

Interdisciplinary approaches to physical education: A systematic review Enfoques interdisciplinarios en educación física: una revisión sistemática

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Abstract. This study aims to provide an overview of research articles published in the Scopus, WoS and ERIC databases, from 2000 to 2022, related to the interdisciplinary approach of Physical Education (PE) subject to summarise the benefits that this approach can offer to students. The study was conceived as a systematic review based on the Flow diagram of PRISMA declaration. Taking into account selection criteria, a set of 773 papers was reduced to a final sample of 15 documents for the systematic review. Results provided evidence that PE in mandatory public schooling can contribute to promoting an alternative approach based on helping students to gain knowledge, skills, or competencies related to curricular areas outside PE. This study confirms that interdisciplinary approaches to PE are a growing area in PE and sport pedagogy research. Teachers naturally struggle to carry out objectives from their discipline in collaboration with teachers from other fields, and vice versa, they lack guidance. Though published literature could certainly help to show the way, PE teachers do not always have unlimited access to specialised research published online, and what they find is not always applicable to their particular classroom conditions.

Keywords: physical education; interdisciplinary approach; cross-disciplinary approach; systematic review.

Resumen. El objetivo de este estudio es proporcionar una visión general de los artículos de investigación publicados en las bases de datos Scopus, WoS y ERIC, desde 2000 hasta 2022, relacionados con el enfoque interdisciplinario de la asignatura de educación física. El estudio fue concebido como una revisión sistemática basada en el Diagrama de flujo de la declaración PRISMA. Teniendo en cuenta los criterios de selección, el conjunto inicial de 773 artículos se redujo a una muestra final de 15 documentos para la revisión sistemática. Los resultados obtenidos inducen a pensar que la educación física puede contribuir a promover un enfoque pedagógico alternativo basado en ayudar a los estudiantes a adquirir conocimientos, habilidades o competencias relacionadas con otras áreas curriculares fuera de la educación física. Este estudio confirma que los enfoques interdisciplinarios de la educación física son un área en crecimiento en la investigación de la pedagogía de la educación física y el deporte. Los docentes que pretenden llevar a cabo este enfoque más allá de su propia disciplina, en colaboración con docentes de otras áreas suelen carecer de orientaciones claras para hacerlo. Aunque la literatura publicada ciertamente podría ayudar a su implementación en el aula, los profesores de educación física no siempre tienen acceso ilimitado a investigaciones especializadas publicadas en línea, y lo que encuentran no siempre es aplicable a las condiciones particulares de su aula.

Palabras clave: educación física; enfoque interdisciplinario; enfoque transversal; revisión sistemática.

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Introduction

Historically, the value of PE at school has rarely received the same recognition as other curricular areas, considered serious areas (Kirk, 2010). Since the second half of the 20th century, the function of PE has tended to be perceived as limited to instruction in particular sports, it bearing no relation whatsoever to achieving the high academic marks and key competencies that are considered crucial to becoming successful in life (Crum, 2012; Devís, 2018; Jung et al., 2016; Kirk, 2010; Larsson & Nyberg, 2017; McNamee, 2005; Quarmby et al., 2019; Sprake & Temple, 2018; Svendsen & Svendsen, 2016).

Besides, according to these authors, this situation is the result of one or more of the following circumstances:

- The prevalence of an academic model of schooling is centred on a very narrow understanding of the learning outcomes students can achieve at the end of the schooling process.
- The predominance of a weak disciplinary epistemological approach at the theoretical level.
- The tendency of Physical Education Teacher Education (PETE) programmes to perpetuate a teaching-learning model that is centred on mastering a specific set of sports, as opposed to a pedagogical model that

is directed at meeting the needs of today's digital society.

There are also other reasons for PE's current low status, which are historically related to three types of discourse. The first type places heavy importance on achieving strong results in national or international competency rankings like the Programme for International Student Assessment (PISA). In this case, the main goal for schools and educational systems is to achieve high scores relative to the benchmark standards. According to Davidson (2017), this explains the heavy priority often given to specific subjects related to languages or STEM (Science, Technology, Engineering, and Mathematics) competencies in curriculums. The second type of discourse relates to the steady replacement of the traditional curriculum based only on academic knowledge with the competency-based curriculum (Barker et al., 2021; Whitehead, 2010). This in turn is linked to the third type of discourse, which revolves around the notion that PE offers students no competencies as such, but serves rather as a source of diversion through games and sports which will help students tackle the more serious — that is, academic — tasks they undertake at school (Crum 2012; Nyberg & Larsson, 2014; Sprake & Temple, 2018, Tul et al., 2019).

Fortunately, various arguments backed by research

lend support to an alternative point of view regarding the value of PE. One of these arguments highlights PE as one of the few subjects whose effects are centred on the body (Devis, 2018). Another line of argumentation points to the usefulness of physical activity (PA) as a way to engage students who are at risk of social exclusion and thereby enhance their academic performance (UNESCO, 2015; Robinson & Aronica, 2015). Other studies point to PE's potential to create situated and meaningful contexts for teaching and learning how to address the needs and challenges of the digital era (Ní Chróinín et al., 2018; Harari, 2018).

Moreover, from a pedagogical point of view of PE, the interdisciplinary approach could be a solution to engage all students in the learning process of any subject or curricular area (Masden and Aggerholm, 2019). These authors considered PE teachers could design significant and situated teaching-learning activities or contexts related to knowledge, skills, values or competencies of every curricular discipline. Thanks to the properties of the movement, students can develop their executive functions which they need to be aware of and engage in teaching-learning situations with a specific cognitive charge (Bueno, 2018). On the other hand, the kinesthetic and metaphoric properties of the movement can also help students to understand abstract concepts, processes or procedures and establish the anchorage point to connect other learnings or still be learning other more complex learnings (Gallagher and Lindgren, 2015; Meurs, 2012; Ricoeur, 2018).

In general, two theoretical approaches, which will be presented and further developed as follows, support the educational relevance of the movement at schools.

The first approach refers to the applied research that justifies, with empirical evidence, the relationship between embodied and enactive education and cognition development. According to this, it is possible to find systematic reviews of literature that highlight research oriented to reflect research studies that demonstrate supporting with empirical evidence how engaging students to do regular Physical Activity (PA) has physical and mental health benefits and, consequently, enhances academic outcomes (Mavildi et.al, 2018). Regarding this cognitive framework it's possible to find studies that remark on the relevance of PA in the development of executive functions such as engagement and motivation to learn; paying attention, designing and applying an action plan to solve any problem; or assessing this plan that students can use to learn contents to every scholarly area (Donnelly et al., 2016; Jäger et al., 2014; Lindgren et al., 2016; Vazou et al., 2014).

The second approach refers to research and innovation in didactics. In this case, the evidence is represented by practices situated in the specific context of the classroom where PE contributes to reaching interdisciplinary learning outcomes. Although, it is not possible to find many studies related to how PE can improve them, in comparison to the previous approach. As Mavildi and their collaborators conclude in a recent systematic review about how

movement-based interventions can provide academic and behavioural outcomes (2022), this fact could be related to the huge specificity and standardisation of disciplinary skills that are difficult to develop in certain motor teaching-learning situations which are considered decontextualized by school teachers.

Nevertheless, the potential of an interdisciplinary approach can be fulfilled if educational administrations, educators and the social community all understand that PA can help students to learn in a meaningful manner not only PE content but also content from other disciplines, and in the process acquire all values like social justice, respect for diversity, and equality of opportunities—that are essential to a democratic society (Almond, 2012; Devis, 2006, 2018; Enis, 2014; Harari, 2018; Lindgren & Barker, 2019; Ní Chróinín et al., 2018).

These authors also concur that this alternative approach to PE requires leaving behind the traditional approach focused only on the teaching of sport, and broadening the goals of PE beyond its historical disciplinary boundaries in a transversal approach focused on pedagogical and social issues. In other words, they believe PE must help to create autonomous, critical, and proactive individuals who carry out PA in a healthy way by environmentally aware and democratic values which cultivate respect for the environment and their fellow humans.

Against the traditional approach to PE in which the student's body is regarded as an object which must be trained, this approach focuses on individuals as wholes — not just their bodies — and understands PA as one of the best ways to help students not only achieve self-awareness but also develop the values required to live successfully in the digital era (European Commission, 2012; UNESCO, 2015).

Though this approach has received support since the early 1990s in a substantial number of articles, conference proceedings, and books, there is evidence that the traditional approach to PE continues to predominate, both in the beliefs of students and PE teachers and in the guiding philosophies of an overwhelming majority of schools and PETE programmes (Crum, 2012; Quarmby, 2019; Svendsen & Svendsen, 2016). It is difficult to ascertain exactly what factors are responsible for this. Setting aside the influence exerted by certain lobbies operating in the fields of sports and the sports sciences, one such factor is related to the actual impact and transferability of this specialised literature on the thoughts and classroom practices of teacher educators (Casey & Kirk, 2021; Kirk, 2010; Larsson, 2021). In other words, how much of a role can journal articles play in changing attitudes toward PE at schools and in the classrooms?

In light of this situation, the three aims of the present study are: a) to summarise and synthesise the main bibliometric topics found in the journal articles selected; b) to identify the kinds of learning outcomes that such interdisciplinary programmes could promote at schools through PE; and c) to describe how the authors of the articles selected considered in the conclusions of their works how

the interdisciplinary approach provides significant learnings students to face throughout PE the main challenges of 21st Century.

It should be noted that the present study, given the unpublished and unique character of this systematic review on the subject, can be a great contribution to the field of physical education and the interdisciplinary approach. At the same time, it complements some of the works and systematic reviews cited above, as well as others in this journal on physical education (Ferrando-Félix et al., 2019) or the treatment of interdisciplinarity in education in other subjects (Rodrigues-Silva & Alsina, (2022) and other general related topics in education (Menéndez-Álvarez-Hevia et al., 2022). In this way, there are studies which provide evidence focused on disciplinary knowledge and skills narrowly related to PA (Borrull-Riera & Valls-Bautista, 2022; Hraste et al. 2018), as soft skills related to achieving values or behaviours that it is possible to find in any academic discipline (Fernández-García & Fernández-Rio, 2019; Garcia-Calvo et al., 2016; Koç and Alper, 2017; Sotoca et al., 2023).

Method

Our study is framed by the PICOS acronym (Moher et al., 2009; Page et al., 2021), as follows:

- Population: Students and PE teachers who were taking part in early childhood, primary, or secondary education.
- Intervention: Various interventions are intended to test the effectiveness of an interdisciplinary approach to PE at school compared to the traditional approach.
- Comparability: All studies were concerned with implementing an interdisciplinary approach in the PE classroom.
- Outcomes: Gains in knowledge, skills, or competencies, sometimes PE-related, sometimes related to other disciplines or áreas.
- Study design: The Studies themselves were quantitative, qualitative, or mixed-in design, so our review itself is necessarily qualitative.

Finally, taking all of this into account, our research question was as follows: How do the research articles published in international databases characterise the interdisciplinary approach of Physical Education subject and summarise the benefits that this approach can offer?

This question formulated based on PICOS allows us to guide the research route and the subsequent decisions regarding the method presented later in this section.

This study aims to provide an overview of research articles published in the Scopus, Web of Science (WoS) and the Education Resources Information Center database (hereinafter, ERIC) databases, from 2000 to 2022, related to the interdisciplinary approach of Physical Education subject to summarise the benefits that this approach can offer to students.

Protocol

To answer this question a systematic review was carried out following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Higgins & Green, 2011; Moher et al., 2009; Page et al., 2021).

Databases selected, search string and eligibility criteria

The three online databases deemed most relevant to the topic were Scopus, WoS and ERIC. All of these databases have a huge impact and exert enormous influence on Physical Education and Sport Pedagogy (PESP) research.

It was decided to limit our search to articles published from 2000 to July 2022, the moment at which the search was conducted. The year 2000 was set as the starting point because it was in that year that the key competencies discourse first became widespread in education curricula in Europe (Marco, 2008). Besides, it also was the period when the idea of PE started to change to a Pedagogical approach and began to consolidate their specific topics in the PE and Sports research field (Kirk, 2010; Peiró-Velert & Molina-Albentosa, 2020).

To find the most suitable articles for the object of study, a search strategy using specific terms was used. The AND/OR operators and the wildcard (*) were used to find possible endings of the same word. The following search string was set up: (PE OR "Physical education*" OR "Sport pedagog*") AND ("Interdisciplinar*" OR "cross-disciplinar*"). This combination of terms was chosen as it provided the best number of results consistent with the object of the study in the databases selected after an extensive process of selection of the Boolean terms and indicators. The search string selected was not only the one that yielded the most results in terms of the object of study, but also the results and articles obtained for each database were the most appropriate to the subject matter to be addressed, being as relevant and appropriate as possible.

The search was carried out for abstract, title, and keywords in all four databases selected. Search results were then screened under the inclusion and exclusion criteria listed in Table 1.

Table 1.

Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Language of publication: English, Spanish, Portuguese, or French	Other languages
Publication type: Research studies, peer-reviewed and in open access or full-text access	Non-research articles, articles published in non-peer-reviewed journals, and limited access publications
Field: Physical Education (PE); Sport Pedagogy (SP); Physical Education Teacher Education (PETE)	Sports Training; Sport Sciences
Education level: Early childhood education, mandatory primary and secondary education	Higher education
Publication date: from 2000 to 2022	Before 2000
The papers include words referring to Physical Education and Interdisciplinarity in their different varieties as indicated by the search string, in the title, abstract and keywords.	They do not include the designated search terms in the title, abstract and keywords.

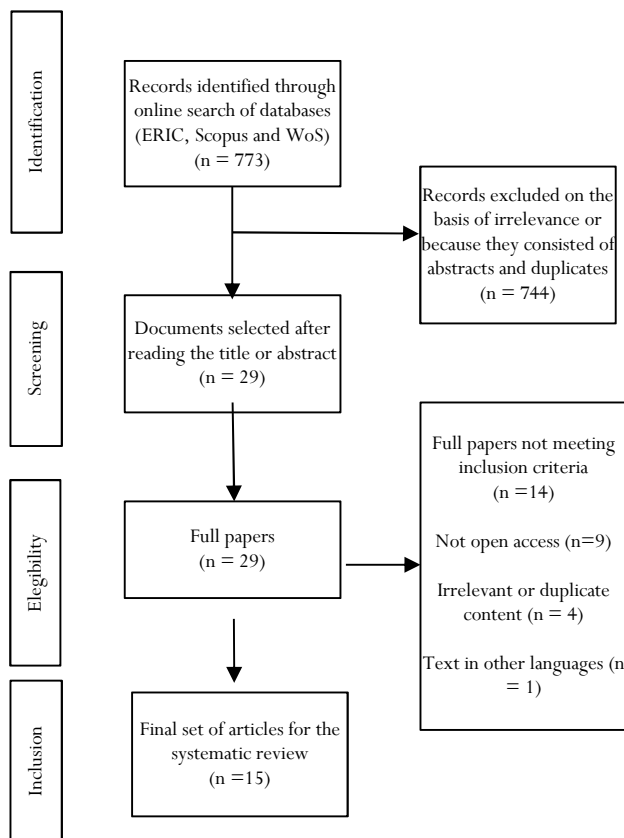


Figure 1. Study selection process following the PRISMA flow chart (adapted from Moher et al. 2009; Page et al, 2021).

Paper selection process and data extraction

Under the PRISMA procedure, and following the ver-

sion most in line with the process to be followed, the two authors working independently searched the four databases to identify all potentially relevant studies using the same search criteria. These independent searches yielded the same set of 773 publications. This set of texts was then screened to remove duplicates, irrelevant titles and abstracts, leaving only 29 full articles. It should be noted that in this first selection, some of the selection criteria were already applied, referring to the title, the abstract and the keywords that had to fit the object of study and the words that referred to what was being searched for. Finally, the remaining exclusion criteria also described above were applied to this set, leaving a total of 15 final research articles for the systematic review. The complete selection procedure is schematically depicted in figure 1.

The quality of the selected articles is not only corroborated by the rigorous and systematic method applied for systematic reviews, through the Flow Diagram of the Prisma Statement (Moher et al., 2009; Page et al., 2021) but also by their provenance from a priori selected databases that include peer-reviewed scientific articles on the subject under study.

Results

A breakdown of information about the 15 articles selected for analysis is given in Table 2, including title, author(s), year of publication, a topic covered, study objective, type of data collected, population sample (size and age), learning outcomes, and conclusions.

Table 2. Articles included in the systematic review

#	Title	Author(s) Year	Study	Main topics	Study objective	Data Collection	Sample size/age	Learning outcomes	Conclusions
1	Análisis del trabajo de contenidos matemáticos desde el área de Educación Física	Arias and Lafuente (2022)	Quantitative (quasi-experimental design)	Learning mathematics contents through sport (volleyball)	To assess student motivation, difficulties and learning when an interdisciplinary approach is adopted	Pre/post tests and students' diaries	72 Spanish sixth-grade primary school students, divided into an experimental group (n = 36) and a control group (n = 36).	Performance in volleyball and geometry, probability, and statistics	The students who experienced the interdisciplinary approach showed a higher degree of motivation and learning.
2	Educação infantil e educação física na perspectiva interdisciplinar: (im)possibilidades	Brostolin and Diniz (2021)	Mixed methods (descriptive)	Adopting an interdisciplinary approach to PE in early childhood education	To determine whether an interdisciplinary approach is taken by an interdisciplinary pedagogical practice among PE teachers and other educators that work at CEINFs	Questionnaire and a focus-group	111 Teachers working in 100 CEINFs in Brazil	(Not applicable)	Though it can provide small children opportunities for dialogue and group learning, PE is not formally part of early childhood education, and it is still seen as a discipline that is performed by specialists.
3	Análisis Inicial de la Enseñanza del Idioma Español por Medio de Actividades Deportivas en Varsovia (Polonia)	Maliszewska (2020)	Quantitative (descriptive)	Teaching & learning a second language through CLIL PE	To assess the impact of PE on L2 Spanish learning outcomes	Questionnaires	102 Children aged 7–12 undergoing primary education in Poland	Academic results in L2 Spanish	It was not possible to demonstrate a relationship between the learning of sports activities and gains in language performance.
4	The Effectiveness of a CLIL Basketball Lesson: A Case Study of Japanese Junior High School.	Ito (2019)	Qualitative (case study)	Teaching and learning a second language through CLIL PE	To assess the impact of being instructed in basketball in English on L2	Semi-structured interviews, language tests and questionnaires	23 Girls aged 13–14 attending Junior High (middle	1) Mastery of basic basketball skills, 2) knowledge of English	Students enjoyed the class and simultaneously learned English expressions and basketball terms.

				English learning and student attitudes		school) in Japan	expressions and ability to use English situationally, 3) levels of cooperation and teamwork		
5	Fine Motor Skills, Writing Skills and Physical Education Based Assistive Intervention Program in Children at Grade	Akin (2019)	Quantitative (programme assessment)	Developing fine motor skills through sport	To assess the effect of a PE-based intervention intended to foster the development of writing skills in primary school children	Tests	104 Turkish primary school children at grade 1 with at least 2 years of preschool education	Motor skills	PE-Based intervention programmes focusing on small muscle groups positively affect the development of children's fine motor skills and thus their interest in writing and schooling.
6	The relationship between sportsmanship level of secondary school students and their success regarding the religious culture and knowledge of ethics course	Coç and Karabundak (2017)	Quantitative (descriptive)	Learning contents from other disciplines (in this case ethical values) through PE; digital era issues and SDGs	To assess how the degree of sportsmanship among secondary school students relates to their success in a course on religion and ethics	Survey	609 Turkish public secondary school students aged 12–14 (310 females and 299 males)	Ethical behaviours as reflected in sportsmanship	PE can play an important role in teaching ethical behaviours to students, albeit to a lower degree than expected.
7	Effects of an intervention programme with teachers on the development of positive behaviours in Spanish physical education classes	García-Calvo et al. (2016)	Quantitative (programme assessment)	Learning 21st century skills (positive behaviours) through PE	To assess of training for PE teachers in how to help students develop positive behaviours in the course of PE lessons	Questionnaires	20 PE teachers (16 male, 6 female, mean age 35 years), 777 students (377 male, 400 female, mean age 12 years), all from Spanish public schools	Positive student behaviours during PE activities	There is a need for training programmes to help PE teachers apply to promote the development of positive student behaviour.
8	An Empirical Study Investigating Interdisciplinary Teaching of Biology and Physical Education	Spintzyk et al. (2016)	Quantitative (quasi-experimental design)	Learning biology through PE	To assess whether interdisciplinary teaching increases students' knowledge of content and their ability to apply what they have learnt	Pre/post tests	141 German sixth form students divided into a test group and a control group	Critical reflection on what has been learned theoretically and practically	Students in the test group attained a significant increase in knowledge whereas those in the control group did not
9	O diálogo na Educação infantil; o movimento, a interdisciplinaridade e a Educação Física	Bento et al. (2016)	Quantitative (descriptive)	Movement in early childhood education	To analyse the presence of movement in daily preschool routines and its relation with other activities	Interviews	29 Teachers, 4 non-teacher members of school staff, 149 children, and their parents at a Brazilian preschool	Relationship among children, spatial relation, natural movements	Interdisciplinary approaches are possible and are already present in preschool routines, although movement as an end is not often encouraged in children's daily experiences.
10	Empowering Girls with Chemistry, Exercise and Physical Activity	Clapham et al. (2015)	Quantitative (descriptive)	Learning content from other disciplines through PE; meaningful teaching and learning contexts	To describe a set of activities intended to teach girls chemistry through PA	Description of a classroom activity	42 Girls in middle school (grades 6–8) in the USA	Student satisfaction and attitudes	An interdisciplinary approach combining science and PA was found by students to be fun and interesting.
11	The 'function-to-flow' model: an interdisciplinary approach to assessing movement within and beyond the context of climbing	Lloyd (2015)	Qualitative (case study)	Emotional education; corporal awareness through climbing	To analyse students' self-reported corporal awareness as they developed climbing skills	Small group interviews, researcher observations	153 Students in Grades 1, 5, 7, 8, and 9 from seven different schools in Canada	Student awareness of their own development of climbing skills	Movement analysis by students using the F2F paradigm enhances their corporal awareness and could be extended beyond climbing to change the traditional narrow view of PE.
12	Teachers' and Students' Perceptions of the Active Science Curriculum: Incorporating Physical Activity Into Middle School Science Classrooms	Finn and McInnis (2014)	Mixed methods (descriptive)	PA and health; PA and ICTs; digital era issues	To get students to use PA data in their science curriculum, and to analyse student and teacher perceptions of the Active Science curriculum in order to determine the	Surveys, interviews, and focus-groups	47 Female 5th and 6th grade students and two science teachers at a US school	Student reactions to a multidisciplinary approach to PE.	Students reported that incorporating PA into lessons improved their alertness, focus, and concentration. For their part, teachers reported gains in student science inquiry skills, science content knowledge, and ICT skills.

					feasibility of incorporating a classroom-based PA program into middle school science lessons				
1 3	The Mystery Behind the Code: Differentiated Instruction with Quick Response Codes in Secondary	Adkins et al. (2013)	Practical experience	Sport and ICTs	To explain how QR codes can be integrated into and enliven of PE instruction	Description of a classroom activity	(Not applicable)	(Not applicable)	In PE, QR codes can be used to address different student skill levels while keeping activities engaging and applying ICT skills.
1 4	Games for Multicultural Physical Education	Kelle and Maeda (2012)	Practical experience	Learning about other cultures through motor games; digital era issues; SDGs	To describe how playing games from different geographical areas can enhance the PE curriculum	Description of a classroom activity	(Not applicable)	(Not applicable)	No reference Incorporating activities from other cultures into the PE classroom can enhance student awareness and appreciation of diversity in modern societies.
1 5	Inserção da Educação Física na área de Linguagens, Códigos e suas Tecnologias	Dos Santos et al. (2012)	Quantitative (descriptive)	Learning contents from other fields and developing key competences through PE	To investigate how teachers understand PE in relation to language instruction, communication and technologies	Questionnaires	16 Teachers from three public schools in Brazil	(Not applicable)	Though the Brazilian National Curriculum has included PE under the category of Languages, Codes, and their Technologies, teachers there struggle to identify the possible relationships among these disciplines and hence to adopt an interdisciplinary approach.

PE: Physical Education; ICTs: Information and Communication Technologies; F2F: Function-to-Flow; SDGs: Sustainable Development Goals; PA: Physical Activity; CEINFs: Centers of Infant Education; CLIL: Content and Language Integrated Learning; PETE: Physical Education Teacher Education;IdT: Interdisciplinary Teaching.

What were the main features of the journal articles selected?

Of the 15 articles analysed, 12 were research studies, the most common case studies ($n = 8$) based on qualitative data. The remainder consisted of three quantitative studies following a quasi-experimental design and one study in which mixed methods were applied. All these research articles are used to describe the same sections: introduction, purposes, population, instruments, procedure, data analysis, results, discussion and conclusions. Most participants in these studies were PE students or teachers. In a few cases, data was also taken from teachers of other fields or instructors in charge of extracurricular PE programmes.

Finally, three papers focused only on describing a specific programme or set of learning activities as applied in PE classrooms. In this case, the authors didn't use a similar structure to describe their experience. Nevertheless, they ever prioritised describing the main features of the programmes applied in PE classrooms

Referring to the individuals who participated in the studies, 12 journal articles reported the population and the context in which they were applied. Thus, the majority of participants in these types of studies were students and PE teachers. Teachers of other areas or instructors in charge of external PE programmes were also present, but it only was observed in punctual studies. It's also necessary to highlight that all the studies were placed in the PE classroom. That could mean that independent of the type of study, they tried to make studies in natural contexts as a strategy to justify the transferability of their research results or practical experiences.

Regarding the language of publication, ten of the articles selected were written in English, three were written in Portuguese and two were written in Spanish. In terms of the geographic setting for the research, three studies

were carried out in Brazil, two in Turkey, two in Spain, and one each in Japan, Germany, Poland, Canada, and the US. All three activity descriptions were written by authors in the US context.

What kind of results did they show?

In the research articles, three broad categories of learning outcomes could be discerned. The first category was made up of outcomes related to the PE curriculum itself (e.g., articles 5, 11, and 13 in Table 2). In these instances, the interdisciplinary approach was intended to promote the development of motor skills or sports techniques but also that is, an understanding of movement about the human muscular and physiological systems — through alternative physical activities such as climbing or a specific methodology. In these cases, the PA was tightly integrated into the content to be learnt, to make student learning situated and thus more meaningful.

The second category of learning outcomes was present in studies (e.g., articles 1, 4, 8, or 10), which sought to demonstrate that PE was an excellent medium by which to learn academic knowledge, skills or competencies in other areas such as biology, maths or foreign languages.

The third category of outcomes was exemplified by studies (e.g., articles 4, 13, 14, or 15) centred on developing “21st-century competencies”, that is, ICT skills, the ability to work towards sustainable development goals, or respect for cultural diversity. Here again, given that student gains were related to values or behaviours, PA was intended to afford a context for meaningful and situated learning.

It should be noted that the three articles that merely described learning tools or techniques naturally did not offer quantified results as such, though they share the standpoints that an interdisciplinary approach to PE will have a positive impact on student outcomes.

How PE can help students face the challenges of the 21st Century

All the studies selected focused their aims on giving reliable evidence showing that adopting interdisciplinary or cross-disciplinary approaches can play a role in changing social expectations about PE at school. In some cases they conclude by highlighting the value of PE as a teaching-learning context in which to achieve outcomes related to other curricular areas (e.g.; articles 1, 4, 7 or 8).

A subset of these articles (see 10, 12, 13 or 14 in Table 2) also spotlight the value of PE as a didactic strategy to motivate, engage and empower the students to live an active life by carrying out PA both inside and outside the PE classroom. In this connection, an interdisciplinary approach is very important because it offers students contexts in which to perform PA while simultaneously integrating the contents of other academic areas or using specific technological resources such as QR codes or pedometers. According to the conclusions of these articles, this is possible because the goals of interdisciplinary PE are focused on giving students a positive and broad approach to their content (promoting respect for other cultures, gender differences or unequal levels of physical ability or competence) of instead of being only focused on performance and sport-as-technique — in other words, an approach to PE centred on achieving knowledge, skills, and competencies that are key for life in the 21st century.

A few of these studies (e.g., 2, 7, 9, and 15) were focused on the perspective of PE teachers regarding the possibilities of bringing current PE practices into line with an interdisciplinary approach. The barriers identified by teachers in these articles were often related to the difficulties that PE teachers and teachers from other disciplines have working together in a common programme. Part of this has to do with finding meaningful relationships among their specific curriculum curricular contents. They also noted how hard they found it to share responsibility for teaching content which they are accustomed to teaching alone with other teachers and by the same token assume some responsibility for student learning of non-PE content. Despite such reservations, however, the views recorded in these studies show that PE teachers believe that an interdisciplinary approach is not only possible but could also be an effective pedagogical strategy to achieve deep and situated learning of the sort required by current student needs.

Discussion

All of the studies included in the systematic review show how PA can help students achieve learning outcomes related to the development of competencies that are key to facing the challenges of the digital Era. Also, report evidence that PE can provide valuable learning outcomes well outside its traditional disciplinary boundaries. In this way, if the pedagogical principles underlying PE are based

on providing meaningful and situated teaching and learning experiences, it will be possible to achieve a range of knowledge, skills, and competencies that is much broader than that afforded by the traditional approach centred on physical performance and sports (Hsu, 2011; Ní Chróinín et al., Fletcher, & O'Sullivan, 2018; Kirk & Haerens, 2014; Madsen and Aggerholm, 2020; Whitehead, 2001, 2005). Several articles in this study also provide concrete illustrations of how this shift in approaches can be carried out in the PE classroom in the form of evidence-based recommendations for practice.

This change bears on a wide range of themes, including social inclusion, social and moral values, social and interpersonal competence, motor competence and corporal awareness, personal well-being, and citizenship education. These themes are closely linked to PE because it is by nature an interdisciplinary area, in which students must apply knowledge, skills, and competencies from different fields to achieve their learning outcomes under a pedagogical approach (Kirk & Haerens 2014). As a consequence, PE deserves to be on the curriculum agenda of any country that intends to keep PE in its syllabus (Almond, 2012; Beni et al., 2016; Kirk, 2010; Kirk & Haerens, 2014; UNESCO, 2015).

Nevertheless, changing the PE approach depends on the channels of information which produce and spread the official discourse about the social function and practices by which education policies are intended to achieve their specific goals (Bernstein, 2000; Kirk, 2010). Certainly, research that is published and indexed in top databases is one such channel, and could therefore play a role in bringing about this change in approaches. That said, published material needs to be read critically. For example, among the set of papers analysed here, we have noted several that described how specific interdisciplinary classroom techniques or programmes designed *ad hoc* can help students achieve some learning and competencies consistent with current social needs. However, it was observed that: a) these studies did not all report empirical evidence; b) they did not obey a pedagogical model and therefore failed to report what interdisciplinary learning outcomes students could achieve; and c) none of them provided any evidence that they were framed within a current school curriculum. As a consequence, even when innovative programmes are designed by their respective school syllabi and national standards, without a wide and reliable list of benchmarks about the impact of these studies it will be impossible to confirm how successful and effective any shift in the approach to PE may be (Crum, 2012; Kirk, 2010).

Another factor bearing on the real impact of publications like these are related to the accessibility of this specialised body of literature to its intended readership. As we noted above, 744 articles identified in the first step of this systematic review were excluded because they were not available in open access. Moreover, though the technical and specialised language used in most of them (and possibly also they're being written in a foreign language)

might not be a deterrent for PETE researchers, it might well be so for PE teachers.

These handicaps may explain why PE teachers tend not to consult research articles to address their needs or solve practical problems in the PE classroom, preferring instead to repeat the same familiar practices first learnt during their teacher training, under the conviction that the traditional approach is still the only one possible (Garret & Wrench, 2007; Kirk and Haerens, 2014; Svendsen & Svendsen, 2016). It is also likely that the perceived lack of context or transferability in the research could condition the potential of published research to influence PE teachers' beliefs and consequently their capacity to change other social agents' beliefs (Backman & Larsson, 2016; Garrett & Wrench, 2007; Herold & Waring, 2017).

However, PE teachers should be encouraged to carry out and publish research themselves, not merely as participants but also as researchers and authors. Such involvement would certainly help them view specialised literature about their field as one of the best ways to gain exposure to novel practices which would allow them to implement the interdisciplinary approach in their classrooms. On the other hand, it might also increase the interest of high-quality publications in this new approach while, at the same time, heightening their awareness of the topics that are most relevant to current PE teachers' needs and problems (Kirk & Haerens 2014)

Conclusions

This study was released to know how the research articles published in international databases characterise the interdisciplinary approach of Physical Education. Thus, the present study has provided a satisfactory response to the research objectives proposed, as follows:

Firstly, the objective concerning summarising and synthesising the main bibliometric topics found in the journal articles selected has been possible to get. Thus, according to the results obtained by the systematic review presented here, it has been possible to gather evidence of a shift in PE from a traditional approach centred around sports instruction, health centred on exercise, and active leisure to an interdisciplinary framework based on new pedagogic principles. Given the large number of publications initially identified in our first broad search, or the variety of countries where research is being carried out, it is clear that such a shift is of interest to growing numbers of researchers and education systems.

Secondly, the objective relating to identifying the kinds of learning outcomes that such interdisciplinary programmes could promote at schools through PE has been achieved. The systematic review results have shown experiences that have obtained evidence of several knowledge, skills or competencies related to areas such as maths, natural sciences, English language or biology achieved in interdisciplinary programs. Nevertheless, paying attention to the main features of the final set of articles selected, it

seems the interdisciplinary approach It's only possible in the PE classroom through punctual experiences applied in singular groups and led by PE teachers and sports pedagogy scientists.

Finally, to describe how the authors of the articles selected considered in the conclusions of their works how the interdisciplinary approach provides significant learning opportunities for students to face throughout PE the main challenges of the 21st Century. This aspect has also been provided throughout the manuscript providing information about these learning outcomes through PE in interdisciplinary contexts. The articles analysed have reported results related to achieving values and soft competences applied in any context or curricular area. Nevertheless, as we have reported before, we haven't found any interdisciplinary experience released in the framework of other curricular areas. Consequently, It is not possible to confirm that the interdisciplinary approach could be applied in every classroom integrating the movement as a pedagogical method to achieve all these contents of other disciplines narrowly related to PE or movement.

Moreover, for this reason, a future line of investigations and studies could be opened to find more interdisciplinary experiences searching articles commonly published in other curricular fields and not necessarily staged in scientific databases.

Shifting PE to an interdisciplinary approach is possible, despite all the factors which will condition this process. As we have seen, there is substantial evidence that this change is already underway. Nonetheless, it is still necessary to ensure that this evidence is available to all the agents who will have to make this change happen in the classroom, and also ensure that what they read applies to their particular contexts.

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