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Cover: A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP

Effectiveness and Adherence to Physical Activity and Physical Exercise mHealth Interventions: A Systematic Review

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Abstract

The inclusion of physical activity and physical exercise prescription in the field of mHealth offers a new field of research in an increasingly digitized society. In this context, it is necessary to assess the applicability, reliability and adequacy of the control variables and assessment, taking into account the criteria of individualization and specificity of the pathology. This systematic review was aimed to study the adherence and effectiveness of physical activity or physical exercise mHealth programs depending on its variables, communication channels and technological resources for randomized clinical trials performed from 2011 to 2021. A literature research was carried out using the Pubmed, Science Direct, Scopus, Web of Science and Google Scholar platforms following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Out of 865 initial results, 13 clinical studies were included in the analysis, related to cardiac (n = 4), oncological (n = 3), pulmonary n = 1), Parkinson's (n = 1) diseases, as well as the promotion of PA in sedentary people (n = 2), general population (n = 1) and pregnant women (n = 1). In relation to the effectiveness of the intervention, 9 of the final results (70%) showed differences of improvement in the experimental group. Workload is usually quantified with non-specific variables, with daily steps and the minutes of physical activity or exercise per day being the most common ones. The most used technological resources were specific applications and the FitBit® wristband. Main communication channels were SMS and the social network Facebook. However, there were no interventions specifically designed to meet technological capabilities of their target population. mHealth interventions had a greater effectiveness and adherence to prescription programs than in those prescribed in person or without technological support.

Keywords: adherence, app, mhealth, physical activity, physical exercise, workload.

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Introduction

Regular physical activity (PA) offers significant health benefits and mitigates health risks. It is defined by the World Health Organization (WHO) as a key protective factor for the prevention and management of noncommunicable diseases, for its benefits for mental health and delaying the onset of dementia, and for its contribution to the maintenance of healthy weight and general well-being (Bull et al., 2020). The American College of Sports Medicine defines PA as "the body movement that is produced by the contraction of skeletal muscles and that increases energy expenditure". Physical exercise (PE), on the other hand, refers "to planned, structured, and repetitive movement to improve or maintain one or more components of physical fitness". PE and the accumulation of PA improve physical fitness, allowing to assume a state of well-being with a low risk of premature health problems, and the energy to participate regularly in a variety of physical activities (Chodzko-Zajko et al., 2009). In that context, PA and PE prescription and its concurrent inclusion in the field of mobile health or mHealth offer a new field of research in an increasingly digitized society (Watson, 2020).

mHealth, as a component of eHealth, is a medical and public health practice supported by mobile and wireless devices, involving the use of mobile phone functionalities and its applications (WHO, 2015). mHealth is presented as a technological advance that could be useful for the promotion of healthy PA and PE, both in industrialized or rural areas (Griffin et al., 2020). mHealth could be a new solution for the management, assessment and control of PA or PE, taking into account the use of mobile phones in today's society as well as the emergence of 5G (Silva et al., 2015). It is accessible everywhere and a person does not necessarily need a specific time and place to start exercising. One can also think that it does not need to be attended by a PA and PE professional (Sohaib Aslam et al., 2020), although this current perception could be counterproductive, both for the health of the person who exercises without concrete or specific guidelines in their sports practice and in the interpretation of the PE prescription for health. In this sense, it would be necessary to assess one of the differential effects of sports practice and its adherence, such as socialization (Short et al., 2018). mHealth interventions should be presented as facilitators for the practice of healthy PA and PE, but under mechanisms and control criteria which are individualized to each user or patient and are specifically targeted for each specific group of people suffering from a specific pathology (Paglialonga et al., 2018). However, it is necessary to assess the applicability, reliability and adequacy of the control variables for volume and intensity of PE, taking into account criteria of individualization and specificity of the pathology (Duscha et al., 2018a), as well as the development of technological resources and the communication channel to every specific population group need (Sohaib Aslam et al., 2020).

In that context, exercise prescription is defined by two main workload parameters: external load (EL) and internal load (IL). Both are independent parameters used to assess the effect of exercise, and their control is integrated and ruled by training theory (Foster et al., 2017). A certain EL will generate different physiological and psychological responses in every person; this response is IL (Soligard et al., 2016). Time, steps, distance, accelerometry, sets, repetitions, etc., are variables applicable to the quantification of EL (Mujika, 2017). IL has been useful to guide the training process or control fatigue (Soligard et al., 2016). Objective variables to measure IL (apart from all physiological parameters analyzed form blood test) are Heart Rate (HR), Heart Rate Variability (HRV) (Capdevila et al., 2008), or those obtained from blood test like myosins or cortisol. A subjective tool in terms of IL is the Rate of Perceived Exertion (RPE) or Borg scale (Muyor, 2013), which is defined as not invasive and ecological (Moreno Sánchez et al., 2013).

EL and IL are related, the first being defined as the external physical stimulus applied to the athlete during exercise or training (Soligard et al., 2016). Individual assessment of the relationships between the two loads offers specific information of each person as a specific tool for controlling its own adaptation processes and recovery (Martín-Guillaumes et al., 2018). With these variables, sports scientists or Physical Education graduates have the possibility of adjusting load according to individual responses (Foster et al., 2017). However, the analysis of these variables during the prescription process would allow to individually design exercises, and to better adapt the workloads to the required health objectives, individual needs, and pathology requirements (Zenko & Ekkekakis, 2015).

This systematic review aims to study the adherence and effectiveness of physical exercise and physical activity mHealth programs depending on its workload variables, communication channels and technological resources.

Methods

This systematic review was registered in PROSPERO (registration number: CRD42021270081) and was reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). Due to the methodological and statistical heterogeneity of the studies included, a descriptive approach has been adopted in the research synthesis (Rethlefsen et al., 2021).

Eligibility criteria

The inclusion criteria were randomized clinical trials performed from 2011 to 2021 that assessed effectiveness of and adherence to mHealth programs whose main outcome was to increase physical activity (PA) or physical exercise (PE). All interventions were prior to COVID-19. Interventions mainly based on changes in dietary patterns, mixed virtual and face-to-face interventions, non-controlled trials, letters to the editor, conference abstracts, books, and reviews were excluded. Methodological quality was rated depending on their risk of bias according to the Scottish Intercollegiate Guidelines Network Group (SIGN) grading system, as high (minimal risk of bias), good (moderate risk of bias) and fair (high risk of bias) methodological quality (Harbour & Miller, 2001). No studies were excluded on the basis of methodological quality.

Information sources

A systematic search was conducted in the following databases: PubMed, Science Direct, Scopus, Web of Science and Google Scholar. The survey period included all articles published from January 1, 2011 to August 30, 2021.

Search strategy

The search strategy included both controlled-vocabulary and free-text terms. The terms used were "physical activity", "physical exercise", "mHealth" and "eHealth" (see Table 1).

Study selection and data collection process

All identified references were imported into Mendeley v1.19.8 (Elsevier) and duplicates were eliminated. A total of 3 researchers undertook the review process, which was conducted in 3 stages. As a first step, the titles, abstracts, and

keywords of the relevant studies were screened by the authors. In the second step, the full-text articles were screened, while in the third step the reference lists of the included articles and of review articles on PA and PE prescription in mHealth were searched for additional articles. None of these were included. Any disagreement was discussed until consensus was reached.

A protocol was developed for data extraction from the articles. Information was extracted related to the article (author, year of publication), participants (number, gender, mean age), objective, pathology, intervention (description of intervention, duration, physical activity or exercise prescription, communication channel), workload variables, mHealth tools, results (conditioning, quality of life, adherence), and conclusions.

Results

Selection of the studies

A total of 403 potentially relevant publications were identified as eligible. After screening the titles and abstracts, 40 (9.9%) were accepted for full-text review. Out of these 40, 27 (67%) were excluded for not meeting the inclusion criteria: not presenting variables related to PA or PE, not describing the prescribed PE protocol (n = 3), prescription of PE with mixed care (face-to-face and virtual) (n = 5), not using a control group (n = 2) or using a PA protocol that did not meet the aim of the review (n = 16). After peer review, 13 articles were included in this non-quantitative review (see Figure 1; see Table 2).

Table 1

Search strategy for "Physical activity and physical exercise mHealth interventions".

Search engine	Strategy
PUBMED	((((physical activity[Title]) OR exercise[Title]) AND mhealth[Title]) OR ehealth[Title]) NOT diet[Title]) NOT dietaty[Title] Filters: Clinical Trial, Humans
SCIENCE DIRECT	(physical activity OR physical exercise) AND (mHealth OR eHealth) AND clinical trials AND humans NOT diet OR dietary
SCOPUS	Your query: ((physical activity OR physical exercise) AND (mHealth OR eHealth) AND clinical trials AND humans NOT diet OR dietary AND (LIMIT-TO (PUBYEAR,2021) OR LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT- TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012) OR LIMIT-TO (PUBYEAR,2011)) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (SUBJAREA,"MEDI") OR LIMIT-TO (SUBJAREA,"HEAL")) AND (LIMIT- TO (SRCTYPE,"j")))
GOOGLE SCHOLAR	allintitle:("physical activity" OR exercise) AND (mhealth OR ehealth) -diet -dietary
WEB OF SCIENCE	eHealth mhealth physical activity exercise



Figure 1 Identification of studies via databases and registers.

Table 2

Excluded studies after full-text review and reasons why they were excluded.

Study	Reason for exclusion
Pumper, M. A., Mendoza, J. A., Arseniev-Koehler, A., Holm, M., Waite, A., & Moreno, M. A. (2015). Using a Facebook group as an adjunct to a pilot mHealth physical activity intervention: a mixed methods approach. Annual Review of Cybertherapy and Telemedicine 2015, 97-101. PMID: 26799887	Outcome: quality assessment. Final outcomes other than efficacy, safety or effectiveness.
Wong, E. M., Leung, D. Y., Sit, J. W., & Leung, K. P. (2018). Home-based interactive e-health educational intervention for middle-aged adults to improve total exercise, adherence rate, exercise efficacy, and outcome: a randomised controlled trial. <i>Hong Kong medical journal= Xianggang yi xue za zhi, 24</i> (1), 34-38. PMID: 29938656	Outcome: quality assessment. Final outcomes other than efficacy, safety or effectiveness.
Van Dyck, D., Plaete, J., Cardon, G., Crombez, G., & De Bourdeaudhuij, I. (2016). Effectiveness of the self-regulation eHealth intervention 'MyPlan1. 0.' on physical activity levels of recently retired Belgian adults: a randomized controlled trial. <i>Health education research</i> , 31(5), 653-664. PMID: 27422898	Outcome: quality assessment. Final outcomes other than efficacy, safety or effectiveness
Lee, H., Uhm, K. E., Cheong, I. Y., Yoo, J. S., Chung, S. H., Park, Y. H., & Hwang, J. H. (2018). Patient satisfaction with mobile health (mHealth) application for exercise intervention in breast cancer survivors. <i>Journal of medical systems, 42</i> (12), 1-9. PMID: 30402781	Methodology: not controlled trial.
Feldman, D. I., Theodore Robison, W., Pacor, J. M., Caddell, L. C., Feldman, E. B., Deitz, R. L., & Blaha, M. J. (2018). Harnessing mHealth technologies to increase physical activity and prevent cardiovascular disease. <i>Clinical cardiology, 41</i> (7), 985-991. PMID: 29671879	Methodology: not controlled trial.
Aguilera, A., Figueroa, C. A., Hernandez-Ramos, R., Sarkar, U., Cemballi, A., Gomez-Pathak, L., Miramontes, J., Yom-Tov, E., Chakraborty, B., Yan, X., Xu, J., Modiri, A., Aggarwal, J., Jay Williams, J., & Lyles, C. R. (2020). MHealth app using machine learning to increase physical activity in diabetes and depression: Clinical trial protocol for the DIAMANTE Study. BMJ Open, 10(8). https://doi.org/10.1136/bmjopen-2019-034723	Methodology: study not concluded.
Krebs, P., Shtaynberger, J., McCabe, M., locolano, M., Williams, K., Shuk, E., & Ostroff, J. S. (2017). An eHealth intervention to increase physical activity and healthy eating in older adult cancer survivors: summative evaluation results. <i>JMIR cancer,</i> 3(1), e6435. PMID: 28410171	Out of scope: mHealth intervention based on dietary patterns and pathology.
Montoya, J. L., Wing, D., Knight, A., Moore, D. J., & Henry, B. L. (2015). Development of an mHealth intervention (iSTEP) to promote physical activity among people living with HIV. Journal of the International Association of Providers of AIDS Care (JIAPAC), 14(6), 471-475. PMID: 26307212	Out of scope: Not a mixed assistance (face-to-face and virtual) physical activity intervention.
Klausen, S. H., Mikkelsen, U. R., Hirth, A., Wetterslev, J., Kjærgaard, H., Søndergaard, L., & Andersen, L. L. (2012). Design and rationale for the PREVAIL study: Effect of e-Health individually tailored encouragements to physical exercise on aerobic fitness among adolescents with congenital heart disease — a randomized clinical trial. American heart journal, 163(4), 549-556. PMID: 22520519	Out of scope: Not a mixed assistance (face-to-face and virtual) physical activity intervention.

Table 2 (Continued)

Excluded studies after full-text review and reasons why they were excluded.

Study	Reason for exclusion
Pas, H. I. M. F. L., Pluim, B. M., Kilic, O., Verhagen, E., Gouttebarge, V., Holman, R., & Tol, J. L. (2020). Effectiveness of an e-health tennis-specific injury prevention programme: randomised controlled trial in adult recreational tennis players. <i>British journal of sports medicine, 54</i> (17), 1036-1041. PMID: 32001517	Out of scope: mHealth intervention sport injury prevention oriented.
Mailuhu, A. K., Verhagen, E. A., van Ochten, J. M., Bindels, P. J., Bierma-Zeinstra, S. M., & van Middelkoop, M. (2015). The trAPP-study: cost-effectiveness of an unsupervised e-health supported neuromuscular training program for the treatment of acute ankle sprains in general practice: design of a randomized controlled trial. <i>BMC musculoskeletal disorders, 16</i> (1), 1-8. PMID: 25887998	Out of scope: mHealth intervention sport injury prevention oriented.
O'Shea, O., Woods, C., McDermott, L., Buys, R., Cornelis, N., Claes, J., & Moran, K. (2020). A qualitative exploration of cardiovascular disease patients' views and experiences with an eHealth cardiac rehabilitation intervention: The PATHway Project. <i>PloS one, 15(7)</i> , e0235274. PMID: 32628688	Out of scope: Not a physical activity intervention.
Carney, R., & Firth, J. (2018). mHealth and Physical Activity Interventions Among People With Mental Illness. <i>In Exercise-Based Interventions for Mental Illness</i> (pp. 217-242). Academic Press. https://doi.org/10.1016/B978-0-12-812605-9.00012-5	Out of scope: mHealth intervention based on the effect on a pathology.
Griffin, J. B., Struempler, B., Funderburk, K., Parmer, S. M., Tran, C., & Wadsworth, D. D. (2020). My Quest, a Community-Based mHealth Intervention to Increase Physical Activity and Promote Weight Loss in Predominantly Rural-Dwelling, Low-Income, Alabama Women. <i>Family & community health, 43</i> (2), 131-140. PMID: 32079969	Out of scope: mHealth intervention based on dietary patterns
Wienert, J., Kuhlmann, T., Storm, V., Reinwand, D., & Lippke, S. (2019). Latent user groups of an eHealth physical activity behaviour change intervention for people interested in reducing their cardiovascular risk. <i>Research in Sports Medicine</i> , 27(1), 34-49. PMID: 30047785	Out of scope: Not a physical activity intervention.
Meyers, L., Ginocchio, C. C., Faucett, A. N., Nolte, F. S., Gesteland, P. H., Leber, A., & Poritz, M. A. (2018). Automated real-time collection of pathogen-specific diagnostic data: syndromic infectious disease epidemiology. <i>JMIR public health and surveillance, 4</i> (3), e9876. PMID: 29295808	Out of scope: Not a physical activity intervention.
Salvi, D., Ottaviano, M., Muuraiskangas, S., Martínez-Romero, A., Vera-Muñoz, C., Triantafyllidis, A., & Deighan, C. (2018). An m-Health system for education and motivation in cardiac rehabilitation: the experience of HeartCycle guided exercise. Journal of telemedicine and telecare, 24(4), 303-316. PMID: 28350282	Out of scope: Not a physical activity intervention.
Henry, B. L., & Moore, D. J. (2016). Preliminary findings describing participant experience with iSTEP, an mHealth intervention to increase physical activity and improve neurocognitive function in people living with HIV. Journal of the Association of Nurses in AIDS Care, 27(4), 495-511. PMID: 26847379	Out of scope: mHealth intervention based on the effect on a pathology.

Table 2 (Continued)

Excluded studies after full-text review and reasons why they were excluded.

Study	Reason for exclusion
Bogaerts, A., Ameye, L., Bijlholt, M., Amuli, K., Heynickx, D., & Devlieger, R. (2017). INTER-ACT: prevention of pregnancy complications through an e-health driven interpregnancy lifestyle intervention-study protocol of a multicentre randomised controlled trial. BMC pregnancy and childbirth, 17(1), 1-9. PMID: 28549455	Out of scope: Not a mixed assistance (face-to-face and virtual) physical activity intervention.
Van Den Berg, M., Crotty, M., Liu, E., Killington, M., Kwakkel, G., & Van Wegen, E. (2016). Early supported discharge by caregiver-mediated exercises and e-health support after stroke: a proof-of-concept trial. Stroke, 47(7), 1885-1892. PMID: 27301941	Out of scope: mHealth intervention based on the effect on a pathology.
Van der Meij, E., Anema, J. R., Leclercq, W. K., Bongers, M. Y., Consten, E. C., Koops, S. E. S., & Huirne, J. A. (2018). Personalised perioperative care by e-health after intermediate-grade abdominal surgery: a multicentre, single-blind, randomised, placebo-controlled trial. <i>The Lancet, 392</i> (10141), 51-59. PMID: 29937195	Out of scope: mHealth intervention rehabilitation oriented.
Koziol-McLain, J., McLean, C., Rohan, M., Sisk, R., Dobbs, T., Nada-Raja, S., & Vandal, A. C. (2016). Participant recruitment and engagement in automated eHealth trial registration: challenges and opportunities for recruiting women who experience violence. Journal of medical internet research, 18(10), e281. PMID: 27780796	Out of scope: Not a physical activity intervention.
Helle, C., Hillesund, E. R., Wills, A. K., & Øverby, N. C. (2019). Examining the effects of an eHealth intervention from infant age 6 to 12 months on child eating behaviors and maternal feeding practices one year after cessation: The Norwegian randomized controlled trial Early Food for Future Health. <i>PloS one, 14</i> (8), e0220437. PMID: 31442241	Out of scope: Not a physical activity intervention.
Lally, R. M., Kupzyk, K. A., Bellavia, G., Hydeman, J., Gallo, S., Helgeson, V. S., & Brown, J. K. (2020). CaringGuidance™ after breast cancer diagnosis eHealth psychoeducational intervention to reduce early post-diagnosis distress. Supportive Care in Cancer, 28(5), 2163-2174. PMID: 31414245	Out of scope: Not a mixed assistance (face-to-face and virtual) physical activity intervention.
Wagenaar, K. P., Broekhuizen, B. D., Jaarsma, T., Kok, I., Mosterd, A., Willems, F. F., & Rutten, F. H. (2019). Effectiveness of the European Society of Cardiology/ Heart Failure Association website 'heartfailurematters. org'and an e health adjusted care pathway in patients with stable heart failure: results of the 'e Vita HF'randomized controlled trial. <i>European journal of heart failure, 21</i> (2), 238-246. PMID: 30485612	Out of scope: Not a physical activity intervention.
Watson, N. L., Mull, K. E., Heffner, J. L., McClure, J. B., & Bricker, J. B. (2018). Participant recruitment and retention in remote eHealth intervention trials: methods and lessons learned from a large randomized controlled trial of two web-based smoking interventions. <i>Journal of medical Internet research, 20</i> (8), e10351. PMID: 30143479	Out of scope: Not a mixed assistance (face-to-face and virtual) physical activity intervention.
Vloothuis, J. D., Mulder, M., Nijland, R. H., Goedhart, Q. S., Konijnenbelt, M., Mulder, H., & Kwakkel, G. (2019). Caregiver-mediated exercises with e-health support for early supported discharge after stroke (CARE4STROKE): A randomized controlled trial. <i>PloS one, 14</i> (4), e0214241. PMID: 30958833	Out of scope: mHealth intervention based on dietary patterns.

Table 3

Characteristics of the selected studies.

Author (year)	Country	Population	Intervention	Outcomes	Quality	Limitations
Choi et al., 2015	United States of America	30 inactive pregnant women aged 33.7 ± 2.6 years, between 10 and 20 weeks of gestation. 56% belonged to ethnic minorities.	12-week intervention with a mobile phone application developed by a research team and Fitbit Ultra. Women were asked to increase their steps by 10% each week until they reached at least 8,500 steps/day, 5 days or more per week. A daily text message or short video script was sent, to support PA or to reinforce their prescheduled weekly goal.	The change between groups in weekly mean steps per day was not statistically significant. The intervention group reported lower perceived barrier to being active, lack of energy ($p = .02$). The rates of responding to daily messages and using the diary through the mobile app declined during the study period.	Fair	Findings may not be generalizable due to the small size of the sample and to non-English speakers or women who are not motivated to use those technologies. Self- perceived scales are not defined. No CONSORT criteria.
Duscha et al., 2018a	United States of America	25 cardiac rehabilitation adult patients. An mHealth group (n = 16) aged 59.9 ± 8.1 years, 81.2% of which were male. Usual care group (n = 9) aged 66.5 ± 7.2 years of which 66.7% were male.	12-week mHealth program was implemented using physical activity trackers and health coaching. Patients were randomized into mHealth or usual care after completing cardiac rehabilitation.	The combination of a 4.7 \pm 13.8% increase in the mHealth and a 8.5 \pm 11.5% decrease in the usual care group resulted in a difference between groups ($p \le .05$) for absolute peak VO ² . The divergent changes between intervention and control group in moderate-high physical activity minutes/ week were significant (21 \pm 103 vs – 46 \pm 36; $p < .05$).	Fair	Previous fitness levels, activity levels, socioeconomic status or comorbidities of this group are not defined. The results can't be generalized. No internal load parameters included on the research. No CONSORT criteria.
Duscha et al., 2018b	United States of America	20 adult and elderly peripheral artery disease patients with peripheral artery disease with intermittent claudication, aged 69.4 ± 8.4 years. 84,2% were male.	12-week mHealth intervention consisting of patient education, smartphones, and physical activity trackers.	Intervention patients significantly increased peak VO ² from 15.2 ± 4.3 to 18.0 ± 4.8 ml/kg/min ($20.3 \pm 26.4\%$; $p \le .05$), while control ones did not change from 14.3 ± 5.4 to 14.5 ± 5.7 ml/ kg/min ($1.0 \pm 6.9\%$; NS).	Fair	Sample size was little. Results can't be generalized. Age and weight of the usual care group could affect the results. No internal load parameters included on the research. No CONSORT criteria.
Ellis et al., 2019	United States of America	51 adult and elderly mild- to-moderately severe (Hoehn and Yahr stages 1–3) idiopathic Parkinson Disease patients, aged 64.1 ± 9.5 years. 45.1% women, and 100% white.	1-year mHealth-mediated exercise strengthening, stretching and walking program, with a pedometer plus engagement in planned exercise supported by a mobile health application was compared with an active control condition (walking with a pedometer and exercise only).	Both groups increased daily steps, moderate-intensity minutes, and 6-Minute Walk Test, with non-statistically significant between-group differences. The less active subgroup changes in daily steps and moderate-intensity minutes were clinically meaningful. There was a statistical improvement in the Parkinson Disease Questionnaire 39 mobility score in intervention overall comparison.	Fair	Further study in a larger group of people with low activity baseline is needed. More measures would offer a longitudinal data of the program outcomes and patients' behavior. Strength program data is not registered. No internal load parameters included on the research. No CONSORT criteria.

Table 3 (Continued)

Characteristics of the selected studies.

Author (year)	Country	Population	Intervention	Outcomes	Quality	Limitations
Gomez Quiñonez et al., 2016	Netherlands	373 Dutch adults, ≥1 year post cancer therapy, aged 38.69 ± 11.99 years. 69.2% women.	6-month intervention where all participants were asked to complete questionnaires at the 5 points in time baseline (after 1 week, after 2 weeks, after 3 weeks, and after 6 months). Participants in the eHealth and mHealth group received fully automated tailored feedback messages about their current level of PA. Followed CONSORT criteria	Participants receiving feedback messages were significantly more physically active after 6 months than participants in the control group (B = 8.48, df = 2, P = .03, Cohen $d = 0.27$)	Fair	All outcome measures were self- reported. The process analyses were not accompanied by qualitative measurements. No internal load parameters included on the research
Hart et al., 2017	United States of America	15 inactive to moderate active rural college students	Intervention components lasted four weeks. The eHealth group received four week-long health education modules via a campus- based website. Each weekly module consisted of lecture slides and a short multiple-choice quiz. The mHealth group also received four week-long modules with similar content as eHealth but with use of instant messaging and Facebook.	Positive values indicate improvement with exception of BMI, PBF, perceived control over physical activity, and sitting time. mHealth made improvement on all physical fitness measures. Also, mHealth made more improvement on physical activity measures than either eHealth or control.	Fair	Small size of the sample. Gender not defined. The control group did not receive any education that could affect a behavioral effect. No CONSORT criteria
Klaussen et al., 2016	Denmark	158 adolescents (66 girls, 92 boys), aged 13–16 (intervention group 14.6 \pm 1.3; control group 14.6 \pm 1.2) years with no physical activity restrictions after repaired complex congenital heart disease.	A 52-week Internet, mobile application, and SMS-based program delivering individually tailored text messages to encourage physical activity. Patients were asked to wear the accelerometer from 6 AM to 10 PM for two weekends and four weekdays. The patients could monitor their results and goals on a personal website. Followed CONSORT criteria.	The difference between the intervention group and the control group in mean VO ² peak at 1 year was -0.65 ml/kg-1·min-1 (95% CI -2.66 to 1.36). Between group differences at 1 year in physical activity, generic health-related quality of life, and disease-specific quality of life were not statistically significant.	Fair	Just 75% of the sample (119 subjects) finished the intervention. The intervention did not allow for interaction between patients due to concerns regarding safeguarding minors on the Internet.
Martin et al., 2015	United States of America	48 mActive adults and elderly outpatients (46% women, 21% nonwhite) aged 58 ± 8 years	After establishing baseline activity during a blinded run-in (week 1), in phase I (weeks w2 to 3), we randomized 2:1 to unblinded versus blinded tracking. Unblinding allowed continuous access to activity data through a smartphone interface. Followed CONSORT criteria.	Participants receiving texts increased their daily steps over those not receiving texts by 2,534 (95% Cl, 1,318 to 3750; P < .001) and over blinded controls by 3,376 (95% Cl, 1,951 to 4,801; P < .001)	Fair	The mActive trial lends support to the notion of new mHealth devices as facilitators, not drivers, of behavior change, because sequential randomization suggested that unblinding to device data did not significantly modify behavior, whereas coupling it with smart texts did. Not internal load parameters included on the research.

Table 3 (Continued)

Characteristics of the selected studies.

Author (year)	Country	Population	Intervention	Outcomes	Quality	Limitations
Mendoza et al., 2017	United States of America	59 adolescents and young adults, \geq 1 year post cancer therapy, aged 16.6 ± 1.5 years. 59.3% women, and 71.2%, non- Hispanic white.	The 10-week intervention consisted of a wearable physical activity-tracking device (Fitbit Flex) and a peer-based virtual support group (Facebook group). Research staff helped set step goals and awarded badges weekly.	Some modest differences were found for select subscales of quality of life and motivation for physical activity.	Fair	Social network not active for this group age. Few external parameters. Not internal load parameters included on the research. No CONSORT criteria.
Shcherbina et al., 2019	United States of America	2,783 adults, mean age of users was 44.4 years (SD 7.5), 73.5% men, and of those who reported ethnicity, 86.6% self- identified as white.	7-day intervention consisted of daily prompts to complete 10,000 steps and to stand following 1 h of sitting. Instructions to read the guidelines from the American Heart Association website, or e-coaching based upon the individual's personal activity patterns from the baseline week of data collection.	All interventions significantly increased mean daily step count from baseline.	Fair	Despite the large size of the sample, it is too heterogeneous and conditioned by the app download self-intention. No CONSORT criteria.
Uhm et al., 2016	Korea	365 breast cancer patients, aged 50.3 ± 9.5 years, whose treatment had been terminated when enrolled.	12 week aerobic and resistance exercise intervention. The mHealth group received a pedometer and a newly smartphone app to provide information and monitor prescribed exercises.	Physical function, physical activity and quality of life were significantly improved regardless of the intervention method, and changes were not significantly different between the two groups.	Good	Workload values are not reported during the intervention. NO CONSORT criteria.
Vasankari et al., 2019	Finland	540 patients scheduled for elective coronary artery bypass grafting, aortic valve replacement or mitral valve repair.	Postsurgical rehabilitation personalised physical guidance during 90 days after discharge, receiving personalized daily goals, via application. Feedback of accomplishing their activity goals will be given and customized by the physiotherapy team.	Change was observed in mean daily step count between the baseline and 3 and 12 months after hospital discharge.	Low	Detailed data from the sample not provided. Baseline values may differ from patients' normal habitual activity profiles. Many patients have comorbidities during their postoperative rehabilitation. No internal load parameters included on the research. No CONSORT criteria.
Vorrink et al., 2016	Netherlands	157 adults and elderly subjects (79 women, 78 men), aged 62 ± 9 years for the intervention group and 63 ± 8 for the control group, diagnosed with chronic obstructive lung disease.	Multicenter intervention of 6 months duration, consisted of a smartphone application for the patients and a monitoring website for the physiotherapists. Physical activity, functional exercise capacity, lung function, health- related quality of life and body mass index were assessed. Subjects were persuaded to achieve their personalized physical activity goal by automated persuasive messages and an emoticon. Followed CONSORT criteria.	There were no significant positive effects of the intervention on physical activity. There was a significant decrease over time in physical activity ($p < .001$), lung function ($p < .001$) and mastery ($p = .017$), but not in functional exercise capacity ($p = .585$).	Low	Drop-out in the intervention group was 39%. Worries about the smartphone were reasons for patients to drop out of the study. Patients might have received insufficient support to adhere to the personalized PA goals. The sample was designed with different population groups and did not measure baseline values at the start of the program.

The main characteristics of the 13 studies included are set out in Table 3. Studies appear in alphabetical order of the first author within chronological years. All the selected studies focused on mHealth interventions to identify their effectiveness, PA load variables, technology, and communication channels. All studies were clinical trials. All studies were compared pre and post outcomes to analyze the effectiveness of the intervention, but just 4 of them (30%) followed the CONSORT criteria (Hopewell et al., 2008). According to SIGN criteria, the majority of the studies were of low quality (n = 12), with only one of good quality. A fair quality rating most often resulted from small sample size, inadequate length of study, or possible selection and information bias.

The studies presented have a high clinical heterogeneity, according to the number of participants in the trials, the type of pathologies and the duration of the intervention (Page et al., 2021). The number of participants ranged from 15 to 2,783 and just over half of the studies (n = 7) included less than 100 people. Most studies had a majority of adult participants (n = 10); in 4, the participants were adolescents or young adults, and in 2 they were women. Out of the 13 clinical studies included in the analysis, 4 were related to cardiac illness (Duscha et al., 2018a; Duscha et al., 2018b; Klausen et al., 2016; Vansankary et al., 2019), 3 to cancer (Mendoza et al., 2017; Quiñonez et al., 2016; Uhm et al., 2017), 1 to pulmonary disease (Vorrink et al., 2016b), 1 to Parkinson's disease (Ellis et al., 2019), and 4 to the promotion of PA in sedentary people (Hart et al., 2020; Shcherbina et al., 2019), general population (Martin et al., 2015), and pregnant women (Choi et al., 2016).

The studies were conducted over periods of a week (n = 2), four weeks (n = 1), 10 weeks (n = 1), 12 weeks (n = 4) 90 days (n = 1), six months (n = 1), or a year (n = 3). The countries where the studies were carried out were the United States (n = 10), the Netherlands (n = 2), Finland (n = 1), and Germany (n = 1).

Effectiveness of intervention

With regard to the effectiveness of the intervention in PArelated terms, the final results in 9 cases (70%) showed differences in improvement within the experimental group. Out of these, 7 (54%) showed improvements in relation to an increase in PA before and after the intervention, 1 (80%) only in relation to physical fitness, and 1 (8%) only in relation to the quality of life (QoL) of its participants. In 4 studies (30%), no differences were found between the mHealth intervention group and the face-to-face or mixed groups.

With reference to pathologies, the four studies related to heart disease presented differing results: in two of them, an improvement in PA was observed; in a third one, an improvement only in physical fitness (VO₂max), and in the fourth one no differences between the study groups were reported. Nor were differences shown in terms of effectiveness of the mHealth intervention in the studies conducted with Parkinson's patients, breast cancer survivors, or elderly women.

Adherence to physical activity

Eleven of the 13 studies (85%) concluded that mHealth prescription is more effective within the control group, and 2 (15%) that it shows no differences or it is worse in relation to face-to-face or mixed options. The results of one of these two studies could be affected by the unwillingness of the participants to use the technologies and communication channels proposed.

Workload variables used in the physical activity and physical exercise mHealth interventions

Regarding the variables used to assess workload, the results obtained showed that in the case of EL all the trials presented were based on quantifying the volume of steps or time (in minutes or hours) per day or per week, regardless of the disease and the population group in the sample. With respect to these quantitative variables, some cases offered variables related to intensity according to average values (5 out of 13, 38%), considering this a defining variable of intensity. IL was taken as referring to work intensity in 5 out of 13 cases (38%), of which 1 (7% of the total) presented an objective physical variable, heart rate (HR), and 3 (23% of the total) used an arbitrary unit (a.u.). Only 1 study (7%) used a subjective variable: rate of perceived exertion (RPE).

Communication channels and technological resources

During the interventions, various mechanisms were established to communicate with the patients. Nine of the studies (69%) were based on the use of mobile phones, 4 of these (31%) using apps designed specifically for the intervention and 2 (15%) by means of websites as an additional channel, while 6 (46%) of the studies provided their patients with information by text messaging (SMS). Two studies (15%) used Facebook for this purpose.

With regard to technological resources and tools for obtaining information, 8 of the 13 studies (62%) were based on personalized questionnaires which made it possible to ascertain the patients' initial and final state. Monitoring of the workloads used in the interventions was performed, in turn, in 8 of the studies (62%): 3 using accelerometers (23%), a further 3 with the FitBit® wristband and 2 with pedometers (15%).

Discussion

Main findings

In this systematic review, we identified a greater effectiveness of and adherence to PA or PE prescription programs using digital devices than in those prescribed in person or without technological support. Workload was evaluated using variables of a quantitative and non-specific nature. Out of the variables used, EL was evaluated, in most cases, through total steps per day or minutes of PA or PE per day, while IL was evaluated in 5 of the 13 results obtained. The most commonly used technological resources were specific applications and the FitBit® wristband. The main communication channels were SMS and Facebook.

Effectiveness of PA and PE prescription for health (Muellmann et al., 2018) was assessed in terms of adherence to practicing PA and education in habits related to it (Wong et al., 2018), as well as the intent to improve and continue these habits (Shcherbina et al., 2019). Although the effectiveness criterion was not standardized, only 2 trials concluded that mHealth prescription was less effective or no better in the experimental groups than in the control groups (Quiñonez et al., 2016; Vorrink et al., 2016) and the remaining 11 concluded that mHealth prescription offered greater feasibility or effectiveness. These were notable for using and recording variables to determine whether or not there was an improvement in the patients' satisfaction (Lee et al., 2018) and confidence (Partridge et al., 2017) in terms of QoL, as reflected in four of the studies presented here (Ellis et al., 2019; Mendoza et al., 2017; Uhm et al., 2017; Vorrink et al., 2016).

Workload can be evaluated using a range of variables, but the results obtained here show that in the case of EL all the studies presented are based on quantifying the volume of steps or time (in minutes or hours) per day or per week, regardless of the disease and the population group in the sample. With respect to these quantitative variables, some cases offered variables related to intensity according to average values (Duscha et al., 2018a; Duscha et al., 2018b; Ellis et al., 2019; Klausen et al., 2016; Mendoza et al., 2017), considering this a defining variable of intensity. For this purpose, IL should be applied (Soligard et al., 2016), and five studies do take it as a benchmark. One of them presented an objective physiological variable, HR (Klausen et al., 2016), identifying possible contraindications for adolescent patients with heart disease included in the study, and

three used an arbitrary unit (a.u.), such as metabolic equivalents (METs) (Uhm et al., 2017; Vasankari et al., 2019; Vorrink et al., 2016). Only one study, with pregnant women, used a subjective variable: RPE (Choi et al., 2016). This individual variable was reliable in the health field (Utter et al., 2004) and was also applicable to a range of diseases (Fernández Lao et al., 2009).

In this context, the diagnosis determined the prescription (Paglialonga et al., 2018), but the individualization of the program (Duscha et al., 2018a) was defined both by patients' habits with respect to PA and PE (Chodzko-Zajko et al., 2009) and by their initial physical capacity (Foster et al., 2017). For the purposes of the former, the studies presented here asked their participants to complete a series of validated questionnaires before starting the intervention, most notably the International Physical Activity Questionnaire (IPAQ) (Yu et al., 2015). However, none of them conducted a follow-up during the process in relation to PA or PE and issues of a behavioral or cognitive nature (Griffin et al., 2020), information that could be provided by the exercise questionnaire based on Prochaska and DiClemente's transtheoretical model (Leyton et al., 2019) or a perceived quality of life questionnaire, such as COOP/WONCA (Van Weel et al., 2012). This factor was explored by four of the studies (Ellis et al., 2019; Mendoza et al., 2017a; Uhm et al., 2017; Vorrink et al., 2016), but only at the end of the intervention. The same pattern was repeated in relation to patients' capacity. Only one study with heart patients (Vasankari et al., 2019) adapted PA prescription to each patient's initial capacity. Ecological tests for this purpose could enable us to determine initial values in terms of volume, such as the Six-Minute Walk Test (Segura-Ortí & Martínez Olmos, 2009), which is reliable and adaptable to outpatients (Cabedo & Garcés, 2010), or the UKK test (Laukkanen et al., 2000). In any case, these must be able to be modulated to the prescribed needs, and the Talk Test (Reed & Pipe, 2014) may be an applicable tool in this area. Baseline improvement must be carried out during the process, as was done in a study with respiratory disease patients (Vorrink et al., 2016a) and another with Parkinson's disease sufferers (Ellis et al., 2019).

The recording of these variables may be affected by the technological resource used during the intervention. In terms of quality and reliability, the outstanding option was the accelerometer (Rowlands & Eston, 2007), since it offered information on both the volume and the intensity of PA and PE. A limitation of this resource was that it requires a certain level of financial investment. It has been used in studies with respiratory pathologies (Vasankari et al., 2019; Vorrink et al., 2016) and with heart disease in adolescent patients (Klausen et al., 2012) as well as for the general population (Martin et al., 2015). A commercial product for recording PA and PE, the FitBit® wristband wearable tracking device, was used for recording load variables in studies with adolescent cancer survivors (Mendoza et al., 2017) and pregnant women (Choi et al., 2016), as well as older adults and people of advanced age with pulmonary diseases (Duscha et al., 2018b). This diversity of population groups is a notable feature (Powell & Deetjen, 2019; Shcherbina et al., 2019). The pedometer, a more affordable resource, was used in two cases: with adult Parkinson's disease patients (Ellis et al., 2019) and with women who had survived breast cancer (Uhm et al., 2017).

However, the communication channel may circumscribe the capacity and individualization of the intervention if it does not allow records to be updated (Sohaib Aslam et al., 2020), which could improve patient involvement (Klausen et al., 2012), as well as enhancing the conduct of the intervention (Eckerstorfer et al., 2018) in terms of managing workload prescription. Most of the studies (9) developed smartphone apps to communicate and to update the work plan individually on the basis of the achievements attained or the activity carried out, and 8 used SMS text messages to update or recall the information. Two studies, one in young adults with no definite pathology (Hart et al., 2020) and another one in older adult cancer survivors (Mendoza et al., 2017), used the social media platform Facebook and two used a website specially created for the intervention (Quiñonez et al., 2016; Vorrink et al., 2016). One of those that used Facebook (Hart et al., 2020) also used quizzes to encourage adherence among its young adult users (Wong et al., 2018), but in no case did the studies make use of a current resource such as pervasive games (Santos et al., 2021). In this context, the greatest limitations of the studies were found, since the technical problems arising from connectivity, use and understanding of the technology have been described as one of the causes of patients abandoning interventions (Klausen et al., 2016; Vorrink et al., 2016). Practically all the trials used technological options to explain their programs, some to improve motivation though personalized messages with this aim (Shcherbina et al., 2019; Vasankari et al., 2019), but only two (Hart et al., 2020; Mendoza et al., 2017a) through socialization (Short et al., 2018), although in

one of these cases, with older adult patients, the social network used —Facebook— was not in keeping with their generation. In this connection, only one of the studies, in which no differences were observed between the mHealth intervention and the control groups, presented the results as having been affected by the reluctance of the participants to use technological options and their low participation (Klausen et al., 2016). Similarly, another study, which obtained positive results in relation to an improvement in the values for the patients' adherence to PA, highlights the need to modify communication channels, in view of how participation in the program decreased in the course of the intervention (Choi et al., 2016).

This systematic review has certain limitations inherent in the novelty of the subject addressed, as the number of clinical studies that met the inclusion criteria was limited. In addition, given the diversity of the pathologies and the ages and sociocultural circumstances of the population groups, the results presented are only exploratory. The low quality of the studies according to the SIGN criteria, few numbers of variables recorded, especially for IL, their heterogeneity, and the lack of consensus on the definition of concepts such as the effectiveness of the intervention mean that these data must be considered preliminary, while reflecting the need for future lines of research in this area.

In conclusion, mHealth interventions showed greater effectiveness and adherence compared to those prescribed in person or without technological support. However, workload was assessed by quantitative and non-specific parameters, and no interventions designed specifically for the needs or technological abilities of their target population were observed.

Practical Applications

A line of research has been established for improving PE prescription in the field of mHealth. Prescription of PA and PE must be validated with attention to individual needs, defined by pathologies, prescribed according to medical criteria and baseline physical fitness, and designed taking into account the patients' technological abilities. Physical activity and physical exercise must be prescribed by professionals with a certified expertise in health and PA and PE adaptations. More effective PE prescription would make it possible to reach a larger population, as well as reduce treatment costs and manage the process more flexibly (Watson, 2020).

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References

- Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J.P., Chastin, S., Chou, R., Dempsey, P.C., Di Pietro, L. Ekelund, U., Firth, J., Friedenreich, C.M., Garcia, L., Gichu, M., Jago, R., Katzmarzy P.T., Lambert, E., Leitzmann, M., Milton, K., Ortega, F.B., Ranasinghe, Ch., Stamatakis, E., Tiedemann, A., Troiano, R.P., P van der Ploeg, H., Wari, V. & Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British journal of sports medicine*, 54(24), 1451-1462. http://dx.doi.org/10.1136/bjsports-2020-102955
- Cabedo, V. R., & Garcés, C. R. (2010). ¿Es útil la prueba de la marcha durante 6 min en Atención Primaria? *Semergen*, 36(5), 259–265. https://doi.org/10.1016/j.semerg.2009.06.002
- Capdevila, L., Rodas, G., Ocaña, M., Parrado, E., Pintanel, M., & Valero, M. (2008). Variabilitat de la freqüència cardíaca com a indicador de salut en esport: validació amb un qüestionari de qualitat de vida (SF-12). *Apunts. Medicina de l'Esport, 158*, 62–69. https://doi.org/10.1016/S1886-6581(08)70073-2
- Chodzko-Zajko, W. J., Proctor, D. N., Fiatarone Singh, M. A., Minson, C. T., Nigg, C. R., Salem, G. J., & Skinner, J. S. (2009). Exercise and physical activity for older adults. *Medicine and Science in Sports and Exercise*, 41(7), 1510–1530. https://doi.org/10.1249/MSS.0b013e3181a0c95c
- Choi, J., Lee, J. H., Vittinghoff, E., & Fukuoka, Y. (2016). mHealth Physical Activity Intervention: A Randomized Pilot Study in Physically Inactive Pregnant Women. *Maternal and Child Health Journal*, 20(5), 1091–1101. https://doi.org/10.1007/s10995-015-1895-7
- Duscha, B. D., Piner, L. W., Patel, M. P., Craig, K. P., Brady, M., McGarrah, R. W., Chen, C., & Kraus, W. E. (2018a). Effects of a 12-week mHealth program on peak VO 2 and physical activity patterns after completing cardiac rehabilitation: A randomized controlled trial. *American Heart Journal*, 199, 105–114. https://doi.org/10.1016/j.ahj.2018.02.001
- Duscha, B. D., Piner, L. W., Patel, M. P., Crawford, L. E., Jones, W. S., Patel, M. R., & Kraus, W. E. (2018b). Effects of a 12-Week mHealth Program on Functional Capacity and Physical Activity in Patients With Peripheral Artery Disease. *American Journal of Cardiology*, 122(5), 879–884. https://doi.org/10.1016/j.amjcard.2018.05.018
- Eckerstorfer, L. V., Tanzer, N. K., Vogrincic-Haselbacher, C., Kedia, G., Brohmer, H., Dinslaken, I., & Corcoran, K. (2018). Key elements of mHealth interventions to successfully increase physical activity: Meta-regression. *JMIR MHealth and UHealth*, 6(11). https://doi.org/10.2196/10076
- Ellis, T. D., Cavanaugh, J. T., DeAngelis, T., Kathryn Hendron, K., Thomas, C. A., Saint-Hilaire, M., Pencina, K., & Latham, N. K. (2019). Comparative effectiveness of mHealth-supported exercise compared with exercise alone for people with Parkinson disease: Randomized controlled pilot study. *Physical Therapy*, 2019; *99*:203-216. https://doi.org/10.1093/ptj/pzaa061

- Fernández Lao, C., Valenza, M. C., García Ríos, M. C., & Valenza, G. (2009). Estudio de la disnea según la escala de Borg en un grupo de pacientes diagnosticados de asma bronquial que han seguido y recibido entrenamiento de fisioterapia respiratoria. *Fisioterapia*, 31(1), 12–16. https://doi.org/10.1016/j.ft.2008.01.004
- Foster, C., Rodriguez-Marroyo, J. A., & De Koning, J. J. (2017). Monitoring training loads: the past, the present, and the future. *International journal of sports physiology and performance*, 12(s2), S2-2. https://doi.org/10.1123/ijspp.2016-0388.
- Griffin, J. B., Struempler, B., Funderburk, K., Parmer, S. M., Tran, C., & Wadsworth, D. D. (2020). *My Quest*, a Community-Based mHealth Intervention to Increase Physical Activity and Promote Weight Loss in Predominantly Rural-Dwelling, Low-Income, Alabama Women. *Family and Community Health*, 43(2), 131– 140. https://doi.org/10.1097/FCH.00000000000251
- Harbour, R., & Miller, J. (2001). A new system for grading recommendations in evidence based guidelines. *Bmj*, 323(7308), 334-336. https://doi.org/10.1136/bmj.323.7308.334
- Hart, P. D., Benavidez, G., Potter, A., Rech, K., Budak, C. M., Auzenne, C., Failing, J., Kirkaldie, T., Lonebear, M., Miller, L., Auzenne, C., Failing, J., Kirkaldie, T., Lonebear, M., Miller, L., & Randomized, A. P. (2017). A Pilot Randomized Controlled Trial to Promote Physical Activity and Change Fitness Scores in Rural College Students: The Northern eHealth/ mHealth Trial (N-EMT). 5(1), 43–48. https://doi.org/10.12691/jpm-5-1-6
- Hopewell, S., Clarke, M., Moher, D., Wager, E., Middleton, P., Altman, D.G., Schulz, K.F. & the CONSORT Group. (2008) CONSORT for Reporting Randomized Controlled Trials in Journal and Conference Abstracts: Explanation and Elaboration. PLOS Medicine 5(1): e20. https://doi.org/10.1371/journal.pmed.0050020
- Klausen, S. H., Andersen, L. L., Søndergaard, L., Jakobsen, J. C., Zoffmann, V., Dideriksen, K., Kruse, A., Mikkelsen, U. R., & Wetterslev, J. (2016). Effects of eHealth physical activity encouragement in adolescents with complex congenital heart disease: The PReVaiL randomized clinical trial. *International Journal of Cardiology*, 221, 1100–1106. https://doi.org/10.1016/j.ijcard.2016.07.092
- Klausen, S. H., Mikkelsen, U. R., Hirth, A., Wetterslev, J., Kjærgaard, H., Søndergaard, L., & Andersen, L. L. (2012). Design and rationale for the PREVAIL study: Effect of e-Health individually tailored encouragements to physical exercise on aerobic fitness among adolescents with congenital heart disease - a randomized clinical trial. *American Heart Journal*, 163(4), 549–556. https://doi.org/10.1016/j.ahj.2012.01.021
- Laukkanen, R. M. T., Kukkonen-Harjula, T. K., Oja, P., Pasanen, M. E., & Vuori, I. M. (2000). Prediction of change in maximal aerobic power by the 2-km walk test after walking training in middle-aged adults. *International journal of sports medicine*, 21(02), 113-116. https://doi.org/10.1055/s-2000-8872
- Lee, H., Uhm, K. E., Cheong, I. Y., Yoo, J. S., Chung, S. H., Park, Y. H., Lee, J. Y., & Hwang, J. H. (2018). Patient Satisfaction with Mobile Health (mHealth) Application for Exercise Intervention in Breast Cancer Survivors. *Journal of Medical Systems*, 42(12), 254. https://doi.org/10.1007/s10916-018-1096-1
- Leyton, M., Batista, M., Lobato, S., & Jimenez, R. (2019). Validación del cuestionario del modelo transteórico del cambio de ejercicio físico. *Revista internacional de medicina y ciencias de la actividad física y del deporte*, 19(74), 329-350. http://doi.org/10.15366/rimcafd2019.74.010
- Martín-Guillaumes, J., Caparrós, T., Cruz-Puntí, D., Montull, L., Orriols, G., & Capdevila, L. (2018). Psychophysiological monitoring of the recovery process in the elite athletes of the Spanish National Ski Mountaineering Team through the RMSSD and the subjective perception of recovery. *Revista Iberoamericana de Psicología del Ejercicio y el Deporte*, 13(2), 219-223.

- Martin, S. S., Feldman, D. I., Blumenthal, R. S., Jones, S. R., Post, W. S., McKibben, R. A., Michos, E. D., Ndumele, C. E., Ratchford, E. V., Coresh, J., & Blaha, M. J. (2015). mActive: A randomized clinical trial of an automated mHealth intervention for physical activity promotion. *Journal of the American Heart Association*, 4(11). https://doi.org/10.1161/JAHA.115.002239
- Mendoza, J. A., Baker, K. S., Moreno, M. A., Whitlock, K., Abbey-Lambertz, M., Waite, A., Colburn, T., & Chow, E. J. (2017). A Fitbit and Facebook mHealth intervention for promoting physical activity among adolescent and young adult childhood cancer survivors: A pilot study. *Pediatric Blood and Cancer*, 64(12), 1–9. https://doi.org/10.1002/pbc.26660
- Moreno, J., Cervantes, J., Parrado, E., & Ll, C. (2013). Variabilidad de la frecuencia cardíaca y perfiles psicofisiológicos en deportes de equipo de alto rendimiento. *Revista de Psicología del Deporte*, 22(2), 345-352. https://ddd.uab.cat/record/114200
- Muellmann, S., Forberger, S., Möllers, T., Bröring, E., Zeeb, H., & Pischke, C. R. (2018). Effectiveness of eHealth interventions for the promotion of physical activity in older adults: A systematic review. *Preventive Medicine*, 108(November 2017), 93–110. https://doi.org/10.1016/j.ypmed.2017.12.026
- Mujika, I. (2017). Quantification of training and competition loads in endurance sports: methods and applications. *International journal of sports physiology and performance*, *12*(s2), S2-9. https://doi.org/10.1123/ijspp.2016-0403
- Muyor, J. M. (2013). Exercise intensity and validity of the ratings of perceived exertion (Borg and OMNI Scales) in an indoor cycling session. *Journal of Human Kinetics*, 39(1), 93–101. https://doi.org/10.2478/hukin-2013-0072
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness; L.A., Stewart, L.A., Thomas, J., Tricco, A.C., Welch, V.A., Whiting, P. & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Systematic reviews*, 10(1), 1-11. https://doi.org/10.1186/s13643-021-01626-4
- Paglialonga, A., Lugo, A., & Santoro, E. (2018). An overview on the emerging area of identification, characterization, and assessment of health apps. *Journal of Biomedical Informatics*, 83(May), 97–102. https://doi.org/10.1016/j.jbi.2018.05.017
- Partridge, S. R., McGeechan, K., Bauman, A., Phongsavan, P., & Allman-Farinelli, M. (2017). Improved confidence in performing nutrition and physical activity behaviours mediates behavioural change in young adults: Mediation results of a randomised controlled mHealth intervention. *Appetite*, 108, 425–433. https://doi.org/10.1016/j.appet.2016.11.005
- Powell, J., & Deetjen, U. (2019). Characterizing the digital health citizen: Mixed-methods study deriving a new typology. *Journal of Medical Internet Research*, 21(3). https://doi.org/10.2196/11279
- Quiñonez, S. G., Walthouwer, M. J. L., Schulz, D. N., & De Vries, H. (2016). MHealth or eHealth? Efficacy, use, and appreciation of a webbased computer-tailored physical activity intervention for Dutch adults: A randomized controlled trial. *Journal of Medical Internet Research*, 18(11), 1–12. https://doi.org/10.2196/jmir.6171
- Reed, J. L., & Pipe, A. L. (2014). The talk test: A useful tool for prescribing and monitoring exercise intensity. *Current Opinion in Cardiology*, 29(5), 475–480. https://doi.org/10.1097/HCO.000000000000097
- Rethlefsen, M. L., Kirtley, S., Waffenschmidt, S., Ayala, A. P., Moher, D., Page, M. J., & Koffel, J. B. (2021). PRISMA-S: an extension to the PRISMA statement for reporting literature searches in systematic reviews. *Systematic reviews*, 10(1), 1-19. https://doi.org/10.1186/s13643-020-01542-z

- Rowlands, A. V., & Eston, R. G. (2007). The measurement and interpretation of children's physical activity. *Journal of Sports Science and Medicine*, 6(3), 270–276.
- Santos, L. H. D. O., Okamoto, K., Otsuki, R., Hiragi, S., Yamamoto, G., Sugiyama, O., Aoyama, T., & Kuroda, T. (2021). Promoting Physical Activity in Japanese Older Adults Using a Social Pervasive Game: Randomized Controlled Trial. *JMIR Serious Games*, 9(1), e16458. https://doi.org/10.2196/16458
- Segura-Ortí, E., & Martínez Olmos, F. J. (2009). Análisis de correlaciones entre los resultados de una prueba de esfuerzo y de la prueba de 6 minutos marcha en población sana. *Fisioterapia*, 31(6), 241– 247. https://doi.org/10.1016/j.ft.2009.05.003
- Shcherbina, A., Hershman, S. G., Lazzeroni, L., King, A. C., O'Sullivan, J. W., Hekler, E., Moayedi, Y., Pavlovic, A., Waggott, D., Sharma, A., Yeung, A., Christle, J. W., Wheeler, M. T., McConnell, M. V., Harrington, R. A., & Ashley, E. A. (2019). The effect of digital physical activity interventions on daily step count: a randomised controlled crossover substudy of the MyHeart Counts Cardiovascular Health Study. *The Lancet Digital Health*, *1*(7), e344–e352. https://doi.org/10.1016/S2589-7500(19)30129-3
- Short, C. E., Finlay, A., Sanders, I., & Maher, C. (2018). Development and pilot evaluation of a clinic-based mHealth app referral service to support adult cancer survivors increase their participation in physical activity using publicly available mobile apps. *BMC Health Services Research*, 18(1), 1–11. https://doi.org/10.1186/s12913-017-2818-7
- Silva, B. M. C., Rodrigues, J. J. P. C., de la Torre Díez, I., López-Coronado, M., & Saleem, K. (2015). Mobile-health: A review of current state in 2015. *Journal of Biomedical Informatics*, 56, 265–272. https://doi.org/10.1016/j.jbi.2015.06.003
- Sohaib Aslam, A., van Luenen, S., Aslam, S., van Bodegom, D., & Chavannes, N. H. (2020). A systematic review on the use of mHealth to increase physical activity in older people. *Clinical EHealth*, *3*, 31–39. https://doi.org/10.1016/j.ceh.2020.04.002
- Soligard, T., Schwellnus, M., Alonso, J.-M., Bahr, R., Clarsen, B., Dijkstra, H. P., Gabbett, T., Gleeson, M., Hägglund, M., Hutchinson, M. R., Janse van Rensburg, C., Khan, K. M., Meeusen, R., Orchard, J. W., Pluim, B. M., Raftery, M., Budgett, R., & Engebretsen, L. (2016). How much is too much? (Part 1) International Olympic Committee consensus statement on load in sport and risk of injury. *British Journal of Sports Medicine*, 50(17), 1030–1041. https://doi.org/10.1136/bjsports-2016-096581
- Uhm, K. E., Yoo, J. S., Chung, S. H., Lee, J. D., Lee, I., Kim, J. II, Lee, S. K., Nam, S. J., Park, Y. H., Lee, J. Y., & Hwang, J. H. (2017). Effects of exercise intervention in breast cancer patients: is mobile health (mHealth) with pedometer more effective than conventional program using brochure? *Breast Cancer Research and Treatment*, *161*(3), 443–452. https://doi.org/10.1007/s10549-016-4065-8
- Utter, A. C., Robertson, R. J., Green, J. M., Suminski, R. R., McAnulty, S. R., & Nieman, D. C. (2004). Validation of the adult OMNI Scale of Perceived Exertion for walking/running exercise. *Medicine and Science in Sports and Exercise*, 36(10), 1776–1780. https://doi.org/10.1249/01.MSS.0000142310.97274.94
- Vasankari, V., Halonen, J., Husu, P., Vähä-Ypyä, H., Tokola, K., Suni, J., Sievänen, H., Anttila, V., Airaksinen, J., Vasankari, T., & Hartikainen, J. (2019). Personalised eHealth intervention to increase physical activity and reduce sedentary behaviour in rehabilitation after cardiac operations: Study protocol for the PACO randomised controlled trial (NCT03470246). *BMJ Open Sport and Exercise Medicine*, 5(1), 1–8. https://doi.org/10.1136/bmjsem-2019-000539
- Vorrink, S. N. W., Kort, H. S. M., Troosters, T., Zanen, P., & Lammers, J.-W. J. (2016). Efficacy of an mHealth intervention to stimulate physical activity in COPD patients after pulmonary rehabilitation. *The European Respiratory Journal*, 48(4), 1019–1029. https://doi.org/10.1183/13993003.00083-2016

- Watson, M. (2020). Special Issue on eHealth Innovations and Psychooncology. Psycho-Oncology, 29(1), 3. https://doi.org/10.1002/pon.5308
- Van Weel, C., König-Zahn, C., Touw-Otten, F. W. M. M., van Duijn, N. P., & Meyboom-de Jong, B. (2012). Measuring functional status with the COOP/WONCA Charts. A manual. Groningen, the Netherlands: Noordelijk Centrum voor GEzondheidsvraagstukken (NCG)/Northern Centre of Health Care Research (NCH). Series, (7)
- Wong, E. M., Chair, S. Y., Leung, D. Y., Sit, J. W., & Leung, K. P. (2018). Home-based interactive e-health educational intervention for middle-aged adults to improve total exercise, adherence rate, exercise efficacy, and outcome: a randomised controlled trial. *Hong Kong Medical Journal = Xianggang Yi Xue Za Zhi, 24 Suppl 2*(1), 34–38. http://www.ncbi.nlm.nih.gov/pubmed/29938656
- WHO Global Observatory for eHealth. (2011). mHealth: new horizons for health through mobile technologies: second global survey on eHealth. World Health Organization. https://apps.who.int/iris/handle/10665/44607

- Yu, C. an, Rouse, P. C., Veldhuijzen Van Zanten, J. J. C. S., Ntoumanis, N., Kitas, G. D., Duda, J. L., & Metsios, G. S. (2015). Subjective and objective levels of physical activity and their association with cardiorespiratory fitness in rheumatoid arthritis patients. *Arthritis Research and Therapy*, 17(1), 1–7. https://doi.org/10.1186/s13075-015-0584-7
- Zenko, Z., & Ekkekakis, P. (2015). Knowledge of Exercise Prescription Guidelines Among Certified Exercise Professionals. *Journal of Strength and Conditioning Research*, 29(5), 1422–1432. https://doi.org/10.1519/JSC.000000000000771

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Cover: A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images

Patterns of Interactive and Motor Behavior: Animal-Assisted Intervention in Inclusive Education

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Abstract

An inclusive education system generates changes in educational teaching practices and opens the need to implement an innovative methodology to offer more opportunities to the student to participate in an inclusive educational system. Animal Assisted Interventions (AAI) bring benefits from human-animal interaction by contributing to the success of inclusive education. This study was conducted through the systematic observational methodology over two case studies of children with disabilities during a school year. The Observational System for Animal Assisted Interventions (OSAAI) has been validated. Observation using the OSAAI system, coding using the LINCE PLUS software and analysis of temporal patterns (t-patterns), using the THEME software, made it possible to obtain behavioral patterns in a systematized way of the interaction and motor behavior between the agents of the triad: the participant, the therapy animal, and the teacher. The results have shown a progressive increase of communicative patterns accompanied by proactive emotional expressions of the participants. These results demonstrate the benefits in cognitive, motor, multisensory, and interactive stimulation reported by the AAI with the student with disabilities of different etiology in an inclusive educational context.

Keywords: Animal-Assisted Intervention (AAI), behavior patterns, functional diversity, Observational System of Animal Assisted Interventions (OSAAI).

International educational policies are committed to the creation of an inclusive educational system that is equitable, which promotes justice, social cohesion (Ainscow, 2020; UNESCO, 2008) and eliminates social exclusion (Ainscow, 2020). Thus, the inclusive educational system has been defined as "the process of strengthening the capacity of the education system to accommodate all learners and people, thus enabling schools to service all children, especially those with special educational needs" (UNESCO, 2008, p. 8).

Educational inclusion generates changes in teaching educational practices and the need to apply new methodological strategies to address the diversity and needs of students (Ainscow, 2006; UNESCO, 2008) with the aim of enabling the presence, participation and success of all students in the educational context (Ainscow, 2020; Echeita & Ainscow, 2011). In addition, to promote the generalization of an inclusive educational system, it is necessary to provide evidence on those educational practices focused on social learning processes that take place in particular contexts (Ainscow, 2020).

An effective inclusive pedagogical methodology adapting learning rhythms to the individual characteristics and needs of students is the personalization of learning (Walkington & Bernacki, 2020). This methodology agrees with current pedagogical optimization trends both in formal education (Valero-Valenzuela et al., 2020) and in informal education, where particular contexts promote inclusive education (Ainscow, 2002; Puigarnau et al., 2016) and also from the point of view of educational psychology and, therefore, of the relationship established between motivation and learning (Bernacki & Walkington, 2018).

Animal Assisted Education (AAE) is based on personcentered learning that facilitates social and curricular learning for students. This generation of student interest in the presence of the intervention dog improves performance and educational success in learning reading skills (Renck, 2005; Xinmei & Tardif Williams, 2019), especially in students with special educational needs (Kirnan et al., 2020). Furthermore, some specific studies have observed an improvement in school performance, social and behavioral competence in an AAI group of students with ADHD (Bunford et al., 2019; Castañer et al., 2020; Schuck et al., 2018). Similarly, the interaction established in AAI programs can have a positive impact on improving the behaviors and social skills of students with autism (Becker et al., 2017; Dimolareva & Dunn, 2020), especially an improvement in verbal and non-verbal communication (Hill et al., 2019).

The International Association of Human-Animal Interaction Organizations (IAHAIO) (2018) clearly states that "Animal Assisted Education (AAE) is a goal oriented, planned and structured intervention directed and/ or delivered by educational and related service professionals included within animal assisted interventions (AAI) together with animal assisted therapy and animal assisted activities" (IAHAIO, 2018, p. 5). Fine (2015) considers AAI as "an intervention that intentionally includes or incorporates animals as part of a therapeutic process" (Fine, 2015, p. 15) where the animal acts as a stimulus or facilitator in this process (Bachi & Parish Plass, 2016; Rodrigo et al., 2017) and as social support for people (Fine, 2018). That is, it is based on the fact that humans promote natural contact with animals, thus facilitating social interaction.

The intervention animal in an AAE session acts as a facilitator to achieve the pedagogical objectives established from the human-animal interaction and communication that is reinforced by the link established between the species (Fine, 2015). This bidirectional relationship is demonstrated by mean of the change of the dog's communication skills towards humans, specifically in relation to the animal's ability to initiate and learn communicative interactions and social routines and recognize human visual gestures (Soproni et al., 2001). The fact that the social competence of dogs can be considered similar in its functioning to that of humans (Miklósi & Topál, 2013) may be an important factor in the development of communicative intervention objectives in AAE programs. Other authors point out that the dynamic human-animal relationships influence the emotions and cognition of the animal and, for this reason, the ability to experience emotions and interact with humans may be essential for the development of benefits in AAI (Fine et al., 2019).

Today there is a claiming need to evaluate benefits of AAI in the natural contexts of inclusive scholars' institutions and the present study offers a consistent methodology to pattering interactive behaviors on AAI during inclusive education.

Methods

Participants

An AAI was carried out for three months to two participants who presented special educational needs and attended an ordinary public school. Both were in primary education and received specific support from ISIS (Intensive Support for Inclusive Schooling) professionals who facilitated their participation and learning in the ordinary educational environment. Participant 1, female, 12 years old, had multiple disabilities without a clear etiology, and participant 2, male, 10 years old, had Autism Spectrum Disorder (ASD). Given the specificity of its individual characteristics, this study is a unique case studied from the follow-up of the evolution of the participants during a certain time that provided the necessary information for its analysis. According to the education inclusion's criteria, the sessions were conducted individually with each participant in the ordinary context of the school and, at the same time, it preserved the eventual reactions to the camera of other students.

The inclusion criteria followed to select the two participants were having a certification of Special Educational Needs (SEN) and a disability. The participants presented a polarized level of abilities, a fact that offered the possibility of being able to contrast the results of the study in a broader spectrum.

The ethical considerations for conducting the study complied with ethical protocols. Regarding animal welfare: a) zoonosis prevention protocol, and b) animal welfare protocol. Regarding the study on participants, the following were obtained: c) information to the families and informed consent for participation in the study, and d) the certificate of the Ethics Committee for Clinical Research of the Sports Administration of Catalonia (reference number 23/2018/ CEICEGC).

Design

We used systematic observation to observe regular behaviors in a natural setting (Anguera et al., 2017). Observational methodology offers eight types of observational designs. This study is a Nomothetic/Followup/Multidimensional (N/F/M) design because our study focused on different participants (nomothetic) within different sequences (follow-up) and addressed multiple criteria and responses included in an *ad hoc* observation instrument (multidimensional).

Procedure

The sessions of 50 minutes of duration were carried out in a classroom of the educational center where the participants are students. The space allowed the AAI sessions to be held, placing the participants, the team of professionals and the intervention animal in different positions depending on the pedagogical needs that arose, either on a table or on a mat. The sessions included activities related to cognitive stimulation by means of enhancing the executive functions of memory, attention and tasks organization.

The team of professionals who participated in the sessions was made up of the teacher in charge of the Intensive Support of Inclusive Education (SIEI, Generalitat de Catalunya, 2017), who performed the functions of AAI technician and participant observer, and by the Special Education Educators, who assumed the development and acquisition of the educational objectives set out in a coordinated way in the Individualized Plan for each participant.

Two intervention dogs, a golden retriever and a toy poodle from the Ilerkan Association participated in the AAI sessions.

All sessions were recorded using a digital camera and a tripod fixed at the same angle, to ensure the habituation of the participants. Specific criteria were followed to ensure the reliability of the sample:

- Control of external interruptions during intervention sessions. In sessions where the interruptions were too significant, the recordings were discarded for analysis.
- The distribution of stable criteria in all sessions (initiation and activation routines, professionals involved in the sessions, therapy animal, duration of the sessions and their timing). The duration of the sessions was established following pedagogical criteria (taking into account the characteristics of the participants and their needs) as well as the animal welfare criteria. The prior habituation of the participants to the technical elements for recording (tripod and video camera) was necessary to avoid the participants' reactance bias.

Instruments

Observational tool

We have designed an *ad hoc* observational tool, OSAAI –(Observational System of Animal Assisted Interventions) to conduct a systematic and objective observation on AAI. It was based on two specific observational tools: a) one specific for motor skills observation, OSMOS (Observational System of Motor Skills) (Castañer et al., 2011), and another one which is specific for communication skills observation SOCIN (Kinetic Observational System) (Castañer et al., 2016). OSAAI was validated by a panel of three expert pedagogues (two in motor skills and communication and one in AAI).

Table 1

OSAAI (Observational System of Animal Assisted Interventions).

Criterion	Category	Code	Description
	Postural changes	POS	The body positioning of the students changes level, for example: sitting upright, lying on the mat, seated, etc.
1. Motor-space interaction	Locomotion	LOC	The positioning of the students is standing and in locomotion.
	Combination of the above	CEM	Any of the above options combined.
	Stereotyped movements	EST	Students perform repetitive motor movements with no end or apparent significance.
2. Kinetic	Segmental movements	SEG	Students perform upper or lower limb movements.
	Combination of the above	CC	Any of the above options combined.
	Expression of emotions of pleasure	PLA	Students express pleasure through verbal or non-verbal communication (guttural sounds, laughter, body movements associated with well-being).
3. Interactive facial behavior	Expression of emotions of displeasure	DES	Students express displeasure through verbal or non-verbal communication (guttural sounds of displeasure, crying).
	Neutral	NEU	Students show a neutral behavior, they remain balanced from the emotional point of view, they do not show any of the two emotional extremes previously described.
	Distance from the animal	DIS	Students take the action of separating from the animal or rejecting its contact.
	Approach to the animal	APR	Students do the action of intentionally approaching the animal.
4. Animal-participant interaction	Contact with the animal	CON	Students do the action of touching/ caressing the animal.
	Manipulation	MAN	Students do the action of manipulating the animal. It is considered the highest gradient of intentionality on the part of the students.
5. Participant emits to the animal	Participant emits to the animal	PAN	Students issue information, slogans or refer to the animal. Whether on a verbal or paraverbal level.
	Participant emits information	PAR	Students issue information addressed to the adult. Whether on a verbal or paraverbal level.
6. Adult-participant interaction	Adult emits information	ADU	The adult provides information addressed to the students. Whether on a verbal or paraverbal level.
	Combination of the above	CAP	Any of the above options combined.
7. Animal-adult interaction	Relocation of the animal	REC	The adult relocates the animal following pedagogical or animal welfare criteria.



Figure 1

Screen of LINCE software. Right box: criteria and categories of behavior to be selected when they appear in the video. Left box: video image; below: rows of data obtained in vvt (variable and value table).

Recording instrument

The free software program LINCE PLUS (Soto et al., 2019; 2022) was used to implement the instrument OSAAI and record the behaviors. LINCE PLUS integrates a wide range of functions, such as coding, recording, data quality check between observers, and exporting data to different data analysis applications (figure 1). Thus, LINCE PLUS software is versatile and easy to use as it was designed to facilitate the observation of spontaneous behaviors in diverse contextual situations (Castañer et al., 2013, 2020). This software also allows the data quality check between the two observers, one expert in motor behavior and the other one in Animal-Assisted Intervention. The Cohen's Kappa coefficient (K) obtained was of .93 for interobserver agreement and .96 for intraobserver agreement.

Data analysis

Data analysis was conducted applying the THEME software package (Magnuson, 2017) to detect t-patterns (TPA) in behavior records. T-pattern detection is a technique that recognizes recurrent patterns such as behavior events over time capturing variability in timing and defines occurrences of patterns based on statistical probabilities (Magnusson, 2017). This technique allows to compare all behavioral patterns and retains only the most complete ones as several studies have shown (Castañer et al., 2016, 2020). The following search criteria were applied: a) presence of at least 3 given t-pattern b) redundancy reduction setting of 90% for occurrences of similar t-patterns, and c) significance level of .005.

Results

The THEME software detected temporal patterns in all 19 sessions recorded; (a) the total number of events, the combinations of animal assisted interventions, analyzed in the 19 sessions, corresponding to the two participants; and (b) 2,253 events, but only 132 event types were repeated in both the first and the second participant; (c) a minimum of 49 and a maximum of 12,398 different patterns.

The analysis of t-patterns demonstrated the combination of interactive behaviors in the triad –participant, animal and educator– represented visually by the dendrogram graphs. These graphs (figure 1 and 2), for each of the two participants, allowed us to visualize a chronological succession of all these interactive and motor behaviors patterns or t-patterns, selected as the most representative, and which occurred according to a chronological order.



Figure 2

T-pattern detection of Animal Assisted Interventions in participant 1.



Figure 3

T-pattern detection of Animal Assisted Interventions in participant 2.

First participant

The interactive behaviors in 8 sessions of the first participant revealed t-patterns we consider the most representative (Figure 2):

- Approaching the animal with expressions of pleasure (POS, SEG, APR, PLA) and emitting guttural sounds (PAN) and verbal interactions (PAN) with the information provided by the educator (ADU).
- With a movement of the arms (POS, SEG) and smiles, laughter (PLA, PAN) when manipulating the animal (MAN) and verbal and non-verbal interactions (PAN) that are responded to by the educator (ADU).

In this behavior pattern, it is considered that there is an increase in intentionality in the participant's communicative interaction and expression of positive emotions with the animal. The fact that a greater frequency of manipulation of the animal is observed implies a higher level of motor intentionality.

The analyzed t-patterns confirm a causal and relational relationship between the interaction with the therapy animal and the increase in the participant's expressions of pleasure. An increase in the motor and communicative initiative of the participant towards the animal and the educational professional is observed together with the multisensory stimulation that the manipulation of the animal provides.

Second participant

The interactive behaviors in the 11 sessions of the second participant revealed t-patterns among which we expose the most representative (Figure 3):

- Change of segmental position of the participant with neutral facial expression (POS, SEG, NEU) with communicative exchange of the educator's verbal stimulus (ADU).
- Change of position without facial expression changes (POS, SEG, NEU) to answer the educator's communication (ADU).
- With motor movements, he continues with an interactive and neutral attitude (POS, SEG, NEU) but with an interactive learning exchange with the educator (ADU) and in the presence of the animal.

The t-pattern that is displayed in this configuration of behaviors highlights the dyadic interaction between the educator and the participant in the presence of the animal that favors the communicative climate between the two, a fact that is interpreted as the creation of a situation of bidirectional communicative interaction between both interlocutors.

We can observe that it is the participant who maintains the communicative initiative during the sessions, making numerous demands on the adult in a neutral communicative climate but favoring the communicative teaching-learning interaction.

This confirms that the educator guides and provides information and instructions to the participant, thanks to the encouraging and mediating presence of the animal. Therefore, it encourages the stimulation of the communicative situation in a teaching-learning situation from the interaction with the therapy animal, where there are curricular situations in which the educator introduces knowledge, offers instructions to start or change activity and/or redirects them.

Discussion

The results obtained through the analysis of t-patterns show us that AAIs in the educational field promote and intensify the interactive behavior patterns between the triad composed of the educator, the participant and the intervention animal. These are behavior patterns that agree with scientific contributions that suggest that humans and animals have the ability to establish an emotional bond between species (Fine, 2018) and that this natural relationship with animals provides health benefits (Barker & Wolen, 2008;) to people with disabilities (Friedman & Krause-Parello, 2018), and also emotional, physical and psychosocial well-being (Fine, 2018). We have also found an increase in social skills and, therefore, a better functioning of social interaction.

Regarding the frequency of appearance of behaviors from the OSAAI observational instrument, we highlight that of interactive facial behavior, specifically the expressions of pleasure of participant 1 in the presence of the intervention animal, coinciding with other studies carried out with participants with disabilities, where the variables related to happiness and relaxation were progressively increased in the AAI sessions and therefore reflected a greater emotional well-being of the students (Rodrigo et al., 2017, 2018). These positive emotional expressions are accompanied by non-verbal language (sounds) and intentional manipulations towards the intervention animal.

The increase in the communicative intentionality of the participants in the educational context is interrelated with the manipulation and interaction with the animal from the planning of the AAI sessions carried out by the educator, promoting multisensory stimulation. It is for this reason that we agree with Hill's et al. (2019) studies when they find that AAIs improve verbal and non-verbal communication. Other studies carried out with participants with special needs suggest that AAI can improve cognition and emotional competencies based on multisensory stimulation (verbal, visual and tactile) provided by interaction and manipulation with an intervention animal (Menna et al., 2016).

In observing this same criterion in participant 2, we highlight the category of neutral expression since the student shows a balanced behavior in the communicative and learning situation while interacting with the educator and the intervention animal. Fung (2015) states an increase in social communication, especially in joint attention and waiting times. Regarding this aspect, Stevenson et al. (2015) also found that students with autism improved at the communicative level, especially in significant vocalizations in those sessions where they interacted with the teacher and the dog.

The AAI sessions analyzed highlight this improvement in social behaviors, coinciding with the research carried out by authors such as Becker et al. (2017), Dimolareva & Dunn (2020), and in the systematic review carried out by O'Haire (2017), where a significant increase in the social interaction of the participants was observed in 22 of the 28 studies analyzed.

We note the creation of a neutral communicative climate where the communicative triangle that is established between the educator and the student is positively reinforced by the guided interaction with the intervention animal. In this aspect, the presence and intervention of the animal exerts a protective factor and therapeutic alliance between the educator and the participant (Fine, 2018) that facilitates the achievement of the educational objectives set. In the AAI sessions in the inclusive educational field we observe that the educator guides and brings knowledge and skills to students from positive interaction with the animal.

This communicative situation that is established between the student and the educator promotes teaching-learning situations and therefore also addresses the diversity of students presenting special educational needs. Authors such as Kirnan et al. (2020) and Schuck (2018) highlighted the positive impact of AAIs on the development of social, behavioral and school competencies especially in children with special educational needs (Kirnan et al., 2020), largely because AAI sessions improve student interest and thus academic performance (Renck, 2005; Xinmei & Tardif-Williams, 2019). In relation to this aspect, the results obtained in the t-patterns analysis show that the animal enhances motivation (Fine, 2018) in the face of the acquisition of the learnings that the educational plan enhances and it facilitates a greater commitment to learning since resistant behaviors are reduced by generalizing an improvement in participation within the class (Dearden et al., 2016).

Authors such as Martin & Farnum (2002) suggest a significant decrease in the communicative intentionality of the student with autism towards the professional as they consider that he spends more time talking to the animal. Contrary to these studies, there has been an increase in the capacity for coherent and meaningful dialogue between participant 2 and the teacher at the AAI sessions.

For both participants t-patterns are detected that relate to the presence and/or manipulation of the intervention dog with an increase of communication competences. However, t-patterns are interpreted individually for each participant as they have very differentiated communicative capabilities. While participant 1 presents nonverbal communicative expressions (sounds, guttural expressions), participant 2 expresses himself with a functional verbal language and more motor actions in relation to participant 1, with movement limitations.

Both prioritize in the Intervention Plan the development of the communication skills that we observe in the AAI sessions. Thus, it stands out, on the one hand, improving the communicative intentionality of participant 1 while manipulating the animal and maintaining a more active connection with reality. On the other hand, in participant 2, we start from a more complex level of language allowing a more consistent interaction with the teacher towards acquiring curriculum learning.

This increase in the intrinsic motivation of the participants towards the development of a greater communication initiative and teacher learning coincides with research conducted by Stevenson (2015), who believes that school intervention dogs can be a tool of motivation and generalization that enhances children's participation in school activities and improves social relationships with other schoolmates.

The latest professionalizing currents in the field of AAIs seek a way to demonstrate their efficiency in the different areas of application. Thus, numerous studies are beginning to be published that seek to quantify and validate the benefits they produce in different groups. In this need and desire to create scientific evidence, it is necessary to be careful and make moderate statements about the possible benefits of AAI based on rigorous research (Crossman & Kazdin, 2020) and, therefore, increase research and raise the standard of methodological rigor in research on AAI (O'Haire, 2017). There are studies that endorse this methodology not as an alternative intervention but as an innovative, effective and complementary program (Rodrigo et al., 2018), to the usual interventions (Rodrigo et al., 2020).

In addition, in the educational field it is also essential to establish new evidence in order to promote and validate tools to offer to the inclusive educational system. Case study stands as a useful methodology in this area of research (Nilholm, 2020).

This study proposes the limitation of the number of participants and the duration in time, coinciding with Kasari (2002). We consider that as a prospective future, it would be interesting to be able to implement and evaluate the AAE in a higher number of participants and with longer time duration, even reaching a longitudinal study. The objective of this study in a naturalistic context has had certain technical limitations, since there was not a prepared classroom with microphones and cameras distributed over the entire surface. This fact has not offered the possibility of being able to analyze recordings in groups with a higher number of participants. As a future prospect of this study, it would be interesting to be able to record AAE group sessions from different angles of vision and thus be able to analyze their benefits throughout an entire school year.

Conclusions

The use of the systematic observational methodology and the analysis by means of the detection technique of t-patterns has allowed us to objectively demonstrate the effectiveness of AAI, which could promote the educational and social inclusion of students in the ordinary educational environment and the generalization of the competences acquired in their closest social context. The communication and social skills developed in AAI sessions are a protective factor and trigger of the improvement of the participants' connection with their educational environment. AAIs provide benefits in cognitive, motor, sensory, communicative, relational and emotional stimulation in children with functional diversity in an inclusive educational context. They are an intensive educational measure that promotes the acquisition of educational and curricular competencies in school and that can be considered one more methodological resource for attention to diversity in ordinary schools.

The validity and usefulness of the OSAAI observational instrument as a tool for systematic observation of the non-verbal behavior of the participants in the AAI sessions is confirmed. From the analysis of the patterns, it is found that AAE sessions influence on the increase of interactive behaviors between the students, the adult and the intervention animal.

These interactive behaviors are materialized in an improvement of the communicative interaction (communicative initiative, spontaneous communicative production, communicative climate, etc.) and the increase of attention and motivation in teaching-learning situations and, therefore, the development and acquisition of educational competencies. In addition to the benefits of multisensory stimulation and the relationship with the immediate environment.

Finally, there is an increase in expressions of pleasure in the interaction with the intervention animal. The participants unequivocally express positive emotions that arise from the emotional bond that is created between the different agents (students, adults and animals). This climate of emotional wellbeing that is evidenced in AAI sessions provides emotional and relaxation benefits that are the basis for building new learning and skills.

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References

- Ainscow, M. (2006). Fer inclusiva l'educació: com s'hauria de conceptualitzar la tasca? Suports: revista catalana d'educació especial i atenció a la diversitat, 2006, Vol. 10, Núm. 1, p. 4-10, https://raco.cat/index.php/Suports/article/view/102233.
- Ainscow, M. (2020). Promoting inclusion and equity in education: lessons from international experiences. Nordic Journal of Studies in Educational Policy, 6(1), 7-16. https://doi.org/10.1080/20020317.2020.1729587
- Anguera, M. T., Camerino, O., Castañer, M., Sánchez-Algarra, P., & Onwuegbuzie, A. J. (2017). The Specificity of Observational Studies in Physical Activity and Sports Sciences: Moving Forward in Mixed Methods Research and Proposals for Achieving Quantitative and Qualitative Symmetry. *Frontiers in Psychology*, 8:2196. http://dx.doi.org/10.3389/fpsyg.2017.02196
- Bachi, K. & Parish-Plass, N. (2016). Animal-assisted psychotherapy: A unique relational therapy for children and adolescents. *Clinical Child Psychology and Psychiatry*, 22(1), 3-8. https://doi. org/10.1177/1359104516672549
- Barker, S. B. & Wolen, A. R. (2008). The benefits of human-companion animal interaction: a review. *Journal of Veterinary Medical Education*, 35(4), 487-495. https://doi.org/10.3138/jvme.35.4.487. PMID: 19228898.
- Becker, J.L., Rogers, E.C. & Burrows, B. (2017). Animal-assisted social skills training for children with autism spectrum disorders. *Anthrozoös*, 30(2), 307–326. https://doi.org/10.1080/08927936.2017.1311055.
- Bernacki, M., & Walkington, C. (2018). The role of situational interest in personalized learning. *Journal of Educational Psychology*, 110(6), 864–881. https://doi.org/10.1037/edu0000250
- Bunford, N., Csibra, B., Peták, C., Ferdinandy, B., Miklósi, Á. & Gácsi, M. (2019). Associations among behavioral inhibition and owner-rated attention, hyperactivity/impulsivity, and personality in the domestic dog (*Canis familiaris*). Journal of Comparative Psychology. 133, 233–243. https://doi.org/10.1037/com0000151
- Castañer, M., Aiello, S., Prat Q., Andueza, J., Crescimanno, G. & Camerino O. (2020). Impulsivity and physical activity: A T-Pattern detection of motor behavior profiles. *Physiology & Behavior*, 219, 112849. https://doi.org/10.1016/j.physbeh.2020.112849
- Castañer, M., Camerino, O., & Anguera, M. T. (2013). Mixed Methods in the Research of Sciences of Physical Activity and Sport. *Apunts Educación Física y Deportes*, 112, 31-36. https://doi.org/10.5672/apunts.2014-0983.es.(2013/2).112.01
- Castañer, M., Camerino, O, Anguera, M. T. & Jonsson, G. K. (2016). Paraverbal Communicative Teaching T-Patterns Using SOCIN and SOPROX Observational Systems. In M. S. Magnusson, J. K. Burgoon & M. Casarrubea (Ed.) (2016): *Discovering Hidden Temporal Patterns in Behavior and Interaction*. (83-100). Neuromethods. Springer. ISSN 978-1-4939-3249-8. https://doi.org/10.1007/978-1-4939-3249-8
- Castañer, M., Camerino, O., Parés, N. & Landry, P. (2011). Fostering body movement in children through an exertion interface as an educational tool. *Procedia - Social and Behavioral Sciences*, 28, 236-240. https://doi.org/10.1016/j.sbspro.2011.11.046
- Crossman, M. K. & Kazdin, A. E. (2020). Perceptions of animal-assisted interventions: The influence of attitudes toward companion animals. *Journal* of Clinical Psychology, 74(4), 566–578. https://doi.org/10.1002/jclp.22548
- Dearden, J., Emerson, A., Lewis, T., & Papp, R. (2016). Transforming engagement: a case study of building intrinsic motivation in a child with autism. *British Journal of Sociology of Education*, 44(1), 8–25. https://doi.org/10.1111/1467-8578.12137

- Dimolareva, M., & Dunn, T. J. (2020). Animal-Assisted Interventions for School-Aged Children with Autism Spectrum Disorder: A Meta-Analysis. *Journal* of autism and developmental disorders, 10.1007/s10803-020-04715-w. Advance online publication. https://doi.org/10.1007/s10803-020-04715-w
- Echeita, G. & Ainscow, M. (2011). La educación inclusiva como derecho: marco de referencia y pautas de acción para el desarrollo de una revolución pendiente. *Tejuelo: Revista de Didáctica de la Lengua y la Literatura, 12,* 26-46.
- Fine A. H. (2018). The role of therapy and service animals in the lives of persons with disabilities. *Revue scientifique et technique (International Office of Epizootics)*, 37(1), 141–149. https://doi.org/10.20506/rst.37.1.2747
- Fine, A. H. (2015). *Handbook on Animal-Assisted Therapy*. (4th Edition). Foundations and Guidelines for Animal-Assisted Interventions.
- Fine, A. H., Beck, A. M. & Ng, Z. (2019). The State of Animal-Assisted Interventions: Addressing the Contemporary Issues that will Shape the Future. *International Journal of Environmental Re*search and Public Health, 16(20), 3997. MDPI AG. Retrieved from http://dx.doi.org/10.3390/ijerph16203997
- Friedman, E., & Krause-Parello, C. A. (2018). Companion animals and human health: benefits, challenges, and the road ahead for human-animal interaction. *Revue scientifique et technique (International Office* of Epizootics), 37(1), 71–82. https://doi.org/10.20506/rst.37.1.2741
- Fung, S. C. (2015). Increasing the social communication of a boy with autism using animal-assisted play therapy: a case report. Advances in Mind Body Medicine, 29(3), 27–31.
- Generalitat de Catalunya. (2017). Decret 150/2017, de 17 d'octubre, de l'atenció educativa a l'alumnat en el marc d'un sistema educatiu inclusiu. DOGC núm. 7477, de 19.10.2017.
- Hill, J., Ziviani, J., Driscoll, C. & Cawdell-Smith, J. (2019). Can Canine-Assisted interventions Affect the Social Behaviours of Children on the Autism Spectrum? A Systematic Review. *Review Journal of Autism and Developmental Disorders*, 6, 13–25. https://doi.org/10.1007/s40489-018-0151-7
- International Association of Human-Animal Interaction Organizations. (2018). The IAHAIO white paper 2018: Definitions for animal assisted intervention and guidelines for wellness of animals involved.
- Kasari, C. (2002). Assessing change in early intervention programs for children with autism. *Journal of Autism and Developmental Disorders*, 32(5), 447–461. https://doi.org/10.1023/a:1020546006971
- Kirnan, J., Shah, S. & Lauletti, C. (2020). A dog-assisted reading programme's unanticipated impact in a special education classroom. *Educational Review*, 72(2), 196-219. https://doi.org/10.1080/00131911.2018.1495181
- Magnusson, M. S. (2017). Why search for hidden repeated temporal behavior patterns: T-Pattern analysis with Theme. *International Journal of Clinical Pharmacology & Pharmacotherapy*, 2(128), 1-7. https://doi.org/10.15344/2456-3501/2017/128
- Martin, F. & Farnum, J. (2002). Animal-assisted therapy for children with pervasive developmental disorders. Western Journal of Nursing Research, 24(6), 657–670. https://doi.org/10.1177/019394502320555403
- Menna, L. F., Santaniello, A., Gerardi, F., Di Maggio, A., & Milan, G. (2016). Evaluation of the efficacy of animal-assisted therapy based on the reality orientation therapy protocol in Alzheimer's disease patients: a pilot study. *Psychogeriatrics*, 16, 240–246. https://doi.org/10.1111/psyg.12145
- Miklósi, Á. & Topál, J. (2013). What does it take to become "best friends"? Evolutionary changes in canine social competence, *Trends in Cognitive Sciences*, 17(6), 1-8. https://doi.org/10.1016/j.tics.2013.04.005
- Nilholm, C. (2020) Research about inclusive education in 2020 How can we improve our theories in order to change practice? *European Journal of Special Needs Education*, *36*(3), 358-370. https://doi.org/10.1080/08856257.2020.1754547

- O'Haire, M. E. (2017). Research on animal-assisted intervention and autism spectrum disorder, 2012–2015. Applied Developmental Science, 21(3), 200-216. https://doi.org/10.1080/10888691.2016.1243988
- Puigarnau, S., Camerino, O., Castañer, M., Prat, Q., & Anguera, M. T. (2016). El apoyo a la autonomía en practicantes de centros deportivos y de fitness para aumentar su motivación. *RICYDE-Revista Internacional de Ciencias del Deporte*, 43(12), 48-64. https://doi.org/10.5232/ricyde2016.04303
- Renck, M. (2005). What are all these Dogs Doing at School? Using Therapy Dogs to Promote Children's Reading Practice. *Childhood Education*, 81(3), 152-158. https://doi.org/10.1080/00094056.2005.10522259
- Rodrigo, M., Malla, B., Marquilles, C., Sol, J., Jové, J., Sole, M., & Ortega, M. (2020). Animal-Assisted Therapy Improves Communication and Mobility among Institutionalized People with Cognitive Impairment. *International Journal of Environmental Research and Public Health*, 17(16), 5899. http://dx.doi.org/10.3390/ijerph17165899
- Rodrigo, M., Malla, B., Rodrigo, E., Jové, J., Bergadà, J. & Marsal, J. (2018). Animal- assisted Therapy for the Emotional Well-being of Children with Intellectual Disabilities and Behavioral Disorders. *Sociology and Anthropology*, 6(1), 94-106. https://doi.org/10.13189/sa.2018.060109
- Rodrigo, M., Rodrigo, E., Bergadà, J., Solé, M., Casanova, C. & Jové, J. (2017). Terapia asistida con animales para mejorar el estado emocional de adultos con autismo. *Quaderns Digitals*, 84, 1-17.
- Schuck, S. E. B., Johnson, H. L., Abdullah, M. M., Stehli, A., Fine, A. H. & Lakes, K. D. (2018). The Role of Animal-Assisted Intervention on Improving Self-Esteem in Children with Attention Deficit/Hyperactivity Disorder. *Frontiers in Pediatrics*, 6(300). https://doi.org/10.3389/fped.2018.00300
- Soproni, K., Miklósi, A., Topál, J., & Csányi, V. (2001). Comprehension of human communicative signs in pet dogs (*Canis familiaris*). Journal of Comparative Psychology, 115(2), 122–126. https://doi.org/10.1037/0735-7036.115.2.122
- Soto, A, Camerino, O, Anguera, M. T., Iglesias, X., & Castañer, M., (2022): LINCE PLUS Software for Systematic Observation Studies of Sports and Health. *Behavior Research Methods*, 54, 1263–1271. https://doi.org/10.3758/s13428-021-01642-1
- Soto, A., Camerino, O., Iglesias, X., Anguera, M. T., & Castañer, M. (2019). LINCE PLUS: Research Software for Behaviour Video Analysis. *Apunts Educación Física y Deportes*, 137, 149-153. https://dx.doi.org/10.5672/apunts.2014-0983.es.(2019/3).137.11
- Stevenson, K., Jarred, S., Hinchcliffe, V., & Roberts, K. (2015). Can a dog be used as a motivator to develop social interaction and engagement with teachers for students with autism? *Support for Learning*, 30(4), 341–363. https://doi.org/10.1111/1467-9604.12105
- UNESCO. (2008). La educación inclusiva: el camino hacia el futuro. http://www.ibe.unesco.org/fileadmin/user_upload/Policy_Dialogue/48th_ ICE/CONFINTED_48-3_Spanish.pdf
- Valero-Valenzuela, A., Camerino, O., Manzano-Sánchez, D., Prat, Q. & Castañer, M. (2020). Enhancing Learner Motivation and Classroom Social Climate: A Mixed Methods Approach. *International Journal of Environmental Research and Public Health*, 17, 5272. https://doi.org/10.3390/ijerph17155272
- Walkington, C. & Bernacki, M. L. (2020). Appraising research on personalized learning: Definitions, theoretical alignment, advancements, and future directions. *Journal of Research on Technology in Education*, 52(3), 235-252. https://doi.org/10.1080/15391523.2020.1747757
- Xinmei, C. & Tardif-Williams, C.Y. (2019). Turning the Page for Spot: The Potential of Therapy Dogs to Support Reading Motivation Among Young Children. *Anthrozoös*, 32(5), 665-677. https://doi.org/10.1080/08927936.2019.1645511

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Physical Education Public Examination as an Obstacle For Long-term Contract Teachers

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Cover:

A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images Abstract

Teaching is a profession in which past professional experiences are particularly relevant, as they are based on the resolution of concrete pedagogical and social situations. The main aim of the study is to analyse how physical education teachers construct their perspectives and ideals about the profession, the conflicts they experience, as well as the belief that their teaching job has an expiry date. Twelve Spanish PE teachers (seven men and five women), with at least 14 years of teaching experience, participated. A qualitative narrative study using semi-structured interviews was used. The results reflected a decrease in commitment and passion for the profession due to the pressure exerted on these educators by the filters and strategies of the Spanish education system's public examinations.

Keywords: contract teachers, Physical Education, precariousness, professional identity, public education system.

Introduction

The admission system for the public teaching service in Spain

In Spain, the admission process for the teaching profession is carried out according to the Organic Law 8/2013, of 9 December, for the improvement of the quality of education. This Law establishes that the admission process will consist of two different tests, each consisting of two different parts: (a) a test of specific knowledge of the speciality, in which the candidate will have to answer a written exam and design an educational intervention in the form of a reasoned and well-founded teaching unit; (b) a test of pedagogical aptitude, in which the candidate will have to present and defend a teaching programme and a teaching unit before a panel composed of five practising specialist teachers. It is a process anchored primarily in the academic preparation and cognitive mastery of applicants.

Once they have successfully undergone the process, future teachers will have to complete an internship period over the course of a school year which, once completed, will grant them the status of civil servants of the State, for life. If they do not pass the process, applicants may obtain a temporary position, i.e. a position in a public school on a temporary basis for a variable duration ranging from fifteen days to a full school year.

It is a selective system in which the discourse of quality is emphasised, based on a competitive and well-established model within a neoliberal context. This means that every year thousands of applicants attempt to pass the admission process unsuccessfully, resulting in job insecurity and presenting them with a Gordian knot from which it is difficult for them to escape, full of difficulties, pressures and stress.

Cycles in the teaching profession

The career and professional development of teachers has a dual dimension (Bolívar Botía et al., 1998): (1) objective or structural, which explains the different phases that make up a teaching career; (2) subjective, which focuses on how the individual experiences his or her teaching career in relation to the present. This dual dimension has prompted numerous studies from different perspectives on teacher professional development.

The objective claims are based on developing the stages that a teacher goes through in the course of his or her profession. According to studies carried out by different authors (Bickmore & Bickmore, 2010; Howe,

2006; Vonk, 1989; Vonk & Schras, 1987), the stages differ in number, duration and in the criteria used to develop some of their main characteristics. However, they all have at least three stages in common —novice teacher, expert and retiring teaching— and they also understand teaching as a gradual process.

In this sense, teachers go through different stages in which they build their own professional image and shape their way of being and approaching the profession. Throughout their careers, teachers undertake an analysis of their personal and working lives that helps to explain the character and provenance of their thinking as teachers, their actions and their practical knowledge about teaching (Bickmore & Bickmore, 2010; Nasser-Abu Alhija & Fresko, 2016).

Among these studies, Berliner (1988) considers teacher professional development to be a gradual process that includes the following phases: (a) apprentice, where the teacher begins to acquire standards and habits related to the profession; (b) advanced participant, gaining confidence and experience in the profession; (c) competent, beginning to make decisions about students and the teaching/learning process; (d) skilled, clearly perceiving teaching situations, showing teaching intuition; and (e) expert, which involves full development in the profession, reached only by some educators.

Vonk (1989) proposes another model of professional development focusing on teacher conflict and its resolution. This proposal is divided into: (a) pre-professional, characterised by how the teacher settles into teaching, including as milestones: initial training; the first teaching year; and professional growth up to the seventh year of the profession; (b) first professional phase, from when the teacher starts to show confidence and begins to innovate until the first major crisis that makes it necessary to reorient his or her understanding of the profession; and (c) second professional phase, a stage in which the solution to the previous crisis is resolved by becoming a pessimistic and defeatist teacher or, on the contrary, one who rethinks teaching and finds motivation in it.

Objectives

The aims of this study are: (a) to investigate the process of professional development of long-term contract teachers; (b) to find out how temporary status conditions the pedagogical practice of the educator; and (c) to examine in depth the role played by the admission process in the personal and professional identity of the teacher.

Methodology

Participants

The participants in this study were 12 volunteers (7 men and 5 women) between the ages of 35 and 47 ($\bar{x} = 41.66$; $\sigma = 3.65$), currently working in public primary education schools within the Physical Education speciality (see Table 1).

Table 1

Participant characteristics.

Pseudonym	Sex	Age	Experience (years)
Javier	Male	39	14
Rodrigo	Male	39	15
Alberto	Male	41	17
Nicolás	Male	45	20
Hugo	Male	45	18
Adrián	Male	46	17
David	Male	47	20
Paula	Female	37	14
Olivia	Female	37	15
Emma	Female	39	17
Patricia	Female	39	16
Leire	Female	46	22

Purposive sampling was utilised for the selection of participants (Suri, 2011), within a radius of 200 kilometres from the home of the study's principal investigator. In order for the selection of teachers to be representative, only those with a minimum of 10 years of experience were invited to participate [range = 14 to 22 years; $\bar{x} = 17.33$]. All of them have sat the selective examination at least six times. Due to the diverse characteristics and professional experience of the participants, the sampling method fostered: (a) rich narratives related to the purpose of the study; (b) rich and high quality descriptions; and (c) identification of significant professional patterns.

Data collection

Data collection began shortly after participants agreed to participate by signing an informed consent form. Data were collected through 12 semi-structured interviews, each lasting between 90 and 120 minutes. The research was approved by the Ethics Committee of the University of Valladolid, following the Code of Good Practice in Research.¹

The participants were asked about: (a) their professional experience as contract teachers; (b) the problems that arise around the public examination process; and (c) the feelings they have about themselves, the work they do in schools and the people they interact with. In order to encourage free and open narratives on these topics, participants chose the time and place of the interviews and were guaranteed anonymity through the use of pseudonyms. In addition, the interviews were conducted informally, as friendly conversations in which the researchers acted as active listeners and gently prompted participants to generate detailed narratives related to the purpose of the study (Smith, 2010).

Analysis of data

The data were analysed in narrative terms (Riessman, 2008). Narrative analysis of the transcripts was carried out by interpreting what was said (Sparkes, 2005). A qualitative software package (Atlas 6.0) was used to assist in data management. Initially, this led to the identification of the main categories or themes. The three researchers then conducted a second round of analysis through a process of constant comparison of the texts in order to establish credible and reliable sub-themes in each category (Gubrium & Holstein, 2009). Relevant quotes were selected below to illustrate these themes and sub-themes. Finally, all this information was again compared and contrasted with relevant literature in pedagogy, sport psychology and cultural studies to compile the final results, discussion and conclusions.

Results and Discussion

The results highlight three main themes: (a) struggle vs. resignation from the system; (b) temporary status as an impediment to teaching commitment; and (c) personal and professional feelings in the life of a contract teacher.

¹ [https://uvadoc.uva.es/bitstream/handle/10324/46283/Codigo-buenas-practicas-investigacion-Universidad-Valladolid.pdf?sequence=1&isAllowed=y] [accessed on 01.07.2022].

The admission process: teacher accreditation vs. resignation from the system

The participants in our study have more than fourteen years of professional experience, making them competent and expert teachers (Bickmore & Bickmore, 2010; Howe, 2006). Moreover, their experience is spread across different educational centres —in rural and urban contexts— and across different stages —early childhood education, primary education and secondary education— which adds an obvious richness to their pedagogical practice. While recognising that the passage of time brings important skills within the profession, none of the participants define themselves as experts:

"I have taught all kinds of children —even adults— in all kinds of schools and in different provinces. I believe that I have a good professional background that makes me a better and better teacher. But I don't consider myself an expert, nor do I believe that the expert teacher exists. [...]. A good teacher has to learn new things every day." (Leire)

"I see myself as just another pupil in the classroom, someone who has to reflect on what happens in each lesson and look for ways to improve. I do believe that every year new skills and learning are acquired, but the students are also changing and evolving, which means that we cannot stop educating ourselves, being critical and learning from our day to day." (Alberto)

"The passage of time brings skills as a teacher. You know more about how to manage children, how to deal with families, with colleagues... But that doesn't make me an expert. It's not as complicated as in the first years, but it's not like being an expert either." (Patricia)

Although they do not define themselves as experts, and although they have not passed the admission process, the participants do consider themselves to be competent professionals in the field of teaching:

"I am competent, of course. If I didn't consider myself competent, I wouldn't do this. I know how to deal with the group, I know what and how I have to teach... This is what I know how to do, and I know that I am qualified for it, even if I have not yet passed the public exam." (Emma)

"All this time I have continued studying, training, learning day after day... I have not passed the public examination, but I know as much or more than anyone who has passed it and I know how to put my knowledge into practice." (Hugo)

While teachers with more than five years' experience are considered in the literature to be accredited as professionals

with real teaching knowledge (Bickmore & Bickmore, 2010; Helms-Lorenz et al., 2012; Howe, 2006; Orland-Barak & Maskit, 2011), in the case of admission to the teaching profession in the public sector in Spain this may not necessarily be the case. Our participants consider themselves competent as teachers, but not so much as "teacher-applicants":

"I have tried so many times now that I don't feel I can prove that I am a good teacher in the public examinations. Maybe it's that the examining board doesn't like what I'm trying to defend, or maybe I get too nervous and I don't know how to explain it... The fact is that I do think I'm a good teacher, but I'm not good when it comes to the examination." (Olivia)

"I maintain a duality with myself between being a teacher and being an applicant. [...]. Although in my day-to-day life I prepare a lot for my lessons and I know I am good at teaching, not being able to get the job stresses me out and depresses me. It makes me think that I'm not such a good teacher after all." (Alberto)

"Examinations are 'my worst enemy'. They make me feel useless and defeated." (Adrián)

At times, participants are conflicted about their perceived competence in relation to that of other newly qualified teachers. They tend to justify their professional competence in dichotomous terms: while novices are more proficient in the theoretical aspects of teaching, they are more proficient in practical skills, which they consider more valuable:

"I have much more knowledge about what and how to run the class, how to teach, how to control the students [...]. Of course, those who have just passed know more about education law, the theoretical aspects of teaching... But in terms of daily work, which in the end is what is important, I have much more knowledge than they do." (Olivia)

This theory-practice dichotomy means that participants do not see study for the examination and the preparation of the didactic programme —essential prerequisites for successfully passing the admission proces— as professional growth activities. On the contrary, they consider these aspects to be far removed from school reality:

"What you study and prepare for the examination brings very little to the work in the classroom. In daily work, the aspects learnt in the syllabus do not come into play, the programme you have had to prepare often does not coincide with the reality of the institution where you work [...]" (David).

PHYSICAL EDUCATION

"Each course I try to rework the syllabus, the programme, the lessons I teach in the classroom... I try to connect what I practise every day at school with what is required in the public examinations. But it's not an easy task: one thing is what I do with the children, and another what I am asked to defend before the panel." (Paula)

For the participants, the difficulty of successfully passing the admission process —they have all been through the process at least six times— causes a deep emotional wound that causes them to resign themselves from the process, and doubts arise as to whether their choice of profession was the right one:

"It makes me very angry when I see that other people pass the examination. It makes me very angry, but not for them, but for myself, because I think that I have also tried many times, I have tried hard for many years, and it doesn't help." (Leire)

"Years go by and again and again I have to take the exam. It's almost like a routine in my life now. I am resigned to it. I go through one school, another, one year, another year, and it's always the same. Eternal temp." (Nicolás)

However, despite the negative emotions associated with the admission process, they are still interested in preparing for it. Partly because it is the only thing they have done professionally; partly because of the attraction of a job for life in the context of the economic crisis in which we live:

"I will continue to dedicate myself to this and do it to the best of my ability. If I have to take the exam every two years in order to be able to work in teaching, I will do it. Besides, I don't know if I would know how to do anything else after so many years of doing this." (Emma)

"Not knowing whether you will be working next year or not, where you will have to live, preparing for the exam again [...]. All of this discourages me a lot. But I am encouraged to know that, if I get the job, I will have a job for life and that gives me the strength to go on." (Javier)

The participants in our study face a daily dichotomy between theory and practice that leads them to reject study for the public examination and the development of their didactic programming as activities of professional growth and pedagogical enrichment, which feeds back into these feelings of insecurity that negatively condition their personal and professional identity (González-Calvo, 2020). Nor do they believe that the system, and in particular the syllabus, responds to content that is relevant and meaningful for their profession or even for students. As a result, the admission process is far removed from the real problems they face on a daily basis in their profession, and needs to be updated to provide greater motivation and reinforce their reflective and investigative spirit.

Temporary status as an impediment to teaching commitment

The status of contract teacher in Spain implies that the teacher can work throughout the school year in the same school, or work in different schools as a substitute for a fixed period of time. In both cases, at the end of the school year, the teacher will be put back into a job bank and it will not be until the beginning of the following school year that he/she will know if and where he/she has been assigned to a school. This temporary situation makes it difficult for our participants to commit themselves to the school and to teaching, as they see themselves as "temporary teachers":

"I feel that, year after year, I lose my passion for teaching. My motivation is not the same as it was years ago, I feel more tired, more frustrated. Being in a different place every year means that I don't get as involved as I used to because, after all, what I do now won't have continuity next year. So, although there are things I would like to do, as they involve a lot of time and effort and little reward, I don't." (Patricia)

"It is not easy to have a say in the cloisters when you are a 'passing' teacher in the school. There are aspects that are debated and that have an impact on school life in the long term, but how can I give my opinion on these issues if next year I don't know if I will be in the same school or not?" (Javier)

"I am totally committed to teaching. But it is true that there are things I could do, like coordinating workshops, volunteering to go on different excursions [...] but I don't do them because I am not part of the culture of the centre as much as other colleagues are." (Olivia)

Although the temporary situation leads to less commitment to the projects carried out in the school, the contract status implies greater pressure in the classroom and a greater burden of trying to meet the expectations expected of an educator. This situation leads to teaching stress more typical in the early years of the profession (Helms-Lorenz et al., 2012; Nasser-Abu Alhija & Fresko, 2016), which, nevertheless, these educators continue to experience today. This teaching stress is characterised by a lack of energy, by the development of negative attitudes towards others and by a feeling of inadequacy in relation to their own work (Cano-García et al., 2005; Yavuz, 2009) which, again, hinders commitment to the profession:

"I have to prove that I am as good an educator as anyone else, regardless of whether or not I have passed the public examination. You can't imagine the amount of time and effort that, fifteen years later, I still dedicate to preparing the lessons. [...] I feel overwhelmed almost all the year and, moreover, I am convinced that the management teams sometimes put more pressure on me in the preparation and presentation of the teaching programmes than on my permanent colleagues at the school." (Adrián)

"I work very hard during the course and also when it comes to the dreaded public examinations. I go through very stressful periods, which increase proportionally when the exam date approaches or when I am waiting to be called to work in a new centre. Sometimes I think that if I have to continue under this level of stress, my health will suffer." (Patricia)

The teaching stress of our participants is characterised by a lack of energy, by the development of negative attitudes towards others and by a feeling of inadequacy in relation to their own work (Laval & Dardot, 2018) which, again, hinders commitment to the profession and has obvious repercussions on personal life. Thus, teachers postpone what they see as a meaningful life for the sake of future fulfilment and job security, which encourages them to endure the fear, increasingly prevalent as time goes on, that they will never fully achieve the goal.

Personal and professional dilemmas in the life of a contract teacher

On a personal level, a common area of concern for participants relates to their age and loss of fitness over

time. Body ideals, increasingly present in body culture, are partly constructed inside and outside schools (Shilling, 2010). These ideals are legitimised in the profession of physical education:

"There are certain body ideals that, due to my age, I am no longer embodying. Although I take care of myself and lead a healthy life, the way the system is set up, it is inevitable that I will be left out of it a bit." (Javier)

"I consider myself in good physical condition, with good motor skills [...]. But I am worried that the selection panel that assesses me will question my eligibility on the basis of my age. It seems that this is a profession where being young is more highly valued." (Olivia)

Eman (2012) speaks of 'age of ability', which is assessed primarily through comparisons of current physical experiences with previous abilities and with the abilities of others. Until not so long ago, the admission system to the teaching profession introduced, as part of the selective process, tests for physical fitness and motor skills.² These tests —and today there are plans to reintroduce them favour a docile body, easily subjected, transformed and perfected (Foucault, 1979). The uncertainty surrounding the return of physical tests to the selection process undermines the personal and professional identity of the participants:

"If the physical tests were to return, as it is believed they will, it would not be a fair situation. I am no longer 20 years old, I am not in the same physical condition as I used to be, I can't compete with those who have just finished their degree. What can I do if the physical standards return?" (Paula)

"I have already faced the physical entrance exams on several occasions. Although I didn't notice them at the time, probably because I was young and passed them without difficulty, today I consider them to be unfair. I don't think I will be able to pass the tests at this stage, so they will act as a sieve so that only young teachers will be able to teach physical education." (Nicolás)

² Until 2003, aspiring teachers had to pass a physical test consisting of an agility circuit, driving and kicking a ball with the feet, an aerobic endurance test and a body expression test. There is currently a debate as to whether these tests, which in the case of physical education teachers at secondary level (from 12 to 16 years of age) are ongoing, should be reintroduced into the selection procedure.

Gubrium & Holstein (2003) rightly criticise the common view of ageing bodies as a pervasive phenomenon when, in fact, in many everyday interactions it is sometimes "invisible". The body is an object of experience whose visibility is determined by the action of acquiring meaning in specific contexts where the body is directly encountered in particular ways by the self and others. This is the case for some of our participants:

"When the time comes to take the exam, I look at the rest of the applicants, and I realise that I am usually one of the oldest. [...] Being older is relative, something that is constituted in interaction and that takes on context in relation to other people. And, in this context, surrounded by people several years younger, it makes me feel out of place." (Alberto)

At other times, participants have feelings of anger and shame, stemming from sharing cultural standards of healthy and eternally youthful bodies that denote a perfect appearance (Charmaz, 1995). There is anger at not meeting those standards:

"I have a struggle against my own body, I look much older than the rest. And although it is true that the loss of physical condition is not very noticeable and does not influence the examinations, the truth is that it makes me feel somewhat self-conscious. [...] But I can't fight against age, I can only give up or move on." (Nicolás)

"I'm very accepting of myself and the passage of time. I don't have any complexes, I don't feel old or anything like that [...]. Although when I see other opponents I realise that they are younger, they seem 'healthier', they are 'fitter', I feel a bit excluded." (Leire)

These ideas confirm that identity change generally takes place through three parallel processes: a personal process, an interpersonal process and an intercultural process (Spector-Mersel, 2010).

Another key issue in the lives of contract teachers has to do with the uncertainty of knowing whether or not they will be able to work next school year and, if so, where. This situation presents them with a number of dilemmas that make it difficult for them to reconcile their personal and professional lives:

"In recent years, thanks to the fact that I have enough points on the list of contracts, I have been offered a job close to my home. It is not like in the beginning, when I had to travel many kilometres to work. Now there are things I can consider that were difficult before, such as having children. [...] Although now, with the economic crisis, I'm a bit scared about whether they will cut staff, whether I'll be able to work, and that also conditions my life projects." (Hugo)

"It's annoying when the summer comes and you're unemployed, not knowing whether you'll be working next year or not. In my case, I have had no shortage of work for years, but now it is different. They are cutting staff, I find it hard to explain that I am unemployed again until they call me back to work... When summer comes, I cry because of it." (Adrián)

"I don't like summers at all, let alone people thinking I'm lucky to be a teacher and have two months' holiday. It is a time of fears, of not knowing whether I will work or not, where I will be sent, how I am going to organise my personal life with work [...]. Other things, such as buying a car or a house, are also complicated, because it is a nonstable job that makes it difficult to borrow money. All this, on a psychological level, is not easy to cope with." (Emma)

Although all the participants emphasise that they feel well valued by their students and by the families of the students, they suffer and/or have suffered situations in which they have felt undervalued due to their temporary status and the little support they have received from the management teams. This situation of loneliness generates a certain mistrust towards teamwork and towards the teaching profession in general:

"It's not that I feel mistreated or anything like that, but the management team has not behaved well and neither have my colleagues. I have been left with the worst groups, the most troubled pupils [...]. I don't deserve this treatment, but the centre treats all of us who are contract teachers like this." (Javier)

"I do feel I am treated worse because I am a contract teacher. From the way courses are chosen, when I am always the last one chosen, to making some derogatory comments to me because of my status as a temp." (Paula)

The participants accept with reluctance that, despite having several years of experience behind them (in many cases, more than the rest of the colleagues in the centre and even the management teams), they are always considered "the last ones", which generates feelings of insecurity and loneliness:

"It hurts me to be treated like a rookie who has just arrived. I always get the groups that others don't want to go near because they are difficult. They don't make things too easy for me, or even patronise me for being the eternal temp." (Rodrigo) "There are all sorts of things. I have felt very comfortable in several of the schools I have been in. Although it's true that, in general, I have that feeling of being the last. [...] I'm not bitter about it either, I know it's something common in this profession and that's it." (Olivia)

The subjectivities of these teachers are continually changing and, as fluids, they do not remain in any one form for long and need to be constantly prepared (and prone) to change (Bauman, 2000). They prioritised their professional subjectivities over their personal ones. As having a permanent job in Spain can give a sense of long-term security, they aspired to get one, even if it was necessary to undergo the stressful ordeal of gaining a permanent teaching post several times (González-Calvo, 2020). Productive times in which haste works mean that teachers have to live in a rushed and fast-pace way, where there is no time for everything.

Conclusions

This article has addressed the concerns and particularities of a group of teachers with several years of experience in the profession who, despite this, do not have a permanent position in public education. From the dialogue that emerged in the interviews and the reflection of the participants, we understand that giving voice to these educators serves to reconstruct and re-examine their professional identity (Ambler, 2012; Pritzker, 2012), revealing their fears, hopes and uncertainties. The stories of these participants thus help to build their professional identity by bringing to light their strengths and weaknesses, finding new ways of approaching pedagogical practice and connecting these with their dayto-day classroom experiences.

When we considered studying the personal and professional identity of teachers with several years of experience as temporary teachers, a very common situation in Spain, we chose teachers with at least fifteen years of teaching experience. This extensive experience, coupled with the fact that the administration does not recognise these professionals as "teachers in their own right", gives rise to dilemmas and conflicts about their chosen profession. Thus, in all the participants we have found a special way of looking at and dealing with educational phenomena, as subjectively experienced phenomena that affect their personal and professional identity: interpersonal relationships with other colleagues, management teams, feelings of insecurity and incompetence in relation to others, feelings of isolation and loneliness, are phenomena that need to be thought about and understood, as they leave their mark on professional identity and, in many cases, make a dent in it.

Although this study is based only on 12 teaching professionals from their own personal and professional

experiences, the findings support similar results found by other authors (e.g. Cañadas et al., 2019; González-Calvo, 2020; O'Connor, 2008; Watson, 2006; Zembylas, 2004), so they may be applicable to other studies and nationalities. The data in this study aim to shed light on the admission system for the teaching profession in Spain and to understand the relationship between the system and teaching identity. The study can also serve as a framework for conceptualising the experiences of long-term contract teachers for the benefit of all those involved in teaching and education.

This is a significant contribution to the existing literature on this topic, as it also delves into the personal sphere of how teachers deal with the process of obtaining a permanent teaching position. It also allows us to reflect on what 'true educational quality' is, conditioned to a large extent by the instability of teaching that emerges with current neoliberal education policies (Luna, 2015). Our schools deserve welltrained teachers who invest in their pedagogical training because they have the certainty of a permanent position and job security for years to come. Similarly, our children deserve motivated professionals who enjoy teaching without needing to worry about their employment status. When the government does not make a firm commitment to quality public education, and budget restrictions are put in place in various areas, we are impoverishing ourselves as a society. This, which undoubtedly serves clear economic interests, commodifies a profession as important and responsible as that of teaching. Sadly, teachers have to be more concerned about whether their job will be renewed the following year than about carrying out their teaching profession with peace of mind and security.

References

- Ambler, T. B. (2012). Autobiographical vignettes: a medium for teachers' professional learning through self-study and reflection. *Teacher Development*, 16(2), 181-197. https://doi.org/10.1080/13664530.2012.679864
- Bauman, Z. (2000). Liquid modernity. Malden, MA: Polity Press.
- Berliner, D. C. (1988). *The development of expertise in pedagogy*. Washington, DC: AACTE Publications.
- Bickmore, D. L., & Bickmore, S. T. (2010). A multifaceted approach to teacher induction. *Teaching and Teacher Education*, *26*(4), 1006-1014. https://doi.org/10.1016/j.tate.2009.10.043
- Bolívar Botía, A., Domingo Segovia, J., & Fernández Cruz, M. (1998). La investigación biográfico-narrativa en educación. Guía para indagar en el campo. Granada: University of Granada.
- Cano-García, F. J., Padilla-Muñoz, E. M., & Carrasco-Ortiz, M. Á. (2005). Personality and contextual variables in teacher burnout. Personality and Individual Differences, 38(4), 929-940. https://doi.org/10.1016/j.paid.2004.06.018
- Cañadas, L., Santos-Pastor, M. L., & Castejón, F. J. (2019). Physical Education Teachers' Competencies and Assessment in Professional Practice. *Apunts Educación Física y Deportes*, 139, 33-41. https://doi.org/10.5672/apunts.2014-0983.es.(2020/1).139.05
- Charmaz, K. (1995). The body, identity and self. *Sociological Quarterly*, 36(4), 657-680. https://doi.org/10.1111/j.1533-8525.1995.tb00459.x
- Eman, J. (2012). The role of sport in making sense of growing old. Journal of Ageing Studies, 26, 467-475. https://doi.org/10.1016/j.jaging.2012.06.006

- Foucault, M. (1979). *Discipline and punish: The birth of the prison*. New York: Vintage Books.
- González-Calvo, G. (2020). "Sin luz al final de mi túnel". Un enfoque narrativo en torno al profesorado interino de Educación Física de larga duración. *Ágora para la Educación Física y el Deporte, 22,* 85-105. https://doi.org/10.24197/aefd.0.2020.85-105
- Gubrium, J. F., & Holstein, J. A. (2003). The everyday visibility of the ageing body. In C. Faircloth (Ed.), *Ageing bodies* (p. 205-227). New York: Altamira Press.
- Gubrium, J. F., & Holstein, J. A. (2009). Analyzing narrative reality. Thousand Oaks: Sage.
- Helms-Lorenz, M., Slof, B., Vermue, C. E., & Canrinus, E. T. (2012). Beginning teachers' self-efficacy and stress and the supposed effects of induction arrangements. Educational Studies, 38(2), 189-207. https://doi.org/10.1080/03055698.2011.598679
- Howe, E. R. (2006). Exemplary Teacher Induction: An international review. *Educational Philosophy and Theory*, *38*(3), 287-297. https://doi.org/10.1111/j.1469-5812.2006.00195.x
- Laval, C., & Dardot, P. (2018). El ser neoliberal. Barcelona: Gedisa.
- Luna, V. M. I. (2015). From Neoliberalism to Possible Alternatives. Economía Informa, 395, 35-49. https://doi.org/10.1016/j.ecin.2015.10.004
- Nasser-Abu Alhija, F. M., & Fresko, B. (2016). A Retrospective Appraisal of Teacher Induction. *Australian Journal of Teacher Education*, 41(2), 16-31. https://doi.org/10.14221/ajte.2016v41n2.2
- O'Connor, K. E. (2008). "You choose to care": Teachers, emotions and professional identity. *Teaching and Teacher Education*, 24, 117-126. https://doi.org/10.1016/j.tate.2006.11.008
- Orland-Barak, L., & Maskit, D. (2011). Novices "in story": What firstyear teachers' narratives reveal about the shady corners of teaching. *Teachers and Teaching*, 17(4), 435-450. https://doi.org/10.1080/1354 0602.2011.580520
- Pritzker, D. (2012). Narrative analysis of "hidden stories": a potential tool for teacher training. *Teacher Development*, *16*(2), 199-215. https://doi.org/10.1080/13664530.2012.688681
- Riessman, C. K. (2008). Narrative methods for the human sciences. Los Angeles: Sage.
- Shilling, C. (2010). Exploring the society-body-school nexus: theoretical and methodology issues in the study of body pedagogics. *Sport, Education* and Society, 15(2), 151-167. https://doi.org/10.1080/13573321003683786
- Smith, B. (2010). Narrative inquiry: Ongoing conversations and questions for sport and exercise psychology research. *International Review of Sport and Exercise Psychology*, 3, 87-107. https://doi.org/10.1080/17509840903390937

- Sparkes, A. (2005). Narrative analysis: Exploring the whats and hows of personal stories. In M. Holloway (Ed.), *Qualitative research in health care*. Milton Keynes: Open University Press.
- Spector-Mersel, G. (2010). Narrative research: Time for a paradigm. *Narrative Inquiry*, 20(1), 204-224. https://doi.org/10.1075/ni.20.1.10spe
- Suri, H. (2011). Purposeful sampling in qualitative research synthesis. *Qualitative Research Journal*, 11(2), 63-75. https://doi.org/10.3316/ QRJ1102063
- Vonk, J. H. (1989). Beggining teacher's professional development and its implications for teacher education and training. *The Irish Journal of Education*, 23(1), 5-21.
- Vonk, J. H., & Schras, G. A. (1987). From beginning to experienced teacher: A study of the professional development of teachers during their first four years of service. *European Journal of Teacher Education*, 10(1), 95-110. https://doi.org/10.1080/0261976870100111
- Watson, C. (2006). Narratives of practice and the construction of identity in teaching. *Teachers and Teaching: Theory and practice*, 12(5), 509-526. https://doi.org/10.1080/13540600600832213
- Yavuz, M. (2009). An investigation of burn-out levels of teachers working in elementary and secondary educational institutions and their attitudes to classroom management. *Educational Research and Reviews*, *4*(12), 642-649.
- Zembylas, M. (2004). The emotional characteristics of teaching: An ethnographic study of one teacher. *Teaching and Teacher Education*, 20(2), 185-201. https://doi.org/10.1016/j.tate.2003.09.008

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"PE Money Heist": Gamification, Motivational Regulations and Qualifications in Physical Education

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Cover:

A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images Abstract

The aim of this study was to assess the impact of a gamified programme in Physical Education classes on the motivational regulations and grades of secondary school students in comparison to a traditional teaching approach. The sample consisted of 102 students in the year 10 (4th year of secondary education) (16.7 \pm 0.43 years old) from the same school in the province of Barcelona, who were divided into an experimental group (gamification) (n = 51, 18 boys and 33 girls) and a comparison group (traditional approach) (n = 51, 20 boys and 31 girls). The study followed a quasi-experimental design, pretest-posttest (eight weeks), using the Perceived Locus of Causality Scale (PLOC) and analysis of final ratings. Only the gamified programme achieved significant changes in intrinsic motivation, lack of motivation and identified, introjected and external regulations, although to a greater extent in intrinsic motivation. These students also obtained significantly higher final grades. In short, the application of a gamified programme as an emerging pedagogical model can generate positive effects among students in terms of motivation and academic performance.

Keywords: motivation, pedagogical innovation, pedagogical models, secondary education.

Introduction

One of the main theoretical frameworks used to understand individuals' motivational regulations in different contexts, as well as in physical education (PE) (Erpič, 2011), is that of the Self-Determination Theory (SDT; Deci & Ryan, 1985). SDT posits the existence of different types of regulation along a continuum of self-determination (Boiché et al., 2008). At one extreme is intrinsic motivation (the most self-determined), which refers to doing an activity that is satisfying in itself and that, as a result of doing it, provides fun and enjoyment (these become important to the individual). It must be noted that intrinsic motivation has been linked to better PE experiences and positive outcomes (Vasconcellos et al., 2020), including physical activity practice (Kalagas-Tilga et al., 2020). At the other end of the continuum is lack of motivation, which refers to a lack of interest in doing an activity (Vansteenkiste et al., 2010). Between the two, extrinsic motivation is situated in its four types according to the degree of internalisation of the individual's behaviour and self-determination (Ferriz et al., 2015): a) external regulation: regulated behaviour to avoid punishment or obtain a reward (the activity has not been internalised at all); b) introjected regulation: regulated behaviour to avoid feelings of guilt and increase selfesteem in an activity that has been internalised somewhat (these two regulations are included in controlled extrinsic motivation); c) identified regulation: behaviour regulated by the benefits of performing a task that is understood and to which a certain personal value is associated; and d) integrated regulation: behaviour regulated by the integration of a specific behaviour among those consistent with oneself after a process of reflection and awareness of what one wants to be (these last two regulations are included in independent extrinsic motivation). Along these lines, more self-determined forms of motivational regulation (intrinsic motivation, integrated regulation, identified regulation) have been associated with an active and healthy lifestyle, whereas less self-determined forms (external regulation, introjected regulation, lack of motivation) have been associated with negative results, such as withdrawal from physical activity (Granero et al., 2014; Hagger & Chatzisarantis, 2007).

Elements that are external to the individual that arouse a feeling of "controlling" their behaviour, such as rewards, punishments, deadlines, competitions or monitoring, and that seem to "force" them to behave in a particular way, decrease intrinsic motivation, interest and willingness to do an activity, because they shift the perceived focus of causality from internal (self) to external (other) (Deci & Ryan, 1985). Furthermore, some types of regulation, such as introjected regulation, have been associated with both adaptive and non-adaptive outcomes (Vasconcellos et al., 2020), although, as the behaviour is only partially internalised, it is often not sustained over time (Pelletier et al., 2001). Fortunately, autonomy-supportive contexts, which promote individuals' basic psychological needs, also promote their intrinsic motivation (Deci & Ryan, 1985).

Researchers, such as Pérez-Pueyo & Hortigüela (2020), argue that PE is an essential curricular subject when it comes to promoting students' healthy physical habits which are transferable to their daily lives outside school and that will accompany them throughout their adult lives. However, not all students feel motivated towards PE (Ntoumanis, 2001); an idea that is exacerbated with students in secondary schools, some of whom describe it as "humiliating, frustrating, embarrassing and barely tolerable" (Portman, 1995, p. 452). Contrary to the profile of the uncritical and romanticised teacher, whose blindness reaffirms his or her idea that PE is liked by all students (Flores-Aguilar et al., 2019), teachers should remove the blindfold to act on the basis of the real socio-emotional and psychological needs of 21st century students, especially the young adults (Gutiérrez et al., 2011). For this reason, the new PE model calls for an urgent rethinking of its teaching across multiple aspects (López-Pastor et al., 2016). For example, teachers need to incorporate innovative pedagogical approaches that increase student ownership (Lim et al., 2019), in order to facilitate a set of successful experiences that meet their needs and maintain and/or increase their motivation (Fernández-Río et al., 2020; Pérez-Pueyo & Hortigüela, 2020).

Against this backdrop, the emergence of gamification in educational institutions is of particular interest. With its origins in the business world, gamification refers to the introduction of the main elements of games in nongame environments (Werbach & Hunter, 2012), with the eventual goal of bringing about a change in users' (players') behaviour (Zichermann & Cunningham, 2011). At the school level, this study considers gamification to be an emerging pedagogical model (PM) "that uses game elements to develop specific curricular content within a context, which includes tasks and activities adapted to the dynamics of the game to achieve the educational objectives set, and not simply for fun" (Fernández-Río & Flores-Aguilar, 2019, p. 11). When it comes to its design, and under this perspective of gamification as a PM, Blázquez & Flores-Aguilar (2020) propose a structure centred on two phases: a) the "didactic phase", which corresponds to the



Figure 1 Basic elements of games according to Werbach and Hunter (2012).

selection of competences, objectives, contents, assessment criteria, etc. according to the corresponding curricular regulations; and b) the "gamified phase", which focuses on the choice and adaptation of some of the main basic elements of Werbach & Hunter's (2012) game (Figure 1).

Despite the fact that the incorporation of gamification in PE lessons is on the rise, its research is still incipient, and even inconsistent and vague (Fernández-Río et al., 2020; Ferriz et al., 2020; Navarro-Mateos et al., 2021). In the framework of primary and secondary education, Fernández-Río et al. (2020) found an increase in the participating students' intrinsic motivation; something that was also found, together with an increase in the levels of autonomy and responsibility, in Valero et al. (2020) study (especially in girls), although in the latter the gamified experience was hybridised with the personal and social responsibility model. Intrinsic motivation, basic psychological needs and intention to be physically active also increased among the secondary school students studied in Fernández-Río et al. (2022) study. Also in

secondary education, Segura et al. (2020) found an increase in young adults' intrinsic motivation, autonomy, satisfaction, enjoyment and academic performance after the application of gamification hybridised with the flipped classroom. Again in this educational cycle, the gamified experience of Sotos et al. (2022) study produced positive changes in intrinsic motivation. In addition to improving basic psychological needs, this gamification increased selfdetermined motivation and reduced lack of motivation. In contrast, Quintas et al. (2020) found no impact on students' intrinsic motivation, external regulation and lack of motivation, but some positive effects on basic psychological needs and academic performance. On the other hand, the students in Monguillot et al. (2015) study agreed in describing gamification as a useful and motivating experience, with which they better learned the skills that were taught. Together with the decrease in PE anxiety, improved learning of physical fitness content was also one of the advantages reported by primary school girls in Rodríguez-Martín et al. (2022) study.

Despite all these positive results, gamification is not effective (Quintas et al., 2020) per se (Quintas et al., 2020). An uncritical and mistaken conception of educational gamification can lead to the reduction of all its potentialities with the emergence of the so-called "pseudogamifications" (Flores-Aguilar & Fernández-Río, 2021), whose motivational effects (mostly extrinsic) are very detrimental to students (obsession with winning, group conflicts, etc.) (Dichev & Dicheva, 2017, Hanus & Fox, 2015; Pérez-Pueyo & Hortigüela, 2020). For this reason, in addition to disseminating a set of didactic guidelines that allow teachers to design appropriate gamified experiences (Blázquez & Flores-Aguilar, 2020), more research is currently needed, with clear procedures, validated tools and larger samples, to evaluate the real impact of gamification on students (Fernández-Río et al., 2020), especially at the motivational level (Ferriz et al., 2020).

Therefore, the main objective of the study was to assess the impact of a gamified PE programme on all motivational regulations and grades on a set of secondary school students in comparison with a traditional teaching approach. Unlike previous studies, this intervention programme followed the guidelines of Blázquez and Flores-Aguilar (2020) for the adoption of gamification as an emerging PM.

Methodology

Participants

A total of 102 students in year 10 (4th year of secondary education) (16.7 ± 0.43) from the same school (subsidised) in the province of Barcelona agreed to participate. An experimental (gamification) group was randomly assigned (51 students: 18 boys and 33 girls) and another comparison group (traditional approach) (51 students: 20 boys and 31 girls). It should be highlighted that neither group had experienced gamification before, and that the same PE teacher delivered the sessions for both groups. This teacher was trained in the design and use of gamification over an entire academic year at university. Similarly, during the course of the experiment, the teacher was constantly supported and supervised by two experienced researchers in the field. The study followed a quasi-experimental, pretest-posttest experimental and comparison group design (eight sessions) (Cohen et al., 2011).

Materials

A validated Spanish version of the Perceived Locus of Causality Scale (PLOC) (Ferriz et al., 2015) was used. This tool consists of 24 items grouped into six subscales: intrinsic

motivation (i.e. "because PE is fun"), integrated regulation (i.e. "because it suits my way of life"), identified regulation (i.e. "because I want to learn sport skills"), introjected regulation (i.e. "because I want the teacher to think I am a good student"), external regulation (i.e. "because I will get in trouble if I don't do it") and lack of motivation (i.e. "I don't really know why"). The scale had the title: "I participate in PE classes..." and participants responded on a Likert scale from one ("strongly disagree") to seven ("strongly agree"). In the present study the Cronbach's alphas obtained were the following, in the pretest and posttest, respectively: intrinsic motivation: .810 and .756; integrated regulation: .884 and .881; identified regulation: .801 and .849; introjected regulation: .645 and .619; external regulation: .661 and .707, and lack of motivation: .666 and .614. All are considered to be acceptable (Martínez et al., 2014). At the end of the intervention programme, final marks were awarded to each student (scale from 0 to 10) on the basis of the same assessment tools used in the two groups.

Procedure

In accordance with the Declaration of Helsinki (2013) protocol, ethical consent was obtained from the University of Vic-Central University of Catalonia. Secondly, the leadership team of the school where the intervention programme was to be carried out was contacted to obtain their permission. Thirdly, the students and their families were contacted to explain the project and all those who wanted to participate handed in a consent form signed by their parents or legal guardians. It stated that they could leave the study at any time, that all data would be treated confidentially and anonymously, and that the data would not affect their academic grade in PE. Finally, the main researcher administered the questionnaires to all students during the PE class and encouraged the participants to answer as truthfully as possible. The approximate duration of the administration was about 20 minutes.

Intervention Programmes

During the 2019/20 academic year, two didactic units (DU) were carried out simultaneously: one was developed with gamification as a PM and the other with a traditional methodology. Both DUs had eight fitness and health-oriented sessions, distributed in two one-hour sessions per week over a four-week period. The two intervention programmes had the same learning objectives, content, criteria and assessment tools (table 1 and 2). For its preparation, the teacher resorted to the existing curriculum in Catalonia: Decree 187/2015, of 25 August, on the organisation of the teaching of compulsory secondary education.

Table 1

Curricular information of the two learning experiences.

Competences specific to PE	Curricular content	Curricular assessment criteria
C1. Implement a work plan to improve or maintain individual fitness in relation to health.	 Strength and speed: concept, characteristics, effects and training methods. Safety standards and risk prevention. 	 Relate physical activities to the effects they have on the human body's various systems.
	• Fitness and health assessment tests (questionnaires, tests and quizzes).	 Measure the intensity of the task performed using the heart rate. Become aware of individual physical condition and show willingness to improve it.
	 Design and execution of a warm-up suitable to the physical activity to be performed. Elements of a task plan. 	1. Plan and implement a general warm-up, recognising its main effects.
Learning objectives	Learning content	Specific assessment criteria
1. Assessing individual fitness and health.	 Physical fitness tests (Cooper run test, long jump, medicine ball throw, etc.) 	 Identify individual physical fitness strengths and weaknesses. Identify individual physical condition and develop personal commitments, through a portfolio.
2. Identify the elements of a task plan.	 The elements of the task plan: assessment of the level of physical condition, assessment of interests, establishment of objectives, selection of physical capacities, selection of exercises, review of materials to be used and organisation of the session. 	3. Develop a task plan aimed at strength or speed work.
 Design appropriate warm-ups for the designed physical activity. 	 Indentifying the different parts of an activation-warm-up phase: joint mobility, continuous running, stretching. 	 Develop an appropriate activation phase for the physical activity to be performed.
	• Creating an appropriate warm-up for the activity to be performed.	5. Perform heart rate monitoring during the activation phase.
4. Build a task plan for each skill (strength and speed).	Creating a task plan to work on strength.Creating a work plan to work on speed.	 Develop a task plan aimed at strength or speed work. Execute a task plan developed by another group and relate the work plan to the effects it has on the various systems in the humar body.

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Table 2

Assessment schedule in the two learning experiences.

Means: assessment activities	Assessment techniques	Assessme	nt tools	Minimum requirements
		Types	Weight (%)	Indicators
Activity 1: Develop and perform a strength or speed- related activation phase in groups.	Self-assessment +	Culmination	15%	 Calculate heart rate based on the intensity of the PC. Select the exercises according to the session objectives. The three parts of the activation phase appear. Select creative and different exercises
	Peer-assessment		15%	
Activity 2: Develop and execute a strength or speed-related task plan as a group.	Co-evaluation +	Evaluation target	10%	 The elements of a task plan appear. All members of the group participate in the creation of the training template and the development of the exercises. Select creative and different exercises according to the session.
	Peer-assessment		20%	 Propose different levels of execution so that each person can work according to their physical capacities.
Activity 3: Physical Activity Diary	Self-assessment	Checklist	20%	 Evidence of the daily steps through screenshots posted weekly in the shared document on the <i>Drive</i>. Use digital resources (<i>app</i> mobile phone, fitness watches, etc.) to measure daily steps. Demonstrate a progression of daily steps. Accumulate the agreed daily steps to be an active person.
Activity 4: Creating a learning folder (portfolio).	Peer-assessment	Culmination	20%	 Includes an individual sheet of personal commitments. The portfolio is submitted with the formal aspects relevant to the school's rules on the presentation of work and has a coherent structure. Selects materials and procedures that demonstrate the teaching and learning process, justifying their choices. Makes corrections and improvements in relation to the <i>feedback</i> made by the teacher and peers. Makes a final critical and reflective reflection of their learning process.

Based on ORDER ENS/108/2018, of 4 July, to express the degree of attainment of the curricular competence, the teacher carries out the following conversion: 0-49 points (NA: not achieved); 50-69 (SA: satisfactory achievement); 70-89 (NA: notable achievement (grade B)); 90-100 (EX: excellent achievement (grade A)).

Experimental Group: Gamified Approach

The experimental group was subjected to a gamified DU based on the TV series "Money Heist". The entire intervention programme was designed based on Blázquez

& Flores-Aguilar's (2020) instructions for the creation of gamification in PE as a PM. Table 3 describes and summarises some of the most relevant features of the gamified phase.

Table 3

Description of the key elements of gamification.

Narrative

The general objective of the students, who were organised in groups, was to break into "The Royal Mint and The Health Care Centre" to make one million euros during the time they were inside and, as a result, escape to live in a paradise of money and health. To make this money they had to show evidence of healthy physical activity. This money accumulated throughout the DU was used to buy a plane ticket to Thailand to see the Professor (a character in the series), who was waiting for them on the island of Koh Tao.

Challenges and Missions

- In order to achieve their goal, the students had to overcome a set of challenges grouped into 4 different missions:
- Mission 1: Seize "The Royal Mint and the Health Care Centre." They had to create a good team and prepare to enter "The Royal Mint and the Health Care Centre" (examples of activities: passing fitness tests and initiating the construction of a task plan) (Sessions 1 and 2).
- Mission 2: Let's start the machines! They had to make as much money as possible to be able to buy the plane tickets to go to Thailand (examples of activities: creating and leading warm-ups) (Sessions 3 and 4).
- Mission 3: Let's build the tunnel. This consisted of digging the longest possible tunnel in order to escape from the "The Royal Mint and Health Care Centre" and not get caught by the police (examples of activities: conducting strength and speed training; developing and conducting their own training, etc.) (Sessions 5, 6 and 7).
- Mission 4: Escape! They had to escape the country without being seen by the police and reach Thailand (Koh Tao island), where the Professor (character in the series) was waiting for them in order to live an idyllic and healthy life (examples of activities: see special event) (Session 8).

All these missions are identified on the experience platform (Genially) (Figure 2): https://view.genial.ly/5dd9098751a61a0f71d7c123

Teams, Players and Avatars

Based on the initial physical assessment tests (speed and strength tests) and other criteria, such as gender, mixed groups of five were organised and stayed the same throughout the DU. Within each team, the students had to choose one of the characters from the series according to the one they felt most identified with: Berlin, Denver, Rio, Nairobi and Tokyo. There was also the character of the Professor, played by the PE teacher.

Rewards

- Banknotes: These were rewarded through the daily steps recorded (outside school hours) with the app, Strava. Each step was equivalent to €1.
- Gold coins: They were acquired in the different sessions through completing each session's challenges. Each coin was worth €100.
- Gold bars: These were rewarded for completing extra (non-compulsory) activities that were presented through Instagram. One bar was equivalent to €1,000.
- Unlock codes: These were rewarded for completing each mission and allowed access to the next mission by means of a secret code.

Rewards	Badges (mission keys)
10 gold coins	Mobile code
10 gold coins	(code 173)
50 gold coins	Mobile code
50 gold coins	(code 27193)
100 gold coins	
100 gold coins	Mobile code (code 548F)
100 gold coins	(00000.01)
10,000 gold coins	Mobile code (code 8056)
	Rewards 10 gold coins 10 gold coins 50 gold coins 50 gold coins 100 gold coins 100 gold coins 100 gold coins 100 gold coins

Table 3 (Continued)

Description of the fundamental elements of gamification

Extra Activities

Through the Professors's Instagram account, extra activities were uploaded as "stories" and "*posts*" which the students had to perform and provide evidence of completion through photos, videos or screenshots in order to get some gold bars in return. These activities were as follows: a) Performing different strength exercises (examples: push-up challenge; plank and side plank challenges; squat challenge, etc.) *burpees* challenge; plank and side plank challenges; squat challenge, etc.); b) Recording a walking or running route with Strava (examples: routes of between 4 and 10 km; 15' or 30' routes, etc.).

Special Events

A single special event was held at the end of the DU (relating to an assessment activity, in this case a summative one).

• Capture a million! With the "Capture a million!" competition, all the money they had collected during the course of the DU was put up for grabs, through different theory-related questions about the content of the DU. At the end they had to buy a plane ticket to escape. To achieve this, the whole class had to finish the competition with more than 50% of the money they had to make, so that if the class contained six groups and each group had the goal of making 1 million euros (six million in total), the budget of the whole class to be able to get the airline tickets was more than three million euros.

Social Area - Board

- Drive: An Excel file was created on Google Drive, shared with all the groups, and one of the members was responsible for ensuring that the rest of the group attached weekly screenshots of the steps taken that week, in order to keep track of the weekly activity and be able to exchange them for money in the last session of the DU.
- Instagram: A private Instagram account was created where the teacher communicated with the students and gave them specific challenges. This tool was also used to share healthy lifestyle habits and the different content worked on in the sessions (strength, speed, warm-up, work plan, etc.), as well as the amount of money they had accumulated (Figure 3).
- Genially: This is the platform that the students used to find out where they were in the game and to watch the videos of the missions and their objectives (board). https://view.genial.ly/5dd9098751a61a0f71d7c123

Certificates: The Plane Ticket

When the class as a whole achieved the final goal of raising more than 50% of the money set out in the initial objective (1 million per group), in recognition of their involvement and participation in the experience, they were given a plane ticket to Koh Tao so they could escape and complete the mission.



Figure 2 Visualisation of the Genially platform with the missions.



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Grups	Diners (1 pas = 1 €)	Monedes d'or (1 moneda = 100€)	Lingots (1 lingot = 1.000€)	TOTAL
1C	447.304€	261	0	473.404€
2C	309.504€	254	0	334.904€
3C	524.538€	225	0	547.038€
4C	82.832€	168	0	99.632€
5C	59.694€	167	0	76.394€
6C	240.079€	162	3	259.279€

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Figure 3 Visualisation of the teacher's Instagram account.

Control Group: Traditional Approach

The comparison group experienced the same DU but designed and developed in a more traditional teaching format, in which directive and task allocation styles were predominant (Metzler, 2017). This group performed different tasks in teams, which, unlike the experimental group, were organised randomly in each session. Activities such as physical tests for the initial assessment of physical condition, the construction of a task plan and the creation and application of warm-ups, as well as the development and implementation of speed and strength training were proposed. In the last session, the students completed a questionnaire online with different theoretical questions on all the content covered during the DU.

Data Analysis

All data collected from the questionnaire was analysed using SPSS 22.0 statistical software. Normality tests, descriptive

and inferential statistics (T-tests, ANOVAs, MANOVAs and MANCOVAs) were performed. Finally, statistical power and effect size were calculated, using Cohen's (1988) *d* (small < .5, moderate .50-.79, large \geq .80) and η^2 (Miles & Shevlin, 2001; small \geq .01, moderate \geq .06, large \geq .14).

Results

Firstly, the Kolmogorov-Smirnov test showed that almost none of the variables followed a normal distribution (p < .05), but as skewness (.245) and kurtosis (.485) were within the allowed ranges (-1 and +1) parametric tests were used (Blanca et al., 2017). Secondly, a MANOVA was performed with the pretest values to check the initial homogeneity of the sample and the results showed that there was no significant difference in any of the variables between the comparison and experimental groups: Wilks' Lambda: .950, F (6, 90) = .791, p = .579. Therefore, both research groups could be considered similar. To test for

Table 4	Та	bl	е	4
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Pre and posttest results of motivational regulations.

	Experimental group		Comparisor	n group		
	Pre M (SD)	Post M (SD)	Pre M (SD)	Post M (SD)	þ	d
Intrinsic motivation	3.38 (0.96)	4.00 ^{*a} (0.64)	3.37 (0.81)	3.56 ^b (0.70)	.001	.65
Integrated regulation	3.34 (1.07)	3.67ª (0.98)	3.41 (1.07)	3.56 ^a (1.02)	.063	-
Regulation identified	3.61 (0.92)	3.96 ^{*a} (0.89)	3.75 (0.86)	3.68ª (0.87)	.025	.31
Introjected regulation	2.91 (0.79)	3.47 [•] a (0.87)	3.08 (0.75)	3.12 ^b (0.72)	.001	.43
External regulation	3.01 (.93)	3.33 ^{*a} (.91)	2.98 (.82)	2.95 ^b (.82)	.042	.43
Lack of motivation	2.20 (.72)	1.87 [•] a (.54)	2.01 (.87)	1.95ª (.75)	.016	.12

Note: M = mean; SD = standard deviation; * = pre-post intragroup differences; different superscripts in the same row indicate significant intergroup differences at posttest. p < .05; d = effect size (*Cohen's d*).

intra-group changes pre-post, a T test for related samples was performed. The results showed that there were significant changes only in the experimental group and in the intrinsic motivation variables (p = .001, d = .65), identified regulation (p = .025, d = .31), introjected regulation (p = .001, d = .43), external regulation (p = .042, d = .43) and lack of motivation (p = .042, d = .12). The data shows that the effect size was larger for intrinsic motivation (moderate) than for the three regulations (small). Finally, to test for intergroup differences in the posttest, a MANCOVA was performed, which gave positive results: Wilks' Lambda: .810, F (6, 84) = 3.278, p = .006, $\eta^2 = .190$, power = .915. Subsequent univariate analyses showed that statistically significant differences occurred in intrinsic motivation $(p = .01, \eta^2 = .117, \text{ introjected regulation } (p = .01, \eta^2 = .080)$ and external regulation (p = .05, $\eta^2 = .042$) (Table 4).

Finally, a one-factor ANOVA was performed to compare the final marks obtained by each of the groups. The results showed significant differences (p = .001) between those obtained by the group that experienced gamification: 7.94 ± 1.53 and the traditional approach: 6.75 ± 1.13 .

Discussion and Conclusions

The main objective of the present study was to assess the impact of a gamified programme on all motivational regulations of secondary school students in comparison to a traditional teaching approach. The results showed that only the gamified programme achieved significant changes after the intervention in intrinsic motivation, lack of motivation and identified, introjected and external regulations, although these were more significant in intrinsic motivation. In addition, after the intervention, the experimental group had higher levels of intrinsic motivation, introjected regulation and external regulation than the control group. Finally, students who experienced the gamified approach achieved significantly higher final marks.

The group of students who experienced gamification in their classes improved most significantly in all motivational regulations (including a decrease in lack of motivation), but most strongly in intrinsic motivation, so it can be considered a success. Previous research has shown contrasting results (Navarro-Mateos et al., 2021). While Fernández-Río et al. (2020 and 2022), Sotos et al. (2022), Segura et al. (2020) and Valero et al. (2020) found similar increases in motivation in secondary school students -albeit only the former used a "pure" gamified approach (the other two used the personal and social responsibility model and flipped learning, respectively)---, Quintas et al. (2020) found no significant increases. The increase in intrinsic motivation in the present study seems to indicate that students have internalised the gamified approach, that they find it intrinsically satisfying and, as a result, enjoy the activity, in this case the PE class in a gamified environment. This is highly significant, as intrinsic motivation, as well as more self-determined forms of motivation (integrated and identified regulation) have been associated with an active and healthy lifestyle (Granero et al., 2014; Hagger & Chatzisarantis, 2007) -one of the fundamental objectives of PE-, in addition to many other benefits noted in two recent reviews (Vasconcellos et al., 2020; White et al., 2020).

In the present study, identified regulation also increased significantly in the group that experienced gamification, reinforcing the positive connections promoted by intrinsic motivation. This increase seems to indicate that students understood the approach and the tasks that they were performing, and attached a certain personal value to them, engaging themselves by possibly experiencing a certain sense of freedom in performing them (Vansteenkiste et al., 2010). Elements that enhance the development of students' autonomy, such as the possibility of choice (of tasks or their intensity or size) or group work, have been pointed out as contributing to the development of more self-referenced forms of motivation (Vasconcellos et al., 2020), which is consistent with the findings of the present study.

On the other hand, introjected regulation and external regulation also increased significantly after experiencing gamification, although these increases were more subtle than those of intrinsic motivation. The increase in introjected regulation seems to indicate that students performed the tasks partly to increase their self-esteem and to avoid internalised feelings of guilt (Vanteenkiste et al., 2010). The fact that students worked in groups, and that individual contributions to the group were important to achieve group goals, likely made it easier for students to strive to do things to avoid disadvantaging their group and not feel guilty. Introjected regulation is associated with a certain internalisation of tasks (Deci & Ryan, 1985) —in the case of this study, to help the group-, which can also be considered positive. Moreover, this type of regulation has been associated with both positive and negative results (Vasconcellos et al., 2020), because it can promote feelings of anxiety or self-confidence. The increase in more self-determined forms of motivation seems to indicate that in the present study introjected motivation reflects students' positive feelings about the class design. This is, of course, speculation and more research is needed to verify this idea.

Likewise, the increase in external regulation indicates that students were motivated to achieve the final rewards of gamification, even if the behaviour was not internalised (White et al., 2020). Ryan (1982) noted that interest in an activity can be diminished by "controls" external to the person, but also "internal"; for example, when they feel that their self-esteem depends on the successful completion of an activity. Just as mentioned, students work in a group to achieve goals and their contributions were very important, therefore they likely felt "under pressure" to perform the task properly and "look good". In other words, in gamification there is a "battle" between elements that "encourage" the learners' autonomy, and thus their more self-determined motivation, such as the choice of tasks or the level of intensity of completion, and elements that "control" them, and thus

increase their less self-determined motivation, such as the pressure to "contribute" to the group's achievement or to achieve the final rewards. In relation to the latter, research indicates that they can produce positive, negative or neutral results, and those that are performance-dependent, such as those of the gamification studied, do not have such a negative effect (Deci & Ryan, 1985), probably because they entail a satisfaction of competence in achieving them (Vansteenkiste et al., 2010). The results of the present study indicate that gamified contexts can direct students' motivational regulations towards a more or less self-determined point and therefore teachers should consider the elements of the context on which they place more or less value. As some authors have pointed out, the wrong approach to gamification can lead to a reduction of its potential (Dichev & Dicheva, 2017; Hanus & Fox, 2015) or, as the results of the present study point out, motivate students in a less "positive" (less self-referenced) way.

Finally, the final grades of the students who experienced gamification were significantly better compared to the group who experienced a traditional methodology. Previous research indicated that students reported improved performance through a gamified environment (Segura et al., 2020; Monguillot et al., 2015). Therefore, the results of the present study indicate that gamification is not "just playing", but that, if properly structured, can influence students' learning, improving their final performance. Again, we must remember that a correct approach is necessary in which the learning objectives are clearly integrated into the gamified structure (Fernández-Río & Flores-Aguilar, 2019). This is the only way to achieve learning outcomes and not just about novel and fun experiences.

In conclusion, gamification can significantly improve almost all types of motivational regulations of secondary school students, but most strongly intrinsic motivation. It could be said that in gamified environments there is a struggle between elements that favour students' autonomy and therefore their more self-determined motivation, such as the possibilities of choice of tasks or the level of intensity of completion, and elements that control them and therefore increase their less self-determined motivation, such as the pressure to contribute to the group's achievement or to reach the final results. Thus, gamified contexts can direct students' motivational regulations towards a more or less self-determined point and therefore teachers must consider the elements of the context they want to influence, to a greater or lesser extent, in order to achieve the desired positive effect. However, more studies with greater variability of contexts, participants and content are needed to confirm or refute the results obtained in the present study.

References

- Blanca, M. J., Alarcón, R., Arnau, J., Bono, R., & Bendayan, R. (2017). Non-normal data: Is ANOVA still a valid option? *Psicothema*, 29(4), 552–557. https://doi.org/10.7334/psicothema2016.383
- Blázquez, D., & Flores-Aguilar, G. (2020). Gamificación Educativa GE. En D. Blázquez (Ed.) Métodos de enseñanza en educación física. Enfoques innovadores para la enseñanza de competencias (3.ª ed., p. 297-325). Barcelona: INDE.
- Boiché, J. C. S., Sarrazin, P. G., Grouzet, F. M. E., Pelletier, L. G., & Chanal, J. P. (2008). Students' Motivational Profiles and Achievement Outcomes in Physical Education: A Self-Determination Perspective. *Journal of Educational Psychology*, *100*(3), 688-701. https://doi.org/10.1037/0022-0663.100.3.688
- Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences (2nd ed.). Hillsdale, NJ: Erlbaum.
- Cohen, L., Manion, L., & Morrison, K. (2011). *Research methods in education*. London: Routledge.
- Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, *19*, 109–134. https://doi.org/10.1016/0092-6566(85)90023-6
- Dichev, C., & Dicheva, D. (2017). Gamifying Education: What is known, what is believed and what remains uncertain: a critical review. *International Journal of Educational Technology in Higher Education*, 14(9), 1–36. https://doi.org/10.1186/s41239-017-0042-5
- Erpič, S. C. (2011). Motivation for physical education: a review of the recent literature from an achievement goal and self-determination perspective. *International Journal of Physical Education*, 48(2), 2-13.
- Fernández-Río, J., Zumajo, M., & Flores-Aguilar, G. (2022). Motivation, basic psychological needs and intention to be physically active after a gamified intervention programme. *European Physical Education Review*, 28(2), 432-445. https://doi.org/10.1177/1356336X211052883
- Fernández-Río, J., de las Heras, E., González, T., Trillo, V., & Palomares, J. (2020) Gamification and physical education. Viability and preliminary views from students and teachers. *Physical Education and Sport Pedagogy*, 25(5), 509-524. https://doi.org/10.1080/17408989.2020.1743253
- Fernández-Río, J., & Flores-Aguilar, G. (2019). Fundamentación teórica de la Gamificación. En J. Fernández-Río (coord.) Gamificando la Educación Física. De la teoría a la práctica en Educación Primaria y Secundaria (p. 9–18). Oviedo: University of Oviedo.
- Ferriz, R., González-Cutre, D., & Sicilia, A. (2015). Revisión de la Escala del Locus Percibido de Causalidad (PLOC) para la Inclusión de la Medida de la Regulación Integrada en educación física. *Revista de Psicología del Deporte*, 24(2), 329-338.
- Ferriz, A., Østerlie, O., García-Martínez, S., & García-Jaén, M. (2020). Gamification in physical education: evaluation of impact on motivation and academic performance within higher education. *International Journal Environment Research and Public Health 17*, 4465. https://doi.org/10.3390/ijerph17124465
- Flores-Aguilar, G., Prat, M., & Soler, S. (2019). Perfis pedagógicos de professores de educação física em uma escola multicultural. *Movimento*, 25, 1-14. https://doi.org/10.22456/1982-8918.82139
- Flores-Aguilar, G., & Fernández-Río, J. (2021). Gamificación. En A. Pérez-Pueyo, D. Hortigüela y J. Fernández-Río (Eds). Los modelos pedagógicos en educación física: qué, cómo, por qué y para qué (p. 382-399). Leon: University of Leon.
- Generalitat de Catalunya. Decreto 187/2015, de 25 de agosto, de ordenación de las enseñanzas de la educación secundaria obligatoria. DOGC no. 6945, of 28/8/2015.
- Generalitat de Catalunya. Orden ENS/108/2018, de 4 de julio, por la que se determinan el procedimiento, los documentos y los requisitos formales del proceso de evaluación en la educación secundaria obligatoria. DOGC no. 7659, de 9.7.2018.
- Granero, A., Baena, A., Sánchez-Fuentes, J. A., & Martínez-Molina, M. (2014). Perfiles motivacionales de apoyo a la autonomía, autodeterminación, satisfacción, importancia de la educación física e intención de práctica física en tiempo libre. *Cuadernos de Psicología del Deporte, 14*(2), 59-70. https://doi.org/10.4321/s1578-84232014000200007

- Gutiérrez, M., Ruiz-Pérez, L.M., & López, E. (2011). Clima motivacional en educación física: Concordancia entre las percepciones de los alumnos y las de sus profesores. *Revista de Psicología del Deporte*, 20, 321–335.
- Hagger, M. S., & Chatzisarantis, N. L. D. (Eds.). (2007). Intrinsic motivation and self-determination in exercise and sport. Human Kinetics.
- Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers and Education*, 80, 152–161. https://doi.org/10.1016/j.compedu.2014.08.019
- Kalagas-Tilga, H., Koka, A., Vein, V., Tilga, H., & Raudsepp, L. (2020). Motivational processes in physical education and objectively measured physical activity among adolescents. *Journal of Sport and Health Science*, 9(5), 462-471. https://doi.org/10.1016/j.jshs.2019.06.001
- Lim, M., Carpio, G., & Ong, C. (2019). Evaluation of engagement in learning within active learning classrooms: does novelty make a difference? *Journal of Learning Spaces*, 8(2), 1–11.
- López-Pastor, V., Pérez, D., Manrique, J. C., & Monjas, R. (2016). Los retos de la educación física en el siglo XXI. *Retos*, 29, 182-187. https://doi.org/10.47197/retos.v0i29.42552
- Martínez, M.A., Hernández, M.J. & Hernández, M.V. (2014). *Psicometría*. Madrid: Alianza.
- Metzler, M. (2017). *Instructional models for physical education* (3rd ed.). London: Routledge.
- Miles, J., & Shevlin, M. (2001). Applying Regression and Correlation: A Guide for Students and Researchers. London: Sage.
- Monguillot, M. H., Arévalo, C. G., Mon, C. Z., Batet, L. A., & Catasús, M. G. (2015). Play the Game: Gamificación y hábitos saludables en educación física. *Apunts Educación Física y Deportes*, 119, 71-79. https://doi.org/10.5672/apunts.2014-0983.es.(2015/1).119.04
- Navarro-Mateos, C., Pérez-López, I. J., & Marzo, P. F. (2021). La gamificación en el ámbito educativo español: revisión sistemática. *Retos*, 42, 507–516. https://doi.org/10.47197/retos.v42i0.87384
- Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology*, 71(2), 225–242. https://doi.org/10.1348/000709901158497
- Pelletier, L., Fortier, M., Vallerand, R., & Brière, N. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion*, 25, 279–306. http://dx.doi.org/10.1023/A:1014805132406
- Pérez-Pueyo, Á., & Hortigüela, D. (2020). ¿Y si toda la innovación no es positiva en Educación Física? Reflexiones y consideraciones prácticas. *Retos*, 37, 579–587. https://doi.org/10.47197/retos.v37i37.74176
- Portman, P. A. (1995). Who is having fun in physical education classes? Experiences of sixth-grade students in elementary and middle schools. *Journal of Teaching in Physical Education*, 14, 445–453. https://doi.org/10.1123/jtpe.14.4.445
- Quintas, A., Bustamante, J., Pradas, F., & Castellar, C. (2020). Psychological effects of gamified didactics with exergames in physical education at primary schools: Results from a natural experiment. *Computers and Education*, 152. https://doi.org/10.1016/j.compedu.2020.103874
- Rodríguez-Martín, B., Flores-Aguilar, G., & Fernández-Río, J. (2022). Ansiedad ante el fracaso en educación física ¿puede la gamificación promover cambios en las alumnas de primaria? *Retos*, 44, 739-748. https://doi.org/10.47197/retos.v43i0.90864
- Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology*, 43(3), 450–461. https://doi.org/10.1037/0022-3514.43.3.450
- Segura, A., Fuentes, A., Parra, M. E., & López-Belmonte, J. (2020). Effects on personal factors through Flipped Learning and Gamification as combined methodologies in secondary education. *Frontiers in Psychology*, 11, 1103. https://doi.org/10.3389/fpsyg.2020.01103
- Sotos, V. J., Ferriz, A., García-Martínez, S., & Tortosa, J. (2022). The effects of gamification on the motivation and basic psychological needs of secondary school physical education students. *Physical Education* and Sport Pedagogy. https://doi.org/10.1080/17408989.2022.2039611
- Valero, A., Gregorio, D., Camerino, O., & Manzano, D. (2020). Hybridization of the teaching personal and social responsibility model and gamification in physical education. *Apunts Educación Física y Deportes*, 141, 63-74. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.08

- Vansteenkiste, M., Niemiec, C. P., & Soenens, B. (2010). The development of the five mini-theories of self-determination theory: an historical overview, emerging trends, and future directions. In T. C. Urdan and S. A. Karabenick (eds.). *The Decade Ahead: Theoretical Perspectives on Motivation and Achievement Advances in Motivation and Achievement* (p. 105-165). Bingley: Emerald Group Publishing Limited. https://doi.org/10.1108/S0749-7423(2010)000016A007
- Vasconcellos, D., Parker, P. D., Hilland, T., Cinelli, R., Owen, K. B., Kapsal, N., Lee, J., Antczak, D., Ntoumanis, N., Ryan, R. M., & Lonsdale, C. (2020). Self-determination theory applied to physical education: A systematic review and meta-analysis. *Journal of Educational Psychology*, *112*(7), 1444-469. https://doi.org/10.1037/edu0000420
- Werbach, K., & Hunter, D. (2012). For the win: How game thinking can revolutionize your business. Philadelphia: Wharton Digital Press.
- White, R. L., Bennie, A., Vasconcellos, D., Cinelli, R., Hilland, T., Owen, K. B., & Lonsdale, C. (2020). Self-determination theory in physical education: A systematic review of qualitative studies. *Teaching and Teacher Education*, 103247. https://doi.org/10.1016/j.tate.2020.103247
- Zichermann, G., & Cunningham, C. (2011). Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps. Cambridge, MA: O'Reilly Media.

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The Effects of Active Breaks on Primary School Students' Attentional Processes and Motivational Regulation

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Cover:

A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images Abstract

Introduction/objective: Engaging in physical activity (PA) is considered a very costeffective way of improving neurocognitive function. Both moderate-intensity and short-duration vigorous PA have positive effects on brain function, cognition, and academic performance during childhood. The aim of the present study was to analyse the effect of active breaks (AB) on students' attention and motivation, as well as to examine possible sex and grade differences. Method: 215 students (119 girls) from grade 2 to 6 of primary school, aged 7-13 years (M = 9.18; SD = 1.55), distributed between an experimental group (n = 108; 62 girls) and a control groupl (n = 107; 57 girls) participated. A quasi-experimental design with pre-post measurements and quantitative methodology was used. The experimental group underwent an AB programme (20-30/week; 2-5 minutes per active break). Se utilizó el Test de caras-R y el PLOC adaptado. Results: The results for attention showed significant differences between groups only in 3rd grade, where the programme was based on vigorous intensity AB starring the students. The experimental group reported high levels of self-determined motivation. Younger grades were more self-determined. Conclusions: Vigorous AB can have positive effects on students' attention and self-determined motivation.

Keywords: active breaks, executive functions, physical activity, self-determined motivation.

Introduction

Physical inactivity and sedentary behaviour have become a global challenge with adverse effects on both the physical health of young people and the cognition and brain health of children (Chaput et al., 2020; Guthold et al., 2020). Engaging in physical activity (PA) is considered a very cost-effective way of improving neurocognitive function and thus increasing the likelihood of educational success (Pontifex et al., 2019). Recently, the World Health Organization (WHO, 2020) concluded that both moderate-intensity and short-duration vigorous PA have positive effects on brain function, cognition, and academic performance during childhood (Bull et al., 2020). The positive relationship between PA and cognition in children is well substantiated: PA triggers an increase in blood flow, brain-derived neurotrophic factor and plasma catecholamines (Chang et al., 2012). Chronic PA has been shown to alter brain structure and function through synaptogenesis, neurogenesis, and angiogenesis (Hillman et al., 2008).

Despite this evidence, most educational systems rely on essentially sedentary classes, which results in schoolchildren adopting the sedentary position on a mandatory and prolonged basis for around 7-8 hours a day or more (Bedard et al., 2019). However, the educational context is considered a unique opportunity for providing sufficient PA to all schoolchildren for extended periods of time (Donnelly and Lambourne, 2011). Active breaks (AB) (brain/active breaks) consist of independent PA programmes designed as 1-10 min breaks to activate the brain, either during academic classes or during transition periods. The study by Daly-Smith et al. (2018) concluded that AB interventions increased PA and time-on-task, but, unlike previous reviews (e.g., Donnelly et al., 2016), did not provide evidence for improved cognition or academic performance. In the same vein, the systematic review and meta-analysis of the study by Masini et al. (2020) also found a significant effect on increasing PA levels in primary school children (both in AFMV and step count), and a significant increase in time on task. However, the effects on cognitive functions (attention components, working memory, executive functions) and academic achievement (mathematics, reading) were inconclusive. As the previous review by De Greeff et al. (2016) had identified acute PA programmes' positive effect on attention and executive functions, Masini et al. (2020) pointed to two possible explanations for these contradictory results: a) the variability of the measurements used in the studies, and b) the different typology (with

or without cognitive compromise) and duration of the AB interventions. In another meta-analysis, Chang et al. (2012) had specified the activity threshold of \geq 20 min of MVPA for an improvement in cognition; however, almost no intervention in the review by Masini et al. (2020) reached or exceeded 20 min. On the other hand, Schmidt et al. (2015) argued that cognitively engaging PA is more beneficial for cognitive functions than purely aerobic PA. In relation to academic performance results, Masini et al. (2020) concluded that ABs have limited or no impact, which contradicts the findings of Watson et al. (2017) and Mavilidi et al. (2020). These contrasting results may be due to the different AB interventions included in the reviews.

Some studies have focused on learner satisfaction in AB interventions. Howie et al. (2014) showed that children who received a Brain BITES programme enjoyed the intervention more than doing sedentary activities. However, little is known about the type of motivational regulation that triggers AB among students. The study by Hajar et al. (2019) found that ABs were successful in maintaining motivation for PA in the experimental group, while the control group showed a decrease in motivation for PA among Malaysian primary school students. One of the most relevant theoretical frameworks to explain motivational processes in the school setting is the self-determination theory (SDT) (Deci & Ryan, 1985). SDT postulates that motivation can be defined on a continuum of self-determination ranging from intrinsic motivation to demotivation, including at least three forms of extrinsic motivation: identified, introjected and external regulation. Research has connected more self-determined motivation (intrinsic motivation and identified regulation) with positive emotions (fun and satisfaction at school), executive functions (e.g., attention, memory) and academic performance (Di Domenico & Ryan, 2017; Muñoz-Parreño et al., 2021; Watson et al., 2017). To date, no study has connected AB and participants' motivational regulation from a SDT perspective.

Against this background, a study was designed in Spain with three objectives: a) to analyse the effect that AB can have on the visuoperceptual and attentional skills (correct answers, errors, net correct answers, impulsivity control index) of primary school students, b) to study the type of motivational regulation that these resources provoke, and c) to examine possible differences in terms of gender and grade level. Compared to the strategy used in other studies (Suárez-Manzano et al., 2018), in the present study the AB were supported exclusively by audiovisual material generated by the teachers themselves (not commercialised) and the breaks took place during the classroom sessions (not during breaks or between classes). It was hypothesised that the application of breaks during classroom sessions in the most academically demanding subjects could contribute to distension, relaxation and, consequently, improve students' attention levels. A high level of the most self-determined motivation (intrinsic motivation and identified regulation) is expected to be found, which should be higher in lower grades. No sex differences were predicted for any of the variables under study.

Methodology

Research design

A quasi-experimental design with a pre- and post- repeated measurements design was used, randomly assigning control groups (5 groups, one per course) and experimental groups (5 groups, one per course). Quantitative methodology was used.

Participants

The study was carried out in a public school in a city in northern Spain, selected for its receptiveness and cooperation in the research.

Schoolchildren. The study population was 220 children in grades 2-6 of primary school from 10 ethnic groups and of intermediate socio-economic status. The inclusion criterion was that participants had attended 90% of the classes and had all their records duly completed, both in the pre-test and post-test. As a result of this filtering, five children were excluded from the analyses. A sample of 215 participants (96 boys and 119 girls) took part in the study, aged between 7 and 13 years (M = 9.18; SD = 1.55). The control group consisted of 107 participants (50 boys and 57 girls) and the intervention group consisted of 108 participants (46 boys and 62 girls). As for the calculation of the *a priori*sample size using the statistical package G*Power 3.1.9.7: for an effect size = .1, the sample size = 592; for an effect size = .2, the sample size = 150, and for an effect size = .4, the sample size = 40.

Teachers. There were ten teachers (six female and four male, three and two respectively for the control and experimental groups). They ranged in age from 28 to 52

years, had an average teaching experience of 7 years, and had no experience in using AB.

Resources

Perceptual and attentional aspects. Thurstone & Yela's (2012) R-Faces Test or Test of Differences-Revised, a test of perception of differences that assesses perceptual and attentional aspects, was used. The test has been proposed as a tool for assessing sustained and selective attention and the control of impulsive responses in schoolchildren (Monteoliva et al., 2014). It consists of 60 graphic illustrations, each consisting of three schematic drawings of faces, two of which are the same and one of which is different. Participants must determine which face is different and cross it out. The results are interpreted by considering the number of correct answers (A), the number of errors (E), the number of net correct answers (correct answers minus errors, A-E), which measures the efficiency of the subjects' responses, and the impulsivity control index [(A-E/A+E) x 100]. In terms of reliability by primary grade, the original study obtained Cronbach's alpha levels (α) ranging from .82 to .92. In the present study, the free software Jamovi 2.3.16.0 was used to calculate the McDonald Omega coefficient for the whole sample: $\omega = .90$ in the pretest and $\omega = .89$ in the postest.

Motivational regulation during the AB. Motivational regulation during the AB was assessed by adapting the Perceived Locus of Causality (PLOC; Goudas et al., 1994) scale translated into Spanish and validated in the context of PE by Moreno et al. (2009). This scale measures the different types of motivation set out in the SDT. In order to contextualise the instruments and adjust them to the scope of the study, the statement "I participate in PE classes" was replaced by "I participate in active breaks..." before each item of the five factors (18 items), and the wording of minor aspects was modified. Examples of items for each scale are: intrinsic motivation (e.g., "...because they are fun"), identified regulation (e.g., "...because I want to learn how to do moves, jumps, turns...", introjected regulation (e.g., "...because I want peers to think I'm doing well"), external regulation (e.g., "...because I'll get in trouble if I don't") and demotivation (e.g., "...well, I don't really know why"). A 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree) was used. The study by Moreno et al. (2009) obtained the following Cronbach's alpha values (α): .80 for intrinsic motivation, .80 for identified regulation, .67 for introjected regulation, .70 for external regulation and .74 for demotivation. In the present study McDonald's omega values (ω) were: .72 for intrinsic motivation, .84 for identified regulation, .67 for introjected regulation, .75 for external regulation and .86 for demotivation. Although the reliability levels of introjected regulation were low, it was decided that the analyses with this variable should be maintained because of the interest of the study, the age of the students and its possible impact on future studies.

Procedure

During the 2018-2019 school year, an innovation and research project was carried out in two phases:

1. Video editing for the AB. A working group (18 teachers and a coordinator) was set up with the aim of generating audiovisual resources *ad hoc* to promote PA in class. The training of the teachers who implemented the AB in their respective subjects was carried out by the group coordinator and lasted 10 hours. The teachers were able to choose the type of material they considered most suitable for this purpose (e.g. based on choreographies from the internet or based on pupils' own choreographies, musical themes, etc.). The 3rd grade teacher involved the students in taking photographs, designing and filming choreographies, and composing rhythms and melodies.

2. Research. Informed consent forms for families and pre-intervention data collection were administered during March and April 2019. The investigation took place during April and May of that year. The study was carried out over two weeks. The pretest was carried out during the first one. In the second week, the experimental group was tested with the AB programme and the second wave of administration of the attention test took place. The intervention was carried out during a single week due to organisational issues at the centre. Additionally, the motivational questionnaire was only administered to the experimental group after the intervention. The experimental group completed the tests under the same general conditions as the control group, after an active break. The AB took place during regular classes in the subjects with the greatest curricular weight (languages, mathematics, natural, social, science and foreign languages). In line with Chang et al. (2012) with at least 20 min of PA to obtain benefits, teachers were told that they should include at least four AB each day during the week, but that they could distribute them as they saw fit. This meant a total of 20-30 breaks during the week. The duration of each video ranged from 2-5 minutes. The AB consisted in the reproduction (by the students) of the movements and gestures proposed to the rhythm of the music during the language, mathematics, natural, social and science classes. The activities varied in intensity: light and moderate for Grades 2, 4 and 6; vigorous for Grade 3. They consisted of segmental movements on the spot and on the move: jogging, jumping and twisting, varying in pace and intensity. The school management, parents and guardians, as well as the school council gave their informed consent. Support was also provided by the university of the corresponding autonomous community. The voluntary participation of both families and teachers was respected at all times. The tests were administered by a researcher and an expert teacher. The regular teachers were responsible for the implementation of the AB in the experimental group classes. The procedures complied with the standards of the Declaration of Helsinki. Consent was obtained from the Ethical Committee of the University of Oviedo (ID 2019.165). A researcher was present during data collection.

Data analysis

Analysis of visuoperceptual and attentional abilities

The data from the Faces-R test at pre-test and post-test were selected, and the variables under study (correct answers, errors, net correct answers and the impulsivity control index) were calculated and analysed with the SPSS programme for Windows (24.0). To assess the effects of AB on attention levels, 2 x 2 repeated measures ANOVAs were used with time (pre-test-post-test) as the intrasubject factor and group (experimental, control) as the intersubject factor. To investigate differences between boys and girls, sex was included as a second inter-subject factor (time x group x sex). The statistical significance level was set at *p* < .05. The effect size was also calculated(η_p^2). Cohen (1988) classifies the effect size as small ($\eta_p^2 = .20$), medium ($\eta_p^2 = .50$) or large ($\eta_p^2 = .80$).

In addition, the same analyses were carried out on a course-by-course basis.

Analysis of motivational regulation

Homogeneity of variances was analysed using Levene's test. To verify the normality of the data distribution, skewness and kurtosis were examined. The Shapiro Wilk test was also requested (< 50 participants per group). In order to assess whether there were significant differences in motivation for breaks according to gender and grade, Student's *t* t-test and one-factor ANOVAs were carried out, taking each of the forms of motivational regulation as dependent variables and gender and group as factors, respectively. As the assumptions of equal variances were not met, the Games-Howell *post hoc* test was requested in the ANOVAs in relation to the group.

Following Gravetter & Wallnau (2014), a variable was found to follow a normal distribution when the absolute values of skewness and kurtosis were less than 2, which was true in all cases.

Results

Visuoperceptual and attentional skills

Mauchly's test of sphericity indicated that the assumption of sphericity was not met for the condition effect (p < .05); therefore, the degrees of freedom were corrected with the Greenhouse-Geisser estimate of sphericity.

Table 1 shows the means and standard deviations for each of the dependent variables in the total sample and by sex.

Table 2 shows the tests for intrasubject effects on the variables under study. No significant main effects were found over time between the experimental and control groups on any of the variables under study, although a significant effect was found on the variables correct answers and net correct answers over time. In both groups, the values of both variables increased significantly, but not due to the effect of treatment.

Table 1

Descriptive statistics for attentional variables to be studied (sample total, boys y girls, in pre-test y post-test).

			Pre-test			Post-test		
Variables		Sample total <i>M (SD)</i>	Boys <i>M (SD</i>)	Girls <i>M (SD)</i>	Sample total <i>M (SD)</i>	Boys <i>M (SD)</i>	Girls <i>M (SD)</i>	
Correct	Control	36.72 (10.38)	37.62 (10.18)	35.93 (10.58)	44.08*** (12.29)	43.80 (12.71)	44.33 (12.01)	
Answers	Experimental group	34.66 (12.12)	32.26 (11.48)	36.44 (12.37)	42.52*** (11.21)	39.17 (11.34)	45.00 (10.53)	
Errors	Control	1.66 (1.94)	1.52 (2.02)	1.79 (1.87)	1.90 (2.27)	1.26 (1.35)	2.46 (2.73)	
	Experimental group	1.21 (1.53)	1.20 (1.68)	1.23 (1.43)	1.15 (1.80)	.83 (1.37)	1.39 (2.04)	
Net Correct	Control	35.06 (10.41)	36.10 (9.96)	34.14 (10.79)	42.19*** (12.47)	42.54 (12.72)	41.88 (12.34)	
Answers	Experimental group	33.44 (12.14)	31.07 (11.14)	35.21 (12.63)	41.37 (11.44)	38.35 (11.84)	43.61 (10.69)	
Impulsivity	Control	91.29 (10.01)	92.57 (9.72)	90.16 (10.22)	91.64 (9.69)	94.24 (7.03)	89.36 (11.09)	
Index	Experimental group	92.57 (10.05)	92.55 (11.20)	92.59 (9.20)	94.39 (9.66)	94.80 (11.55)	94.09 (8.07)	

Note: (*) p < .001.

Table 2

Tests for intrasubject effects on the variables under study in the total sample (Greenhouse-Geisser sphericity estimate)

	gl	F	Sig.	η_{ρ}^{2}	Power ^a
Correct Answers/T	1	143.092	.000	.404	1.000
T * G	1	0.127	.722	.001	.064
T * S	1	2.378	.125	.011	.336
T * G * S	1	0.052	.820	.000	.056
Error (Correct Answers)	211				
Errors/T	1	0.107	.743	.001	.062
T * G	1	1.032	.311	.005	.173
T * S	1	5.797	.017	.027	.669
T * G * S	1	0.427	.514	.002	.100
Error (Errors)	211				
Net Correct Answers / TIME	1	139.335	.000	.398	1.000
T * G	1	0.356	.552	.002	.091
T * S	1	0.913	.340	.004	.158
T * G * S	1	0.005	.945	.000	.051
Error (Net Correct Answers)	211				
Impulsivity control index / T	1	2.812	.095	.013	.386
T * G	1	1.096	.296	.005	.181
T * S	1	1.374	.242	.006	.215
T * G * S	1	0.390	.533	.002	.095
Error (ICI)	211				

Note: a Calculated using alpha = .05; TIME = T; GROUP = G; SEX = S

Tabla 3

Descriptive statistics for	attentional variables	to be studied for 3	rd grade primary.
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		Pre-test			Post-test			
Variables		Sample total <i>M (SD)</i>	Boys <i>M (SD</i>)	Girls <i>M (SD</i>)	Sample total <i>M (SD)</i>	Boys <i>M (SD)</i>	Girls <i>M (SD)</i>	
Correct	Control (<i>n</i> = 25)	38.36 (9.70)	37.13 (7.94)	40.20 (12.11)	34.00 (9.15)	32.53 (6.01)	36.20 (12.56)	
Answers	Experimental ($n = 25$)	31.72 (7.73)	29.55 (8.57)	33.43 (6.84)	41.52*** (9.82)	37.73 (9.68)	44.50 (9.19)	
Errors	Control	1.32 (1.60)	0.87 (1.36)	2.00 (1.76)	1.44 (1.58)	0.87 (1.06)	2.30 (1.90)	
	Experimental group	1.00 (0.95)	0.82 (0.75)	1.14 (1.10)	.84 (1.106)	0.73 (0.79)	0.93 (1.39)	
Net Correct	Control	37.04 (9.55)	36.27 (8.13)	38.20 (11.74)	32.56 (9.38)	31.67 (6.15)	33.90 (13.13)	
Answers	Experimental group	30.72 (7.67)	28.73 (8.56)	32.29 (6.81)	40.68*** (10.09)	37.00 (10.13)	43.57 (9.40)	
Impulsivity	Control	93.65 (7.89)	95.45 (6.87)	90.95 (8.89)	91.53 (10.26)	94.83 (6.48)	86.58 (13.04)	
Control Index	Experimental group	93.76 (6.13)	93.99 (6.16)	93.58 (6.34)	95.68 [*] (5.49)	95.40 (5.18)	95.91 (5.90)	

Note: * *p* < .05; *** *p* <.001.

Table 4

Tests for intrasubject effects on the variables under study in 3rd grade primary (Greenhouse-Geisser sphericity estimate).

	gl	F	Sig.	η_{ρ}^{2}	Power ^a
Correct answers/TIME	1	10.004	.003	.179	.872
TIME * GROUP	1	68.385	.000	.598	1.000
TIME * SEX	1	1.073	.306	.023	.174
TIME * GROUP * SEX	1	0.462	.500	.010	.102
Error (Correct Answers)	46				
Errors/TIME	1	0.023	.995	.000	.050
TIME * GROUP	1	0.573	.453	.012	.115
TIME * SEX	1	0.049	.826	.001	.055
TIME * GROUP * SEX	1	0.280	.599	.006	.081
Error (Errors)	46				
Net Correct Answers / TIME	1	8.762	.005	.160	.826
TIME * GROUP	1	62.466	.000	.576	1.000
TIME * SEX	1	0.847	.362	.018	.147
TIME * GROUP * SEX	1	0.568	.455	.012	.114
Error (Net Correct Answers)	46				
Impulsivity Control Index / TIME	1	0.089	.766	.002	.060
TIME * GROUP	1	4.326	.043	.086	.531
TIME * SEX	1	0.457	.502	.010	.102
TIME * GROUP * SEX	1	1.238	.272	.026	.193
Error (ICI)	46				

Note: ^{a.} Calculated using alpha = .05

In relation to the grade-by-grade analyses, significant main effects were found over time between the experimental and control groups in 3rd grade primary school on the variables correct answers, net correct answers and impulsivity control index. The AB programme in 3rd grade was based on videos of high-intensity choreography featuring the students themselves. Table 3 shows the means and standard deviations for each of the dependent variables for the 3rd grade group and by sex.

Table 4 shows the tests of intrasubject effects on the attentional variables in that group (Greenhouse-Geisser sphericity estimate).

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Table 5
Descriptive statistics of motivational regulation in the experimental group according to sex and grade

	Sample total (N = 80)		Bc (N =	oys = 33)	Gi (<i>N</i> =	rls = 47)	2	0	3	0	4	0	6	o
	М	SD	М	SD	М	SD	М	SD	М	SD	М	SD	М	SD
IM	4.21	0.83	4.33	0.76	4.12	0.88	4.59ª	0.58	4.43ª	0.36	3.97 ^{ab}	0.87	3.52 ^b	1.18
ldR	3.38	1.18	3.56	1.04	3.26	1.26	4.23ª	0.65	3.40 ^b	0.96	2.63 ^b	1.33	2.91⁵	1.20
IR	2.72	1.06	3.00	.98	2.52	1.07	3.61ª	0.83	2.57 ^b	0.62	1.94 ^b	1.04	2.47 ^b	1.08
ER	2.89	1.16	2.95	1.07	2.85	1.22	3.49ª	1.04	2.82ª	0.67	1.60 ^b	0.84	3.57ª	1.06
D	2.39	1.17	2.58	1.02	2.26	1.25	2.99ª	1.14	2.12⁵	0.71	1.31°	0.61	3.15ª	1.27

Unequal superscripts in the same row indicate significant differences between groups at the p < .05 level.

Note: IM = Intrinsic motivation; IdR = Identified regulation; IR = Introjected regulation; ER = External regulation;

D = Demotivation.

Motivational regulation during the AB

Table 5 shows the descriptive statistics of motivational regulation in the experimental group according to sex and grade (post-test measure). Overall, the most self-determined motivation (intrinsic motivation and identified regulation) was high. In all grades, intrinsic motivation was the most highly rated regulation, except in grade 6. Significant differences between grades were observed in intrinsic motivation [F(3,(75) = 6.548, p = .001], identified regulation [F(3, 75) = 9.705], p < .001, introjected regulation [F (3, 75) = 11.901, p < .001], external regulation [F(3, 75) = 16.379, p < .001], and demotivationn [F(3, 75) = 13.697, p < .001]. The post hoc tests showed differences in intrinsic motivation between the 2nd and 6th grades (p = .20), and 3rd and 6th grades (p = .45); identified regulation between the 2nd and 3rd grades (p = .005), 2nd and 5th grades (p = .001), and 2nd and 6th grades $^{\circ}(p = .005)$; introjected regulation, between grades 2 and 3 (p < .001), grades 2 and 5 (p < .001), and grades 2 and 6 (p = .010); external regulation, between grades 2 and 5 (p < .001), grades 3 and 5 (p < .001), and grades 5 and 6 (p < .001), and demotivation, between grades 2 and 3 (*p* = .017), 2 and 5 (*p* < .001), 3 and 5 (*p* = .002), 3 and 6 (p = .042), and 5 and 6 (p < .001). No differences between the sexes were found.

Discussion

The aims of the study were threefold: a) to analyse the effect that AB can have on the visuoperceptual and attentional skills of primary school students, b) to study the type of motivational regulation that these resources provoke, and c) to examine possible differences in terms of sex and grade level. The results partially supported the first hypothesis (expected improvement in student attention levels). Significant differences were only found between the experimental and control groups in the attentional variables in the 3.rd grade of primary school. Overall, these mixed results are consistent with research evidence reporting inconclusive

results regarding the effect of ABs on cognition and executive functions. While several investigations (De Greeff et al., 2016; Donnelly et al., 2016) have reported small effects of classroom interventions on cognition improvement, the specific reviews on AB by Daly-Smith et al. (2018) and Masini et al. (2020) did not support this view. Masini et al. (2020) pointed to two possible explanations for the contradictory results: a) the variability of the measurements used in the studies, and b) the different typology (with or without cognitive compromise) and duration of the AB interventions.

Since in the present study only pure AB (PA programmes with no connection to subject content) were applied, the results introduce a new element to the discussion, namely concerning the intervention in 3rd grade. Participants in this experimental group obtained significant improvements in number of correct answers, net correct answers, and impulsivity control compared to the control group. The programme of this course was based on videos of choreographies of vigorous intensity starring the students themselves. These results are in line with previous studies linking PA and attention in children and adolescents (Guiney & Machado, 2013; Jiménez-Parra et al., 2022; Pastor-Vicedo et al., 2021). It is argued that the students in this intervention benefited psychologically from the relaxing and recuperative effect of the short-term programme, which allowed them to improve their levels of accuracy, net accuracy and impulsivity control. It is possible that the students' own participation in the production of the videos may have had a positive effect on their motivational state and accelerated the effects on immediate attention compared to the other groups.

The results shed light on the mode, frequency, duration and intensity of PA in AB programmes that aim to produce positive short-term effects on attention. In terms of the mode/typology of resources, the study shows the effects of videos produced by teachers in collaboration with pupils where pupils reproduce choreographies with which they feel identified. This kind of involvement can motivate learners to use it. In terms of duration and frequency, the results promote at least 15-20 minutes of PA daily that can be spread over several breaks during the school day (Fairclough et al. 2021; Muñoz-Parreño et al., 2020). And with regard to intensity, the results seem to support the idea that vigorous intensity PA programmes may accentuate the effect on attentional processes. Future work with longer interventions could examine these assumptions.

Regarding the second and third objective (high levels of selfdetermined motivation are expected, higher in the lower grades, with no sex differences), the results draw a self-determined motivational profile in the participants of the experimental group during the AB. Specifically, students reported high levels of intrinsic motivation and identified regulation and low levels of external regulation and demotivation, which is consistent with the hypothesis formulated. These findings are of particular interest considering the positive effects on outcome variables that SDT anticipates for these motivational forms. More self-determined forms of motivation produce more adaptive outcomes, such as persistence or greater enjoyment in PA, while less self-determined forms of motivation predict less adaptive outcomes, such as boredom or dropout (Méndez-Giménez et al., 2016).

No sex differences were found in the different motivational regulation during the AB. However, these types of motivation varied from year to year, being higher in younger students. The decline of more self-determined motivation with age (intrinsic motivation) has been described in previous research both in the context of PE and in general education (Cecchini et al., 2012). In Grade 6, external regulation levels were higher than intrinsic motivation and demotivation scores were intermediate, suggesting that the programme should be reviewed at pre-pubertal age.

Compared to other school-based programmes, ABs offer the advantage that they can be implemented by all classroom teachers, not only PE specialists (see review by Masini et al., 2020). It simply requires conviction to integrate them into the classroom (increased PA, improved classroom behaviour, more time on task, better attention and academic performance), and the necessary resources.

Depending on the mental fatigue observed in students, teachers could adapt their lessons, choosing the most appropriate time to introduce their AB. Future research could provide further evidence to help teachers systematise their use.

The present study was not without limitations. Firstly, it should be noted that despite the significant increase in daily PA time achieved during the programme, the duration of the intervention was reduced. Although planned to be more extensive, the video editing phase was delayed, resulting in the implementation taking place at the end of the school year. As a result, the effect of ABs may have been compromised. Secondly, the study did not control for variables such as PA performed outside the classroom context, body mass index or students' social status, which may have led to unintended effects in the design. Thirdly, the most important limitation of the study is the intervention time (one week), the control of intervening variables and the sampling technique used. In the case of motivational regulation, only one measurement was obtained at the end of the intervention (post-test). The PA intensity of the AB was not measured with any instrument (e.g. accelerometers). It would have been desirable to test the fidelity of implementation to understand the intensity of ABs and to follow up with observational analysis to see if they were developing well (as indicated in the review by Watson et al., 2017). Finally, an experimental study, with randomised participants (rather than natural groups) would allow for a more complete picture of cause-effect relationships. This is a huge challenge in the educational context when combined with a large number of classes and groups, as was the case here.

In conclusion, vigorous intensity AB programmes can increase the attention span of primary school children. The more self-determined motivation to perform AB decreases with age, while the less self-determined motivation to perform AB increases. Involving students in making videos with PA choreographies in which they themselves are the protagonists can increase students' more self-determined motivation.

References

- Bedard, C., St John, L., Bremer, E., Graham, J. D., & Cairney, J. (2019). A systematic review and meta-analysis on the effects of physically active classrooms on educational and enjoyment outcomes in school age children. *PLoS One*, 14(6), e0218633. https://doi.org/10.1371/ journal.pone.0218633
- Bull, F.C., Al-Ansari, S.S., Biddle, S., et al. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine*, 54, 1451–1462. http://dx.doi.org/10.1136/bjsports-2020-102955
- Cecchini, J. A. Fernández-Losa, J. L., González, C., Fernández-Río, J. & Méndez-Giménez, A. (2012). La caída de la motivación autodeterminada en jóvenes escolares. Sport TK. Revista Euroamericana de Ciencias del Deporte, 1(1), 25-31. https://doi.org/10.6018/185531
- Chaput, J. P., Willumsen, J., Bull, F., Chou, R., Ekelund, U., Firth, J., Jago, R., Ortega, F. B., & Katzmarzyk, P. T. (2020). 2020 WHO guidelines on physical activity and sedentary behaviour for children and adolescents aged 5-17 years: summary of the evidence. *The International Journal of Behavioral Nutrition and Physical Activity*, *17*(1), 141. https://doi.org/10.1186/s12966-020-01037-z
- Chang, Y. K., Labban, J. D., Gapin, J. I., & Etnier, J. L. (2012). The effects of acute exercise on cognitive performance: a meta-analysis. *Brain Research*, 1453, 87–101. http://dx.doi.org/10.1016/j.brainres.2012.02.068
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. 2nd Edition. Hillsdate, NJ: LEA. https://doi.org/10.4324/9780203771587.
- Daly-Smith, A. J., Zwolinsky, S., McKenna, J., Tomporowski, P. D., Defeyter, M. A., & Manley, A. (2018). Systematic review of acute physically active learning and classroom movement breaks on children's physical activity, cognition, academic performance and classroom behaviour: understanding critical design features. *BMJ Open Sport & Exercise Medicine*, 4:e000341. http://dx.doi.org/10.1136/bmjsem-2018-000341

- De Greeff, J. W., Hartman, E., Mullender-Wijnsma, M. J., Bosker, R. J., Doolaard, S., & Visscher, C. (2016). Long-term effects of physically active academic lessons on physical fitness and executive functions in primary school children. *Health Education Research*, 31, 185-194. https://doi.org/10.1093/her/cyv102
- Deci, E.L., & Ryan R.M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum Press.
- Di Domenico, S. I. & Ryan, R. M. (2017). The emerging neuroscience of intrinsic motivation: A new frontier in Self-Determination research. *Frontiers in Human Neuroscience*, 11,145. http://dx.doi.org/10.3389/ fnhum.2017.00145
- Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., Kate Lambourne, K., & Szabo-Reed, A. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: a systematic review. *Medicine & Science in Sports & Exercise*, 48, 1223–1224. http://dx.doi.org/10.1249/MSS.0000000000000001
- Donnelly, J. E. & Lambourne, K. (2011). Classroom-based physical activity, cognition, and academic achievement. *Preventive Medicine*, 52 (Suppl. 1), S36-S42. http://dx.doi.org/10.1016/j.ypmed.2011.01.021
- Fairclough, S. J., Beighle, A., Erwin, H., & Ridgers, N. D. (2012). School day segmented physical activity patterns of high and low active children. *BMC Public Health*, 12(1), 406. https://doi.org/10.1186/1471-2458-12-406
- Goudas, M., Biddle, S. J. H., & Fox, K. (1994). Perceived locus of causality, goal orientations and perceived competence in school physical education classes. *British Journal of Educational Psychology*, 64, 453-463. http://dx.doi.org/10.1111/j.2044-8279.1994.tb01116.x
- Gravetter, F. J. & Wallnau, L. B. (2014). Statistics for the Behavioral Sciences. Belmont, CA: Wadsworth.
- Guiney, H. & Machado, L. (2013). Benefits of regular aerobic exercise for executive functioning in healthy populations. *Psychonomic Bulletin* & *Review*, 20(1), 73-86. http://dx.doi.org/10.3758/s13423-012-0345-4
- Guthold, R., Stevens, G. A., Riley, L. M., & Bull F. C. (2020). Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants. *The Lancet Child & Adolescent Health*, 4(1), 23–35. https://doi.org/10.1016/S2352-4642(19)30323-2
- Hajar, M. S., Rizal, H., Kueh, Y. C., Muhamad, A. S., & Kuan, G. (2019). The effects of Brain-Breaks on Motives of Participation in Physical Activity among Primary School Children in Malaysia. *International Journal of Environmental Research and Public Health 16*, 23 http://dx.doi.org/10.3390/ijerph16132331
- Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: exercise effects on brain and cognition. *Nature Review Neuroscience*, 9, 58–65. http://dx.doi.org/10.1038/nrn2298
- Howie, E. K., Beets, M. W., & Pate, R. R. (2014). Acute classroom exercise breaks improve on-task behavior in 4th and 5th grade students: a dose–response. *Mental Health and Physical Activity*, 7, 65–71. https://doi.org/10.1016/j.mhpa.2014.05.002
- Jiménez-Parra, J. F., Manzano-Sánchez, D., Camerino, O., Castañer, M. & Valero-Valenzuela, A. (2022). Enhancing Physical Activity in the Classroom with Active Breaks: A Mixed Methods Study. *Apunts Educación Física y Deportes*, 147, 84-94. https://doi.org/10.5672/apunts.2014-0983.es.(2022/1).147.09
- Masini, A., Marini, S., Gori, D., Leoni, E., Rochira, A. & Dallolio, L. (2020). Evaluation of school-based interventions of active breaks in primary schools: A systematic review and meta-analysis. *Journal of Science and Medicine in Sport*, 23(4), 377-384. https://doi.org/10.1016/j.jsams.2019.10.008

- Mavilidi, M. F., Drew, R., Morgan, P. J., Lubans, D. R., Schmidt, M., & Riley, N. (2020). Effects of different types of classroom physical activity breaks on children's on-task behaviour, academic achievement and cognition. *Acta Paediatrica*. 109(1), 158-165. https://doi.org/10.1111/apa.14892
- Méndez-Giménez, A., Fernández-Río, J., & Cecchini, J. A. (2016). Vallerand's model in Asturian adolescents: implementation and development. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte*, *16*(64), 703-722. http://dx.doi. org/10.15366/rimcafd2016.64.006
- Monteoliva, J. M., Ison, M. S., & Pattini, A. E. (2014). Evaluación del desempeño atencional en niños: eficacia, eficiencia y rendimiento. *Interdisciplinaria*, 31(2), 213-225. http://dx.doi.org/10.16888/interd.2014.31.2.2
- Moreno, J. A., González-Cutre, D., & Chillón, M. (2009). Preliminary validation in Spanish of a scale designed to measure motivation in physical education classes: The Perceived Locus of Causality (PLOC) Scale. *The Spanish Journal of Psychology*, 12(1), 327-337. https://doi.org/10.1017/S1138741600001724
- Muñoz-Parreño, J. A., Belando-Pedreño, N., Torres-Luque, G., & Valero-Valenzuela, A. (2020). Improvements in physical activity levels after the implementation of an active-break-model-based program in a primary school. *Sustainability*, 12(9), 3592. https://doi.org/10.3390/su12093592
- Murtagh, E., Mulvihill, M., & Markey, O. (2013). Bizzy Break! The effect of a classroom-based activity break on in-school physical activity levels of primary school children. *Pediatric Exercise Science*, 25, 300-307. http://dx.doi.org/10.1123/pes.25.2.300
- World Health Organization (WHO). (2020). Actividad física. Available in: https://www.who.int/es/news-room/fact-sheets/detail/physical-activity (Accessed December, 2020).
- Pastor-Vicedo, J. C., Prieto-Ayuso, A., López Pérez, S. & Martínez-Martínez, J. (2021). Active Breaks and Cognitive Performance in Pupils: A Systematic Review. *Apunts Educación Física y Deportes*, 146, 11-23. https://doi.org/10.5672/apunts.2014-0983.es.(2021/4).146.02
- Pontifex, M. B., McGowan, A. L., Chandler, M. C., Gwizdala, K. L., Parks, A. C., Fenn, K., & Kamijo, K. (2019). A primer on investigating the after effects of acute bouts of physical activity on cognition. *Psychology of Sport and Exercise*, 40, 1-22. https://doi.org/10.1016/j. psychsport.2018.08.015
- Schmidt, M., Jäger, K., Egger, F. et al. (2015). Cognitively engaging chronic physical activity, but not aerobic exercise, affects executive functions in primary school children: a group-randomized controlled trial. *Journal* of Sport & Exercice Psychology, 37(6):575–591.
- Suárez-Manzano, S., Ruiz-Ariza, A., López-Serrano, S., & Martínez López, E. J. (2018). Descansos activos para mejorar la atención en clase: intervenciones educativas. *Profesorado. Revista de Currículum* y Formación de Profesorado, 22(4), 287-304. https://doi.org/10.30827/ profesorado.v22i4.8417
- Thurstone, L. L. & Yela, M. (2012). Test de Percepción de Diferencias– Revisado (CARAS-R). 11th Ed. Madrid: Tea Ediciones, SA.
- Watson, A., Timperio, A., Brown, H., Best, K., & Hesketh, K. D. (2017). Effect of classroom-based physical activity interventions on academic and physical activity outcomes: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 14, 114. https://doi.org/10.1186/s12966-017-0569-9

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A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images

Assessment of a Coding Tool to Analyse Goals in Football (CODITAG)

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Abstract

The most defining event in a football match is scoring a goal; therefore, the analysis of the dynamics of the game and the behaviours that lead to scoring goals can provide an important contribution to the identification of each team's most decisive attacking sequences in order to propose an appropriate strategy. Thus, the aim of this study was to set up and assess an ad hoc coding tool to analyse goals in semi-professional, amateur and training football. Based on several action-research processes, and using a set of experts through the Delphi method, a field-format coding tool was designed and assessed where each criterion is an exhaustive and mutually exclusive system of categories. The results demonstrated excellent content validity values, estimated through the degree of agreement (9.37 out of 10) and importance (9.66 out of 10). Similarly, excellent intra-observer reliability values were obtained ($k \ge .87$), and good to excellent inter-observer agreement values ($\bar{k} \ge .62$). The evaluation of generalisability using a three-facet design (observers, categories, goals) showed excellent reliability (G > .90), and perfect representativeness ($r^2 = 1$), showing that the variability is explained by the categories facet (in isolation or in interaction with the other facets). In conclusion, this study provides a valid and reliable tool that allows for the identification of the teams' most representative traits through the analysis of their goals.

Keywords: attacking phase, attacking sequence, football training, observational methodology, sporting performance, tactical analysis.

Introduction

The internal logic of play in socio-motor sports is influenced by the structure of scoring interactions, as they map out the ways in which scoring goals can take place, and define the way in which teams are able to change the score during game time, as well as the types of interaction that can take place between players and opposing teams (Parlebas, 2001). In the case of football, despite being able to interact with both teammates and opponents, the type of scoring interaction is antagonistic given that the scoreboard changes through scoring a goal, beating the opposition in the collective duel. Due to the nature of scoring interactions in football, only 1% of professional teams' possessions lead to scoring (González et al., 2020). Scoring a goal, therefore, is the most successful action in football and, so, analysing the scenarios that lead to goals can provide an important contribution to the identification of the most emblematic or critical game actions in order to understand the factors that provoke perturbations or imbalances in the attack/defence balance (Hughes, 1996). Therefore, observing the sequences of attacking play from previously defined criteria and categories allows us to understand how the teams behave when they score a goal, either in the moment of attacking transitions or in the execution of their attacks in the attacking phase.

In recent years, different observational tools have been used in order to analyse goals or sequences leading to goal-scoring opportunities. Some of these tools focus on recording exactly each event from the moment the team initiates the attacking sequence after regaining possession of the ball until the end of the action (Aranda et al., 2019; Barreira et al., 2013; Castellano, 2000; Echeazarra, 2014; Ortega-Toro et al., 2019; Papadopoulos et al., 2021; Sarmento et al., 2010; Tenga et al., 2010), while others do not look at the entire sequence of play (Caro Muñoz & Caro Muñoz, 2016; Kubayi, 2020; Ugalde-Ramírez & Rodríguez-Porras, 2021). Spatial characterisation is another criterion that is involved in many of these tools. Some record from where sequences of play start and which areas of the pitch the ball travels across until the end of its completion (Barreira et al., 2013; Castellano, 2000; Echeazarra, 2014; Ortega-Toro et al., 2019; Sarmento et al., 2010). Others have only focused on spatially characterising the last kick (Papadopoulos et al., 2021; Ugalde-Ramírez & Rodríguez-Porras, 2021), or the area where possession is initiated (Aranda et al., 2019; Caro Muñoz & Caro Muñoz, 2016; Kubayi, 2020; Papadopoulos et al., 2021; Tenga et al., 2010). Other criteria studied have been the result of the match before the goal or scoring opportunity (Barreira et al., 2013; Sarmento et al., 2010), the type of attack (Aranda et al., 2019; Kubayi, 2020; Papadopoulos et al.,

2021; Sarmento et al., 2010; Tenga et al., 2010; Ugalde-Ramírez & Rodríguez-Porras, 2021), the behaviours that appear during the development and completion (Aranda et al., 2019; Barreira et al., 2013; Echeazarra, 2014; Ortega-Toro et al., 2019; Sarmento et al., 2010), the surface used in the last contact (Echeazarra, 2014; Ortega-Toro et al., 2019; Papadopoulos et al., 2021), the number of contacts made by the player (Echeazarra, 2014; Ortega-Toro et al., 2019), the number of passes before completion (Aranda et al., 2019; Caro Muñoz & Caro Muñoz, 2016; Kubayi, 2020; Papadopoulos et al., 2021; Sarmento et al., 2010), the typology or direction of the passes (Echeazarra, 2014; Sarmento et al., 2010; Tenga et al., 2010), the temporality of goals or goal-scoring opportunities (Barreira et al., 2013; Kubayi, 2020; Papadopoulos et al., 2021; Sarmento et al, 2010; Ugalde-Ramírez & Rodríguez-Porras, 2021), whether the home or away team finishes (Echeazarra, 2014; Sarmento et al., 2010), the centre of play (Barreira et al., 2013), the context of interaction between the two teams (Barreira et al., 2013; Castellano, 2000; Echeazarra, 2014; Ortega-Toro et al., 2019) and the context of opposition applied by the opposing team (Aranda et al., 2019; Ortega-Toro et al., 2019; Tenga et al., 2010).

Although some of these tools offer a high level of detail, they are often not sustainable in certain contexts, as they require high-quality recordings to record everything that it intends to. As a result, it would be of interest to design a tool that is sustainable in non-professional and training football and that, in addition to allowing delayed analysis, can be used live, and focuses in a particular way on what happens in the last seconds before the goal is scored; structured on the basis of some of the criteria considered and other criteria not yet considered in the scientific literature.

In light of the above, the aim of this study was to set up and assess a coding tool designed *ad hoc* to specifically analyse goals in football. The results of the present study will allow the tool to be applied both in the scientific field and in the field of sports competition analysis. In order to achieve this objective, the degree of validity and reliability of the data collected was determined to ensure the quality of the coding tool.

Methodology

Design

The study presented responded to a follow-up observational, nomothetic and multidimensional design (Anguera et al., 2011). It was follow-up because the data collection was carried out in one season or competitive period over several matches; it was nomothetic because the data was recorded in a cross-sectional way (Hernández-Mendo & Molina, 2002), coding the goals of all the teams that participated in the same league, independently, without any link between them; and it was multi-dimensional because the goals were analysed according to several criteria. The data type was therefore concurrent and event-based, in other words, type II (Bakeman, 1978), because several dimensions were recorded in the same cluster, irrespective of the duration of the events. Therefore, data collection required the configuration of an *ad hoc* coding tool which, based on the structure of the observational design, was a combination of field format and category systems (Anguera & Blanco-Villaseñor, 2006).

Participants

To assess the tool, a total of 12 experts contributed their findings via Google Forms in two phases (n = 6, n = 6). Each of the selected experts met at least two of the following four requirements: (1) work as a coach or analyst with more than 10 years of experience; (2) be a coach with a minimum level 3 qualification; (3) have a degree in Physical Activity and Sport Sciences with a specialisation in football; (4) possess a Ph.D. on football.

For the design and optimisation of the coding tool, a sample of 477 goals corresponding to 18 match days of the 2019/20 season in the 3rd division of the RFEF group 7 (Madrid) was used. Subsequently, to calculate the reliability, a sample of 52 goals corresponding to match days 1 and 2 of the 2021/22 season in the 3rd RFEF Group 7 (Madrid) was used, with three observers for this process.

As no recordings were made directly on participants, no ethical consent was required as no invasive measures were taken to gather the data. The sequences of play were observed using the videos that the Madrid Football Federation offers openly and publicly on its website, in which all the goals are shown after each match day of 3^{rd} RFEF group 7.

Coding Tool

The initial tool was developed using other previous tools aimed at the analysis of goals or attacking sequences as a reference (Barreira et al., 2013; Caro Muñoz & Caro Muñoz, 2016; Sarmento et al., 2010), and was used for the first time during the 2019/20 season. In that season, and alongside the recording of observed goals, the tool was modified to accommodate those criteria that could be

analysed with their consequent exhaustive and mutually exclusive category systems. In the 2020/21 season, the tool was presented to the first group of experts (n = 6), who, using the Delphi method, provided their contributions in order to provide evidence of content validity. In the 2021/22 season, again following the Delphi method, a second group of experts (n = 6) assessed the tool, modifying it for analysing goals in football (CODITAG). The tool consists of a combination of a field format and exhaustive and mutually exclusive category systems, with 11 criteria, as shown in Table 1. It should be noted that 6 of these 11 criteria (match day, home team, away team, scoring team, minute of the goal, status of the scoreboard before the goal) do not depend on the analysis of the game action, as they can be verified without the need to observe the attacking sequence leading to the goal. Therefore, they have not been taken into account in the process of estimating validity and reliability. The criteria that had to undergo a process of estimating their validity and reliability for inclusion in the tool, due to their direct relationship with the observation of the game action, were: the type of attack, the contextualisation of the penultimate action, the contextualisation of the last action, the number of contacts of the last action and the surface used in the last contact.



Figure 1 *Recovery zones to record goals in transition.*

Table 1

Criteria and categories of the coding tool for analysing goals in football -CODITAG-

Criterion	Categories	Definition for observation				
Match day	1 to total number of days	No. of match days in which the match that gives rise to the analysed goal is played				
Home team	1 to total number of teams	No. of the home team that gives rise to the analysed goal				
Away team	1 to total number of teams	No. of the away team that gives rise to the analysed goal				
Toom that approx	Home	The home team scores the goal				
ream that scores	Away	The away team scores the goal				
Minute	1 to the minute signifying the end of the match	Minute that the goal was scored				
	Draw	Neither of the teams were winning before the goal				
Scoreboard status	Home victory	The home team were beating the away team by one goal				
before the goal was	2+ home victory	The home team were beating the away team by two or more goals				
scored	Home defeat	The home team were losing against the away team by one goal				
	2+ home defeat	The home team were losing against the away team by two or more goals				
	Positional combination play	The goal is preceded by a combination of passes by the team's players that allows them to progressively advance towards the opponent's goal, getting past an organised defence and completing most of the following indices: the opposing team is forced into their own half, great width of play, many players in front of the ball during the development of play, alternating pause and rhythm in the execution, very elaborate and positional attack.				
Type of attack	Quick combination play	The goal is preceded by a combination of passes by the team's players that allows them to advance quickly to the opponent's goal, getting past an organised defence and completing most of the following indices: distance and space is taken advantage of between the opponent's lines, verticality in the play, few players involved in the creation of play, great rhythm and speed in the execution and simplicity in a completion.				
	Direct attack	The goal is preceded by a long throw-in to the team's attacking line over the opponent's midfielding area.				
	Completion after recovery on exit of opposition's ball	The goal is preceded by a steal or interception of the ball in the opposition's starting end (see Figure 1).				
	Counter-attack after recovery at the opposition's end	The goal is preceded by a quick move by the team's players that allows them to advance towards the opposition's goal, getting past an unorganised defence. The ball is recovered in the opposition's half, excluding the opposition's starting end (see Figure 1).				

Table 1 (Continued)

Criteria and categories of the coding tool for analysing goals in football -CODITAG-

Criterion	Categories	Definition for observation					
Type of attack	Counter-attack at team's own end	The goal is preceded by a quick move by the team's players that allows them to advance towards the opposition's goal, getting past an unorganised defence. The ball is recovered in own half, excluding the opposition's end (see image 1).					
	Set piece: foul in the penalty box	The goal is preceded by a set-piece action from a direct or indirect free kick that is kicked into the opponent's penalty box.					
	Set-piece: foul to restart play	The goal is preceded by a set-piece action from a direct or indirect free kick that is not kicked into the opponent's penalty box.					
	Set-piece: corner to the penalty box is touched in by an attacker	The goal is preceded by a set-piece from a corner. The corner is played into the box and the first contact is made by an attacker.					
	Set-piece: corner to the penalty box is touched in by a defender	The goal is preceded by a set-piece from a corner. The corner is played into the box and the first contact is made by a defender.					
	Set-piece: corner outside the box	The goal is preceded by a set-piece from a corner. The corner is not hit into the penalty box, is taken short or sought by an attacker outside the penalty box.					
	Set-piece: throw-in	The goal is preceded by a set-piece from a throw-in.					
	Penalty	The goal came from a penalty either directly or from a second action.					
	Other	It is not properly indicated what precedes the goal or it is not possible to include it in any of the other categories.					
	Pass into space (outside-outside and outside-inside)	The player who scores receives a pass at the back of the last line of defence. The passer is outside the box.					
	Pass outside the box (outside-outside and inside-outside)	The player who scores receives a pass outside the box. The passer can be inside or outside the box (not including passes into space and long balls).					
	Pass inside the box (inside-in)	The player who scores receives a pass inside the penalty box. The passer is also inside the box.					
Contextualisation	Pass or cross from the wing (outside-inside)	The player who scores receives a pass or cross inside the box from a runner on the wing.					
penultimate action	Long ball (outside-outside and outside-inside)	The player who scores receives a long ball (not including balls at the back of the defence which are considered passes into space).					
	Through-pass (outside-inside)	The player who scores receives a pass inside the penalty box.					
	Header	The player who scores receives a pass inside the box from the inside runner (excludes passes into space and long balls).					
	Rebound	The player who scores takes advantage of a rebound or a failure to clear the ball.					
	Steal-interception	The player who scores steals the ball or intercepts a pass.					

Table 1 (Continued)

Criteria and categories of the coding tool for analysing goals in football -CODITAG-

Criterion	Categories	Definition for observation					
Contextualisation penultimate action	Throw-in	The player who scores receives the ball from a throw-in.					
	None	Usually penalties and direct free kicks.					
	Other	It is not properly indicated how the scoring player receives the ball or it is not possible to include it in any of the other categories.					
	1v0 (empty goal)	The player who scores the goal shoots with no challenge from the opposition between the ball and the goal (not includir scenarios where the goalkeeper or the last defender is dribbled past).					
	1vP	The player who scores the goal shoots or dribbles to finish with only the goalkeeper or a defender marking them (not including completions).					
	Completion	The player who scores the goal contacts the ball in the air (not including goals from outside the box or empty goals).					
Contextualisation last	Inside shot (no 1vP)	The player who scores the goal shoots inside the penalty box with at least one defender and the goalkeeper marking them. Contact with the ball is at ground level.					
action	Outside shot	The player who scores the goal shoots from outside the box (not including direct free kicks).					
	Own goal	The player who scores the goal does so in their own goal.					
	Direct foul	The player who scores the goal shoots a direct free kick.					
	Penalty	The player who scores the goal kicks a penalty.					
	Other	It is not properly indicated how the player scores the goal or it is not possible to include it in any of the other categories.					
	1 touch	The player who scores the goal does so with their first touch of the ball.					
No. of contacts last	2 touches	The player who scores the goal does so after a previous control of the ball.					
action	3 touches	The player who scores the goal touches the ball three times.					
	4+ touches	The player who scores the goal makes four or more touches with the ball.					
	Right side	The player who scores the goal does so with their right foot.					
	Left side	The player who scores the goal does so with their left foot.					
	Header	The player who scores the goal does so with their head.					
	Other	The player who scores the goal scores with any part of the body except their right foot, left foot or head.					

Procedure

The design of the tool and the processes to provide evidence of validity and reliability were carried out in six stages (see Figure 2): (a) literature review and design of the provisional coding tool, (b) action research processes through piloting to ensure that the criteria category systems were exhaustive and mutually exclusive, (c) optimisation and content validation of the coding tool using two expert groups, (d) development of the inter- and intra-observer reliability estimation processes, (e) data quality control based on the analysis of generalisability and, finally, (f) quality assessment of the whole process using the checklist of methodological quality for studies based on observational methodology —MQCOM— (Chacón-Moscoso et al., 2019).

In the first stage, the selection of the observation categories that make up the tool was made through a literature review of a set of studies that had used coding tools for the analysis of goals in football (Caro Muñoz & Caro Muñoz, 2016; Sarmento et al., 2010; Tenga et al., 2010).



Figure 2

Phases to design and assess CODITAG.

In the second stage, the *ad hoc* coding tool was implemented for the data collection process using the software Microsoft Excel 365 (Microsoft Corporation, Washington, USA). The use of other types of more specific software within observational studies was discarded, because several criteria of the coding tool had a large number of categories (e.g. the criterion "minute of goal" has 90 categories). In this stage, the coding tool was used to record and analyse 477 goals in the 3rd national division group 7 (Community of Madrid), during 18 match days of the 2019/20 season. Alongside this process, the problems that arose in assessing the criteria that made up the tool were resolved to ensure that the category systems were exhaustive and mutually exclusive.

The third stage consisted of two phases: optimisation of the tool and content validity. In the first phase, through the suggestions of the first group of experts (n = 6), 5 new categories were created and the definitions of 11 categories were reformulated. In the second phase, the content validity of the tool was established by the second group of experts (n = 6) through the content validity coefficient (CVC) (Hernández Nieto, 2002). For this, a 1-10 scale was used with the experts to facilitate their responses on two factors: the degree of agreement and the degree of importance of each of the criteria and categories. Subsequently, the data was remodelled to a 0.1-1 scale, averaging the experts' responses for each criterion and category, according to factor. All of the tool's categories had agreement and acceptance values above 0.8, with all categories being accepted (Bulger & Housner, 2007). This was because the tool had undergone many pilots before being presented to this second group of experts. Finally, the resulting values were remodelled back to the 1-10 scale. After the coding tool was approved, it was updated in Excel.

In the fourth stage, the process of gathering evidence of the tool's reliability — both intra-observer and interobserver - was carried out. Following the procedures developed in other works (Barreira et al., 2013; Fernandes et al., 2019; Ortega-Toro et al., 2019; Sánchez-López et al., 2021), 3 observers performed the analysis of the goals (n = 52) of the first and second league match day of the 3rd RFEF group 7 (Community of Madrid), 2021/22 season. Using the software SPSS Statistics for Windows, v19 (IBM Corporation, New York, USA), as well as the Microsoft Excel 365 add-in XrealStats, inter-observer reliability was calculated, and the criteria analysed as different between observers were discussed and analysed again, with the first author of the article acting as observer-moderator. Six weeks later, using the test-retest reliability method, one of the observers repeated the analysis process and the results obtained were compared with their previous analysis in order to calculate intra-observer reliability.



Figure 3

Descriptive analysis of goals according to the criterion "type of attack" using the criteria home, away and scoring team.

In the fifth stage, given the nature of the data analysed and in order to control their quality, the generalisability theory (Cronbach et al., 1972) was applied by modelling the different sources of variability or facets (observers [O], goals [G] and categories [C] of the taxonomic system), designing six possible models: [CG/O], [O/CG], [OG/C], [C/OG], [OC/G] and [G/OC].

In the sixth and final stage, the study was evaluated using the checklist of methodological quality for studies based on observational methodology —MQCOM— (Chacón-Moscoso et al., 2019), consisting of 20 items (1 point per item). The study scored 16.67 out of 18 points (2 items were not analysed).

Once the stages were completed, the coding tool could be used to code the goals, documenting the data in Excel. From this same application, the data is analysed descriptively through dashboards designed *ad hoc* to obtain the frequency and percentage of occurrence of each category within each criterion, as well as linking data between criteria in order to obtain more information. The following is an example (see figure 3) of the criterion "type of attack" on a sample of 273 goals corresponding to the first 12 match days of 3rd RFEF Group 7 (Community of Madrid) of the 2021/22 season.

Statistical Analysis

The coding tool was assessed in relation to the quality of the data. To achieve this, the content validity of the tool was reached qualitatively through the consensus agreement of a group of experts following the Delphi method and using the CVC (Hernández Nieto, 2002). The tool was also analysed quantitatively, calculating its intra-observer reliability using Cohen's kappa coefficient, and its inter-observer reliability using Fleiss' kappa coefficient for comparing more than 2 observers, as well as Cohen's kappa coefficient for comparing pairs of observers.

Results

Content Validity

To estimate the CVC (Hernández Nieto, 2002), the averages of the two factors used with the expert group were calculated following the Delphi method: the degree of agreement (9.37 out of 10), which reflects the clarity of the language ("do you think that the definition of the category is well elaborated and exclusive with respect to the other categories of the criterion?"), and the degree of importance or appropriateness (9.66 out of 10), which represents the theoretical and practical relevance ("do you think that the category should be part of the criterion?"). The scores obtained for both factors showed very high content validity.

Intra-Observer Reliability

In order to calculate the intra-observer stability index, the test-retest method was used by applying Cohen's kappa coefficient to data recorded by the same observer twelve weeks apart. The results showed agreement rates $(k \ge .87)$ that could be rated as very good (Altman, 1991) for the five criteria analysed, for a coding tool of these characteristics.

Table 2

Intra-observer reliability through the test-retest method with Cohen's kappa coefficient.

Criterion	Cohen's kappa (k)
Type of attack	.91
Context penultimate action	.93
Context last action	.87
No. of scoring touches	.96
Last contact surface	.97

Inter-Observer Reliability

Inter-observer agreement was estimated from two perspectives. On the one hand, through Cohen's kappa coefficient (k) between pairs of observers, and, on the other hand, using Fleiss' kappa coefficient (k_{-}) to calculate the total reliability for more than two observers (n = 3). The results obtained show good (k > .60 and $k_{-} > .60$) and excellent (k > .80 and $k_{-} > .80$) agreement values between observers from the two perspectives.

Generalisability Evaluation

The evaluation of generalisability was carried out using the *software* SAGT v1.0 build 218.0.1. (Hernández-Mendo et al., 2016). For this, three facets (observers [O], categories [C] and goals [G]) were used, resulting in six possible models (see table 4).

Based on the analysis, three aspects were addressed: reliability, variability and representativeness of the model.

Designs that used the "Categories" facet as a differentiating facet showed relative and absolute generalisability coefficients close to 1. It seems, then, that the observers agreed on their observations, linking this to a high reliability when discussing the generalisability of the results (close to 1).

The possible sources of variance showed that most of the variability (70.84%) is explained when the facet "Categories" is linked to the facet "Goals", the remaining part being explained by the facet "Categories" in isolation (15.38%) or in interaction with the other facets (13.78%). This reveals the heterogeneity shown by both the categories established and the goals observed, as well as the homogeneity in the observations, an ideal situation which means that the recording made by the observers has not influenced the values obtained, with no notable differences between the records (Usabiaga et al., 2013). Therefore, the categories can be considered as exclusive within the taxonomic system set up.

Lastly, the coefficient of determination (r^2) was estimated using the following formula ($r^2 = SCE/SCT$) as follows: with SCT being the total sum of squares, SCE the sum of squares explained, and SCR the residual sum of squares, STC = SCE + SCR (representing the ideal model STC = SCE, and SCR = 0). When using a three-facet design, there were seven possible sums of squares (each facet in isolation, the facets in pairs, and all three facets). Taking the four options where the facet "Categories" appears as a differentiating facet for the calculation of the SCE, it was obtained that SCR = 0, since the sum of squares of [O], [G] and [O][G] is 0.00, as shown in table 4. Therefore, $r^2 = 1.00$. This would mean that the model is fully representative.

Table 3

Inter-observer reliability calculated pairwise using Cohen's kappa and for more than 2 observers using Fleiss's kappa.

Critorion		Fleiss's kappa ($ar{k}$)		
Cinteriori	Obs1/Obs2	Obs1/Obs3	Obs1/Obs2	Obs1/Obs2/Obs3
Type of attack	.79	.88	.86	.83
Context penultimate action	.77	.82	.86	.83
Context last action	.62	.78	.65	.71
No. of scoring touches	.92	.88	.89	.90
Last contact surface	.97	.97	1.00	.98

Table 4

Estimated values of the relative $(\xi \rho^2_{(5)})$ and absolute $(\xi \rho^2_{(\Delta)})$ generalisability coefficients for the designs: [CG/O], [O/CG], [O/CG], [C/OG], [O/CG] y [G/OC].

	Sum of squares type III	Degrees of freedom	Average squares	Standard error	%
Observers [O]	0.00	2	0.00	0.000	0.00
Categories [C]	116.982	42	2.750	0.004	15.38
[O][C]	3.128	84	0.037	0.000	0.42
Goals [G]	0.00	51	0.00	0.000	0.00
[O][G]	0.00	102	0.00	0.000	0.00
[C][G]	508.98	2142	0.238	0.002	70.84
[O][C][G]	60.205	4284	0.01	0.000	13.36
		r ² = 1.00			
$\begin{bmatrix} CG/O \end{bmatrix} \xi \rho_{(5)}^{2} = .949 \text{ and } \xi \rho_{(\Delta)}^{2} = .949 \\ \begin{bmatrix} O/CG \end{bmatrix} \xi \rho_{(5)}^{2} = .000 \text{ and } \xi \rho_{(\Delta)}^{2} = .000 \\ \begin{bmatrix} OG/C \end{bmatrix} \xi \rho_{(5)}^{2} = .000 \text{ and } \xi \rho_{(\Delta)}^{2} = .000 \\ \begin{bmatrix} C/OG \end{bmatrix} \xi \rho_{(5)}^{2} = .906 \text{ and } \xi \rho_{(\Delta)}^{2} = .906 \\ \begin{bmatrix} OC/G \end{bmatrix} \xi \rho_{(5)}^{2} = .907 \text{ and } \xi \rho_{(\Delta)}^{2} = .907 \\ \begin{bmatrix} OC/G \end{bmatrix} \xi \rho_{(5)}^{2} = .000 \text{ and } \xi \rho_{(\Delta)}^{2} = .000 \\ \end{bmatrix}$					

Discussion

The aim of this study was to outline the steps taken to set up and assess an *ad hoc* coding tool for analysing goals in football. The survey provides a valid and reliable tool that allows for the collection of data in a rigorous and relevant, yet agile and simple manner.

This tool was purposely built to allow its sustainable use in semi-professional, amateur and training football teams where sometimes coaching staff face serious complications when properly recording their matches and obtaining records of opposing teams. Therefore, it differs from other tools in existing scientific literature in that it is composed of criteria aimed at analysing the events that take place in the last few seconds before a goal, with the possibility of collecting live and delayed data. It is even possible to use it in match summaries that do not offer a full visualisation of the game sequences, as was done in the process of obtaining evidence of reliability in this study.

The coding tool consists of 11 criteria, five of which depend on the observation of the game action (the type of attack, the contextualisation of the penultimate action, the contextualisation of the last action, the number of contacts of the last action and the surface used in the last contact). Thanks to the process of obtaining evidence of validity, for the criterion "type of attack", a very broad classification of categories was developed to bring together all the expert contribution. Combination play was divided into positional and quick, in order to identify the strategic use of space (Amatria et al., 2019). In other words, in the positional combination play, width was prioritised over depth, while in the quick combination play, depth was prioritised over width. The counter-attacks were divided according to the recovery zone, and the set-piece was also distinguished according to the situation leading to the goal. For the criterion "contextualising the penultimate action" the large box was used as the main reference (insideinside, inside-outside, outside-inside, outside-outside) to determine the type of pass, which greatly facilitated the classification of the play action. This idea was based on previous work (Echeazarra, 2014), in which the action of the player in possession of the ball is contextualised by taking the effective playing space as a reference (Castellano, 2000). When the penultimate action was not a pass as such, other categories were used (header, rebound, steal-interception, throw-in, no handball, other). For the criterion "contextualisation of the last action" the level of opposition (1v0, 1vP, rest) and again the large box (last contact inside or outside) were used as references. A distinction was also made as to whether the last action was with the ball in play or a set-piece (direct foul or penalty). Lastly, the criteria "number of contacts of the last action" and "surface area used in the last contact" were used, as seen in previous work as outlined in the introduction of this paper.

With regard to the contribution of the other six criteria, it can be noted that the criterion "match day" allows the tracking of goals by comparing their progression in a league championship. The criteria "home team" and "away team" allow the identification of patterns of attacking play in terms of scoring and conceding goals by teams when playing at home or away. This, undoubtedly, can be linked to the teams' game model, since knowing these game patterns allows us to identify and define their most characteristic features (Martín Barrero et al., 2021), in order to incorporate a specific tactical intention that fits with that game idea when designing training tasks (Lapresa et al., 2020). The criterion "scoring team" identifies whether it is the home or away team that scores the goal. The criterion "minute of the goal" allows the goals to be analysed by the time that they were scored. As mentioned previously, it has 90 categories, from minute 1 to minute 90, with the intention of establishing post-observation time intervals, due to the fact that in training football the duration of matches depends on the age category. The criterion "scoreboard status before the goal" allows us to analyse the goals in terms of the result, looking at whether the goals scored serve to widen the lead on the scoreboard or are decisive in drawing or winning the match (Fernández-Hermógenes et al., 2017).

In terms of the applicability of the tool, several options can be found in two different ways: research and competition. At the research level, one could differentiate how goals are scored or conceded using some of the criteria that make up the observational tool as independent variables, as well as to compare goals from different leagues or sport contexts. On a competitive level, one could analyse and compare the goals scored by a club's teams to establish differences and similarities between them, as well as compare the goals scored and conceded by one's own team with respect to teams in its league.

The coding tool is one that does not study the whole sequence of play. This is a limitation when it comes to going into detail on the action of the game, although it is true that it is an intentional fact that facilitates the recording of the goals in an easy way.

In terms of future prospects, the tool could include new criteria, with their respective category systems, which could support more in-depth analyses that would allow for other possible comparisons to be made.

Conclusions

As a conclusion of the study, it is worth mentioning that the presented coding tool presents optimal validity and reliability values. This ensures its use in possible research projects or specific scientific studies; as well as by clubs, sports performance analysis departments and coaches in order to analyse and assess how goals are scored, improving their teaching and training processes.

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References

- Altman, D. (1991). Practical statistics for medical research (1st Edition). New York: Chapman and Hall/CRC. http://dx.doi.org/10.1201/9780429258589
- Amatria, M., Maneiro-Dios, R. & Anguera-Argilaga, M. T. (2019). Análisis del éxito de la Selección Española en la UEFA-Euro 2012. Apunts Educación Física y Deportes, 137. https://doi.org/10.5672/apunts.2014-0983.es.(2019/3).137.07
- Anguera, M. T. & Blanco-Villaseñor, Á. (2006). ¿Cómo se lleva a cabo un registro observacional? *Butlletí LaRecerca*, 4.
- Anguera, M. T., Blanco-Villaseñor, Á., Hernández-Mendo, A. & Losada, J. L. (2011). Diseños observacionales: Ajuste y aplicación en psicología del deporte. *Cuadernos de Psicología del Deporte*, 11(2), 63-76. Retrieved from https://revistas.um.es/cpd/article/view/133241 (Accessed 30 September 2021)
- Aranda, R., González-Ródenas, J., López-Bondia, I., Aranda-Malavés, R., Tudela-Desantes, A. & Anguera, M. T. (2019). "REOFUT" as an Observation Tool for Tactical Analysis on Offensive Performance in Soccer: Mixed Method Perspective. *Frontiers in Psychology*, 10. https://doi.org/10.3389/fpsyg.2019.01476
- Bakeman, R. (1978). Untangling Streams of Behavior: Sequential Analysis of Observation Data. In G. P. Sackett (Ed.), *Observing Behavior*. *Data collection and analysis methods* (Vol. 2, pp. 63-78). Baltimore: University Park Press.
- Barreira, D., Garganta, J., Castellano, J. & Anguera, M. T. (2013). SoccerEye: A Software Solution to Observe and Record Behaviours in Sport Settings. *The Open Sports Sciences Journal*, 6(1), 47-55. https://doi.org/10.2174/1875399x01306010047
- Bulger, S. M. & Housner, L. D. (2007). Modified Delphi Investigation of Exercise Science in Physical Education Teacher Education. *Journal of Teaching in Physical Education*, 26, 57-80. https://doi.org/10.1123/jtpe.26.1.57
- Caro Muñoz, Ó. & Caro Muñoz, A. (2016). Aproximación a los modelos tácticos generales ofensivos mediante el análisis de los goles en fútbol profesional. *Journal of sport and health research*, 8(1), 1-12. www.journalshr.com/papers/Vol%208_N%201/V08_1_1.pdf (Accessed 14 October 2021)
- Castellano, J. (2000). *Observación y análisis de juego en el fútbol*. Tesis doctoral. University of the Basque Country.
- Chacón-Moscoso, S., Anguera, M. T., Sanduvete-Chaves, S., Losada, J. L., Lozano-Lozano, J. A. & Portell, M. (2019). Methodological quality checklist for studies based on observational methodology (MQCOM). *Psicothema*, 31(4). https://doi.org/10.7334/psicothema2019.116
- Cronbach, L. J., Gleser, G. C., Nanda, H. & Rajaratnam, N. (1972). The Dependability of Behavioral Measurements: Theory of Generalizability for Scores and Profiles. New York: J. W. and Sons.
- Echeazarra, I. (2014). Análisis de la respuesta física y del comportamiento motor en competición de futbolistas de categoría alevín, infantil y cadete. Tesis doctoral. University of the Basque Country.
- Fernandes, T., Camerino, O., Garganta, J., Pereira, R. & Barreira, D. (2019). Design and validation of an observational instrument for defence in soccer based on the Dynamical Systems Theory. *International Journal of Sports Science and Coaching*. https://doi.org/10.1177/1747954119827283

- Fernández-Hermógenes, D., Camerino, O. & García De Alcaraz, A. (2017). Acciones ofensivas a balón parado en el fútbol. Apunts Educación Física y Deportes, 129. https://doi.org/10.5672/apunts.2014-0983.es.(2017/3).129.06
- González, R., Aranda, R., Tudela, A., Sanz, E., Crespo, J. & Aranda, R. (2020). Past, present and future of goal scoring analysis in professional soccer. *Retos*, 37, 774-785. https://doi.org/10.47197/retos.v37i37.69837
- Hernández-Mendo, A., Blanco-Villaseñor, Á., Pastrana, J. L., Morales-Sánchez, V. & Ramos-Pérez, F. J. (2016). Aplicación informática para análisis de generalizabilidad. *Revista Iberoamericana de Psicología del Ejercicio y el Deporte*, 11(1),77-89.
- Hernández-Mendo, A. & Molina, M. (2002). Cómo usar la observación en la psicología del deporte: principios metodológicos. *Efdeportes*, 8(49). http://www.efdeportes.com/ (Accessed 9 September 2021)
- Hernández Nieto, H. (2002). Contributions to statistical analysis. *Mérida: University of the Andes.*
- Hughes, M. (1996). Notational analysis. In T. Reilly (Ed.), *Science and Soccer* (pp. 343-361). London: Routledge. https://doi.org/10.4324/9780203417553
- Kubayi, A. (2020). Analysis of Goal Scoring Patterns in the 2018 FIFA World Cup. *Journal of Human Kinetics*, 71(1). https://doi.org/10.2478/hukin-2019-0084
- Lapresa, D., Blanco, F., Amatria, M., Arana, J. & Teresa Anguera, M. (2020). Observational Analysis of the Execution of the "Control" Core Technical/Tactical Concept by Sergio Busquets. *Apunts Educación Física y Deportes*, 140. https://doi.org/10.5672/apunts.2014-0983. es.(2020/2).140.08
- Martín Barrero, A., Marcos Gutierrez, I. & Falces Prieto, M. (2021). Analysis of the game model in a professional football team in the German First Division. Case study. *Retos*, 39, 628-634. https://doi.org/10.47197/retos.v0i39.79923
- Ortega-Toro, E., García-Angulo, A., Giménez-Egido, J. M., García-Angulo, F. J. & Palao, J. M. (2019). Design, Validation, and Reliability of an Observation Instrument for Technical and Tactical Actions of the Offense Phase in Soccer. *Frontiers in Psychology*, 10. https://doi.org/10.3389/fpsyg.2019.00022
- Papadopoulos, S., Papadimitriou, K., Konstantinidou, X., Matsouka, O., Pafis, G. & Papadopoulos, D. (2021). Factors Leading to Goal Scoring in the Spanish and Italian Soccer Leagues. *Sport Mont*, 19(1), 13-18. https://doi.org/10.26773/SMJ.210205
- Parlebas, P. (2001). Juegos, Deporte y Sociedad. Léxico de praxiología motriz. Barcelona: Paidotribo.

- Sánchez-López, R., Echeazarra, I. & Castellano, J. (2021). Validation of a Football Competence Observation System (FOCOS), Linked to Procedural Tactical Knowledge. *Sustainability*, *13*(12), 6780. https://doi.org/10.3390/su13126780
- Sarmento, H., Anguera, T., Campaniço, J. & Leitão, J. (2010). Development and validation of a notational system to study the offensive process in football. *Medicina*, 46(6). https://doi.org/10.3390/medicina46060056
- Tenga, A., Holme, I., Ronglan, L. T. & Bahr, R. (2010). Effect of playing tactics on achieving score-box possessions in a random series of team possessions from Norwegian professional soccer matches. *Journal of Sports Sciences*, 28(3), 245-255. https://doi.org/10.1080/02640410903502766
- Ugalde-Ramírez, A. & Rodríguez-Porras, L. (2021). Análisis de los patrones de anotación y su asociación con el resultado del partido en la Copa Oro 2019. *SPORTTK-Revista EuroAmericana de Ciencias del Deporte*, *10*(2). https://doi.org/10.6018/sportk.447221
- Usabiaga, O., Castellano, J., Blanco-Villaseñor, Á. & Casamichana, D. (2013). La Teoría de la Generalizabilidad en las primeras fases del método observacional aplicado en el Ámbito de la iniciación deportiva: calidad del dato y estimación de la muestra. *Revista de Psicología del Deporte*, 22(1). 103-109.

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A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images Abstract

This paper aims to look at the relationship between functional and central quality, value and satisfaction with the intention to participate again in a popular race, observing potential differences according to gender. A total of 866 participants in a popular 21 km race in the city of Granada were randomly selected and self-administered a questionnaire. A confirmatory factor analysis of the model and a multi-group analysis were carried out. The results of the present study indicated that central quality is a precursor of value and satisfaction, with no differences according to gender, as is functional quality. Value is a predecessor of satisfaction, with no differences in gender being presented. In contrast to functional quality - an indicator of intention to take part again, irrespective of gender - no direct relationship between central quality and intention to re-participate was found. Value is not directly related to intention to take part again, but indirectly through satisfaction, as satisfaction is a direct predictor of re-participation, with no difference according to gender. The foci of this study should be known by the organisers of sporting events in order to apply these sociodemographic variables when organising any event or deciding which event would be the most recommendable for their city.

Keywords: future intentions, gender, running, satisfaction, sporting event, value.

Introduction

The number and importance of sporting events, as well as their impact and effects on society, have grown significantly. Sport has become established as a resource for the development of society; as a result, small communities and even entire nations use sporting events as a tool to achieve various objectives, for example for economic, tourism and cultural growth (Fernández-Martínez et al., 2021). It is worth adding the increase in interest in physical activity and participation in recreational competitions, which has led to the proliferation of a greater number of sporting events, mainly races (Angosto-Sánchez et al., 2016), becoming tourist attractions that increase the number of participants year after year.

The literature underlines that even small or mediumscale sporting events, such as the Granada Marathon, can represent a potential form of sustainable tourism development and help communities' economic development by promoting and diversifying the tourism attraction (Bazzanella, 2019). The majority of studies are based on large events and spectators' ratings, so more research is needed on the role of medium and small sporting events that focus on participants' experiences, as studies on future intentions based on runners' feedback are few and far between (Fernández-Martínez et al., 2021). Furthermore, few studies focus on gender differentiation, perceptions of quality, value and satisfaction in sport services (Nuviala et al., 2021), and less so when the constructs "central quality" and "future intentions" are included. The few existing studies are limited to the realm of fitness (García-Fernández et al., 2016; León et al., 2020), or sports centres (Berber & Mollaoğulları, 2020; Castillo et al., 2019), but in no case is the variable "future intentions" included.

Literature Review

Relationship Between Central Quality, Functional Quality and Perceived Value.

Quality is the customer's evaluation of the service received (Theodorakis et al., 2013). Quality has two measurements. The first measurement, central quality, refers to what the customer gets after receiving the service. These benefits and outcomes should be as close as possible to the motivations for engaging in specific behaviours (Foroughi et al., 2019). Yoshida (2017) clarified this concept, distinguishing between central quality for spectators and participants. It should be highlighted that three attributes related to this measurement are included in sport performance: team characteristics, player performance and evaluation of results. In the case of the participants, these attributes are manifested in physical condition, in the sport programmes themselves and physical changes, i.e. the perception of their sport performance (Theodorakis et al., 2013). The second measurement, functional quality, is understood as the users' evaluation of the physical elements and interactions with human resources (Theodorakis et al., 2013). It is important to highlight that the consumer perceives the service as something that combines both of the measurements, and a perception of quality is obtained by comparing these perceptions with the expectations of the service (Watanabe et al., 2018).

Perceived value is closely related to the quality or benefits they get from the service in return for the price they pay. It is defined as the consumer's evaluation of the usefulness of the product based on the perception of what is received and what is given (Crespo-Hervás et al., 2019). It has been demonstrated that value is a highly subjective, multi-dimensional and dynamic concept that comprises both cognitive and affective elements; can vary between individuals and situations; and is dependent on the moment of valuation by the customer, which determines that quality is an indicator of perceived value among runners (Cabello-Manrique et al., 2021; Crespo-Hervás et al., 2019).

Therefore, the following hypotheses were developed for both male and female runners:

- H₁: The central quality by participants of popular races is an indicator of perceived value.
- H_2 : The functional quality by participants of popular races is an indicator of the value.

Central Quality, Functional Quality and Value as an Indicator of Satisfaction.

Satisfaction (Foroughi et al., 2019) is an emotional reaction to an act of consumption or a subjective evaluation made as a post-choice cognitive judgement based on prior perceptions or surmises of quality. Research on sport services has identified a relationship between quality, value and satisfaction (Cabello-Manrique et al., 2021; Crespo-Hervás et al., 2019), with this being a post-consumer response that is susceptible to change, depending on the circumstances and the individual (Foroughi et al., 2019), which has become a key focus when organising a sporting event. The analysis of satisfaction is highly interesting for the proper management of sporting events, allowing the establishment of management and marketing strategies for the attraction and retention of different categories of attendees (Cabello-Manrique et al., 2021).
Numerous studies support the idea of value as a positive and direct indicator of satisfaction among participants of recreational races (Haro-González et al., 2018; Theodorakis et al., 2014), as value has a strong effect on satisfaction and should be taken into account by those in charge to improve participants' level of satisfaction.

Moreover, there is a strong correlation between quality and satisfaction with sport services, supporting the idea that customer satisfaction results from customer quality (Foroughi et al., 2019; Theodorakis et al., 2014). In short, quality is an indicator of both perceived value and satisfaction (Fernández-Martínez et al., 2020a).

Based on this, the following hypotheses were made for both male and female runners:

 H_3 : The perceived central quality by participants of popular races is an indicator of satisfaction.

H₄: Functional quality is an indicator of satisfaction.

H₅: Perceived value is an indicator of satisfaction.

Precursors to the Intention to Take Part Again: Quality, Value and Satisfaction.

Participation is a personal variable that expresses the amount of attention, arousal and motivation activated by a situation, affecting consumers' behaviours in the buyer decision process (Eskiler & Altunışık, 2021). Similarly, loyalty can be understood as customer's favourable attitudes towards a sport service, which drives them to both recommendation and repurchase, with a joint and positive relationship between quality, perceived value and satisfaction with users' continuity in these sporting events (Nuviala et al., 2021).

One of the most widely used variables to assess loyalty is satisfaction. When customers are satisfied, they are likely to have a positive perception of the organisation and demonstrate loyalty (Theodorakis et al., 2014). Several studies report a strong relationship between these variables (Cabello-Manrique et al., 2021; Eskiler & Altunışık, 2021). Service quality influences loyalty directly and indirectly through satisfaction (Crespo-Hervás et al., 2019; Theodorakis et al., 2013). Other studies report that perceived value influences loyalty both directly and indirectly through satisfaction (Eskiler & Altunişik, 2021). Value is directly related to satisfaction and indirectly related to loyalty; it is a predictive determinant for future intentions and behaviours, and the positive and combined influence that these three constructs have on customer behaviour and service loyalty has been proven (Watanabe et al., 2018). Several studies have also supported the idea that future intentions have been determined through service quality, perceived value and satisfaction, where value is the variable that has the greatest weight in predicting spectators' future intentions (Calabuig-Moreno et al., 2016).

Therefore, the following hypotheses were suggested for both male and female runners:

 H_6 : The perceived central quality of participants in popular races is a precursor of the intention to take part again.

 H_7 : Functional quality is an indicator of the intention to take part in the event again.

 H_8 : Value is a precursor of the intention to take part again. H_9 : Satisfaction is an indicator of the intention to take part again.



Figure 1 Proposed model for analysis.

Methodology

Participants and Sample

A total of 866 participants of a popular 21 km race took part in this study, 84.4% of which were male. The average age was 41.63 ± 9.27 years. The majority said they had a higher education (66.3%), and 89.9% of participants said they were employed. 77.2% lived with a partner. More than half, 54.6%, had previously participated in this race, while 77.8% considered themselves to be frequent runners of races of this type. Only 8.1% held a federation licence.

Measures

A multi-item scale was used for this study (Table 1). Firstly, to measure the functional quality of the race, 14 items were used from the questionnaire proposed by Angosto-Sánchez et al. (2016). To measure the quality of the result perceived by the runner after the race, three items were proposed. Perceived value was measured through a single item used, and satisfaction was measured with three items, all from

Table 1

Descriptive statistics of the tool

the EPOD2 tool (Nuviala et al., 2013). Three items were used to measure intention to take part in the race again.

Respondents were instructed to rate their level of agreement with each item, using a seven-point Likert scale ranging from strongly disagree (1) to strongly agree (7). Several socio-demographic questions were added to the scales, such as age, gender education, frequency of weekly exercise and experience of this type of race.

Procedure

The study received consent from Pablo de Olavide University's Ethics Committee. Those responsible for the organisations participating in the study were informed of the aims and objectives of the research. The research was carried out after obtaining the organisation's approval. The study's design is considered throughout the Spanish legal framework (Organic Law 3/2018). Informed consent was obtained from the participants prior to carrying out the study. It was then carried out by means of a self-administered questionnaire, in the presence of a member of the research team. The time taken to complete the questionnaire was approximately 10 minutes.

Construct	Items	Average	Std. Dev	Factorial Weight
Functional quality	The personnel of the organisation is ready to help/advise.	5.19	1.14	.731
	The volunteers are friendly.	5.52	0.91	.648
	The race is well promoted and publicised, providing sufficient practical information about the race.	4.75	1.30	.695
	During the event, clear and precise information about the layout of the competition is given.	4.94	1.24	.753
	It was easy to register.	5.20	1.18	.544
	The results and the podium are visible to all spectators.	4.53	1.41	.588
	The race course has sufficient and appropriate refreshment points.	5.30	1.18	.583
	The runner's goodie bag is adequate and complete.	4.38	1.46	.537
	The race has sufficient facilities (toilets, changing rooms, cloakroom, massage areas, stands, etc.).	4.21	1.54	.643
	Near the race start/finish line there are places with easy commercial accessibility (cafés, bars).	5.27	0.96	.610
	The signposting of the event makes it easy to reach the start line.	4.98	1.24	.693
	Sufficient parking is available near the race start/finish line.	3.79	1.63	.573
	The material elements used by the event are visually attractive (banners, fences, start, finish line, route).	4.97	1.09	.772
	The race route is well signposted and safe.	5.19	1.10	.649

Table 1 (Continued)
Descriptive statistics of the tool

Construct	Items	Average	Std. Dev	Factorial Weight
Central quality	You have shown a high level of preparedness to carry out the race.	4.37	1.14	.793
	You achieved a good result in the race based on preparation.	4.69	1.20	.857
	You enjoyed running the race.	5.44	0.98	.768
Satisfaction	I made a good decision choosing this race.	5.48	0.93	.972
	It was a good decision to run the half marathon in Granada.	5.53	0.89	.982
	I am glad I signed up for this event.	5.51	0.91	.972
Intention to	I intend to continue attending more events held in Granada.	5.39	1.049	.825
take part again	I would recommend the Granada half marathon to my friends and relatives.	5.57	0.933	.919
	If I had the opportunity to attend the half marathon in Granada I would do it again.	5.54	1.021	.926
Value	Overall, I think that attending the half marathon is worth the price.	5.36	0.96	

Statistical Analysis

Several exploratory tests such as averages, standard deviations, factorial loads and t-tests were performed. The correlations between constructs were subsequently calculated, as well as Cronbach's alpha, average variance extracted (AVE) and composite reliability (CF). Common method bias was calculated using Harman's Single Factor Test. All this was done with the software SPSS.22. Acceptable values for Cronbach's alpha are around .70, and values between .80 and .90 are considered correct. In the case of FC, the results should be above .6, and for AVE they should be above .5 (Hair et al., 2006). Podsakoff et al. (2003) highlight that a percentage of total variance of less than 50% indicates that common method bias does not significantly affect the results of the study.

A confirmatory factor analysis of the model and a multi-group analysis were carried out using the AMOS.22 programme. The model fit was tested for each group separately (total population, model 0; male runners, model 0a; female runners, model 0b). Variation in the model between groups was then observed. The maximum likelihood method was used. The fit of each model was assessed by examining various indices. The Root Mean Square Error of Approximation (RMSEA) index, Comparative Fit Index (CFI), Akaike information criterion (AIC) and Expected Cross-Validation Index (ECVI) were used. Additionally, the value of the Chi-square ratio (CMIN) and the value of the Chi-square divided by the degrees of freedom (CMIN/ DF) were used. Values of RMSEA < .08 would indicate an acceptable fit, or values $\leq .05$ would indicate a good fit. In terms of CFI \ge .95 are considered acceptable. Lower

values of the AIC index and ECVI mean a better model fit. As regards the values of the ratio between χ^2 and the DFs, a model considered perfect would have a value of 1.00, and ratios below 2.00 are considered to be a very good model fit, while values below 3.00 are considered acceptable (Schermelleh-Engel et al., 2003). Measurement invariance between groups was assessed using the $\Delta \gamma 2$ test and the recommendations of Chen (2007), according to which cut-off values of $\Delta CFI \leq .01$ and $\Delta RMSEA \leq .015$ would signify no differences between models. Finally, standardised regression coefficients for ratios and critical ratios were calculated to estimate group differences using AMOS.

Event Quality: The Intention to Take Part in a Popular Race Again

Results

As can be seen in Table 2, functional quality was rated positively, with women showing a more positive rating than men. The other constructs were also rated positively, with no differences according to gender. The construct "satisfaction" obtained the highest rating, followed by the constructs "intention to take part again" and "value" (Table 2).

The results of the exploratory factor analysis explain 38.99% of the total variance, indicating that common method bias did not significantly affect the results of the study. Internal consistency was then assessed and measured with Cronbach's alpha, obtaining correct values. The calculation of FC and AVE showed acceptable values. The discriminant validity of the data was verified by calculating the correlation matrix between the factors, and there was a significant and positive correlation between the factors that make up the study (Table 2).

Table 2

Average and standard deviation. T-test and level of significance. Correlation between constructs, Cronbach's alpha on the diagonal, AVE and FC.

Total	Male runners	Female runners	1	2	3	4	5	AVE	FC
4.87 ± 0.80	4.83 ± 0.79**	5.06 ± 0.80**	(.886)	.392**	.588**	.573**	.580**	.52	.90
4.83 ± 0.89	4.83 ± 0.91	4.85 ± 0.83		(.731)	.498**	.437**	.425**	.65	.84
$5.50~\pm~0.89$	5.50 ± 0.86	5.51 ± 0.99			(.974)	.795**	.771**	.95	.98
$5.49~\pm~0.89$	5.49 ± 0.87	5.50 ± 0.96				(.866)	.670**	.79	.92
$5.36~\pm~0.96$	$5.35~\pm~0.95$	5.44 ± 1.03					-	-	-
	Total 4.87 ± 0.80 4.83 ± 0.89 5.50 ± 0.89 5.49 ± 0.89 5.36 ± 0.96	TotalMale runners 4.87 ± 0.80 $4.83 \pm 0.79^{**}$ 4.83 ± 0.89 4.83 ± 0.91 5.50 ± 0.89 5.50 ± 0.86 5.49 ± 0.89 5.49 ± 0.87 5.36 ± 0.96 5.35 ± 0.95	TotalMale runnersFemale runners 4.87 ± 0.80 $4.83 \pm 0.79^{**}$ $5.06 \pm 0.80^{**}$ 4.83 ± 0.89 4.83 ± 0.91 4.85 ± 0.83 5.50 ± 0.89 5.50 ± 0.86 5.51 ± 0.99 5.49 ± 0.89 5.49 ± 0.87 5.50 ± 0.96 5.36 ± 0.96 5.35 ± 0.95 5.44 ± 1.03	TotalMale runnersFemale runners1 4.87 ± 0.80 $4.83 \pm 0.79^{**}$ $5.06 \pm 0.80^{**}$ $(.886)$ 4.83 ± 0.89 4.83 ± 0.91 4.85 ± 0.83 5.50 ± 0.89 5.50 ± 0.89 5.50 ± 0.86 5.51 ± 0.99 5.49 ± 0.89 5.49 ± 0.87 5.50 ± 0.96 5.36 ± 0.96 5.35 ± 0.95 5.44 ± 1.03	TotalMale runnersFemale runners12 4.87 ± 0.80 $4.83 \pm 0.79^{**}$ $5.06 \pm 0.80^{**}$ $(.886)$ $.392^{**}$ 4.83 ± 0.89 4.83 ± 0.91 4.85 ± 0.83 $(.731)$ 5.50 ± 0.89 5.50 ± 0.86 5.51 ± 0.99 $(.731)$ 5.49 ± 0.89 5.49 ± 0.87 5.50 ± 0.96 $(.731)$ 5.36 ± 0.96 5.35 ± 0.95 5.44 ± 1.03 $(.731)$	TotalMale runnersFemale runners123 4.87 ± 0.80 $4.83 \pm 0.79^{**}$ $5.06 \pm 0.80^{**}$ $(.886)$ $.392^{**}$ $.588^{**}$ 4.83 ± 0.89 4.83 ± 0.91 4.85 ± 0.83 $(.731)$ $.498^{**}$ 5.50 ± 0.89 5.50 ± 0.86 5.51 ± 0.99 $(.731)$ $.498^{**}$ 5.49 ± 0.89 5.49 ± 0.87 5.50 ± 0.96 $$ $$ 5.36 ± 0.96 5.35 ± 0.95 5.44 ± 1.03 $$ $$	TotalMale runnersFemale runners1234 4.87 ± 0.80 $4.83 \pm 0.79^{**}$ $5.06 \pm 0.80^{**}$ $(.886)$ $.392^{**}$ $.588^{**}$ $.573^{**}$ 4.83 ± 0.89 4.83 ± 0.91 4.85 ± 0.83 $(.731)$ $.498^{**}$ $.437^{**}$ 5.50 ± 0.89 5.50 ± 0.86 5.51 ± 0.99 $(.731)$ $.498^{**}$ $.437^{**}$ 5.49 ± 0.89 5.49 ± 0.87 5.50 ± 0.966 $(.731)$ $.498^{**}$ $.437^{**}$ 5.36 ± 0.96 5.35 ± 0.95 5.44 ± 1.03 $(.731)$ $.498^{**}$ $.437^{**}$	TotalMale runnersFemale runners12345 4.87 ± 0.80 $4.83 \pm 0.79^{**}$ $5.06 \pm 0.80^{**}$ $(.886)$ $.392^{**}$ $.588^{**}$ $.573^{**}$ $.580^{**}$ 4.83 ± 0.89 4.83 ± 0.91 4.85 ± 0.83 $(.731)$ $.498^{**}$ $.437^{**}$ $.425^{**}$ 5.50 ± 0.89 5.50 ± 0.86 5.51 ± 0.99 $(.731)$ $.498^{**}$ $.437^{**}$ $.425^{**}$ 5.49 ± 0.89 5.49 ± 0.87 5.50 ± 0.966 $(.731)$ $.498^{**}$ $.437^{**}$ $.425^{**}$ 5.36 ± 0.96 5.49 ± 0.87 5.50 ± 0.966 $(.731)$ $.498^{**}$ $.437^{**}$ $.425^{**}$ 5.36 ± 0.96 5.44 ± 1.03 $(.731)$ $.498^{**}$ $.437^{**}$ $.425^{**}$ 5.36 ± 0.96 5.35 ± 0.955 5.44 ± 1.03 $(.731)$ $.498^{**}$ $.437^{**}$ $.425^{**}$ 5.36 ± 0.96 5.35 ± 0.955 5.44 ± 1.03 $(.731)$ $.498^{**}$ $.437^{**}$ $.425^{**}$	TotalMale runnersFemale runners12345AVE 4.87 ± 0.80 $4.83 \pm 0.79^{**}$ $5.06 \pm 0.80^{**}$ $(.886)$ $.392^{**}$ 5.88^{**} $.573^{**}$ $.580^{**}$ $.52$ 4.83 ± 0.89 4.83 ± 0.91 4.85 ± 0.83 $(.731)$ $.498^{**}$ $.437^{**}$ $.425^{**}$ $.65$ 5.50 ± 0.89 5.51 ± 0.99 \cdot \cdot $(.974)$ $.795^{**}$ $.771^{**}$ $.95$ 5.49 ± 0.87 5.50 ± 0.96 \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot \cdot $ 5.36 \pm 0.96$ 5.35 ± 0.95 5.44 ± 1.03 \cdot \cdot \cdot \cdot \cdot $ -$

Note: (**) p < .01.

In order to find out the relationships between the constructs, and possible differences according to gender, the validity of the model was first tested. Table 3 shows that the fit indices of the model analysed have correct indices for all runners (model 0), for both male (model 0a) and female (model 0b).

The validity of the factor structure of the model is correct, as the goodness-of-fit indices are acceptable for all participants (Table 3). Once the model has been verified to be correct, and in order to compare the model according to the partcipants' gender, it is necessary to carry out factorial invariance tests. Considering the difference in χ^2 between the unrestricted model (model 1) and the rest of the models in the two groups of participants, no significant differences are observed, except with model 5. On the contrary, differences can be found when comparing models 2, 3, 4 and 5 to each other. The differences in χ^2 do not allow the invariance hypothesis to be accepted, but the rest of the indices go against this conclusion. When looking at the value of CFI and RMSEA in the models, it can be seen that they all present very similar values, with a difference of less than .01 and .015, respectively, suggesting the factorial invariance of the model for the study according to the gender of all the runners (Table 3).

Table 3

Fit statistics for the models. Comparisons of conditions using measurement invariance procedures.

	Goodness-of-fit indices and model comparisons for tested models								
Model	CMIN	DF	CMIN/DF	CFI	RMSEA	ECVI	AIC		
0	463.269	240	1.930	.959	.050	1.594	583.269		
0a	463.095	240	1.930	.954	.053	1.762	583.095		
0b	299.156	240	1.246	.958	.054	4.990	419.156		
1	806.332	480	1.680	.953	.038	2.250	1046.332		
2	834.803	501	1.666	.952	.038	2.221	1032.803		
3	844.630	507	1.666	.952	.038	2.216	1030.630		
4	848.113	511	1.660	.952	.038	2.207	1026.113		
5	900.382	540	1.667	.948	.038	2.194	1020.382		
		Comparison of	conditions using m	easurement invari	ance procedures	5			
		Model	Dif. DF	Dif. CMIN	p	Dif. CFI	Dif. RMSEA		
		2	21	28.471	.127	.001	.000		
Assuming that		3	27	38.298	.073	.001	.000		
model 1 is con	rect	4	31	41.781	.094	.001	.000		
		5	60	94.050	.003	.004	.000		
		3	6	9.827	.019	.000	.000		
Assuming that	rect	4	10	13.310	.000	.000	.000		
		5	39	65.579	.000	.006	.000		
Assuming that		4	4	3.483	.001	.000	.000		
model 3 is con	rect	5	33	55.752	.000	.004	.000		
Assuming that model 4 is cor	rect	5	29	52.269	.005	.004	.000		

Note: Model 0, total runners; model 0a male runners; model 0b, female runners; model 1, indicates that no parameters are restricted to being equal in all groups; model 2, factorial loads restricted to being equal; model 3, observed structural weights and factorial loads restricted to being equal; model 4, observed structural covariances, structural weights and factorial loads restricted to being equal; model 5, observed structural residues, structural residues, structural covariances, structural weights and factorial loads restricted to being equal. Dif. CMIN, difference between the model and the other models; Dif. DF. difference between the model and the other models; p, level of significance across models.

Table 4

Comparison of standardised parameter estimates of direct and indirect effects of the structural equation total users and modelling with respect to gender.

				Total r	unners	Male runners		Female runners		Male runners
				Direct effects	Indirect effects	Direct effects	Indirect effects	Direct effects	Indirect effects	runners
Hypothesis	3			Beta	Beta	Beta	Beta	Beta	Beta	z-score
H.1.	Value	←	OQ	.375**		.418**		.173		518
H.2.	Value	←	FQ	.532**		.494**		.687**		.764
H.3.	Satisfaction	←	OQ	.327**		.353**		.253*		.665
H.4.	Satisfaction	←	FQ	.258**		.239**		.375**		.887
H.5.	Satisfaction	←	Value	.482**		.460**		.514**		.672
H.6.	Take part again	←	OQ	.079	.375**	.119*	.392**	111	.248*	-1.156
H.7.	Take part again	←	FQ	.158**	.386**	.150**	.340**	.248*	.531**	.629
H.8.	Take part again	←	Value	.042	.340**	.037	.317**	.008	.371**	204
H.9.	Take part again	←	Satisfaction	.706**		.690**		.722**		.295

Note: **p < .01; *p < .05 FQ = Functional quality; OQ = Central quality; Take part again = Intention to take part again

The results that appear in Table 4 show that functional quality and central quality are direct indicators of value and satisfaction in the total participants, as well as in the male runners' group and the female runners' group. Equally it can be seen that value is a direct indicator of satisfaction in the total sample, as well as in both groups. Having the intention to take part in the race again has, as a direct indicator, the functional quality in the total number of participants and in the two groups of runners according to gender. "Central quality" is only directly related to the group of male runners. Satisfaction is indeed a direct indicator in all groups to the intention to take part again. As far as indirect relationships are concerned, functional quality, central quality and value are indicators of intention to take part again through satisfaction in all runners' groups. As can be seen in Table 4, there are no significant differences in these relationships according to participants' gender.

Discussion

The present study aims to explore at the relationship between functional and central quality, value and satisfaction with the intention of taking part in a popular race again, looking at the possible differences according to gender. This data is of interest to researchers because it provides insight into the relationship between all the constructs analysed and allows them to observe the impact that gender has on the model. Similarly, the results are of interest to those responsible for the organisation of these events and for the tourism companies, because they allow the implementation of strategies to improve the sporting event itself, as well as the tourist activity, which could lead to an increase in satisfaction and loyalty to the event, which would translate into an increase in the benefits of any kind that the organisation of these events may entail.

The descriptive results have shown a good general assessment of the event and the intention to participate again, but recognising how the different constructs relate to each other is necessary, especially the effect that functional quality and outcome quality, precursor variables of future intentions (Crespo-Hervás et al., 2019), may have on satisfaction and the future intention to participate in the event, which would make the sporting event a tool that promotes tourism and, with it, the economic and social development of the city that hosts it.

The idea of quality proposed by Grönroos (1984) is that which has guided the proposal of the model analysed in this paper. Firstly, it has been observed that central quality is a precursor of value and satisfaction, with no differences according to gender thus confirming hypotheses 1 and 3. Similarly, funtional quality is a precursor of value and satisfaction in participants of popular races, with no differences between male and female runners, thus hypotheses 2 and 4 can be confirmed. It is worth mentioning that functional quality has a higher beta value than central quality in predicting value. This result is significant since value, understood as an evaluation of the sacrifices and rewards obtained, has a great impact on satisfaction (Crespo-Hervás et al., 2019) and is a factor that those responsible for the management of the sport tourism event can work on.

Likewise, it should also be highlighted that central quality has a higher beta value in relation to satisfaction than functional quality. This result can be explained by understanding satisfaction as a summary of the evaluation of the experiences of the service received and, following Yoshida (2017), for participants in sporting events, it is related to the sporting performance obtained.

Hypothesis 5 could also be confirmed by showing value as a predictor of satisfaction, with no differences according to gender. Similar results have been found in other studies on sport services (Haro-González et al., 2018; Theodorakis et al., 2014).

The results support the sixth hypothesis. The results have not reflected a direct relationship between these constructs, but indirectly through satisfaction. Central quality is a precursor to value and satisfaction in participants of such events. As a result those responsible must increase the central quality among participants, either by adapting the test to different levels, or by improving the training, with advice in the different means of communication that the organisation uses, since communication is a very important tool in the evaluation and loyalty of people who use sports services (Fernández-Martínez et al., 2020b). No significant differences were found according to gender, so the strategies used can, *a priori*, have the same effect.

Functional quality, on the other hand, is an indicator of intention to take part again, regardless of gender. In the literature, there are studies that support this idea (Cabello-Manrique et al., 2021; Calabuig-Moreno et al., 2016; Theodorakis et al., 2013), although they were attendees at sporting events and not participants. Therefore, on the basis of these results, hypothesis 7, according to which functional quality is an indicator of intention to take part again, can be confirmed.

Value is not directly related to intention to take part again (hypothesis 8), but indirectly through satisfaction. The result may be due to the fact that value is a highly subjective concept, comprising both cognitive and affective elements (Cabello-Manrique et al., 2021), which may condition this relationship. In any case, the literature has highlighted the importance of this dimension in users' future intentions (Crespo-Hervás et al., 2019), so improving its assessment has an effect on future intentions in general and in particular on re-participation.

With respect to hypothesis 9, this has been confirmed by the results gathered in this study. Satisfaction, as expressed in several studies (Cabello-Manrique et al., 2021; Theodorakis et al., 2014), positively affects intention in different types of services, including tourism and sports services, acting as a mediator between different constructs (Vegara-Ferri et al., 2020). The acquisition of positive experiences, satisfaction, is closely related to the intention to continue practising and to repeat similar experiences (Diloy-Peña et al., 2021). Therefore, their increase implies an increase in the intention to take part again. The results obtained do not present differences according to gender and establish strategic lines to be followed by organisers of sport tourism events, such as improving functional quality and outcome quality as primary precursors of satisfaction, since satisfaction is conditioned by various factors (Doña-Toledo et al., 2019).

Conclusions

The results of the present study indicate that there is a direct and significant relationship between functional quality and outcome quality as indicators of perceived value and satisfaction of participants of popular races, with no differences between genders. Satisfaction has been found to be a direct predictor of the intention to take part again. These results highlight the importance of quality management for sports tourists participating in small-scale events. The main application for the organisers of this type of tourism and sporting events is the need to dedicate sufficient resources to achieve optimal levels of functional quality.

Possible future lines of research include studies that include variables related to sporting results, economic aspects or motivational aspects. Similarly, a line of work with a quasi-experimental methodology could be developed.

The most significant limitation is that a search for genderbased differences has been carried out, with the percentage of female runners being considerably lower than that of male runners. Furthermore, it should be noted that the results only refer to one race event.

References

- Angosto-Sánchez, S., López-Gullón, J. M., & Díaz-Suárez, A. (2016). Participants' perceived quality in two editions of a popular race. *Intangible Capital*, 12(3), 789-804. http://dx.doi.org/10.3926/ic.782
- Bazzanella, F. (2019). Perceptions and Role of Tourist Destination Residents Compared to Other Event Stakeholders in a Small-Scale Sports Event. The Case of the FIS World Junior Alpine Ski Championships 2019 in Val di Fassa. Sustainability, 11(24), 6909. https://doi.org/10.3390/SU11246909
- Berber, U., & Mollaoğulları, H. (2020). The effect of Service quality on satisfaction of athletes participating in sport programmes. *European Journal of Physical Education and Sport Science*, 6(1), 1-11. https://doi.org/10.5281/zenodo.3609298
- Cabello-Manrique, D., Nuviala, R., Pappous, A., Puga-González, E., & Nuviala, A. (2021). The Mediation of Emotions in Sport Events: A Case Study in Badminton. *Journal of Hospitality & Tourism Research*, 45(4), 591-609. https://doi.org/10.1177/1096348020950813
- Calabuig-Moreno, F., Crespo-Hervas, J., Nunez-Pomar, J., Valantinė, I., & Staškevičiūtė-Butienė, I. (2016). Role of perceived value and emotions in the satisfaction and future intentions of spectators in sporting events. *Engineering Economics*, 27(2), 221-229. https://doi.org/10.5755/j01. ee.27.2.12288

- Castillo, A., Onetti, W., & Chinchilla, J. L. (2019). Perceived Quality in Sports Centers in Southern Spain: A Case Study. *Sustainability*, 11(14), 39-83. https://doi.org/10.3390/su11143983
- Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural equation modeling: a multidisciplinary journal*, 14(3), 464-504. https://doi.org/10.1080/10705510701301834
- Crespo-Hervás, J., Calabuig-Moreno, F., Prado-Gascó, V., Añó-Sanz, V., & Núñez-Pomar, J. (2019). The role of passion in the quality-valuesatisfaction-intentions chain: Linear models and the QCA approach for athletes. *Economic research-Ekonomska istraživanja*, *32*(1), 352-369. https://doi.org/10.1080/1331677X.2018.1553683
- Diloy-Peña, S., García-González, L., Sevil-Serrano, J., Sanz-Remacha, M., & Abós, A. (2021). Motivational Teaching Style in Physical Education: How does it affect students' experiences? *Apunts Educación Física y Deportes*, 144, 44-51. https://doi.org/10.5672/apunts.2014-0983. es.(2021/2).144.06
- Doña-Toledo, L., Doña-Toledo, J., Velicia-Martín, F., & López-Rodríguez, S. (2019). Values Associated with Satisfaction with Physical Activity in the Adolescent Population. *Apunts Educación Física y Deportes*, 138, 95-110. https://dx.doi.org/10.5672/apunts.2014-0983.es.(2019/4).138.08
- Eskiler, E., & Altunişık, R. (2021). The Moderating Effect of Involvement in the Relationship Between Customer Behavioral Intentions and Its Antecedents. *SAGE Open*, *11*(2), 21582440211014496. https://doi.org/10.1177/21582440211014495
- Fernández-Martínez, A., Haro-González, M., Nuviala, R., Pérez-Ordás, R., & Nuviala, A. (2020a). Women and physical activity in fitness centres. Analysis of future intentions and their relationship with age. *International Journal of Environmental Research and Public Health*, 17(15), 5289. https://doi.org/10.3390/ijerph17155289
- Fernández-Martínez, A., Pérez-Ordás, R., Nuviala, R., Aznar, M., Porcel-Gálvez, A. M., & Nuviala, A. (2020b). Communication as a strategy to promote sports and health activities designed for adolescents. *International Journal of Environmental Research and Public Health*, 17(13), 4861. https://doi.org/10.3390/ijerph17134861
- Fernández-Martínez, A., Tamayo-Fajardo, J. A., Nuviala, R., Cabello-Manrique, D., & Nuviala, A. (2021). The management of major sporting events as an antecedent to having the city recommended. *Journal of Destination Marketing & Management*, 19, 100528. https://doi.org/10.1016/j.jdmm.2020.100528
- Foroughi, B., Iranmanesh, M., Gholipour, H. F., & Hyun, S. H. S. (2019). Examining relationships among process quality, outcome quality, delight, satisfaction and behavioural intentions in fitness centres in Malaysia. *International Journal of Sports Marketing and Sponsorship*, 20(3), 374-389. https://doi.org/10.1108/IJSMS-08-2018-0078
- García-Fernández, J., Grimaldi, M., Gómez, R., & Bernal, A. (2016). Calidad y valor en centros fitness low-cost: diferencia según característica de los clientes. *Revista Intercontinental de Gestión Desportiva*, 6(1), 63-72.
- Grönroos, C. (1984). A service quality model and its marketing implications. *European Journal of marketing*. https://doi.org/10.1108/EUM000000004784

- Hair, J. F., Black, W. C., Babin, B., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate Data Analysis* (6th ed.). Upper Saddle River, NJ: Prentice-Hall.
- Haro-González, M., Pérez-Ordás, R., Grao-Cruces, A., Nuviala, R., & Nuviala, A. (2018). Female users of unisex fitness centres and of fitness centres exclusive for women: Satisfaction. *International Journal of Sports Marketing and Sponsorship*, 19(4), 384-395. https://doi.org/10.1108/IJSMS-08-2016-0044
- León, J., García, J., & Burillo, P. (2020). Service Perceptions in Fitness Centers: IPA Approach by Gender and Age. *International Journal of Environmental Research and Public Health*, *17*(8), 28-44. https://doi.org/10.3390/ijerph17082844
- Nuviala, A., Grao-Cruces, A., Tamayo, J., Nuviala, R., Álvarez, J., & Fernández-Martínez, A. (2013). Diseño y análisis del cuestionario de valoración de servicios deportivos (EPOD2). Revista Internacional de Medicina y Ciencias de la Actividad Física y del Deporte/International Journal of Medicine and Science of Physical Activity and Sport, 13(51), 419-436.
- Nuviala, R., Pérez-Ordás, R., Morán-Gámez, G., & Falcón-Miguel, D. (2021). Incidence of gender and age on the quality, satisfaction and perceived value of users of organized sports activities. *Retos*, 42, 37-46. https://doi.org/10.47197/RETOS.V4210.83480
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of applied psychology*, 88(5), 879. https://doi.org/10.1037/0021-9010.88.5.879
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the Fit of Structural Equation Models: Tests of Significance and Descriptive Goodness-of-Fit Measures. *Methods of Psychological Research*, 8(2), 23–74.
- Theodorakis, N. D., Alexandris, K., Tsigilis, N., & Karvounis, S. (2013). Predicting spectators' behavioural intentions in professional football: The role of satisfaction and service quality. *Sport management review*, *16*(1), 85-96. https://doi.org/10.1016/j.smr.2012.05.004
- Theodorakis, N. D., Howat, G., Ko, Y. J., & Avourdiadou, S. (2014). A comparison of service evaluation models in the context of sport and fitness centres in Greece. *Managing Leisure*, *19*(1), 18-35. https://doi.org/10.1080/13606719.2013.849505
- Vegara-Ferri, J. M., López-Gullón, J. M., Valantine, I., Díaz Suárez, A., & Angosto, S. (2020). Factors Influencing the Tourist's Future Intentions in Small-Scale Sports Events. *Sustainability*, *12*(19), 8103. https://doi.org/10.3390/su12198103
- Watanabe, Y., Gilbert, C., Aman, M. S., & Zhang, J. J. (2018). Attracting international spectators to a sport event held in Asia: The case of Formula One Petronas Malaysia Grand Prix. *International Journal of Sports Marketing and Sponsorship*. https://doi.org/10.1108/IJSMS-08-2017-0077
- Yoshida, M. (2017). Consumer experience quality: A review and extension of the sport management literature. *Sport Management Review*, 20(5), 427-442. https://doi.org/10.1016/j.smr.2017.01.002

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Internal and External Load in International Women's Beach Handball. Official and Unofficial Competition

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Cover:

A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images Abstract

This study aimed to determine the kinematic, kinetic and heart rate demands of elite women's beach handball, differentiating between official and unofficial matches. Fourteen players (60.0 ± 4.1 kg; 168.5 ± 5.9 cm; 24.6 ± 4.0 years) from the Spanish Beach Handball Absolute National Team were monitored during eleven matches prior to the 2018 World Championship. The external load was gathered using the GPS device and the internal load was obtained using heart rate measured through a chest strap. The distance travelled by players per set in official matches (OMs) was greater $(334.79 \pm 135.41 \text{ m})$ than that of training matches (TMs) $(324.97 \pm 90.88 \text{ m})$ and friendly matches (FMs) (263.52 \pm 133.92 m), with significant differences (p < .001) between OMs and FMs. The same applies to the S_{max} recorded in the OMs (14.00 ± 2.68 km/h⁻¹) compared to the FMs (13.47 \pm 2.33 km h⁻¹). There were significant differences (p < .05) between OMs and FMs in both accelerations and decelerations in Zone 2 (2 to 3 m·s⁻²) and it was the second set that reported the highest number of accelerations and decelerations. In the TMs, the second set showed a lower number of accelerations and decelerations as a higher level of fatigue was obtained. Therefore, OMs had a higher kinematic and kinetic demand than TMs and FMs. But it is in the TMs that the highest level of fatigue is recorded.

Keywords: beach sport, Global Positioning System, monitoring of matches, physical performance, team sport.

Introduction

Beach handball is a sport discipline that was introduced in the 1990s and has developed in recent decades (Dol et al., 2020; Morillo et al., 2021). One particular feature of this kind of sport is that it has a development format in which, over three days of competition, up to three matches can be played on the same day. In relation to the higher level competitions, the World and Continental Championships take place over five rounds, amounting to between six and nine matches in total at the end of the competition. As a result, and due to the high demands required in elite sport, it is vital to have a specific and individualised knowledge of the kinematic, kinetic and physiological demands required in the practice of beach handball.

When analysing beach handball —internal and external load—, the structure and duration of the matches must also be taken into account, consisting of two sets (halves) of 10 minutes each and a five-minute break, with an unlimited number of player substitutions (Morillo et al., 2021). Derived from the rules and the game itself (Lara et al., 2018), the demands required in the practice of elite women's beach handball have been studied in recent years and the findings demonstrate the demands of this discipline at a competitive level (Sánchez-Sáez et al., 2021); it has been shown that there are periods in which the intensity and duration of exertion varies intermittently, causing periods of high intensity activity interspersed with periods of low intensity and with players constantly switching roles.

Like in other women's team sports, for example hockey (McGuinness et al., 2019), football (Vescovi, 2012) or handball (Kniubaite et al., 2019), and more specifically beach sports, i.e. beach football (Larsen et al., 2021), in women's beach handball, the analysis of the kinematic, kinetic and physiological demands required has been essential to be able to design, with higher precision and with greater similarity to the real demands of competition in official matches, the training tasks, plan the competitions and the season (Lemos et al., 2020; Pueo et al., 2017; Sánchez-Sáez et al., 2021; Zapardiel & Asín-Izquierdo, 2020). These studies have been developed in different types of competitions: a) training: matches played between players of the same team (Pueo et al., 2017); b) friendly: unofficial matches outside competition (Zapardiel & Asín-Izquierdo, 2020); c) official: matches played during an official competition (Sánchez-Sáez et al., 2021). However, in this study, matches against other teams which have a friendly feel to them but counted towards their players' international caps were considered official matches.

Yet in these studies carried out on beach handball, no comparison between the different types of competition (training, friendly and official) has been proposed, with a resulting scarcity of information. However, in other sports, for example football (Campos-Vázquez et al., 2019), the differences between physical demands in training sessions compared to in friendly matches were analysed (Castellano & Casamichana, 2013), resulting in a higher demand during competition.

In order to obtain the most accurate information about the specific needs of team sports, some of the most commonly used methodologies and tools, etc. have been: a) external load: Global Positioning System (GPS) in outdoor sports (Aughey, 2011); this technology allows, in an effective and efficient way, the assessment of athletes' external load in different contexts, e.g. distances travelled, speed, jumps, impacts, collisions, tactical positioning aspects, etc., as the GPS device can be coupled with gyroscopes and accelerometers; b) internal load: heart rate (HR) monitoring (Vanrenterghem et al., 2017).

Therefore, the aim of this study was to establish and analyse the kinematic and kinetic demands and heart rate of women's international beach handball (Spanish Women's National Team) in official and unofficial competitions, using GPS and HR_{max} , with the aim of providing new data to coaches when planning the training load.

Methodology

Participants

Fourteen female players from the Spanish Absolute Beach Handball Team participated in the study $(60.0 \pm 4.1 \text{ kg})$ body mass; height of 168.5 ± 5.9 cm; 24.6 ± 4.0 years of age; training experience: five years). The sample was selected on the basis of the following inclusion criteria: a) being a field player; b) having completed 100% of the matches; c) not having any physical limitations or musculoskeletal injuries that reduced their performance; d) having participated regularly in the national beach handball circuit (Arena Handball Tour®); this ensured consistent competition during the season. All players were notified of the research design, procedures, requirements, benefits and risks prior to data collection and agreed to participate voluntarily by signing the informed consent form. The technical and medical staff was also briefed in detail. The study complied with the guidelines of the Declaration of Helsinki.

Resources

The monitoring was carried out using a GPS device and the data obtained was collected using 10 Hz units (SPI HPU; GPSports Systems[®], Canberra, Australia; mass: 67 g; size: $74 \times 42 \times 16$ mm), in line with previous studies (Morencos et al., 2019) which indicated that this frequency unit appears to be more accurate than devices using frequencies of 1 Hz and 5 Hz (Macfarlane et al., 2016). The number of satellites in connection with each device was 10.5 ± 1.1 across all measurements, as recommended by Ashman et al. (2018). Together, all the devices used included a 100 Hz triaxial accelerometer.

Each athlete wore a bib underneath the competition shirt and each monitor was placed between the shoulder blades over the upper spine (T2-T4), where it was held stable by a padded neoprene waistcoat. Data from each device was then downloaded to a laptop using Team AMS software (v. R1.2; Canberra, Australia). HR was recorded via a coded chest strap worn by each player (Polar Electro, Kempele, Finland).

Procedure

The players were monitored across eleven matches in preparation for the 2018 World Championships in Kazan (Russia) — the team finished fourth at the World Championships. The classification of the matches was as follows: a) training matches: matches played between players of the same team; b) friendly matches: unofficial matches outside competition; c) official matches: official matches that counted as internationals for their players.

Recording of data was carried out on an individual basis, per player, irrespective of their usual position. It was not considered necessary to differentiate by specific position, as each player in the course of the same set (and for tactical reasons) frequently changed their position, as well as by the total number of participants in the sample. Similarly, due to the short duration of each set and the game play cycle of beach handball (Lara et al., 2018), where players are constantly coming on and off the court, the individual time variable was not considered, as in Pueo et al. (2017) and Sánchez-Sáez et al.'s (2021) studies.

The total playing time of the sets (10 mins each) was analysed without excluding the time-outs (1 min) during the sets; however, the rest time (5 mins) between sets was excluded. All matches took place in similar environmental conditions of 20-25 °C, with no wind; after individual and collective warm-up of 10 minutes off the court; and 20 minutes on the court. A total of eleven matches were monitored: 3 training (TMs), 3 friendly (FMs) and 5 official (OMs).

The variables recorded for subsequent analysis were based on previous studies by Pueo et al. (2017), Sánchez-Sáez et al. (2021) and Zapardiel and Asín-Izquierdo (2020): total distance travelled (m) and relative distance (m/min⁻¹), maximum speed achieved (km/h⁻¹), distance travelled in the different zones (Z) of maximum speed (S_{max}) obtained by each player during all the matches recorded: Z1: < 10% S_{max} , Z2: 10-29% S_{max}, Z3: 30-49% S_{max}, Z4: 50-79% S_{max}, Z5: 80-95% S_{max} and Z6: > 95% S_{max} . The total number of accelerations and decelerations was also taken into account, with actions greater than 2 m/s⁻² being analysed (Vázquez-Guerrero et al., 2019) Finally, HR_{max}, as physiological demand, was analysed, establishing the following zones: Zone 1: < 60% HR_{max}, Zone 2: 61-70% HR_{max}, Zone 3: 71-80% HR_{max}, Zone 4: 81-90 HR_{max}, Zone 5: 91-95% HR_{max} and Zone 6: >95% HR_{max}. This was collected by means of the Yo-Yo Intermittent Recovery Test Level 1 indirect stress test, designed to obtain aerobic capacity by determining the recovery of the athlete to accumulated intermittent efforts (Bangsbo et al., 2008).

Statistical Analysis

The descriptive statistical study was presented as averages and standard deviation. The distribution of the variables was examined using the Shapiro-Wilk test for normality and the homogeneity of variance was tested using Levene's test. The analysis of the differences between the different types of competition was examined through analysing averages (one-way ANOVA) and the level of significance accepted was p < .05, with *post hoc* analysis using Bonferroni. The free statistical package JASP (Version, 0.9.2; University of Amsterdam) and GPower for the calculation of statistical power were used for the data analysis.

Results

Kinematic Variables

Analysis of the data showed that the distance travelled by players per set in OMs was greater $(334.79 \pm 135.41 \text{ m})$ compared to TMs $(324.97 \pm 90.88 \text{ m})$ and FMs $(263.52 \pm 133.92 \text{ m})$. The differences were significant (p < .001). The *post hoc* analyses carried out using Bonferroni showed that greater distances were travelled in the OMs than in the FMs (p < .001) 95% CI [-264.87, -78.43] based on the differences in distance travelled in the first set (p = .006)

95% CI [-173.75, -24.52]. Similarly, greater distances were travelled in TMs compared to FMs (p < .001) 95% CI [-259.19, -61.19] based on differences in the first set (p = .005) 95% CI [-196.32, -30.35].

Only in the second set were differences found between OMs and TMs (p = 0.15) 95% CI [-114.14, -10.67]. It occurred similarly in the S_{max} recorded in OMs (14.00 ± 2.68 km/h⁻¹) versus FMs (13.47 ± 2.33 km/h⁻¹). This same analysis showed that the S_{max} achieved in OMs was higher than in FMs (p < .001) 95% CI [-2.93, -1.10], both in the first set (p = .003) 95% CI [-3.07, -0,52] and in the second set (p = .009) 95% CI [-3.23, -0.40]. Similarly a higher S_{max} was recorded in TMs versus FMs (p < .001) 95% CI [-2.69, -0.75] based on the first set (p = .048) 95% CI [-2.86, -0.04] (Table 1).

The relative distance variable as a function of playing time is defined as the distance travelled per minute. This variable determined that it was in the TMs $(35.28 \pm 8.17 \text{ m/min}^{-1})$ where greater distances were

covered compared to the OMs $(34.70 \pm 11.34 \text{ m/min}^{-1})$ and FMs $(34.55 \pm 14.02 \text{ m/min}^{-1})$. The differences were not significant (Table 1).

Figure 1 shows the distance that was covered in the six zones (Z) of maximum speed. It was Z2 and Z4 where the greatest distance travelled per set was achieved. It was in the TMs that longer distances were covered at low speeds (Z2) and in the OMs at high speeds (Z4 and Z5).

The comparison between the different matches and sets played in the different speed zones showed that in TMs greater distances were made in the first set than in FMs Z2: p = .42; 95% CI [98.92 5.93], Z3: p = .17; 95% CI [31.84, 2.21], Z4: p = .023; IC 95% [94.64, 5.22], while between OMs and FMs the differences were in Z4: p = .034; 95% CI [85.44, 4.03] and Z5 p = .024; 95% CI [25.76, 1.33]. In the second set of the OMs, players performed a greater distance than in the TMs in Z4: p = .43; 95% CI [89.43, 2.09] and than in the FMs in Z5: p = .015; 95% CI [31.88, 2.36].

Table 1

Kinematic variables	differentiating	the types	of competition.
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	OMs	TMs	FMs	F	n	m ²	1_8	f
	A(SD)	A(SD)	A(SD)	I	ρ	'I p	i-b	J
Comp. Match								
Distance	435.18 (223.22)	423.72 (210.43)	263.52 (133.92)	9.60	<.001	.059	.892	.279
Relative Distance (m/min)	33.33 (10.22)	34.84 (7.66)	34.55 (14.02)	.785	.457	.005	.658	.067
Maximum Speed (km-h-1)	15.49 (1.93)	15.20 (2.20)	13.47 (2.33)	13.59	<.001	.082	.769	.316
Set 1								
Distance	332.37 (130.51)	346.57 (90.21)	233.23 (137.27)	5.96	.003	.008	.576	.314
Relative Distance (m/min)	33.68 (10.78)	36.03 (7.96)	36.51 (15.68)	0.81	.044	.013	.660	.109
Maximum Speed (km-h-1)	14.96 (2.16)	14.61 (1.49)	13.16 (2.60)	5.64	.005	.084	.570	.298
Set 2								
Distance	369.89 (119.68)	307.48 (88.65)	304.71 (127.54)	4.957	.009	.076	.563	.280
Relative Distance (m/min)	34.83 (10.65)	34.67 (8.38)	32.48 (11.97)	0.32	.726	.005	.788	.070
Maximum Speed (km·h·*)	15.62 (1.69)	15.00 (2.49)	13.80 (2.00)	4.957	.009	.076	.554	.278

Note: Comp. Match: complete match; OMs: official matches; TMs: training matches; FMs: friendly matches.; A: average; SD: standard deviation.



Figure 1

Distance travelled by maximum speed zones depending on the type of competition.

Kinetic Variables

With regard to the kinetic variables, there was a relationship from highest to lowest in OMs, TMs and FMs in terms of accelerations and decelerations. The *post hoc* analyses carried out using Bonferroni showed that a greater number of 2 to 3 m/s⁻² accelerations were performed in the OMs than in the FMs (p < .001) 95% CI [-4.71, -1.02] both in the first set (p < .001) 95% CI [-8.13, -1.79] and in the second set (p = .004) 95% CI [-9.21, -1.43]. In the same way that occurred in the 2 a 3 m·s⁻² decelerations, where they were higher in the OMs compared to the FMs (p < .001) 95% CI [-6.12, -1.37], appreciated in both the first set (p = .35) 95% CI [-6.33, -0.24] and the second set (p = .026) 95% CI [-7.95, -0.47]. Along the same lines, in the second set in the OPs there was a greater number of accelerations from 2 to 3 m-s⁻² with respect to the TMs (p < .001) 95% CI [-7.41, -1.98] and decelerations of 2 a 3 m·s⁻² (p = .023) 95% CI [-5.59, -0.36] and in decelerations of more than 3 m·s⁻² (p = .007) 95% CI [-2.44, -0.32] (Table 2).

Table 2

Number of accelerations and decelerations according to the type of competition.

	OMs	TMs	FMs	F	2	20 ²	1.0	£
_	A(SD)	A(SD)	A(SD)	F	p	η- _p	т-р	J
Comp. Match								
Zone 1 Accel.	18.07 (8.337)	18.65 (8.23)	16.32 (9.54)	0.898	.409	.007	.655	.082
Zone 2 Accel.	10.01 (6.20)	7.14 (4.74)	4.82 (3.47)	15.24	<.001	.110	.926	.398
Zone 3 Accel.	0.90 (4.31)	0.31 (0.59)	0.23 (0.06)	1.11	.331	.009	.921	.167
Zone 1 Decel.	17.07 (7.83)	17.34 (7.07)	15.67 (9.00)	0.568	.567	.005	.711	.065
Zone 2 Decel.	8.60 (5.99)	7.18 (4.15)	4.85 (4.04)	7.41	<.001	.056	.736	.270
Zone 3 Decel.	2.84 (2.50)	2.02 (1.70)	1.55 (2.43)	5.97	.003	.046	.602	.224

Note: Accel.: acceleration (m·s⁻²); Decel.: deceleration (m·s⁻²); OMs: official matches, TMs: training matches; FMs: friendly matches. A: average, SD: standard deviation.

Table 2 (Continued)

Number of accelerations and decelerations according to the type of competition

	OMs	TMs	FMs					
-	A(SD)	A(SD)	A(SD)	F	p	η _°	1-β	f
Set 1								
Zone 1 Accel.	16.84 (8.66)	21.08 (8.25)	13.89 (9.70)	4.70	.011	.071	.550	.268
Zone 2 Accel.	9.17 (5.84)	7.97 (4.39)	4.21 (3.45)	6.92	.001	.101	.699	.376
Zone 3 Accel.	0.49 (0.72)	0.29 (0.67)	0.21 (0.41)	1.84	.162	.029	.682	.190
Zone 1 Decel.	15.28 (7.62)	19.05 (5.82)	13.21 (8.03)	4.78	.010	.072	.581	.278
Zone 2 Decel.	7.97 (5.43)	7.97 (4.28)	4.68 (4.17)	3.51	.033	.054	.334	.254
Zone 3 Decel.	2.71 (2.56)	2.47 (1.79)	1.31 (2.18)	2.71	.070	.042	.297	.221
Set 2								
Zone 1 Accel.	19.38 (7.82)	16.45 (7.79)	19.40 (8.68)	1.85	.0161	.030	.593	.169
Zone 2 Accel.	10.92 (6.50)	6.22 (4.94)	5.6 (3.46)	10.96	<.001	.156	.843	.489
Zone 3 Accel.	1.35 (6.15)	0.30 (0.46)	0.26 (0.79)	0.804	.450	.013	.919	.213
Zone 1 Decel.	18.98 (7.64)	15.50 (7.23)	18.80 (9.45)	2.681	.073	.043	.552	.199
Zone 2 Decel.	9.27 (6.51)	6.30 (3.92)	5.06 (4.00)	5.741	.004	.087	.732	.350
Zone 3 Decel.	2.985 (2.446)	1.60 (1.56)	1.867 (2.77)	5.278	.006	.081	.546	.290

Note: Accel.: acceleration (m·s⁻²); Decel.: deceleration (m·s⁻²); OMs: official matches, TMs: training matches; FMs: friendly matches. A: average, SD: standard deviation.

In the TMs, the differences between the first and second sets were in favour of the first set, where a higher number of accelerations of 1-2 m-s⁻² (p = .015) 95% CI [1.86, 0.91], decelerations of 2-3 m-s⁻² (p = .024) 95% CI [1.54, 0.478] and of more than 3 m-s⁻² (p = .029) 95% CI [0.39, 0.09]. In both the OMs and FMs this ratio was in favour of the second set.

Physiological Variable

Figure 2 shows the percentage of playing time that the players spent at different intensities of HR_{max} . In this sense, it was

in the low intensity zones of the FMs (Zone 1) and TMs (Zone 2 and 3) where the highest percentages of playing time were obtained, while in the OMs a higher percentage of playing time was recorded in Zones 4, 5 and 6.

Significant differences were found in Zone 1 in favour of FMs compared to TMs: p = .007; 95% CI [0.05, 0.39] and to OMs: p = .022; 95% CI [0.02, 0.33], while in Zone 2 the differences were significant between TMs and OMs: p < .001; 95% CI [0.03, 0.11]. In Zone 3 TMs reported a higher percentage of time than FMs: p = .005; 95% CI [0.15, 0.02] and than OMs: p < .001; 95% CI [0.02, 0.11].



Figure 2

Percentage of time in the HRmax zones differentiating the type of competition.

Discussion

Different original findings were found that can help to understand the performance of the elite beach handball player in different conditioning activities such as TMs and FMs, with the aim of improving sporting performance during official competition.

The analysis of the data obtained in this research shows that the kinematic variables of distance travelled and maximum speed reached in OMs are greater than those observed in TMs and FMs, similarly to the findings found by Palucci et al. (2016) in indoor football. Likewise, the kinetic variables at high intensities (accelerations > 2 m·s⁻² / decelerations > 2 m·s⁻²) in OMs presented higher values compared to TMs and FMs, following Nobari et al.'s (2021) line of research, which compared accelerations and decelerations in professional football players in OMs and FMs.

At low intensities (Zone 1 to Zone 3 HR_{max}), TMs and FMs have a longer time at low heart rates —from < 60% HR_{max} to 71-80% HR_{max} - than OMs. This aspect, despite not having been analysed in previous publications, is similar to studies that related FMs to training activities, where competition (friendlies) has a greater external and internal load than tactical and physical preparation sessions in professional football players (Campos-Vázquez et al., 2019).

The next variable studied was the evolution of kinematic and kinetic variables in the first and second sets in order to provide information on the players' ability to maintain their level of exertion throughout a match and to identify any significant decrease in performance during the second half. In this study, it is observed that it was in the second set where the variables (distance: m/set and maximum speed: km-h⁻¹) were higher in the OMs and FMs, as occurs in OMs in Z5 in Sánchez-Sáez et al.'s (2020) study. These authors also reported that the maximum speed achieved in an official women's beach handball match was higher in the second set than in the first set, coinciding with the present study. On the other hand, in the TMs it was in the first set where the greatest distance travelled was reported, coinciding with the values presented by Pueo et al.'s (2017) study.

Similarly, accelerations (1 to > 3 m·s⁻²) and decelerations (1 to > 3 m·s⁻²) in the OMs and FMs were higher in the second set compared to the first. Pueo et al. (2017) provides evidence for the same relationship for accelerations (1-3 m·s⁻²) in beach handball players in TMs. In contrast, in the present study, in the TMs the relationship was inverse; greater in the first set compared to the second, coinciding with other disciplines such as football (Nobari et al., 2021) or in U18 female basketball players (Reina et al., 2019). This may be because it is in this type of match that the player really reaches sufficient fatigue levels to be significant. Decelerations, especially above 3 m·s⁻², is a variable sensitive to fatigue levels.

The comparison between types of competition has remained unpublished until now, although it is true that the various studies carried out in women's beach handball have used different types of competition to analyse the kinematic, kinetic and physiological data. Contrasting the data from the present study with previously published research allows us to define what demands are placed on each of the competitions that a beach handball player performs in. Research published by Pueo et al. (2017), Sánchez-Sáez et al. (2021) and Zapardiel and Asín-Izquierdo (2020) on Spanish beach handball players described the kinematic, kinetic and physiological demands in different types of competition. Whilst Pueo et al. (2017) analysed two TMs, Zapardiel and Asín-Izquierdo (2020) exclusively studied FMs. The only study that was conducted on OMs was Sánchez-Sáez et al.'s (2021) study, where six matches were monitored. The differences in these studies are consistent with the results found in the present study. The total distances travelled in FMs by Zapardiel and Asín-Izquierdo (2020) are less than the OMs studied by Sánchez-Sáez et al. (2021), as well as in the FMs (Zapardiel & Asín-Izquierdo, 2020), fewer accelerations were recorded than in the TMs reported by Pueo et al. (2017) study.

This comparison between studies is obviously biased, not only methodologically but because of the sample used. However, it provides support for the data found in this publication, where the comparison between OMs, TMs or FMs has proven to be valid and reliable.

The most studied physiological variable in beach handball has been the HR_{max} and the percentage of time that a player spends at certain intensity intervals, as explained in the methodological section. In that respect, the present study has been completely in line with the data presented about the OMs found by Sánchez-Sáez et al. (2021), where the distribution of time percentages is concentrated in Zone 4 (81-90% HR_{max}).

On the other hand, with regard to TMs, Pueo et al. (2017) reported a higher percentage of time in Zone 1. (< 60% HR_{max}). In relation to FMs, we can see in the present study that there was a higher percentage of accumulated playing time in the low intensity zone (Zone 1: < 60% HR_{max}). It should be noted that after Zone 1 it was Zone 4 that accumulated the highest HR_{max}.

Conclusions

The OMs have a higher kinematic and kinetic demand than TMs and FMs. It was at high intensities that this difference was found and it was at low intensities that TMs and FMs reported higher external load demands than OMs. Therefore, knowing the demands of unofficial matches (TMs and FMs) will allow coaches to design and plan the dynamic loads more efficiently by using them as a method of preparation for official competition. At the internal load level, OMs accumulate a higher percentage of time at high intensities compared to TMs, as do TMs over FMs.

It was in the second set where the distance covered, maximum speed, number of accelerations and decelerations reported higher data compared to the first set, with the exception of the TMs, where lower values were observed in the second set in the kinetic variables and it was in this type of competition where the player reached higher levels of fatigue.

Therefore, coaches and physical trainers could use the results of this study to modify training sessions and prepare players using different types of competition, according to the specific requirements of each match, season planning, competition typology, players' HR_{max} characteristics, etc.

References

- Ashman, B., Bauer, F. H., Parker, J., & Donaldson, J. (2018). GPS operations in high earth orbit: Recent experiences and future opportunities. In 2018 SpaceOps Conference (p. 2568). https://doi.org/10.2514/6.2018-2568
- Aughey, R. J. (2011). Applications of GPS technologies to field sports. International Journal of Sports Physiology and Performance, 6(3), 295-310. https://doi.org/10.1123/ijspp.6.3.295
- Bangsbo, J., Iaia, F. M., & Krustrup, P. (2008). The Yo-Yo intermittent recovery test. *Sports Medicine*, *38*(1), 37-51. https://doi. org/10.2165/00007256-200838010-00004
- Campos-Vázquez, M. Á., Castellanos, J., Toscano-Bendala, F. J., & Owen, A. (2019). Comparison of the physical and physiological demands of friendly matches and different types of preseason training sessions in professional soccer players. *RICYDE. Revista Internacional de Ciencias del Deporte*, 15(58), 339-352. https://doi.org/10.5232/ricyde2019.05803
- Castellano, J., & Casamichana, D. (2014). Deporte con dispositivos de posicionamiento global (GPS): Aplicaciones y limitaciones. *Revista de Psicología del Deporte*, 23(2), 355-364.
- Dol, G., Onetto, V., Carbonell, V., & González-Ramírez, A. (2020) study. Analysis of throwing performance in elite women's beach handball. *Apunts Educación Física y Deportes*, 141, 49-54. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.06
- Kniubaite, A., Skarbalius, A., Clemente, F. M., & Conte, D. (2019). Quantification of external and internal match loads in elite female team handball. *Biology of Sport*, 36(4), 311. https://doi.org/10.5114/biolsport.2019.88753
- Lara, D., Sánchez-Sáez, J. A., Morillo, J. P., & Sánchez, J. M. (2018). Beach handball game cycle. *Revista Internacional de Deportes Colectivos*, 34, 89–100.
- Larsen, M. N., Ermidis, G., Brito, J., Ørner, C., Martins, C., Lemos, L. F., Krustrup P., & Rago, V. (2021) studies. Fitness and performance testing of male and female beach soccer players. A preliminary investigation. *Frontiers in Sports and Active Living*, 3, 34. https://doi.org/10.3389/ fspor.2021.636308
- Lemos, L. F., Oliveira, V. C., Duncan, M. J., Ortega, J. P., Martins, C. M., Ramirez-Campillo, R., Sanchez, J. S., Nevill, A. M., & Nakamura, F. Y. (2020) study. Physical fitness profile in elite beach handball players of different age categories. *Journal of Sports Medicine and Physical Fitness*, 60, 1536–1543. https://doi.org/10.23736/S0022-4707.20.11104-6
- Macfarlane, S., Tannah, J., & Kelly, V. (2016) The validity and reliavility of global positioning systems in team sport: A Brief Review. *The Journal of Strength and Conditioning Research*, 30(5):1470-90. https://doi.org/10.1519/JSC.000000000001221
- McGuinness, A., Malone, S., Hughes, B., Collins, K., & Passmore, D. (2019). Physical activity and physiological profiles of elite international female field hockey players across the quarters of competitive match play. *The Journal of Strength & Conditioning Research*, 33(9), 2513-2522. https://doi.org/10.1519/JSC.00000000002483

- Morencos, E., Casamichana, D., Torres, L., Romero-Moraleda, B., Haro, X., & Rodas, G. (2019). Kinematic demands of international competition in women's field hockey. *Apunts Educación Física y Deportes*, 137, 56-70. https://dx.doi.org/10.5672/apunts.2014-0983.es.(2019/3).137.05
- Morillo, J. P., Lara, D., Sánchez-Sáez, J. A., & Sánchez, J. M. (2021) studies. *Balonmano playa. De la iniciación al rendimiento*. Real Federación Española de Balonmano.
- Nobari, H., Khalili, S. M., Oliveira, R., Castillo-Rodríguez, A., Pérez-Gómez, J., & Ardigò, L. P. (2021) studies. Comparison of official and friendly matches through acceleration, deceleration and metabolic power measures: A full-season study in professional soccer players. *International Journal of Environmental Research and Public Health*, 18(11), 5980. https://doi.org/10.3390/ijerph18115980
- Palucci, L. H., Doğramaci, S. N., Barbieri, R. A., Milioni, F., Arruda, F., Andrade, V. L. D., Manna, G., & Pereira, P. R. (2016). Preliminary results on organization on the court, physical and technical performance of Brazilian professional futsal players: Comparison between friendly pre-season and official match. *Motriz: Revista de Educação Física*, 22, 80-92. https://doi.org/10.1590/S1980-6574201600020011
- Pueo, B., Jimenez-Olmedo, J. M., Penichet-Tomas, A., Becerra, M. O., & Agullo, J. J. E. (2017) study. Analysis of time-motion and heart rate in elite male and female beach handball. *Journal of Sports Science & Medicine*, 2017 Dec 1;16(4):450-458.
- Reina, M., García-Rubio, J., Pino-Ortega, J., & Ibáñez, S. J. (2019). The acceleration and deceleration profiles of U-18 women's basketball players during competitive matches. *Sports*, 7(7), 165. https://doi.org/10.3390/sports7070165
- Sánchez-Sáez, J. A., Sánchez-Sánchez, J., Martínez-Rodríguez, A., Felipe, J. L., García-Unanue, J., & Lara-Cobos, D. (2021) studies. Global positioning system analysis of physical demands in elite women's beach handball players in an official Spanish championship. *Sensors*, 21(3), 850. https://doi.org/10.3390/s21030850

- Vanrenterghem, J., Nedergaard, N. J., Robinson, M. A., & Drust, B. (2017) study. Training load monitoring in team sports: A novel framework separating physiological and biomechanical load-adaptation pathways. *Sports Medicine*, 47(11), 2135-2142. https://doi.org/10.1007/s40279-017-0714-2
- Vázquez-Guerrero, J., Fernández-Valdés, B., Jones, B., Moras, G., Reche, X., & Sampaio, J. (2019). Changes in physical demands between game quarters of U18 elite official basketball games. *PLoS One, 14*(9), e0221818. https://doi.org/10.1371/journal.pone.0221818
- Vescovi, J. D. (2012). Sprint profile of professional female soccer players during competitive matches: Female athletes in motion (FAiM) study. *Journal of Sports Sciences*, 30(12), 1259-1265. https://doi.org/10.1080/02640414.2012.701760
- Zapardiel, J. C., & Asín-Izquierdo, I. (2020) study. Conditional analysis of elite beach handball according to specific playing position through assessment with GPS. International *Journal of Performance Analysis in Sport*, 20(1), 118-132. https://doi.org/10.1080/24748668.2020.1718458

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ISSUE **151**





Cooperative Learning in Physical Education: A Research Overview

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Abstract

Iglesias, D., Fernandez-Rio, J., & Rodríguez-González, P. (2023). Cooperative Learning in Physical Education: A Research Overview. *Apunts Educación Física y Deportes, 151*, 88-93. https://doi.org/10.5672/apunts.2014-0983.es.(2023/1).151.09

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Corresponding author: Damián Iglesias diglesia@unex.es

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Cover:

A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images The aim of this scientific note was to provide a research overview about cooperative learning in physical education. A literature search was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A total of 46 published articles from Web of Science (Social Science Citation Index and Science Citation Index Expanded) were examined. The results reported: (a) most of the articles were published in 2020 (10 articles), 2021 (9), and 2017 (7); (b) the majority of the articles described intervention studies (32); (c) most articles were published in Journal of Teaching in Physical Education (6), European Physical Education Review (5), and Physical Education and Sport Pedagogy (5), all located in guartile-1 in the latest Journal Citation Reports edition (2020); (d) most studies were conducted in Spain (15), UK (8), and USA (8); (e) the top-ten-cited articles received between 172 (1st) and 47 (10th) citations; (f) only 10 women signed as first authors (21.73%) and only one of them (10%) was among the top-ten-cited articles (10th position). In conclusion, evidence showed a growing expansion of research in this area, especially in intervention studies. However, this positive trend is not homogeneous with respect to geographical areas and the participation of women researchers.

Keywords: pedagogical models, school, teaching.

Introduction

High-quality physical education (PE) research has exponentially increased in the last two decades with nearly 2,000 published articles indexed in the *Journal Citation Report* (JCR) ranked in quartiles (Q) 1 and 2 (Iglesias & Fernandez-Rio, 2022). This same trend has also been highlighted in research conducted on pedagogical models in PE (Fernandez-Rio & Iglesias, 2022) as a way of organizing learning and teaching from student-centred approaches. More particularly, research on cooperative learning (CL) in PE has also experienced a remarkable growth in recent years, becoming one of the most popular and expanded instructional framework (Bores-García et al., 2021).

Positive interdependence, individual accountability, group processing, promotive interaction and interpersonal skills have been identified as the five key elements that mediate the effectiveness of this methodological approach (Johnson et al., 2013). Ample evidence supports the efficacy of CL implementations to positively impact students' cognitive, social, physical and affective domains in PE contexts (Bores-García et al., 2021). Moreover, this framework contributes positively to the challenge of building a student-centred quality PE (Casey & Goodyear, 2015). These could be the reasons that have made CL a trendy pedagogical model.

To our knowledge, no previous research has focused on analysing CL in PE from a retrospective overview of the research conducted to date. To bridge this gap, a research overview is presented in this manuscript capturing seven major themes: (1) publication years, (2) Web of Science (WoS) categories, (3) article types, (4) journals and publishers, (5) countries and languages, (6) top-tencited articles, and (7) authorship.

Method

This research overview was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021).

Information source and search strategy

A literature search was conducted in WoS (*Social Science Citation Index* and *Science Citation Index Expanded*). This database is considered the most complete collection of scholarly publications and research metadata, with a wider coverage of citation information and accuracy in the journal classification system (Ivanović & Ho, 2019).

Searches included article titles, abstracts and keywords following this query string: ["cooperative learning" AND "physical education"]. Further manual searches of reference list citations were conducted to ensure that no studies were missed.

Eligibility criteria

Studies were included if they met the following criteria: (1) peer-reviewed journal articles published and written in any language, (2) focused on elementary, middle or/and high school students, (3) conducted in PE contexts, and (4) any design: theoretical approach, review, intervention and non-intervention studies. Exclusion criteria were: (1) participants from preschool or university settings, (2) studies focused on teachers, and (3) studies on hybridizations of pedagogical models. Since no previous study addressed a research overview in this area, to obtain a major historic perspective picture on the topic, a review period from inception to April 24, 2022, was selected.

Data extraction

The potentially eligible studies were initially screened by two independent researchers, who read titles and abstracts following the stipulated criteria prepared in advance and included in the search protocol. In studies with unclear abstracts and/or titles, peer review was conducted, resolving discrepancies through discussion and consensus. In a second phase, the same two reviewers, independently, read the full text of the studies preselected, creating the final list of potentially eligible studies. A third investigator participated when no consensus was reached regarding acceptability or not of a study. Finally, the full texts of the screened articles were carefully examined.

Results

Study identification and selection

A total of 106 records were identified. A total of 60 articles were excluded attending to the eligibility criteria. Reasons for exclusion were: (a) not about CL in PE (n = 42), (b) focused on teachers (n = 11), (c) conducted in university setting (n = 5), and (d) hybridization of pedagogical models (2). Finally, 46 studies fulfilled the inclusion criteria and were selected for further analysis (Figure 1).



Figure 1

PRISMA flow diagram of studies assessed for eligibility and included for further analysis.

Publication years

Most of the articles were published in 2020 (10), 2021 (9), and 2017 (7). In 2015, three articles were published, while two articles were published in each of these years: 2019, 2018, 2014, 2010, and 2009. Finally, the remaining articles were published in the following years (one per year): 2022, 2018, 2013, 2011, 2011, 2005, 2005, 2004, 2002, and 2001.

Web of Science categories

Most of the articles were indexed in the subject categories: *"Education & Educational Research"* (26) and *"Sport Sciences"* (15).

Article types

The majority of the selected articles described intervention studies (32). A smaller number were cross-sectional (7), review studies (4), and theoretical approaches (3).

Journals and publishers

The journals with the highest number of published articles were the following: *Journal of Teaching in Physical Education* (6), *European Physical Education Review* (5), and *Physical Education and Sport Pedagogy* (5). All of them ranked Q1 in the last JCR edition (2020).

Table 1

Top-ten-cited studies about cooperative learning in physical education.

A (1) - (-)	T '11.		T	Citations		
Author(s), year and country	litle	Journal (rank [*])	Туре	Total	Average per year	
Dyson et al. 2004 USA	Sport education, tactical games, and cooperative learning: Theoretical and pedagogical considerations	<i>Quest</i> (JCR-Q2)	Theoretical approach	172	9.11	
Casey & Goodyear 2015 England	Can cooperative learning achieve the four learning outcomes of physical education? A review of literature	Quest (JCR-Q2)	Review study	100	12.5	
Dyson 2002 USA	The implementation of cooperative learning in an elementary physical education program	Journal of Teaching in Physical Education (JCR-Q1)	Intervention study	99	4.71	
Dyson 2001 USA	Cooperative learning in an elementary physical education program	Journal of Teaching in Physical Education (JCR-Q1)	Intervention study	93	4.23	
Dyson et al. 2010 USA	The ecology of cooperative learning in elementary physical education classes	Journal of Teaching in Physical Education (JCR-Q1)	Intervention study	65	5	
Casey & Dyson 2009 England	The implementation of models-based practice in physical education through action research	European Physical Education Review (JCR-Q1)	Intervention study	62	10.33	
Fernandez-Rio et al. 2017 Spain	Impact of a sustained cooperative learning intervention on student motivation	Physical Education and Sport Pedagogy (JCR-Q1)	Intervention study	61	4.43	
Barret 2005 USA	Effects of cooperative learning on the performance of sixth-grade physical education students	Journal of Teaching in Physical Education (JCR-Q1)	Intervention study	56	3.11	
Goudas & Magotsiou 2009 Greece	The effects of a cooperative physical education program on students' social skills	Journal of Applied Sport Psychology (JCR-Q1)	Intervention study	54	3.86	
Bodsworth & Goodyear 2017 England	Barriers and facilitators to using digital technologies in the cooperative learning model in physical education	Physical Education and Sport Pedagogy (JCR-Q1)	Intervention study	47	8	

Note: *Rank quartile (Q) at Journal Citation Reports (JCR) last edition (2020).

Countries and languages

Most of the studies were conducted in Spain, UK and USA, with a total of 15, 8 and 8 articles, respectively. The rest were conducted in China (4), France (4), New Zealand (4), Taiwan (3), Ireland (2), Norway (2), Turkey (2), Greece (1), Poland (1), South Korea (1), Sweden (1), and Tunisia (1). The vast majority of articles were written in English (43 articles). The rest in Spanish (2) and Turkish (1).

Top-ten-cited articles

To date (Table 1), the most cited article (172 citations) was Dyson et al. (2004), published in the *Quest* journal (JCR-Q2), focused on theoretical and pedagogical considerations of CL in PE. The second most cited article (100 citations) was the systematic review conducted by Casey & Goodyear (2015), also published in the *Quest* journal. The remaining 8 articles corresponding to the top-ten-cited articles described intervention studies that received between 99 and 47 citations and were published in the following journals (JCR-Q1): *Journal of Teaching in Physical Education* (4), *Physical Education and Sport Pedagogy* (2), *European Physical Education Review* (1), and *Journal of Applied Sport Psychology* (1).

Authorship

The author with the largest number of published articles (8) is Ben Dyson (University of North Carolina, USA), including 5 in the top-ten-cited articles. The second author with the most published articles (7) is Javier Fernandez-Rio (University of Oviedo, Spain), including 1 in the top-ten cited articles. Regarding the gender of the first author, only 10 women held first authorship (21.73%). Finally, only one article (10%) was signed by a female as first author in the top-ten-cited articles (10th position).

Discussion

The aim of this scientific note was to provide a research overview on CL in PE. The results showed a notable increase in published articles in recent years, in line with the general evolution of pedagogical models in PE (Fernandez-Rio & Iglesias, 2022; Valero-Valenzuela et al., 2020). Most of the articles described intervention studies that made highquality contributions in this area. The most cited articles were published in journals indexed in JCR-Q1-Q2. Unfortunately, its geographic distribution has not been uniform. Countries such as Spain, UK and USA concentrate most of the research. Therefore, CL implementation beyond these countries is suggested, considering the positive effects found in the literature (Bores-García et al., 2021; Casey & Goodyear, 2015). A low representation of women signatories as first authors was also observed, being even more pronounced in the most cited articles. These findings are in line with previous studies on gender gaps in PE research (Iglesias & Fernandez-Rio, 2022).

Finally, to carry out this research overview, only the WoS database was used because of its high consideration among the scientific community and the study focused on highquality research based on prevalent metrics. However, this could also be considered a limitation. Future studies should expand the search strategy to include more databases (e. g. Scopus, ERIC). On the other hand, the inclusion/exclusion criteria left out studies conducted in other populations and contexts, including hybridizations. New studies should cover these needs observed in the literature.

Conclusions

Based on findings from this research overview, we can draw the following conclusions:

- 1. The number of published articles on CL in PE at JCR journals has increased in recent years, indicating an expanding research topic.
- 2. Most of the studies conducted included intervention programs and the journals with the highest number of published articles are indexed at JCR-Q1.
- 3. Spain, England and the USA were the countries where CL in PE was more frequently implemented. So, an expansion to the rest of the world is suggested.
- 4. The top-ten-cited articles have received between 172 (1^{st}) and 47 (10^{th}) citations.
- 5. Women scholars are underrepresented as first authors and in the top-ten-cited articles.

Finally, evidence showed a growing expansion of research in this area, especially in intervention studies. However, this positive trend is not homogeneous with respect to geographical areas and the participation of women researchers.

References

- Barret, T. (2005). Effects of cooperative learning on performance of sixthgrade physical education students. *Journal of Teaching in Physical Education*, 24(1), 88-102. https://doi.org/10.1123/jtpe.24.1.88
- Bodsworth, H., & Goodyear, V. A. (2017). Barriers and facilitators to using digital technologies in the cooperative learning model in physical education. *Physical Education and Sport Pedagogy*, 22(6), 563-579. https://doi.org/10.1080/17408989.2017.1294672
- Bores-García, D., Hortigüela-Alcalá, D., Fernandez-Rio, J., González-Calvo, G., & Barba-Martín, R. (2021). Research on cooperative learning in physical education: Systematic review of the last five years. *Research Quarterly for Exercise and Sport*, 92(1), 146-155. https://doi.org/10.1080/02701367.2020.1719276

- Casey, A., & Dyson, B. (2009). The implementation of modelsbased practice in physical education through action research. *European Physical Education Review*, 15(2), 175-199. https://doi.org/10.1177/1356336X09345222
- Casey, A., & Goodyear, V. A. (2015). Can cooperative learning achieve the four learning outcomes of physical education? A review of literature. *Quest*, 67(1), 56-72. https://doi.org/10.1080/00336297.2014.984733
- Dyson, B. (2001). Cooperative learning in an elementary physical education program. *Journal of Teaching in Physical Education*, 20(3), 264-281. https://doi.org/10.1123/jtpe.20.3.264
- Dyson, B. (2002). The implementation of cooperative learning in an elementary physical education program. *Journal of Teaching in Physical Education*, 22(1), 69-85. https://doi.org/10.1123/jtpe.22.1.69
- Dyson, B., Griffin, L. L., & Hastie, P. (2004). Sport education, tactical games, and cooperative learning: Theoretical and pedagogical considerations. *Quest*, 56(2), 226-240. https://doi.org/10.1080/00336297.2004.10491823
- Dyson, B., Linehan, N. R., Hastie, P. A. (2010) The ecology of cooperative learning in elementary physical education classes. *Journal of Teaching in Physical Education*, 29(2), 113-130. https://doi.org/10.1123/jtpe.29.2.113
- Fernandez-Rio, J., & Iglesias, D. (2022). What do we know about pedagogical models in physical education so far? An umbrella review. *Physical Education and Sport Pedagogy*, 1-16 (Ahead of print). https:// doi.org/10.1080/17408989.2022.2039615
- Fernandez-Rio, J., Sanz, N., Fernandez-Cando, J., & Santos, L. (2017). Impact of a sustained cooperative learning intervention on student motivation. *Physical Education and Sport Pedagogy*, 22(1), 89-105. https://doi.org/10.1080/17408989.2015.1123238
- Goudas, M., & Magotsiou, E. (2009). The effects of a cooperative physical education program on students' social skills. *Journal of Applied Sport Psychology*, 21(3), 356-364. https://doi.org/10.1080/10413200903026058

- Iglesias, D., & Fernandez-Rio, J. (2022). Are women equally represented in high-quality physical education research? Evidence from 2000 to 2020. *Sport, Education and Society*, 1-14 (Ahead of print). https://doi.org/10.1080/13573322.2022.2054793
- Ivanović, L., & Ho, Y. S. (2019). Highly cited articles in the education and educational research category in the social science citation index: A bibliometric analysis. *Educational Review*, 71(3), 277-286. https://doi.org/10.1080/00131911.2017.1415297
- Johnson, D. W., Johnson, R. T., & Holubec, E. J. (2013). Cooperation in the classroom. (9th ed.). Edina, MN: Interaction Book Company.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Murlrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *71*, 372. https://doi.org/10.1136/bmj.n71
- Valero-Valenzuela, A., Gregorio García, D., Camerino, O., & Manzano, D. (2020). Hybridisation of the teaching personal and social responsibility model and gamification in physical education. *Apunts Educación Física y Deportes*, 141, 63-74. https://doi.org/10.5672/apunts.2014-0983.es.(2020/3).141.08

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ISSUE **151**





Book review: Castañer, M. & Camerino, O. Enfoque dinámico e integrado de la motricidad (EDIM). De la teoría a la práctica

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Cite this article

Buscà, F. (2022). Book review: Castañer, M. & Camerino, O. (2023). Enfoque dinámico e integrado de la motricidad (EDIM). De la teoría a la práctica. *Apunts Educación Física y Deportes*, *151*, 94-95. https://doi.org/10.5672/apunts.2014-0983.es.(2023/1).151.10

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Cover:

A Mexican man in pre-Hispanic Aztec costume eludes the ball during a traditional "Juego de Pelota" (in Spanish), called by the Maya "pok-ta-pok" and by the Aztecs "tlachtli". Xcaret eco-park, Mexico June 5, 2009 © LUIS ACOSTA/AFP via Getty Images This book aims to defend motor activity as a source of learning and theoretical and practical knowledge. Its approach goes a step further in the difficult task of revaluing the pedagogical treatment of motor activity, in the face of the still dominant tendency to consider it as an exclusively physical exercise phenomenon. Thus, the authors are in favour of motor skills that form part of a globalising approach, which dynamically integrates the human being's different motor skills and abilities, as a result of the authors' definition of motor skills as: "kinesthetic manifestation of the human body which, at the same time, is meaningful, emotive and cognitive" (Castañer & Camerino, 2022, p. 15). With this approach, the authors give meaning and substance to Ommo Gruppe's famous aphorism from the 1970s that education will always be more than physical education, although it will certainly not be complete without it.



ENFOQUE DINÁMICO E INTEGRADO DE LA MOTRICIDAD (EDIM) DE LA TEORÍA A LA PRÁCTICA

Motriu 2

ENFOQUE DINÁMICO E INTEGRADO DE LA MOTRICIDAD (EDIM). DE LA TEORÍA A LA PRÁCTICA DYNAMIC AND INTEGRATED APPROACH TO MOTOR SKILLS (DIAMS). FROM THEORY TO PRACTICE

Marta Castañer & Oleguer Camerino

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and evolution (chapter 2). From there, the authors explore the world of motor skills. Firstly, in the perceptive-motor

Readers interested in the subject matter of this book will find that the structure of its content is designed to ensure an enjoyable and, at the same time, rigorous and wellfounded reading, with theoretical reflections and empirical evidence, drawn from both up-to-date scientific articles and teaching practice. Likewise, the authors' effort in selecting the substantial and necessary information to develop each of the chapters that make up the work and, above all, to resolve with precision and efficiency all those reflections or questions that may arise in order to delve deeper into each of the thematic blocks of the book should be valued.

A quick look at the structure of this work shows that the adventure of reading it begins with the proposal of a dynamic and integrated approach to motor skills (DIAMS), while at the same time presenting the initial approach and its intentions (chapter 1). After that, the journey continues with an analysis of motor skills in terms of their form, function skills that make up somatognosia or knowledge of oneself (chapter 3) and stereognosia or knowledge of the space and time that our body occupies in the environment (chapter 4), followed by physical-motor skills (chapter 5) and ending with socio-motor skills (chapter 6). Chapter 7 closes the reading of this book by providing some reflections that are key to understanding how the motor skills and abilities described in the preceding chapters are integrated and interrelated to favour the development of intelligent motor skills and, therefore, useful and necessary to achieve a satisfactory life in full harmony with oneself, others and the world around us.

Conflict of interests: the authors have not declared any conflict of interest.



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