour, on the increase of hippocampal volume, on the growth of newly reproduced cells, on vascularisation and neurogenesis through aerobic exercise, and on social intervention, communication and sports skills in children and adolescents with autism. Furthermore, if physical activity is successfully implemented at an early age, the benefits gained may persist as the child grows older and reaches adulthood due to the acquisition of adaptive

behaviour (Tiner, 2020; MacDonald et al., 2014). In this context, Physical Education emerges as a curricular subject with a high potential for the correct psychomotor development of students with ASD, not to mention the wide range of possibilities that this subject offers in the educational context to achieve their inclusion, not only at school, but also in society in general (Marín-Suelves & Ramón-Llin, 2021).

However, although research on the effects of physical exercise in children with ASD at primary school age is widespread (Dillon et al., 2017; Ferreira et al., 2019), there are few studies that specifically analyse the practice of physical activity within the scope of Physical Education as a curricular subject. Moreover, at present, teaching practice in Physical Education sessions is still not adapted to the abilities and characteristics of autistic pupils for different reasons. While some authors attribute this maladaptation to a lack of resources and administrative support or inadequate teacher preparation (Lirgg et al., 2017), others refer to the lack of curriculum specifications on how to develop Physical Education sessions for autistic students (Maravé-Vivas et al., 2021). For these reasons, it would be advisable to rethink the teaching-learning process based on the characteristics, needs and difficulties of children with ASD in order to adjust to their level of psychomotor development. This would encourage the creation of integrated and inclusive schools where diversity is a challenge for educational planning (Booth et al., 2000).

Therefore, the aim of this systematic review was to find out about and analyse the effects of physical exercise carried out in the area of Physical Education on primary school pupils diagnosed with ASD and to analyse the different methodological strategies applied in order to offer basic guidelines for the design of games and tasks adapted to their characteristics.

## Methodology

A systematic review was developed, according to the taxonomy proposed by Grant & Booth (2009), following the PRISMA (*Preferred Reporting Items for Systematic reviews and Meta-Analyses*) standards (Urrútia & Bonfill, 2010). The search was carried out in the electronic databases Web of Science, Scopus, PubMed and SportDiscus, using the following search strategy: ((*autism*) OR (*autism spectrum disorder*)) AND (*physical education*). Thus, the above terms were searched for in the title, abstract and/or keywords.

In addition, the following inclusion and exclusion criteria were established:

**Inclusion criteria:**

- Experimental articles.
- Publication date between January 2010 and March 2022.
- Published in English or Spanish.
- Full text available online.
- Ages corresponding to the Primary Education stage (6-12 years).
- Students with ASD.
- Exercise-based interventions.
- Study carried out in the area of Physical Education as a curricular subject.

**Exclusion criteria:**

- Review articles, book chapters, books, academic papers and/or meeting proceedings.
- Pupils from educational stages other than Primary.
- Pupils with disorders other than ASD.
- Non-exercise-based interventions.
- Study carried out in areas other than Physical Education as a curricular subject.

Thus, in this first phase of the search (Table 1), a total of 1,165 articles were found, of which 6 were ultimately included in the present review (Figure 1) after applying the above-mentioned eligibility criteria. Additionally, in a second phase, 5 more articles were added by manual search and expert suggestion (Figure 1), identifying articles that contained some of the words included in the search strategy of the first phase and that met all the inclusion criteria, as other authors have done previously (Felis-Anaya et al., 2017). Thus, after this second phase, the search yielded 11 articles, which were subjected to a detailed content analysis (Table 2).

## Results

The analysis of the 11 articles ultimately selected provides different interventions for participants with ASD in Physical Education sessions. Table 2 shows a summary of the articles included in this review, presenting for each of them the sample, the type of intervention, the variables analysed and the main results obtained.

As can be seen in Table 2, it is possible to find similarities between the different articles in relation to the type of intervention and the variables analysed. In general, physical exercise carried out with students diagnosed with ASD in the field of Physical Education improved the variables studied.

Firstly, it seems that the participation of autistic students in Physical Education sessions increases with the use of

cooperative learning methods. In this regard, Ayvazo & Ward (2010) reported an increase in participation after incorporating hitting exercises into the sessions along with a methodology based on peer mentoring (*Classwide Peer Tutoring*). In a similar line of research is the study carried out by Heredia & Duran (2013), in which two cooperative learning strategies were incorporated: cooperative play (*Co-Op Play*) and shared discovery, and also found an increase in the participation of these students.

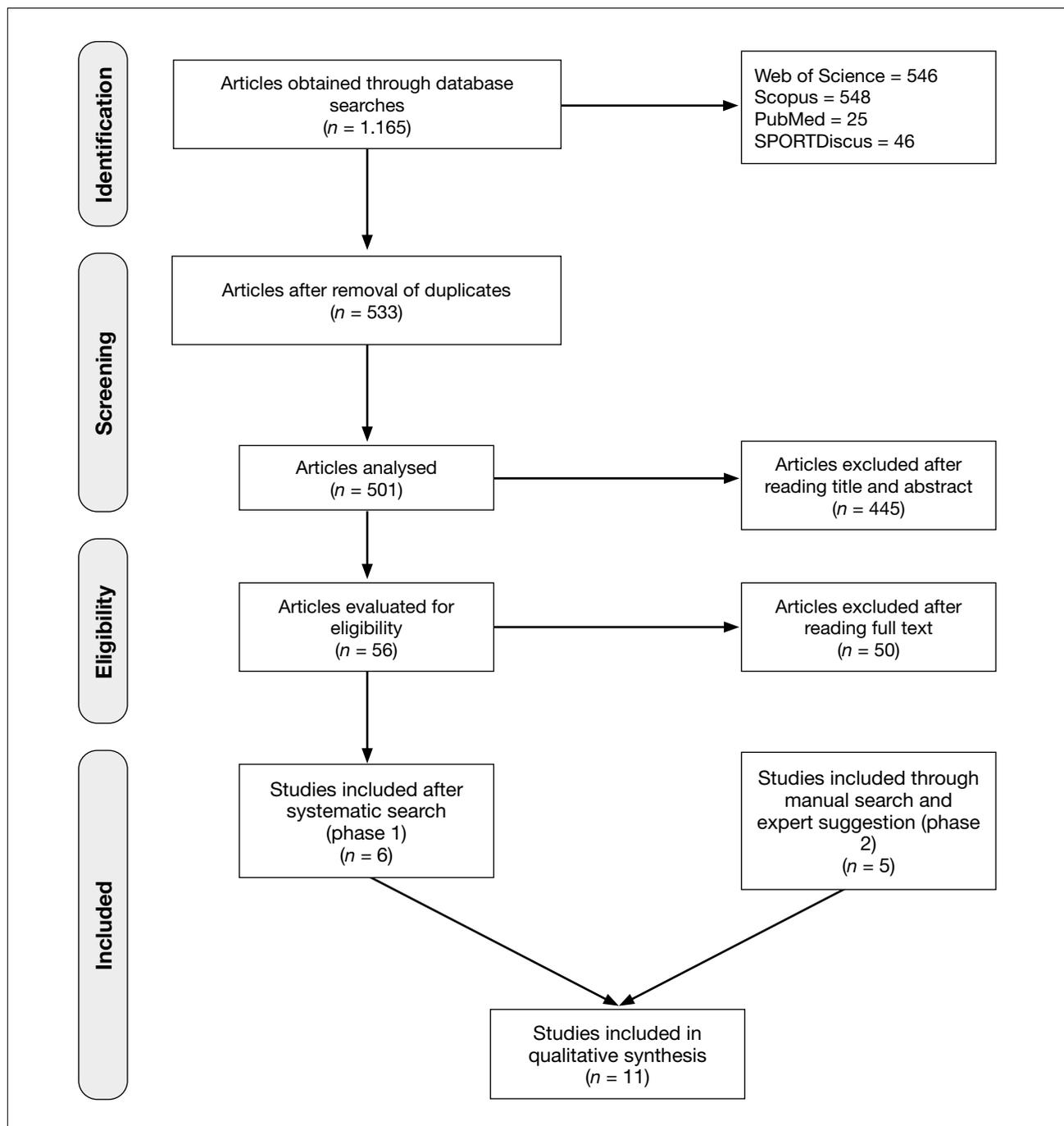
Secondly, the stereotyped behaviour of students with ASD (such as hand flapping or body swaying) has been analysed in several of the articles included in this review, with different results depending on the type of intervention. Tse et al. (2018) conducted an intervention in which they introduced ball-hitting drills followed by a *storytelling* activity. Thus, they observed a reduction in hand flapping after hitting exercises, but not in body sway. In addition, the *storytelling* activity had no effect on either of these two variables. Similarly, Stavrou et al. (2018) succeeded in reducing stereotyped behaviour in students with ASD by incorporating different types of psychomotor activities (balance, self-awareness, visual-motor coordination, lateral movement) and team games and spatial-temporal orientation. Finally, regarding these students' behaviour and emotional regulation, Tse (2020) reported improvements in these two variables through the application of running-based exercises, in comparison to the control group, which did not show any change.

Thirdly, in relation to social and communication skills, Stavrou et al. (2018) reported an improvement in vocabulary use, student/teacher communication and forms of expression used by students with ASD through the above-mentioned psychomotor activities and games, but no significant changes in communicative intention were found. Zhao & Chen (2018) observed an improvement in autistic students' communication skills and socialisation through the use of group games and object manipulation exercises (with a ball). Similarly, Sansi et al. (2021) also saw improvements in social and communication skills after the introduction of the IPA programme (*Inclusive Physical Activity*). In addition, Bo et al. (2019), using the *Classroom Pivotal Response Teaching* (CPRT) methodology, a naturalistic behavioural intervention for children with autism, also found improvements in social functioning, especially in those with greater social impairment prior to the intervention. And finally, Chiva-Bartoll et al. (2021), also observed greater social inclusion of students with ASD in Physical Education sessions through the use of team games involving basic motor skills and body expression, introduced through a service-learning programme.

**Table 1**  
Summary of articles selected in the first phase of the search.

Database	Articles identified	Discarded articles	Selected articles
Web of Science	546	544	2
Scopus	548	547	1
PubMed	25	23	2
SportDiscus	46	45	1

Adapted from Rovira-Font & Vilanova-Soler (2022)



**Figure 1**  
Diagram of PRISMA flow of the articles included in the review after the screening process.

**Table 2**  
Summary of selected articles.

Author(s) (year)	Sample	Intervention	Variables	Results
Ayvazo & Ward (2010)	EG: $n = 2$ (0 W) 8 years old	Hitting exercises + Peer mentoring  • 13 weeks (2 ses./wk. - 30 min/ses.)	Participation	+
Bo et al. (2019).	EG: $n = 9$ (0 W) $9.11 \pm 1.54$ years old	<i>Classroom Pivotal Response Teaching</i>  • 2 weeks (5 ses./wk. - 3.5 h/wk.)	Social functioning Locomotive skills	+ +
Chiva-Bartoll et al. (2021).	EG: $n = 15$ (4 W) $10.13 \pm 2.56$ years old  CG: $n = 10$ (1 W) $10.13 \pm 3.09$ years old	Basic motor skills games, body expression and teamwork introduced through a service-learning programme.  • 31 weeks (2 ses./wk. - 60 min/ses.)	Motor skills Social inclusion	+ +
Heredia & Duran (2013)	EG: $n = 1$ (0 W) 7 years old	Cooperative learning strategies (cooperative play and shared discovery)  • 4 sessions (no further information is provided)	Participation	+
Henderson et al. (2016).	EG: $n = 37$ (2 W) 5-12 years old	Locomotor skills and object manipulation exercises  • 20 weeks (2 ses./wk. - 40 min/ses.)	Locomotive Skills Running Horizontal jumps Gallop Lunge jumping Leap Movement  Manipulation and Control of Objects Turns Grip Hand launch Bouncing Foot launch Hitting	+ + ∅ + ∅ +  + + + + + +
Rafiei Milajerdi et al. (2021) #	EG Spark: $n = 20$ (1 W) $7.95 \pm 1.60$ years old  EG Kinect: $n = 20$ (1 W) $8.15 \pm 1.50$ years old  CG: $n = 20$ (1 W) $8.45 \pm 1.43$ years old	SPARK Programme ( <i>Sports, Play and Active Recreation for Kids</i> )  • 8 weeks (3 ses./wk. - 35 min/ses.)  <i>Exergaming</i> (tennis game on Xbox Kinect)  • 8 weeks (3 ses./wk. - 35 min/ses.)	Motor Skills Aiming Grip Manual dexterity Balance  Executive Functions Correct answers Conceptual answers Persistent errors  Motor Skills Aiming Grip Manual dexterity Balance  Executive Functions Correct answers Conceptual answers Persistent errors	+ + ∅ ∅  ∅ ∅ ∅  - - ∅ ∅  ∅ ∅ ∅

EG = Experimental Group; CG = Control Group; W = women; + = improves; - = worsens; ∅ = no changes;  
# = only the changes found in the interaction group X time are cited.

**Table 2** (Continued)  
Summary of selected articles.

Author(s) (year)	Sample	Intervention	Variables	Results
Sansi et al. (2021).	EG: $n = 13$ (1 W) 8.69 ± 0.86 years old  CG: $n = 9$ (1 W) 8.26 ± 0.78 years old	IPA Programme ( <i>Inclusive Physical Activities</i> )  • 12 weeks (2 ses./wk. – 60 min/ses.)	Locomotive Skills	
			Running	+
			Gallop	+
			Jump	∅
			Leap	+
			Horizontal jump	∅
			Movement	∅
			Ball Skills	
			Two-handed striking	+
			One-handed striking	∅
			Dribbling	∅
			Catching	∅
			Kicking	+
Over-the-shoulder throw				
Below-the-shoulder throw	∅			
Social and Communication Skills	∅			
	+			
Stavrou et al. (2018)	EG: $n = 1$ (0 W) 7 years old	Balance, self-awareness, visual-motor coordination and lateral movement activities; along with team games and spatial-temporal orientation.  • 12 weeks (3 ses./wk. – 40-45 min/ses.)	Motor skills	
			Communication intention	∅
			Use of vocabulary	+
			Communication with teacher	+
			Forms of expression	+
Motor Skills	+			
Stereotyped Behaviours	+			
Tse et al. (2018)	EG: $n = 30$ (8 W) 10 years old	Ball-hitting drills (A) followed by <i>storytelling</i> activity (B)  • No information on frequency and duration is provided	Repetitive hand flapping ( <i>measured after A</i> )	+
			Repetitive hand flapping ( <i>measured after B</i> )	∅
			Body swaying ( <i>measured after A+B</i> )	∅
Tse (2020)	EG: $n = 15$ (2 W) 10 ± 1 years old  CG: $n = 12$ (2 W) 9 ± 1 years old	Running exercises  • 12 weeks (4 ses./wk. – 30 min/ses.)	General behaviour and emotional regulation	+
Zhao & Chen (2018)	EG: $n = 21$ (7 W) 6.14 ± 0.96 years old  CG: $n = 20$ (5 W) 6.1 ± 0.98 years old	Group exercises on manipulation of objects (ball)  • 12 weeks (60 min/ses.)	Social and communication skills	+

EG = Experimental Group; CG = Control Group; W = women; + = improves; - = worsens; ∅ = no changes;  
# = only the changes found in the interaction group X time are cited.

Finally, locomotor skills and object manipulation and control seem to improve after the application of specific exercises for these skills. In this regard, Henderson et al. (2016) found an improvement in all object manipulation and control skills tested, as well as in virtually all locomotor skills (with the exception of galloping and jumping). Similarly, Chiva-Bartoll et al. (2021) observed progress in the motor competence (assessed in three dimensions: manual dexterity, aiming and catching, and balance) of their students, as did Bo et al. (2019), who found a significant improvement in the locomotor skills of their ASD students following their intervention. Furthermore, Sansi et al. (2021) also reported improvements in most of the locomotor and object manipulation and control skills (involving a ball) tested. Finally, Rafiei Milajerdi et al. (2021), following implementation of the SPARK (*Sports, Play and Active Recreation for Kids*) programme, obtained improvements in several of the motor skills examined. It should be noted that these same authors also analysed the evolution of executive functions, but found no significant changes after their intervention.

## Discussion

The aim of this review was to find out about and analyse the effects of physical exercise carried out in Physical Education sessions as a curricular subject on primary school pupils diagnosed with ASD. A further aim was to identify and analyse the different methodological strategies carried out by Physical Education teachers with ASD students in order to offer basic guidelines for the design of games and tasks adapted to their characteristics.

As Menear & Smith (2011) state, Physical Education presents students with ASD with simultaneous sensory challenges. In this way, Physical Education emerges as a favourable working space for the introduction of appropriate methodological strategies that promote the improvement of variables that are essential in the daily development of this type of student, such as participation, behaviour, emotional control, social and communicative skills, or locomotor skills. However, facilitating the potential benefits of Physical Education for autistic students requires careful planning (Lamb et al., 2016), so it is particularly important to understand the effects of different types of interventions in order to adapt the teaching-learning process to meet the specific diagnosis of each student at all times (Menear & Smith, 2011).

### Effects on Participation

Participation is a variable commonly analysed in research with autistic students, both in primary and secondary

schools, as participation levels of autistic students in PE sessions tend to be lower than their non-ASD counterparts (Arnell et al., 2018; Kerem & Kocak, 2020). This lower participation may be due to factors such as a low perception of their physical abilities and their own competence in physical activity, low self-confidence and low self-esteem (Arnell et al., 2018), which also leads them to exhibit reduced levels of motivation to engage in physical activity (Pan et al., 2011). In addition, factors such as the lack of social skills that allow the autistic child to relate satisfactorily with peers, and even the negative view that some families have of these individuals, would also negatively affect their participation (Kerem & Kocak, 2020). According to Arnell et al. (2018), although a small proportion of students with ASD affirm that physical activity reduces their stress levels, most of them suffer from stress and anxiety simply from thinking about it.

Therefore, an appropriate strategy to increase the participation of students with ASD would be to offer them the option to choose the activity they wish to do and to let them know what is expected of them (Arnell et al., 2018). Furthermore, considering that the use of cooperative learning strategies also increases the participation of students with ASD (Ayvazo & Ward, 2010; Heredia & Duran, 2013), the introduction of these types of activities through this methodology could further improve their participation in Physical Education sessions.

### Effects on Stereotyped Behaviour, General Behaviour and Emotional Control

Stereotyped behaviours, such as rocking, hand flapping, repeated manipulation of objects or finger movements, are involuntary movements whose sole function is to produce physical and sensory self-regulation, and are one of the most common symptoms among people with ASD (Ferreira et al., 2019). In addition, according to Lee and Haegele (2016), many autistic individuals also display what are known as 'challenging behaviours', including aggression, self-harm, destructiveness, classroom disruptions and non-compliance. Such behaviours tend to limit student participation in activities, as they tend to divert the teacher's attention (Lee & Haegele, 2016), so minimising all such behaviours in students with ASD will have a direct effect on the overall dynamics of the classroom.

Similar to the studies by Stavrou et al. (2018) and Tse et al. (2018), recent research conducted outside the school setting among autistic children in which interventions based on physical exercise such as running or jogging (Oriol, 2011), kata performance (Bahrami, et al., 2012), or even the self-selection of an aerobic activity (exercise bike, elliptical trainer, or treadmill running)

(Schmitz et al., 2017), have demonstrated the existence of a positive relationship between physical exercise and the improvement of these symptoms, thus emerging as an effective tool to reduce this type of behaviour in autistic children (Ferreira et al., 2019). In fact, as little as 15 minutes of moderate to vigorous intensity physical activity (MVPA) can achieve a decrease in stereotyped behaviour for two hours (Liu et al., 2015).

Like stereotyped behaviour, behavioural problems and emotional control in autistic individuals have also been extensively studied, as these are two of the most prevalent factors associated with ASD (Weiss et al., 2014). Furthermore, the effects of physical exercise on these variables have also been extensively analysed, as behaviour may be determined by the interactions that occur during physical activity between the autistic person and other participants (Bremer et al., 2016). Just as Tse (2020) reported improvements in these variables through the introduction of running exercises in Physical Education sessions, Greco & De Ronzi (2020) also managed to improve them through a martial arts training programme developed outside the school environment. It is worth noting that in the latter study, three non-autistic children were previously trained to support the learning of autistic individuals, using a strategy similar to peer tutoring (*Classwide Peer Tutoring*) implemented by Ayvazo & Ward (2010). In addition, it appears that the introduction of motivational elements and meditation and breathing exercises were key to achieving these improvements.

As mentioned above, the interactions that arise during physical activity between the autistic person and the rest of his/her peers can significantly affect his/her behaviour. In this regard, Lapresa et al. (2020) conducted an observational study in which they applied a motor skills development programme to an adolescent student during six sessions of Physical Education to analyse behaviour and verbal and non-verbal interactions. Although stereotypes and echolalia were not assessed in this study, as was done by Tse et al. (2018), and Stavrou et al. (2018), the timing of these interactions according to the type of interaction between the teacher and the autistic student, was analysed. Thus, the results showed a greater willingness to perform the task, a favourable socio-affective interaction and a positive attitude towards the teacher when the interaction was verbal and based on positive reinforcement, reflection towards the task and the establishment of sanctions.

Therefore, the application of physical exercise programmes, especially those based on psychomotor activities and team games, reinforced with correct verbal interaction by the teacher and focused on positive reinforcement and reflection, would be an appropriate intervention for the reduction of stereotypical behaviour typical of students with ASD.

## Effects on Social and Communication Skills

One of the core symptoms of ASD is social function deficits, which include difficulties in initiating or joining social activities, understanding others' point of view, distancing from people, lack of eye contact and communicative gestures, and poorly functional use of language, etc. (Syriopoulou-Delli et al., 2018).

According to Healy et al. (2013), in general, autistic students have a negative perception of Physical Education sessions, and also show low socialisation and a negative experience (Blagrave, 2017) during their development. Thus, factors such as a preference for free rather than structured activities, fear of injury, experiencing bullying and exclusion by peers, low difficulty of activities (leading to boredom), or an overly stimulating environment would negatively affect their socialisation and participation (Healy et al., 2013). However, students with ASD's interest in physical activity, both inside and outside the classroom, can be increased by addressing a number of factors, such as the inclusion of positive reinforcement, the development of self-management skills, the introduction of self-management activities, etc. (Holland et al., 2019). In this way, Physical Education will emerge as the most appropriate environment to promote greater participation in physical activity for this type of student (Pan et al., 2005).

Therefore, in this context, the subject of Physical Education, due to its eminently practical nature, could emerge as a favourable environment for the development of social and communicative skills, as it develops playful and participative-collaborative activities more frequently than other subjects in the educational curriculum. If the acquisition of these skills does not occur during the pre-school and primary school years, autistic students may reach adolescence and adulthood with serious socio-communicative difficulties (Lee & Shivers, 2019). In fact, according to Cummins et al. (2020), society uses communicative elements that people with ASD are not able to include in their communication (eye contact, appropriate voice volume, etc.) and that the mere fact of communicating makes them anxious.

In this sense, the practice of psychomotor activities and team games during Physical Education sessions in primary school has been shown to be effective in improving social and communication skills (Bo et al., 2019; Sansi et al., 2021; Stavrou et al., 2018; Zhao & Chen, 2018) and social inclusion (Chiva-Bartoll et al., 2021) in students with ASD, as well as outside the school environment through similar interventions, such as the SPARK programme (Sport, Play and Active Recreation for Kids) (Najafabadi et al., 2018). Therefore, as with stereotyped behaviour, general behaviour and emotional control, the practice of activities and games that promote cooperation and interrelation between autistic students and their peers without ASD seems to be, once again, the most effective intervention to improve their social and communication skills.

## Effects on Motor Skills

Although the core deficits of ASD are in the social and behavioural domains, recent evidence suggests that children with ASD experience early-emerging motor developmental delays (Ketcheson et al., 2017). In fact, the emergence of motor impairments at an early age has a later impact on the child's development of social and communication skills (Ohara et al., 2020), possibly because having such problems can lead to adverse motor situations, such as being excluded from playground games, or even problems with academic tasks such as writing (Wilson et al., 2018). In relation to the latter, it appears that children with ASD have lower levels of manual dexterity and fine motor accuracy and integration than their peers without ASD (Lourenço et al., 2020).

Thus, recent studies, such as those by Bo et al. (2019), Chiva-Bartoll et al. (2021), Henderson et al. (2016), Rafiei Milajerdi et al. (2021), Sansi et al. (2021), and Stavrou et al. (2018), in the educational field, have shown that regular physical activity is effective in improving motor skills in children with ASD. While it is true that the interventions carried out by the authors mentioned above are very diverse and different from each other, they are all based on the introduction of tasks and games aimed at the development and improvement of basic motor skills (such as running, jumping or manipulation of objects) and co-ordination skills (such as balance or orientation). Therefore, it seems that this type of physical-sports practice, framed within a cooperative environment, as mentioned above, would be the most appropriate for improving motor skills in students with ASD.

## Conclusions

The following conclusions are drawn from this literature review:

- The use of cooperative learning strategies, such as peer tutoring, shared discovery, or cooperative play, encourages the participation of students with ASD in Physical Education sessions.
- The introduction of psychomotor activities and team games, reinforced with appropriate verbal interaction by the teacher focusing on positive reinforcement and reflection, reduces stereotyped behaviour and improves the behaviour and emotional control of students with ASD.
- Social and communicative skills are fostered through the practice of psychomotor activities and games that encourage cooperation and interpersonal relationships.
- Including tasks and games aimed at developing and improving basic motor skills and coordination skills will enable students with ASD to improve their motor skills.

Based on the results obtained in this systematic review, the introduction of psychomotor team games aimed at the development of basic motor skills and co-ordination abilities carried out through co-operative methodologies is proposed. Therefore, future research should experimentally analyse whether this proposal, developed within the area of Physical Education, is indeed effective in improving the variables analysed in this study in primary school pupils diagnosed with ASD.

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# Satisfaction in Local Sports Events: Elements of Destination and the Event

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## Abstract

Local sporting events have become tools for promoting tourism and the economic dynamisation of the places that host them. Knowing the exact profile of the athletes who participate in them, understanding their expectations and offering them satisfactory experiences is essential for reaping all the benefits that these events can bring to the destinations. In this sense, the aim of this study was to identify the elements of the destination and the event that most influence participants' satisfaction. The sample consisted of 476 athletes who took part in outdoor sporting events in the region of Osona during 2019. 13 event-related and 24 destination-related elements were assessed by means of questionnaires. The results of the study showed the relevant role of the presence or absence of athlete fellow companions in the destination elements affecting athlete satisfaction. They also revealed that the quality of the journey, the professionalism of the organisation and volunteers, the implementation of environmental protection measures and the quality of the refreshment facilities are the elements related to the event that most influence the satisfaction of the participants. With respect to the destination, environmental and natural attractions and the environment and atmosphere were shown to be the most influential elements.

**Keywords:** local sporting events, satisfaction, sport destination, sport tourism.

## Introduction

Sports events can provide multiple benefits to the destinations that host them: added value to the tourist experience, economic impact, creation of destination image, attraction of tourists or prestige for the area (Tasci et al., 2018).

Traditionally, research on this issue has focused on major sporting events. However, since the early 2000s, many destination managers have also realised the economic and tourism potential of local sport events (LSE) (Kaplanidou & Gibson, 2010). Gibson et al. (2012) define them as minor events, with more participants than spectators, aimed at *amateur* athletes, held annually, with low media interest, limited economic activity and low public investment compared to major events.

The number of LSEs has grown significantly in recent years and similarly, interest in studying tourism potential has also grown (Fotiadis et al., 2016). Some of the most studied benefits of LSEs are the promotion of sustainable tourism, the economic impact, the deseasonalisation of tourism (Kenelly, 2017) and the improvement of destination image (Milovanovic et al., 2021).

Although at the national level, LSEs have a minor impact, they do have a special relevance for the destinations that host them. In some cases, the potential for tourism development is even higher for local events than for large events, especially if they are held on a recurring basis (Malchrowicz & Poczta, 2018).

The mere fact of organising and hosting LSEs, however, does not guarantee that all these benefits will be obtained. Zarei et al. (2018) point out that customers are not just buying products and services, but are looking for experiences that meet their expectations. And they suggest that the process of meeting consumer needs requires understanding and aligning them to the sport service before designing, producing and delivering it.

According to these authors, therefore, satisfaction is seen as key to maximising all the potential benefits outlined above. In the field of sport, satisfaction has been studied at various levels, especially at the level of facilities (Elasri et al., 2015) and sport events (Theodorakis et al., 2015). Satisfaction is often described using the expectation-disconfirmation model, which suggests that customer satisfaction is found from the difference between the final perception of the performance of a service and prior expectations of it (Oliver, 1980).

In the context of sport events, Yoshida & James (2010) understand satisfaction as "the rewarding fulfilment of needs arising from participation in the sport event and the services offered". Furthermore, a distinction should be made between overall satisfaction and satisfaction by attributes (Prayag & Grivel, 2018). In this sense, socio-demographic variables, the type of companion or the objective of participation in

the sporting event, condition the attributes that are most valued in both events and destinations (Sato et al., 2017).

Several studies show that participants' satisfaction with sport events acts as a predictor of future participation (Kaplanidou & Gibson, 2010). Thus, higher satisfaction increases intentions to revisit the destination and to recommend it to friends and family (Xiao et al., 2019).

Aicher and Newland (2018) find that organisational elements of events are evaluated by participants when assessing their experience. In this regard, Du et al. (2015) identified several elements that affect participant satisfaction and grouped them into five categories: event operations, event attributes, complementary services, expo amenities and service delivery.

With respect to sport destinations, some of the elements that influence participant satisfaction are: accessibility to the area, transport, quality of accommodation and entertainment options (Aicher & Newland, 2018). In addition, it appears that environmental elements, such as landscape and surroundings, affect the satisfaction of sport tourists (Peric et al., 2018). In a similar vein, Buning & Gibson (2016) highlight the importance of travel conditions when participating in sporting events and warn that the judgement of the event and the destination depends, to a large extent, on fellow travellers.

In short, in the case of local events, a satisfactory experience is directly dependent on the facilities, services and product features of both the destination and the event (Priporas et al., 2018).

Therefore, this study had three objectives: to identify which event elements affect participant satisfaction in local outdoor sport events, to identify which destination elements affect participant satisfaction in local outdoor sport events, and to examine how the type of companion and the number of events in which athletes have participated affect satisfaction.

This study was carried out in the region of Osona (Catalonia), an area located some 60 kilometres from Barcelona where, for more than five years, administrations, companies and sports organisations have been working to position themselves as a sports tourism destination. In 2019, 95 outdoor sporting events were held, attracting more than 23,800 participants.

## Methodology

### Design and Procedure

In collaboration with organisers of five local outdoor events in the Osona region, online questionnaires were sent to athletes who had participated in the 2019 running of these events. The events analysed were three mountain races - "Trail de

les Fonts del Montseny" (1,146 participants), "Pels Camins dels Matxos" (766), "Carrera de Roc Gros" (458)-, one mountain bike event -"Cabrerès BTT" (1,697 participants)-, and one road bike event -"Marxa Jufre Riuprimer" (836 participants)-.

The study was approved by the UVic - UCC Research Ethics Committee (113/2020). Informed consent was also collected from all participants in the study.

## Participants

A total of 476 athletes (119 from the "Trail de les Fonts del Montseny", 95 from "Pels Camins dels Matxos", 27 from "Roc Gros", 115 from the "Cabrerès BTT" and 120 from the "Marxa Jufre Riuprimer") responded to the questionnaires sent. The sample (Table 1) consisted of predominantly male (84%), university-educated (44%), and employed (94%) individuals. The age of the participants ranged from 16 to 73 years, with an average age of 45.57 years, while the most common income bracket (38%) was between €20,000 and €29,000 net per year.

## Instrument

The elements of the event and the destination that most affect participants' satisfaction were measured through a questionnaire divided into four sections. In the first instance, demographic information was collected, including

sex, age, level of education and annual income. The second section related to the athletes' participation in the events and included questions on the number and type of fellow companions and the number of events in which they had participated. Next were questions related to event elements, which contained 13 questions based on previous literature (Newland & Aicher, 2018; Buning & Gibson, 2016; Theodorakis et al., 2015; & Peric et al., 2018). Finally, there were questions relating to destination elements, which consisted of 24 attributes based on the Chi i Qu (2008) proposal.

All these elements were assessed using a 7-point Likert-type scale, as proposed by several previous studies (Theodorakis et al., 2015; Chi & Qu, 2008). The internal consistency of the questionnaire was checked using Cronbach's alpha, which presented an adequate value (.967) for proceeding with the analysis.

## Statistical Analysis

In order to find out the underlying factors in the participants' responses, an exploratory factor analysis (EFA) was carried out with SPSS 28.0 software. The extraction method used was maximum likelihood with Varimax rotation and a minimum factor loading value of .45 was set. Barlett's test of sphericity ( $p < .05$ ) and the Kaiser-Meyer-Olkin index (.945) validated the factor analysis of the data.

**Table 1**  
Sample distribution.

	Sex	Age		Education		Income (€)		Fellow Companions		Number of Times	
M	84%	16-29	9%	ESO	16%	< 9,999	5%	Alone	22%	One	27%
F	16%	30-39	17%	Secondary School	10%	10,000 to 19,999	15%	Partner	10%	Two	31%
NB	0%	40-49	38%	VT	30%	20,000 to 29,999	38%	Family	15%	> Two	42%
		50-59	27%	Degree	25%	30,000 to 39,999	20%	Friends	52%		
		> 59	9%	Postgraduate	18%	40,000 to 49,999	11%	Others	1%		
				Doctorate	1%	50,000 to 59,999	5%				
						> 59,999	7%				

Finally, in accordance with the analysis carried out in similar studies in the field of satisfaction in sports services and events (Elasri et al., 2015; Newland & Aicher, 2018; Peric et al., 2018), T-test for independent samples was performed to segment the results according to sex; and ANOVA with Tukey's *post hoc* analysis was used to detect possible significant differences according to the type of fellow companions at the events.

## Results

The exploratory factor analysis revealed the existence of five factors with eigenvalues greater than 1 that explain 67.57% of the variance (Table 2).

The first factor, termed "event", explains 43.98% of the variance and includes 13 items associated with organisational elements of the sport event. The second factor, labelled "destination prices and services", accounts for 9.44%

**Table 2**  
*Factor structure identified.*

	F1	F2	F3	F4	F5
<b>Factor 1: Event</b>					
Professionalism of the Organisation and Volunteers	0.800				
Quality of the Refreshment Facilities	0.764				
Runner's Goody Bag and Other Giveaways	0.751				
Accessibility	0.746				
Journey Quality	0.736				
Clarity of Prior Information	0.731				
Implementation of Environmental Protection Measures	0.725				
Village Quality	0.678				
Atmosphere and Spectator Support	0.677				
Tradition and History of the Event	0.658				
Registration Fee	0.650				
Photographic Service for the Athletes During the Race.	0.635				
Proximity of the Event to Place of Residence	0.475				
<b>Factor 2: Destination Prices and Services</b>					
Value For Money in Accommodation		0.863			
Price of Activities and Shops		0.845			
Value For Money in Catering		0.784			
Diversity of Accommodation Options		0.714			
Variety of Dining Options and Culinary Options		0.621			
Outdoor Recreational Opportunities		0.574			
Communication and Access		0.505	0.415		
Variety of Spaces For Outdoor Activities		0.486			
Variety of Water Sports and Activities		0.485		0.447	
Parking Available Close to Amenities and Entertainment Options		0.472			

**Table 2** (Continued)  
Factor structure identified.

	F1	F2	F3	F4	F5
<b>Factor 3: Environment and Atmosphere</b>					
Calm and Relaxed Atmosphere			0.824		
Friendly and Hospitable Residents			0.779		
Clean and Orderly Environment			0.766		
Pleasant Climate			0.728		
Uncrowded Environment			0.671		
Safe and Secure Area			0.662		
<b>Factor 4: Entertainment and Leisure</b>					
Variety of Entertainment Options				0.813	
Variety of Nightlife Options				0.787	
Variety of Cultural Events, Festivals, Fairs and Markets				0.670	
Variety of Local Shopping Options		0.540		0.565	
Distinctive Historical and Heritage Elements				0.545	
<b>Factor 5: Environmental Attractions</b>					
Unique Landscapes and Environmental Attractions			0.469		0.762
Attractive Routes and Trails			0.489		0.750
Attractive Rivers and Lakes					0.656
% variance	43.98%	9.44%	8.04%	2.94%	3.35%

and brings together the destination's characteristics in terms of services and accessibility. The third one, called "environment and atmosphere", explains 8.04% of the variance and relates to the area's environment. The fourth, "entertainment and leisure", explains 2.94% of the variance and refers to the entertainment, leisure and cultural options presented by the destination. Finally, the fifth, "environmental attractions", explains 3.35% of the variance and includes the items related to the natural assets of the area.

In relation to the objective of identifying the elements of the events that most affect participants' satisfaction, it was observed that "the quality of the journey" (5.93), "the professionalism of the organisation and volunteers" (5.70), "the implementation of environmental protection measures" (5.50) and "the quality of refreshment facilities" (5.45) were the most influential items (Table 3).

On the other hand, elements with less influence on participants' satisfaction were "the proximity of the event to place of residence" (4.02), "the photo service for the athletes during the event" (4.34) and "the quality of the village" (4.40). These three are the only factors below 4.5 points.

When comparing the elements according to sex, no significant differences were observed between men and women. On the other hand, in relation to the type of companions with whom the participant travels to the event (Table 4), significant differences were obtained for two elements: "the quality of the village" and "the tradition and history of the event". For these elements, according to the *post hoc* analysis, differences were significant between participants going alone and those accompanied by friends.

When making a comparison according to the number of times athletes have participated in the event (Table 5),

**Table 3**  
Average for elements related to the event.

	Average	SD
Professionalism of the Organisation and Volunteers	5.70	1.71
Quality of the Refreshment Facilities	5.45	1.71
Runner's Goody Bag and Other Giveaways	4.79	1.85
Accessibility	5.05	1.86
Journey Quality	5.93	1.68
Clarity of Prior Information	5.18	1.80
Implementation of Environmental Protection Measures	5.50	1.72
Village quality	4.40	1.93
Atmosphere and Spectator Support	4.97	1.85
Tradition and History of the Event	4.80	1.93
Registration Fee	4.95	1.83
Photographic Service for the Athletes During the Race.	4.34	1.92
Proximity of the Event to Place of Residence	4.02	2.11

**Table 4**  
Differences in event-related elements according to the type of accompanying persons.

	Alone (1)	Partner (2)	Family (3)	Friends (4)	Others (5)	F	Sig.	Post Hoc
Professionalism of the Organisation and Volunteers	5.47	5.98	4.42	5.81	5.80	1.559	.184	
Quality of the Refreshment Facilities	5.26	5.49	5.21	5.61	4.80	1.439	.220	
Runner's Goody Bag and Other Giveaways	4.46	4.96	4.73	4.94	3.60	1.865	.115	
Accessibility	5.05	5.06	4.49	5.22	4.40	2.365	.052	
Journey Quality	5.80	6.38	5.72	5.97	5.40	1.457	.214	
Clarity of Prior Information	5.17	5.47	5.01	5.20	4.60	.589	.670	
Implementation of Environmental Protection Measures	5.31	6.00	5.27	5.55	5.20	1.721	.144	
Village quality	3.95	4.66	4.04	4.67	3.00	4.180	.002*	1<4
Atmosphere and Spectator Support	4.68	5.32	5.00	5.04	4.00	1.502	.201	
Tradition and History of the Event	4.53	4.94	4.42	5.02	3.60	2.551	.038*	1<4
Registration Fee	4.91	4.98	4.73	5.04	4.40	0.563	.689	
Photographic Service for the Athletes During the Race.	4.16	4.21	4.40	4.44	3.60	0.645	.630	
Proximity of the Event to Place of Residence	3.78	3.85	3.84	4.21	4.00	1.056	.378	

**Table 5***Differences in event-related elements according to the number of times partaking in the event.*

	1 (a)	2 (b)	> 2 (c)	F	Sig.	Post Hoc
Professionalism of the Organisation and Volunteers	5.60	5.71	5.74	0.291	.747	
Quality of the Refreshment Facilities	5.30	5.55	5.48	0.792	.454	
Runner's Goody Bag and Other Giveaways	4.57	4.89	4.86	1.318	.269	
Accessibility	5.00	5.11	5.04	0.118	.889	
Journey Quality	5.83	6.05	5.90	0.589	.555	
Clarity of Prior Information	5.19	5.26	5.13	0.238	.788	
Implementation of Environmental Protection Measures	5.43	5.57	5.49	0.233	.792	
Village Quality	4.05	4.54	4.51	2.882	.057	
Atmosphere and Spectator Support	4.84	5.13	4.93	0.924	.397	
Tradition and History of the Event	4.49	4.70	5.08	3.917	.021*	a<c
Registration Fee	5.04	4.97	4.89	0.265	.767	
Photographic Service for the Athletes During the Race	4.03	4.55	4.37	2.620	.074	
Proximity of the Event to Place of Residence	3.73	4.12	4.13	1.623	.198	

**Table 6***Average for elements related to the event.*

	Average	SD
Value For Money in Accommodation	4.49	1.98
Price of Activities and Shops	4.61	1.90
Value For Money in Catering	4.84	1.81
Diversity of Accommodation Options	4.04	1.92
Variety of Dining Options and Culinary Options	4.38	1.83
Outdoor Recreational Opportunities	4.60	1.99
Communication and Access	4.96	1.69
Variety of Spaces For Outdoor Activities	4.82	1.99
Variety of Water Sports and Activities	3.25	1.96
Parking Available Close to Amenities and Entertainment Options	5.11	1.80
Calm and Relaxed Atmosphere	5.78	1.39
Friendly and Hospitable Residents	5.60	1.55
Clean and Orderly Environment	5.93	1.36
Pleasant Climate	5.64	1.46
Uncrowded Environment	5.79	1.46
Safe and Secure Area	5.60	1.50
Variety of Entertainment Options	3.56	1.89
Variety of Nightlife Options	2.89	1.86
Variety of Cultural Events, Festivals, Fairs and Markets	4.02	1.89
Variety of Local Shopping Options	3.61	1.83
Distinctive Historical and Heritage Elements	4.13	1.92
Unique Landscapes and Environmental Attractions	6.05	1.42
Attractive Routes and Trails	6.05	1.40
Attractive Rivers and Lakes	5.63	1.64

significant differences were observed in only one item ("Tradition and history of the event"). In this case, the element in question had more influence on the satisfaction of athletes who had participated in more than two events (5.08) than those who participated for the first time (4.49). For the other elements, although there were slight differences, they were not significant.

In terms of the objective of identifying the elements of the destination that most affect participants' satisfaction, the data showed that "unique natural landscapes and attractions" (6.05) and "attractive trails and paths" (6.05) were the only items with values higher than 6 points (Table 6). This was followed by "clean and orderly environment" (5.93), "uncrowded environment" (5.79) and "calm and relaxed

atmosphere" (5.78). On the other hand, the items with the least importance were "variety of nightlife options" (2.89), "variety of sports and water activities" (3.25), "variety of entertainment options" (3.56) and "variety of local shopping options" (3.61).

The comparison of destination attributes according to the type of fellow companions with whom the participant visits the event destination showed significant differences in eighteen items (Table 7). *Post hoc* analysis showed that the items where there were significant differences were between participants who travel alone and those who participate accompanied. This was observed in 8 items for individuals who go with a partner, 5 items for individuals who go with friends and 2 items for individuals who attend with family.

**Table 7**

*Differences in destination-related elements according to the type of accompanying persons.*

	Alone (1)	Partner (2)	Family (3)	Friends (4)	Others (5)	F	Sig.	Post Hoc
Value For Money in Accommodation	4.13	5.04	4.68	4.49	4.20	1.997	.094	
Price of Activities and Shops	4.08	5.34	4.70	4.69	3.40	4.565	.001*	1<2,1<4
Value For Money in Catering	4.44	5.34	4.84	4.94	3.60	3.012	.018*	1<2
Diversity of Accommodation Options	3.63	4.74	4.05	4.07	4.00	2.811	.025*	1<2
Variety of Dining Options and Culinary Options	3.94	4.79	4.36	4.50	3.80	2.495	.042*	
Outdoor Recreational Opportunities	4.15	5.02	4.86	4.67	2.80	3.362	.010*	
Communication and Access	4.62	5.23	5.03	5.02	5.20	1.480	.207	
Variety of Spaces For Outdoor Activities	4.33	5.21	5.03	4.93	3.00	3.530	.007*	
Variety of Water Sports and Activities	2.87	3.77	3.53	3.24	2.20	2.533	.040*	
Parking Available Close to Amenities and Entertainment Options	4.60	5.66	5.03	5.24	5.40	3.632	.006*	1<2,1<4
Calm and Relaxed Atmosphere	5.39	6.02	5.99	5.85	5.20	3.262	.012*	1<3,1<4
Friendly and Hospitable Residents	5.20	5.70	5.59	5.73	5.40	1.664	.157	
Clean and Orderly Environment	5.59	6.13	6.04	6.00	6.40	2.289	.059	
Pleasant Climate	5.25	5.87	5.82	5.69	6.00	2.585	.036*	
Uncrowded Environment	5.45	6.00	5.92	5.85	6.20	2.031	.089	
Safe and Secure Area	5.20	5.85	5.63	5.69	6.40	2.755	.028*	1<4
Variety of Entertainment Options	3.12	3.91	3.90	3.60	2.60	2.824	.024*	1<3
Variety of Nightlife Options	2.47	3.15	3.10	2.98	2.20	2.126	.077	
Variety of Cultural Events, Festivals, Fairs and Markets	3.67	4.68	4.21	4.00	3.60	2.607	.035*	1<2
Variety of Local Shopping Options	3.13	4.17	3.59	3.73	3.00	3.365	.010*	1<2,1<4
Distinctive Historical and Heritage Elements	3.84	4.81	4.01	4.18	2.60	2.974	.019*	1<2
Unique Landscapes and Environmental Attractions	5.78	6.45	6.21	6.06	5.00	2.838	.024*	
Attractive Routes and Trails	5.76	6.45	6.16	6.09	5.20	2.733	.029*	1<2
Attractive Rivers and Lakes	5.40	6.11	5.63	5.66	4.20	2.509	.041*	

In addition, unaccompanied athletes gave lower scores for all items than the other groups. When this comparison was made in relation to sex, as with the event elements, no significant differences were found between men and women.

When making a comparison according to the number of times athletes have participated in the event, significant differences were observed in five items (Table 8). In two of the five elements, differences emerged between athletes

who had participated in only one competition and those who had participated in two competitions ("communication and access" and "clean and orderly environment"). The item "pleasant climate" showed significant differences between athletes who had participated once (5.35) and those who had participated more than twice (5.76). With respect to the item "variety of nightlife options", differences were observed between those who had participated twice (2.63) and those who had participated more than twice (3.14).

**Table 8**

*Differences in destination-related elements according to the number of times partaking in the event.*

	1 (a)	2 (b)	> 2 (c)	F	Sig.	Post Hoc
Value For Money in Accommodation	4.75	4.41	4.39	1.431	.240	
Price of Activities and Shops	4.85	4.55	4.50	1.427	.241	
Value For Money in Catering	4.90	4.89	4.77	.268	.765	
Diversity of Accommodation Options	4.14	3.99	4.01	.255	.775	
Variety of Dining Options and Culinary Options	4.31	4.47	4.35	.272	.762	
Outdoor Recreational Opportunities	4.60	4.69	4.54	.261	.770	
Communication and Access	4.69	5.27	4.89	4.525	.011*	a<b
Variety of spaces for outdoor activities	4.69	4.96	4.80	.635	.530	
Variety of Water Sports and Activities	3.20	3.35	3.21	0.277	.758	
Parking Available Close to Amenities and Entertainment Options	4.91	5.34	5.08	2.091	.125	
Calm and Relaxed Atmosphere	5.63	5.93	5.76	1.683	.187	
Friendly and Hospitable Residents	5.41	5.74	5.62	1.590	.205	
Clean and Orderly Environment	5.74	6.15	5.90	3.209	.041*	a<b
Pleasant Climate	5.35	5.72	5.76	3.540	.030*	a<c
Uncrowded Environment	5.65	6.02	6.71	2.775	.063	
Safe and Secure Area	5.31	5.73	5.68	3.171	.043*	
Variety of Entertainment Options	3.41	3.46	3.73	1.464	.232	
Variety of Nightlife Options	2.82	2.63	3.14	3.361	.036*	b<c
Variety of Cultural Events, Festivals, Fairs and Markets	3.94	3.88	4.18	1.192	.305	
Variety of Local Shopping Options	3.61	3.61	3.61	0	1.000	
Distinctive Historical and Heritage Elements	4.14	4.15	4.10	.030	.970	
Unique Landscapes and Environmental Attractions	5.87	6.19	6.06	1.756	.174	
Attractive Routes and Trails	5.84	6.21	6.08	2.374	.094	
Attractive Rivers and Lakes	5.52	5.63	5.69	0.435	.648	

## Discussion and Conclusions

The results of this study show that the elements that most affect the satisfaction of LSE participants - which in turn influence intentions for future participation, return to the destination and recommendation to friends and family - boil down to five factors: event; destination price and services; environment and atmosphere; entertainment and leisure; and environmental attractions.

The elements related to the event itself are in line with previous studies, with the quality of journey being the most influential, in accordance with the results obtained by Newland & Aicher (2018), Getz & McConnell (2014). The professionalism of the organisation and volunteers is the second most influential element in participants' satisfaction, in line with the findings of Xiao et al. (2019). However, this result is in contrast to the study by Theodorakis et al. (2015), which found no significant relationship between participants' interactions with organisers and satisfaction. From the perspective of bystanders, some studies also show a significant relationship between interaction with staff and satisfaction (Yoshida & James, 2010). The third most important element is the implementation of environmental protection measures, in line with the results obtained by Peric et al. (2018), who suggest that this may be due to a greater environmental awareness among participants and the fact that they want to preserve the natural environment, which is essential for practising their sporting disciplines. A final element that appears quite frequently in the literature on satisfaction at sporting events is the atmosphere and ambience surrounding the event. Whilst Theodorakis et al. (2015) find it to be an important element for participants, the results obtained in this study suggest a minor influence, coinciding with the study by Getz & McConnell (2014), also on mountain bikers and runners.

In relation to the influence of the type of fellow companions, Buning & Gibson (2016) report significant differences when an athlete travels alone or with other cyclists or when travelling with non-athletes. Athletes travelling alone value several elements of the event as more important: the registration fee, the quality of the journey and the tradition of the event. However, in this study only significant differences in the quality of the village have been detected. With regard to the number of times athletes have participated in the event, the differences detected relate, once again, to a single element. Thus, the data from the present research do not coincide with those reported by Buning & Gibson (2016), who report differences in the importance of elements such as the quality of the journey, the registration fee and the clarity of prior information.

With respect to the objective of identifying the attributes of the destination with the greatest influence on participants' satisfaction, the results show that the elements included

in "environmental attractions" and "environment and atmosphere" are the most influential. Particularly relevant are items such as the uniqueness of the environmental attractions, the attractiveness of the paths and trails in the area, the cleanliness of the surroundings, the absence of overcrowding and the peacefulness of the environment. These results are consistent with those obtained by Peric et al. (2018) and Buning & Gibson (2016), which highlight the natural environment and safety aspects of the area. Beyond the environmental and natural attractions, the results reveal that the hospitality of the residents is one of the elements that most influences the satisfaction of the participants. In this sense, Kim & Jogaratnam (2015) point out that hospitality is one of the destination attributes that best predicts visitor satisfaction.

With respect to the type of fellow companions, Buning & Gibson (2016) suggest that certain destination attributes such as entertainment options, historical elements and activities related to the event gain importance among participants accompanied by non-athletes. The results of this study follow the same pattern. Significant differences were found in eight of the ten attributes relating to destination services, and in four of the five relating to entertainment and leisure. In fact, athletes travelling with a partner report a greater influence of destination services and entertainment on their satisfaction than those travelling alone. This may be due to the fact that those travelling alone prioritise participation in the event, while those travelling as a couple seek a balance between sport and leisure.

From the results of the study, practical implications are drawn for the organisation of LSEs and their use for tourism, both from the perspective of the organisers and the destination managers. In this respect, as Kaplanidou et al. (2013) point out, coordination between the different stakeholders involved is paramount. Collaboration between LSE organisers and destination managers is seen as key to maximising the satisfaction of accompanied participants, who also generate more economic impact in the area.

Finally, given the size of the sample in this study, the influence of event and destination elements on participant satisfaction should be further investigated in other types of events, in new destinations and with different samples. It seems particularly relevant to investigate the perspective of fellow companions and spectators, who often play an important role in the final choice of both the event and the destination. Finally, a deeper understanding of the perspective of the organisers, and the possibility of aligning it with that of the participants, is also a very interesting line of research that could contribute to improving and consolidating the quality of local sporting events and the satisfaction of athletes and those accompanying them.

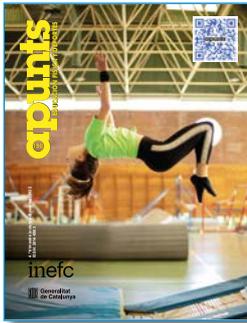
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# Influence of Tactical Levels in School and Extracurricular Football

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## Abstract

Recently, an instrument has been proposed to evaluate tactics in school and extracurricular football based on three levels (team, small groups and individual). The aim of the study was to find out to what extent each tactical level contributed to the successful completion of the attack and defence phases in introductory football. 88 children participated (age:  $M = 10.38$ ,  $SD = 0.77$  years) from eight male football teams (9-12 years old). 1,516 ball possessions from four official matches of the season were analysed. The observational methodology was used through an idiographic, timely and multidimensional design. Two observers viewed the videos of the matches and individually recorded four teams. The observation instrument was *Tactical Assessment Instrument for Soccer*. It was made up of 11 criteria divided into the three tactical levels, differentiated into attack and defence. Spearman's Rho test and logistic regression were used for data analysis. The individual and team level actions were the ones that explained the success in the attack and defence phases at a higher percentage. However, the correlations showed the relationship between the three tactical levels and success in the attack and defence phases. Consequently, tactical training in introductory football is suggested, based on the inclusion of the three tactical levels analysed in this study (team, small groups and individual).

**Keywords:** evaluation, introductory sports, Physical Education, sports teaching, tactical learning, teaching-learning processes.

## Introduction

The tactical teaching of sports games has been valued in recent years thanks to the positive results of work carried out with pedagogical approaches and models such as the Teaching Games for Understanding (e.g. Barquero-Ruiz et al., 2021). This orientation towards tactical teaching requires an evaluation aligned to the teaching-learning process (Kirk, 2017). However, the instruments used to evaluate the tactic to date do not provide full and valid information, since they evaluate it as a sum of actions taken by individuals (Barquero-Ruiz et al., 2020). Considering that actions carried out by individuals represent only a third of the total actions performed in collective sports games, the fact that the evaluation is based only on this level of action makes it difficult to improve the knowledge of tactical learning and to properly plan the teaching-learning process (Gréhaigne & Godbout, 1995).

In collective sports games where the game and mobile spaces are shared, there are three tactical levels based on the number of players involved in the actions carried out (Gréhaigne et al., 2005). According to Gréhaigne et al. (2005), at the team level all or most of the players are involved. At the small group level, a subgroup of players participates, between two and four approximately, with a common aim. Finally, the individual level includes just one player (Godbout & Gréhaigne, 2022). The uncertainty generated by the actions carried out at these three levels demands skills determined not only by each player's personality but also by the game in small groups and together with the whole team (Gréhaigne & Godbout, 1995; Pill & Hyndman, 2018). In other words, it is the interactions within and between the various levels that define the tactics to be developed during the game (Ashford et al., 2020).

Recently, Barquero-Ruiz et al. (2022) have proposed the Tactical Assessment Instrument for Soccer (TAIS), as a tool to enable the more comprehensive evaluation of tactics in school and extracurricular football. Specifically, the novelty of the instrument lies in five advantages. First, it enables the evaluation of the three tactical levels, defined above, within the same observation unit. Second, it enables the evaluation of players in attack and defence, whether in possession of the ball or not. Third, it avoids the use of indices when presenting the results. Fourth, it includes contextual criteria, which help to situate learning within the context of play. Finally, it is a valid instrument for use in various contexts (school, extracurricular and federated).

The tactical evaluation proposal arising from TAIS opens new lines of research on tactical levels and their usefulness. Specifically, the instrument allows one to know what children do during the game in a more ecological way (Kirk, 2017). In this sense, the starting point could

be the exploration of the impact that each tactical level has on success in the game phases (attack and defence). Until now, the development of the team's game phase could only be tactically evaluated based on the players' individual behaviour. With TAIS, however, it is possible to find the influence that the three tactical levels have on the game phases, both independently, considering the influence of the actions carried out at each level, and jointly, considering the influence of the actions included in all three levels. Knowing the influence of tactical levels on the successful construction of game phases is key to optimising the teaching-learning process in introductory football, since football is a sport with a high tactical component (Fardilha & Allen, 2020) and because abstract thought starts to develop between the ages of 9 and 12 (Piaget, 1977). In this sense, the analysis could provide information on the tactical level or levels on which to focus the teaching-learning process for children. Consequently, this study aimed to find out to what extent each tactical level contributed to the successful completion of the attack and defence phases in introductory football.

## Methodology

### Participants

The participants were 88 children (age:  $M = 10.38$ ;  $SD = 0.77$ ) of eight male junior and federated football teams (9-12 years), in an autonomous community located in the southeast of Spain. The players had played football in a federated form for at least two years. Each week, they practised 3 hours over 2 days and played a 40-minute game on the weekends. All teams were federated and played at the regional level. 1,516 ball possessions from four official matches in the season, which took place over the November-February period, of the federated league in which the teams participated, were analysed. The selection of the teams and players was deliberate based on the inclusion criteria: (a) two coaches selected the eight teams with the greatest homogeneity in terms of level and previous experience, in order not to select very disparate teams in terms of sporting performance, (b) the teams had to play each other once, and (c) the participants agreed to be recorded to participate in this study. The selection of ball possessions was through a total sampling (Anguera, 2003). The parents and/or legal guardians of the participants and the coaches provided informed consent for participation in this study. The Research Ethics Committee of the first author's university approved the study (CE091908), which was conducted in accordance with the Declaration of Helsinki.

**Table 1**

*Criteria that make up the Tactical Assessment Instrument for Soccer (TAIS, Barquero-Ruiz et al., 2022).*

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<b>Contextual level</b>
Successful completion of attack
Goal, out of play over goal line, action prior to corner kick or goalkeeper save
Successful completion of defence
Ball put out of play, steal, player interception or goalkeeper block
<b>Team level</b>
Attack type (attack phase)
Appropriate positional
Inappropriate positional
Appropriate counter-attack
Inappropriate counter-attack
Defence type (defence phase)
Defence in appropriate area
Defence in inappropriate area
Appropriate man defence
Inappropriate man defence
Appropriate depth (attack phase)
Inappropriate depth (attack phase)
Appropriate amplitude (attack phase)
Inappropriate amplitude (attack phase)
<b>Small group level</b>
Appropriate pass (attack phase)
Inappropriate pass (attack phase)
Support (attack phase)
Appropriate defensive help (defence phase)
Inappropriate defensive help (defence phase)
<b>Individual level</b>
Appropriate control (attack phase)
Inappropriate control (attack phase)
Appropriate shot (attack phase)
Inappropriate shot (attack phase)
Appropriate interception (defence phase)
Inappropriate interception (defence phase)
Appropriate entry or charge (defence phase)
Inappropriate entry or charge (defence phase)

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## Design

The observational methodology (Anguera & Hernández-Mendo, 2014) was used through an idiographic, timely and multidimensional design (Anguera et al., 2011). The design was idiographic because the participants were analysed as a single unit. Timely, since there was no follow-up of the players and the participants were evaluated in a single match. That is, each team was evaluated only once in a matchup against another of the eight teams, so four matchups were

explored. The confrontations were random, according to the protocol of the sponsoring federation. The design was also multidimensional, since various levels of response were considered within the observation instrument (Table 1). The same rules were followed in all matches to enable inter-session consistency requirements, among which the following stand out: (a) the participants played all matches on identical fields (65 x 45 m), (b) the goals had the same dimensions (2 x 6 m), and (c) matches were 7-a-side.

## Process

The participants were recorded playing the four football games with a video camera (Everio Full HD-GZ-HD7, JVC, Japan), which was placed five metres above the ground and two metres from the field line, next to the touchline, near the corner kick area. The recording allowed the observation of the entire field at all times, so that the behaviour of all the players with and without the ball could be observed throughout the match.

The observers were two research assistants aged 25 and 27, respectively, graduates in Physical Activity and Sports Sciences, with an average experience of 4 years ( $SD = 1.4$ ) in observation of football matches in introductory stages. Both were introductory soccer coaches with a minimum experience of 5 years. They were trained for 30 hours in the specific observation instrument, following the training phase suggested by Anguera (2003). Observer reliability was obtained by intra-observer assessment at the end of the training process. In this assessment, the observers viewed 90 ball possessions from a game not part of the investigation, but of the same category and level as those analysed. Later, the observers observed the same fragment again after seven days of non-observation. Observer reliability was suitable (% agreement = 99.60%, Kappa coefficient = .99). Reliability of the observation was obtained through a final inter-observer assessment. For this assessment, 15% of the ball possessions of the study's matches were used, which meant five randomly selected game periods. Reliability of observation was also suitable (% agreement = 98.51%, Kappa coefficient = .98).

Each observer individually observed and recorded four teams, in both offence and defence. The observation instrument used was TAIS (Aiken's  $V = .92$ ,  $ICC = .70$ , % agreement = 95%, Barquero-Ruiz et al., 2022). This instrument is made up of 11 criteria divided into the three tactical levels (team, small groups and individual). Each tactical level contains criteria from both the attack phase and the defence phase (Table 1). The criteria are categorised into appropriate and inappropriate, except in the case of the "support" criterion at the small group level, which by definition will be considered appropriate whenever it appears. The instrument includes a total of 11 contextual criteria. For this work, all the criteria of all the tactical levels, in attack and defence, and the contextual criteria related to the type of completion in attack and defence were selected. Specifically, successful completion of the attack and successful completion of the defence (Table 1).

To carry out the observation and recording of the matches, the instructions indicated by Barquero-Ruiz et al. (2022) were used. The observation unit was the game phase. The observers had to watch and analyse the game phase at real-time speed, at least three times, and then they could watch the game phase at reduced speed (25 frames per second). The observers had to repeat this process for each criterion, until all criteria of the game phase were completed, in order to proceed to the next phase.

## Analysis of data

The data was treated statistically using the SPSS statistical package v. 17.0 for Windows (SPSS, Inc. USA). The Kolmogorov-Smirnov test was used to analyse the normality of the data. Consequently, Spearman's Rho ( $\rho$ ) was used to analyse the correlations between the actions of the three tactical levels and successful completion. Finally, a logistic regression was performed to explore to what extent each tactical level explained the successful completion of the game phase, in both attack and defence. For this purpose, for the attack completion type of contextual criterion, the attack was considered successful when it ended in a goal, went over the goal line, a corner kick was awarded or the goalkeeper made a saved (Table 1). For the defensive completion type of contextual criterion, the defence was considered successful when it ended by stealing the ball, interception by a player, blocking by the goalkeeper or sending the ball out of play (Table 1).

## Results

Results showed statistically significant correlations between successful completion of the attack and appropriate actions at the team ( $p = .38, p < 0$ ), individual ( $p = .36, p < 0$ ) and small group levels ( $p = .09, p < .013$ , Table 2). However, a correlation was also found between the successful completion of the attack and inappropriate actions at the individual level ( $p = .21, p < 0$ , Table 2).

In the defence phase, the results showed statistically significant correlations between successful completion and appropriate actions at the individual level ( $p = .25, p < 0$ , Table 3). However, statistically significant and negative correlations were also found between successful completion of defence and inappropriate actions at the team, individual, and small group levels ( $p = -.22, p < 0$ ;  $p = -.12, p < .002$ ;  $p = -.09, p < .008$ , respectively, Table 3).

**Table 2**

Descriptive statistics and correlations ( $\rho$ ) between the appropriate and inappropriate actions at the three tactical levels and the successful completion of the attack.

Criteria	Median	Range	M	SD	1	2	3	4	5	6	7
1. Successful completion of attack	0	1	.24	.43	-	-	-	-	-	-	-
2. Appropriate team-level actions	0	1	.10	.22	.38**	-	-	-	-	-	-
3. Inappropriate team-level actions	.33	1	.28	.15	-.35	-.91*	-	-	-	-	-
4. Appropriate small group level actions	.50	7	.74	.92	.09*	.27*	-.19*	-	-	-	-
5. Inappropriate small group level actions	1	4	.98	.78	-.25	-.19*	.23*	-.23*	-	-	-
6. Appropriate individual level actions	0	1.50	.16	.30	.36**	.41*	-.04	.30*	-.19*	-	-
7. Inappropriate individual level actions	0	1	.11	.22	.21**	.17*	-.18*	.14*	-.24	.02	-

Note. M: mean, SD: standard deviation,  $\rho$ : Spearman's Rho correlations, \* $p < .05$ , \*\* $p < .001$ .

**Table 3**

Descriptive statistics and correlations ( $\rho$ ) between the appropriate and inappropriate actions at the three tactical levels and the successful completion of the defence.

Criteria	Median	Range	M	SD	1	2	3	4	5	6	7
1. Successful completion of defence	1	1	.82	.39	-	-	-	-	-	-	-
2. Appropriate team-level actions	0	1	.01	.05	.02	-	-	-	-	-	-
3. Inappropriate team-level actions	1	1	.57	.49	-.22**	-.06	-	-	-	-	-
4. Appropriate small group level actions	0	3	.13	.41	.03	-.02	-.01	-	-	-	-
5. Inappropriate small group level actions	0	3	.13	.38	-.09*	.06	.14*	-.02*	-	-	-
6. Appropriate individual level actions	0	4	.27	.35	.25**	.02	-.07	.20*	.03	-	-
7. Inappropriate individual level actions	.50	2.50	.49	.54	-.12*	.05	.22*	.05	.16*	-.05	-

Note. M: mean, SD: standard deviation,  $\rho$ : Spearman's Rho correlations, \* $p < .05$ , \*\* $p < .001$ .

**Table 4**

Logistic regression of the actions at the three tactical levels with the successful completion of the attack.

Criteria	Odds ratio	Lower confidence interval	Upper confidence interval
Team level	7.03	4.77	10.34
Small group level	1.47	1.04	2.08
Individual level	5.50	3.84	7.88

For the logistic regression analysis for the attacking phase, the adjustment criterion for the final model resulted in a value of 379.32, giving the likelihood ratio tests a chi-square value of 170.91 ( $gl = 6$  and  $p = 0$ ). The value of McFadden's Pseudo  $R^2$  was .20 (Cox and Snell = .19; Nagelkerke = .29). The analysis indicated that successful completion was explained

by both the team level and the individual level (Table 4). Specifically, appropriate actions at the team level explained 57.20% of successful completions. Appropriate actions at the individual level explained 50.50% of successful completions, while inappropriate actions at the individual level explained 89.90% of unsuccessful completions.

**Table 5***Logistic regression of the actions at the three tactical levels with the successful completion in defence.*

Criteria	Odds ratio	Lower confidence interval	Upper confidence interval
Team	1.22	1.18	1.26
Small groups	1.31	.69	2.50
Individual	5.20	3.25	8.32

For the logistic regression analysis for the defence phase, the adjustment criterion for the final model resulted in a value of 208.14, giving the likelihood ratio tests a chi-square value of 73.50 ( $gl = 6$  and  $p = 0$ ). The value of the Pseudo  $R^2$  McFadden's was .10 (Cox & Snell = .09; Nagelkerke = .15). The analysis indicated that successful defence was explained by the individual level (Table 4). Specifically, appropriate actions at the individual level explained 93% of successful defences.

## Discussion

The objective of this study was to find out to what extent each tactical level contributed to the successful completion of the attack and defence phases in introductory football. In general, the results showed that individual and team level actions were the ones that explained a greater percentage of success in the attack and defence phases. However, the correlations showed the relationships between the three tactical levels and success in the attack and defence phases. These results are in line with what the literature suggests, given that tactics are not just the sum of individual actions, but rather the product of the combination of interactions present at the three tactical levels (Godbout & Gréhaigne, 2022; Gréhaigne et al., 2005).

Despite the positive correlations found between successful attack and appropriate actions at the team, small group and individual level, the positive correlation with inappropriate actions at the individual level stood out. This result could be due to the fact that the act of shooting in TAIS is inappropriate if it does not reach the goal. However, in introductory football, children managing to progress with the ball to the vicinity of the opposing goal, despite not scoring a goal, is recognised as an indicator of success in attack (Wunderlich et al., 2021).

Going deeper into the regressions, it was expected that the children would develop successful attack phases mainly through individual and team level actions, for the following reasons. First, according to Nunes et al. (2021) the predominance of individual actions is common in the age range between 9 and 12 years, due to the tendency to use the playing space inefficiently and due to a random and static dispersion of the players on the playing field. Second, at a

practical level, the results seem to suggest that the players were able to position themselves in the playing space, but lacked the initiative to interact with their teammates, as was also found by Barnabé et al. (2016). This lack of interaction at the small group level is often related to a lack of tactical training (Ashford et al., 2020).

In defence, although the success of the phase was correlated with appropriate actions at the individual level, the negative correlation between success and inappropriate actions at the team, small group and individual level stands out. This negative correlation could be due to the fact that, in defence, it was more important not to perform inappropriate actions at the three levels than to perform appropriate actions. Related to that, the coaches prioritise work on offensive actions, limiting the learning of defensive actions to that arising from the understanding and improvement of attacks, without specifically taking into account the work of the defensive phase (Peterson & Bruton, 2020; Pizarro et al., 2020). In fact, the results of the regressions confirmed a higher prevalence of appropriate actions at the individual level (Table 5).

Going deeper into the regressions and into the literature, it seems logical that the successful defence phases were developed through appropriate actions carried out at the individual level (Pizarro et al., 2020). According to Pizarro et al. (2020), when coaches suggest tasks with offensive aims, the participants only learn defensive actions at the individual level. Thus, it is consistent with the results indicating the predominance of individual actions over those of the other two tactical levels when defending. In this regard, it is not possible to learn interactions in small groups and at the team level without being trained specifically in the defensive phase (Pizarro et al., 2020).

In short, this study is relevant insofar as it is the first research work in which the three tactical levels are analysed in a practical way in introductory football. Its fundamental contribution lies in justifying and demonstrating that the play, in both attack and defence, was determined by actions at the three tactical levels: team, small groups and individual. However, the regression analysis for each tactical level seemed to show a predominance of team and individual actions. This result could be due to the fact that introductory football training focuses on positional work and individual

player initiative, not covering the interactive approach between players, which requires tactical learning (Ashford et al., 2020; Fardilha & Allen, 2020).

## Conclusions

In conclusion, the joint analysis of the individual, small group and team levels allowed a more complete explanation of what happened in attack and defence. However, the results reflected a lack of actions at the small group level. Nevertheless, the findings should be taken with caution because they are the result of data from four matches between eight teams, exclusively male, and are only transferable to teams with similar characteristics to those analysed. So, in future research, it would be interesting to corroborate the results from the analysis of the three tactical levels.

As a result of what was observed, the training of tactics in introductory football is suggested, based on the inclusion of the three tactical levels analysed in this study. To encourage tactical learning, teaching approaches that favour understanding of the game would be a fundamental tool (González-Víllora et al., 2020). Across these approaches, three aspects are key. First, the determination of tactical learning objectives, considering each of the three levels. Second, the approach of short plays, as a simulation of real game problems, which enable interactions between players. Lastly, favouring player understanding through feedback queries. Future studies should analyse the effects of this form of teaching on tactical learning at all three levels.

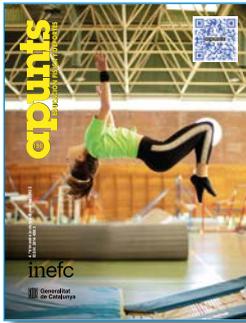
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## Book review: Carreras, D. & Ballestero, D. (2022). *Entrenamiento neuromuscular. Una nueva aportación al rendimiento deportivo*

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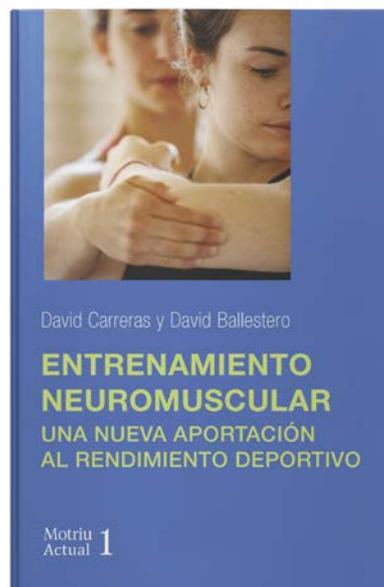
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The book *Neuromuscular training* is a didactic tool aimed at all physical exercise professionals dedicated to sporting performance, with the aim of guiding professionals' intervention from both a performance optimisation and a preventive perspective. The text presents a point of convergence between the contributory paradigm and functional training, and its content is based on the understanding of the athlete's body as a systemic complex subjected to the high demands of sporting performance, which often force it to exceed the threshold of tolerance of its own capabilities. This can lead to imbalances in the neuromuscular system that affect mobility, stability or the execution of the specific technique.



**ENTRENAMIENTO  
NEUROMUSCULAR  
UNA APORTACIÓN AL  
RENDIMIENTO DEPORTIVO**  
*NEUROMUSCULAR TRAINING. A NEW  
CONTRIBUTION TO SPORTING PERFORMANCE.*

**David Carreras and David Ballestero**

**Edicions de la Universitat de Lleida**

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In the context of physical exercise and sport, it is accepted that the concept of neuromuscular training is associated with the set of methods that aim to improve communication between the muscle and the central nervous system in order to enhance the efficiency of the specific actions required by the sporting discipline. This approach allows for a wide range of possibilities to address the optimisation of neuromuscular connectivity. This can include either exercises based on external stimuli that elicit involuntary responses or exercises based on internal commands that trigger voluntary responses.

The Neuromuscular Exercise Sequence<sup>©</sup> is the approach that, based on voluntary exercise, brings together assessment techniques and training methods that favour the adequate control of all the neuromuscular processes for the correct execution of the athlete's movement.

The structure of the book presents, at the beginning, the theoretical construct on which the NES<sup>©</sup> is based and the way in which it justifies its double aspect: optimisation and prevention. It highlights the need for the athlete's training to be approached from a much broader perspective than the mere response to a functional action. And it places control of the movement at the starting point. The second

chapter presents the techniques for detecting, restoring and maintaining possible muscular weaknesses and instabilities, assessed by means of simple tests to determine the level of control of the muscle involved. The third part focuses on how to assess and improve the level of movement control when the voluntary command involves the participation of muscle chains. The fourth chapter presents different systems and methods of functional movement assessment, some of them with obvious origins in therapeutic techniques and others with a clear influence of North American functional training trends. The last chapter discusses how the strengthening of the myotendinous complex can be improved through strength training methods, which allow the optimisation of muscle capacity at the moment of tension generation.

It is without doubt a book that will not leave the reader indifferent and will offer a more complete and coordinated vision of the training of the muscular system and the nervous system.

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



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