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A rubric for pre-service teachers to evaluate meaningful physical education

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This manuscript presents the definition, implementation, and validation of a new rubric for assessing and improving meaningful physical education activities in tertiary education: the Rubric for Meaningful Physical Education Assessment (MEANPE). We present the rubric's validation based on twelve international external experts' appraisals, and on the perception of 250+ pre-service teachers (PST). The manuscript presents the validity, correspondence, formulation and appropriateness of the indicators and their levels. We found that there are statistically significant differences in student scores between the pre- and post-implementation, suggesting that the MEANPE rubric is a valid and reliable instrument with which to assess meaningful physical activities in primary school classes.

KEYWORDS

physical education, rubric, implementation, validation, indicators, meaningful physical education, higher education

1 Introduction

The pedagogical principles of learning to teach physical education rely on the provision of meaningful tools to encompass the realities and challenges of teaching physical education (Ní Chróinín et al., 2018). That said, this premise needs educational experiences to be continually transformed to further experience personal growth (Quennerstedt, 2019). Meaningful physical education may be fostered by instructional approaches with individual and collective proposals solving either contextualized situations of daily life and/or complex motor situations (Beni et al., 2017; Cañabate et al., 2021; Frank et al., 2021; Moghaddaszadeh and Belcastr, 2021; Vaz et al., 2021).

The connections between the theoretical and applied research into physical educational principles and instructional approaches would do well to consider several educational strategies. This is because knowledge is being generated in both the pre-service teacher's professional practice and identity, theoretical grounds for meaningful physical education are being defined, and experiences or instructional approaches for the most effective acquisition of competences and abilities are being validated (Kirk and Haerens, 2014; Colomer et al., 2020).

To date, efforts have been concentrated on the instructional approaches to teaching physical education by, for example, focusing on the pedagogical principles including planning for, experiencing, teaching, analyzing, and reflecting on participation (Ní Chróinín et al., 2018),

or on transformative and pluralistic physical education practices (Quennerstedt, 2019). Strategies may consider providing students with broader curriculum outcomes, thus disrupting the *status quo* of contemporary physical education curriculum design (Wallhead et al., 2021).

Among the pedagogical models available, a number of them concentrate on providing students with psychomotor, cognitive, and affective learning outcomes (Cañabate et al., 2018a,b; Wallhead et al., 2021). Models based on constructivism concentrate on student self-regulation and critical thinking about the quality of the movements and the variety of tasks in order to link new learning to prior knowledge, and to guide social interaction (Chen and Rovegno, 2000; Cohen and Zach, 2013).

In this paper, we present the Rubric for Meaningful Physical Education Assessment (MEANPE) that aligns with the predisposition of pre-service teachers (PST) to reflect on providing and assessing meaningful physical education practices in their professional activity in primary school institutions. We understand that, in their pursuit to become learning facilitators, PST must shape processes of continuous synergies between action and reflection, and that assessment is a key aspect if they are to effectively evaluate their tasks and actions. As pointed out by Dochy et al. (2006), the definition, validation, and further implementation of rubrics in tertiary educational systems (especially during PST in-class and out-of-class practice development), is increasing in demand and responds to more sustainable forms of assessment (Colomer et al., 2018). The objective of this paper is to define a rubric, and then to evaluate its creation and usefulness based on the appraisal and verdict of national and international experts in physical education and sports. To accomplish this objective, qualitative and quantitative analyses from the experiences of 250+ PST, who implemented physical education activities in primary schools, were carried out.

2 Evaluation of meaningful physical education in higher education

Meaningful physical education for students has been defined as a set of physical education experiences that encompass social interaction, enjoyment, challenges, motor competences and personally relevant learning. These learning experiences are carried out with teachers facilitating structure through planning and implementing instructional pedagogical strategies in schools (Beni et al., 2017, 2019). Meaningful physical education is also about what instructional approaches mean to students' emotions, perceptions, hopes, and dreams etc. In other words, the full range of human experience (Kretchmar, 2007; Bailey et al., 2009; Cañabate et al., 2018a,b). How a teacher promotes relevance in physical education is usually concerned with the level to which teachers provide for innate psychological needs (competence, autonomy, and relatedness) by, for example, offering coherent pedagogical strategies for physical education practice (Beni et al., 2019), or strategies that are attentive to social-cultural dimensions so that students can individually construct and understand learning (Light et al., 2013; Casey and MacPhail, 2018), which can then further transcend the social and cultural differences currently present in

many physical education and youth sport contexts (Cañabate et al., 2021).

Teaching meaningful physical education is not limited to a physical exercise but seeks cognitive involvement that promotes decision-making, pursues models of action that show applicability in real practice situations, powers cooperative and peer learning, and places special emphasis on the values that emerge from practice (Lleixà et al., 2016). According to Blázquez (2020), physical education today changes, grows, and develops; attentive to what will happen in global and local realities in the near future (Bailey et al., 2009). Its purpose is to ensure that students learn to experience their bodies, build their psycho-motor and professional identities, and transform these through critical evaluation and understanding. From this premise, a series of topics emerge such as self-management of learning related to the body and motor skills (Vaz et al., 2021), non-discriminatory physical education (Cañabate et al., 2021), integrating physical education into transdisciplinary school projects (Jackman et al., 2021), fostering emotional and subjective physical education (Goddard et al., 2021), and incorporating information technologies and communication to support learning. These, in turn, become a focus of innovation and research in physical education teaching. Not only this, teaching meaningful physical education also creates opportunities to develop motor skills in sport, dance and the performing arts to generate new more integrative and sustainable motor behaviors (Cañabate et al., 2021).

Building meaningful education programmes, relies on assessing learning. Assessment is formative when the evidence is used to adapt teaching to meet students' learning needs (Black and Wiliam, 2009; Chng and Lund, 2018). Formative assessment in physical education has been found to offer structure for student learning, provided that feedback and attention to differentiating assessments for different class levels and abilities are placed at the center of the teaching process (Ní Chróinín and Cosgrave, 2013). Likewise, primary school students appreciate being given more responsibility for their own learning and teachers believe that the use of questioning and feedback increases the number of students positively engaged in physical education classroom activities (MacPhail and Halbert, 2010). Assessment for learning is a standard that implies promoting different kinds of learning through physical education instruction that increases autonomy and the acquisition of prescribed abilities, and also promotes student participation in a community of practice and group development (Tolgfors, 2018). Assessment is viewed then, as a key component of providing meaningful physical education since it relies not only on cognitive processes but also on the powerful discourses of sport and related areas such as health (Leirhaug and MacPhail, 2015) and leisure time (Shen et al., 2007). As a result, the "environment" in which meaningful education can be applied, refers to the educational, cultural, and societal foundations on which cooperative instruction is built.

The Perceived Matterings Questionnaire—Physical Education (PMQ-PE), administered to over 460 physical educators, proved that the discipline of physical education is highly relevant with physical activity correlating positively with resilience and negatively with the stresses in a teacher's role (Richards et al., 2017). The Challenge and Threat in Sport (CAT-Sport) Scale provides a measure of athletes' experience of challenge and threat in

anticipation of sport competition (Rossato et al., 2018). Rubrics in physical education environments are found to improve students' skills, help them to discriminate in their evaluation and enhance a self-approach toward professionalism (Shaw, 2014). Likewise, rubrics in physical education can help to discern teachers' individual differences, i.e., mastery, ability-approach, ability-avoidance, or work-avoidance in relation to their achievement goal orientations and job satisfaction for teaching physical education (Wang et al., 2018). The Teaching Competency while performing Motor Skills and Body Language Games Rubric (TC/MSBLG-R) rubric was proposed to evaluate teaching competency in physical education; specifically with pedagogical approaches in primary education centered on motor skills and body language games (Capella-Peris et al., 2018). The level analysis was based on a Likert scale (1–5) for 10 categories of teacher organization and game adjustment, time, space and game variety, global and specific features of motor skills games and body language games, among others. Similarly, Alfrey et al. (2017) validated the Attitude Toward Healthism Scale (ATHS) which had been constructed to quantify pre-service physical education teachers' attitudes toward healthism. The ATHS also enabled teacher educators and PST to discuss healthism with reference to attitudinal data, and how healthism views change over time. All in all, rubrics have been used to evaluate the dimensions of teaching physical education and/or student learning outcomes, educational goals, skills, competences or achievement (Capella-Peris et al., 2018).

Bearing in mind the significant factors for meaningful physical education, we defined MEANPE from a multifactorial perspective. We considered the assessment of meaningful physical education using six categories with 10 associated indicators (Table 1). As such, MEANPE includes 10 indicators for evaluating meaningful physical education activities in higher education which is delivered by teachers to pre-service teachers, who then take ownership of it in their out-of-class practice in the schools. MEANPE can be a learning tool to initiate meaningful physical education activities and/or assess formative educational approaches in all the domains of physical education.

Therefore, the aim of this paper is to describe the process of elaborating the rubric in two educational contexts (Spain and Lithuania) and having its content (indicators and levels) validated by 12 European and Latin American experts. Furthermore, it describes the final process of ensuring the reliability, validity, and feasibility of the rubric by employing a quantitative analysis with a semi-experimental design based on the perceptions of 250+ PST concerning two tests: one before the in-class definition of the physical education activities and the other following the out-of-class implementation of the physical activities in the schools.

3 Elaborating and validating the MEANPE rubric

Developing and validating the MEANPE was a three-phase process. First, the authors of this manuscript, which belongs to the Teaching Innovation Network on Cooperative and Reflective learning from University of Girona, developed and initial version of MEANPE based on the results from four focus group sessions. Each session was held online. The first and second

focus groups were made up of 16 physical education teachers: eight from the participating university in Lithuania and eight from their counterpart in Spain. The third and fourth focus groups were composed of six schoolteachers, and two professional choreographers: one from Lithuania and the other from Spain. The members of the research team addressed several fixed questions on the development of physical education curricula, physical education students' skills and competencies, pedagogical instruction in physical education, and the role of physical education in enhancing ethical and sustainable principles. In the second phase, the rubric was subjected to a validation process using external experts, which resulted in the second version of the rubric. In the third phase, this second version was used to evaluate the pre-service teachers' physical education activities in the primary schools. To this end, we engaged 250+ PST before and after implementing the activities. This section describes the process followed in each of the three phases in detail.

3.1 First phase: the elaboration of the first version of the rubric

The four focus groups' results analyses were carried out using the transcripts of the recorded sessions. The transcripts were analyzed by combining descriptive and structural coding processes. The initial analysis produced a first coding of the transcripts that included phrases based on the research subject (structural coding) and on the description of the research (descriptive coding). Once the transcripts had all been coded, the codes were then contrasted with the subject contents of physical education curricula in primary education institutions in Lithuania, Spain (Catalonia, Andalusia and the Basque Country), Uruguay, Armenia, Tanzania, Ethiopia, France and Italy. The analysis of the information classified in each code allowed us to identify the following categories: (1) solving motor physical situations, (2) physical education and health, (3) communicating experiences and emotions through physical education, (4) participating in collective physical activities, (5) identifying physical education as a form of leisure-time activity, and (6) fostering creative and choreographic interpretations through physical education. In addition, the rubric's categories were contextualized through a review of relevant articles in the literature presenting evaluation processes of meaningful physical education (Kretchmar, 2007; Bailey et al., 2009; Beni et al., 2017, 2019; Cañabate et al., 2018a,b; Merma-Molina et al., 2023) which enabled us to develop the final contents of the first version of the MEANPE rubric that would contain 10 indicators of analysis. Detailed below are several of the aspects that were considered.

Effective instructional approaches are those in which students are able to explain and verbalize, in a coherent and orderly way, the sensations and emotions generated during the physical activities (Cañabate et al., 2018b). For example, physical activity levels are related to school-aged children's fundamental motor skills when the pedagogical instruction is based on cooperative games. These have also been found to promote health and fitness benefits (Moghaddaszadeh and Belcastr, 2021). Many authors, then, have found that both autonomous and collective creation of meaningful physical activity improves health and wellbeing, especially for

TABLE 1 Indicators (I1–I10) and levels (1–4) of assessment of the Rubric for Meaningful Physical Education Assessment (MEANPE).

1. Solve motor situations effectively in the practice of physical activities	1.1. Identify body parts and notions of space and time. Experience different basic motor skills	1.2. Identify through movement, body axes using different static and/or dynamic positions and in relation to the notions of space and time. Solve simple motor situations	1.3. Solve motor situations created individually and/or in a group. Explain in advance the strategies to be applied to successfully complete a physical activity	1.4. Create movement effectively with individual and collective proposals to solve situations of daily life. Reflect on the most effective motor proposals for a given purpose. Solve complex motor situations created individually and/or in a group. Explain and verbalize in a coherent and orderly way the sensations and emotions generated during physical activity
2. Be aware of the limits and possibilities of the body in carrying out physical activities	2.1. Identify different positions in space and time of the place around the body	2.2. Adapt to the spatio-temporal perception in motion by introducing new bodily elements. Detect motor problems and look for a solution through movement	2.3. Show active behaviors that globally increase individual movement, aware of body limitations and possibilities. Appreciate physical wellbeing as a result of controlled physical activity	2.4. Create autonomous physical activity to improve and provide health and wellbeing. Reflect on the limits and possibilities of the body itself in carrying out physical activities in an argumentative way
3. Show healthy habits in the practice of physical activities and in daily life	3.1. Use basic health-related routines. Use healthy habits in any motor practice	3.2. Identify healthy routines and habits where one's own body and that of others are valued. Identify the reasons for practicing healthy habits	3.3. Apply learning that refers to healthy routines and habits. Develop an individual practice/proposal and/or in cooperative groups that promotes healthy habits	3.4. Reflect on individual and cooperative group healthy movements from a holistic health perspective. Promote healthy routines and habits in daily life
4. To value the regular practice of physical activity as a beneficial factor for health	4.1. Identify the basics elements of a healthy physical activity	4.2. Identify proactive behaviors as an added value to exercise and health	4.3. Assess the relationship between regular physical activity and its health benefits and consider the harm caused by inactivity or overtraining	4.4. Reflect on the fundamental aspects of living a healthy life. Perform physical activity regularly autonomously
5. Communicate experiences, emotions, and ideas using the expressive resources of one's own body	5.1. Express feelings and emotions from everyday situations through movement	5.2. Identify and communicate the expressive resources of the body both individually and collectively. Use the body as language to communicate with others	5.3. Communicate the possibilities offered by moving the body in different situations experienced both individually and in groups. Assess the body as a language to communicate with others	5.4. Communicate creatively through movement. Assess situations, emotions and ideas using the body as a resource to communicate
6. Take part in collective activities of body expression and communication to foster relationships with others	6.1. Participate in simple individual and group expression activities	6.2. Apply individual and group compositions using the expressive resource of the body	6.3. Elaborate gesture and movement as resources for expression and communication	6.4. Reflect on one's own and peers' initiative and creativity in collective expression activities that involve some complexity in problem solving
7. Participate actively in individual and group game and sports showing respect for the rules and classmates	7.1. Participate in individual and group movement activities. Identify the rules and sequences of the proposed games and sports	7.2. Participate actively in the creative activities of the movement game and sports. Value peer cooperation	7.3. Value choreographic play from a point of respect and cooperation. Create games by setting rules	7.4. Reflect on the aspects of improving the procedural work of the members of a cooperative group
8. Practice physical activity linked to the environment from the perspective of sustainable education	8.1. Participate in different types of physical activities as recreation and cooperative learning	8.2. Identify contextualized and sustainable cooperative physical activities	8.3. Propose contextualized and sustainable cooperative physical activities	8.4. Reflect on contextualized and sustainable cooperative physical activities
9. Creative interpretation through movement using the body as a creative engine	9.1. Identify creative motor skills	9.2. Apply creative motor skills	9.3. Propose motor creative abilities	9.4. Create creative motor-skill experiences
10. Be aware of the body's creative possibilities in performing physical/choreographed activities	10.1. Participate in creative strategies to develop gestural vocabulary. Identify short sequences of movement	10.2. Identify the different possibilities and creative strategies from a personal gestural vocabulary. Reproduce motion compositions	10.3. Propose creative strategies through a personal gestural vocabulary. Perform and sequence choreographic compositions	10.4. Reflect on movement in the development of other creative learning

those cases where students reflect on the limits and possibilities of the body itself when carrying out physical activities (Cañabate et al., 2018a). Indeed, reflecting on healthy movement and healthy routines from a holistic health perspective has been found to be a fundamental aspect of living a healthy life (Roliak, 2020).

Meaningful physical education can also be assessed by students experiencing grounded situations, emotions, and ideas, using their body as a resource and communicating creatively through movement (Cañabate et al., 2018a,b). It can be also assessed through reflecting on one's own initiative and creativity in collective or individual expression activities, thus promoting values, socialization, and knowledge of social issues, as well as developing social skills (Kirk and Haerens, 2014; Capella-Peris et al., 2018; Wallhead et al., 2021). Likewise, reflecting on movement can be a way to develop other creative learning. The benefits of physical movement are diverse as it increases resilience and cooperative skills (Buck and Snook, 2020), and promotes inclusion, self-expression and personal engagement (Hains et al., 2021).

One of the challenges involved in evaluating meaningful physical education is in being able to identify the different levels or degrees of each indicator. The most basic involves low levels of attainment, with PST being capable of identifying low levels of physical education activities, able to define physical activities in a basic way, and participate in fundamental physical processes. The highest level involves the processes of creating, implementing, analyzing, and reflecting on meaningful physical activities. The first version then, included the indicators and levels that specified the components of each indicator (Table 1).

3.2 Second phase: validation of the rubric through the appraisal of external experts

To assess the validity of the contents of the rubric, twelve experts on the didactics of physical education and sport pedagogy from four different universities in Spain, three in Latin American and five in Lithuania, were contacted by letter and invited to participate in the validation process. Upon accepting, they were then sent an introductory letter outlining the objectives of the validation, the first version of the rubric and the assessment methodology. All were asked for their suggestions and comments after evaluating the levels and degrees of the rubric. The validation of the first version included a dichotomous response to the validity, correspondence, formulation and belonging of indicators and levels (Alsina et al., 2017). In addition, experts were asked to provide feedback on whether the 10 indicators correspond with the four levels to assess meaningful physical education. They were also asked to comment on the language and terms used to describe the indicators and the levels.

The main aspects raised by the experts were as follows. All agreed that the 10 indicators to assess PST physical education activities are an essential part of providing meaningful physical education (Figure 1). Correspondence, formulation and belonging of indicators and levels were also rated positively (Figure 1). Suggested changes for improvements concerned the use of language, mainly regarding the verbs associated to each level of assessment and the experts also proposed providing definitions

for the terms used in the theoretical foundations such as, motor physical situation, healthy motor physical situation, and creative motor physical situation. Accordingly, the text for the levels of indicators 1, 3, and 9 were changed. For level 1, the verbs were changed to *identify*, *use*, and *participate*, for level 2 *develop*, *identify*, *adapt*, *show*, and *participate*, for level 3 *assess*, *communicate*, *apply*, *propose*, *interpret*, and for level 4 *reflect*, *create*, and *communicate*. In addition, the terms *relevant*, *proper*, *systematize*, *consciously* and *different*, were removed because of their ambiguity and difficulty in recognizing different degrees of expertise in different domains; a problem that had also been pointed out previously by Redy and Andrade (2010) and Alsina et al. (2017).

3.3 Third phase: evaluation of the rubric based on quantitative comparison between the in-class test and out-of-class tests

A quantitative analysis was based on the scores given by 250+ pre-service teachers for all the indicators. The initial analysis (pre-analysis) was based on the scores provided by the PST at the beginning of the experience, while the final analysis (post-analysis) was based on their scores once they had carried out the physical activities in the primary schools. PST were involved in designing, implementing and reflecting on a set of cooperative physical activities: contextualized physical challenges, guided discovery, and psychomotor problem solving. In the schools, the PST implemented 10 cooperative physical activities that were developed during four consecutive weeks (one per week) with students attending a physical education class. In the process, 20 scores per students were counted for each indicator of the rubric: 10 at the pre-analysis and 10 at the post-analysis. The scores were entered onto a spreadsheet and later exported to the software package Stata[®] for analysis.

Figure 2 shows the results for the average scores for the 10 indicators in the rubric for all students considered in the sample. Pre-test analysis in black and post-test analysis in gray. The PST scores for each of the 10 indicators were between 2.5 and 4.0, indicating a medium to high level of assessment (NB: 4 was set as the maximum score and 1 the minimum value). The comparison between pre- and post-test scores showed higher scores once the students had participated in running the meaningful physical education activities in the schools. For almost all the indicators, the difference between pre- and post-test fluctuated from 0.24 to 0.73, which might be considered a high difference given the score range. The confidence levels (also plotted in Figure 2), did not overlap when the pre- and post-test results were compared, inferring that the two statistics are significantly different from one another at a confidence level of 95%. Therefore, the instructional educational approach based on the applicability of meaningful physical activity pointed toward an improvement in the pre-service teachers' level of scoring when using the rubric. Table 2 shows the outcomes of the linear regression for each rubric indicator. Each row indicates a separate regression, and robust standard errors have been used throughout. For all indicators, PST provide higher scores in the post-test analysis. The differences were found to be statistically

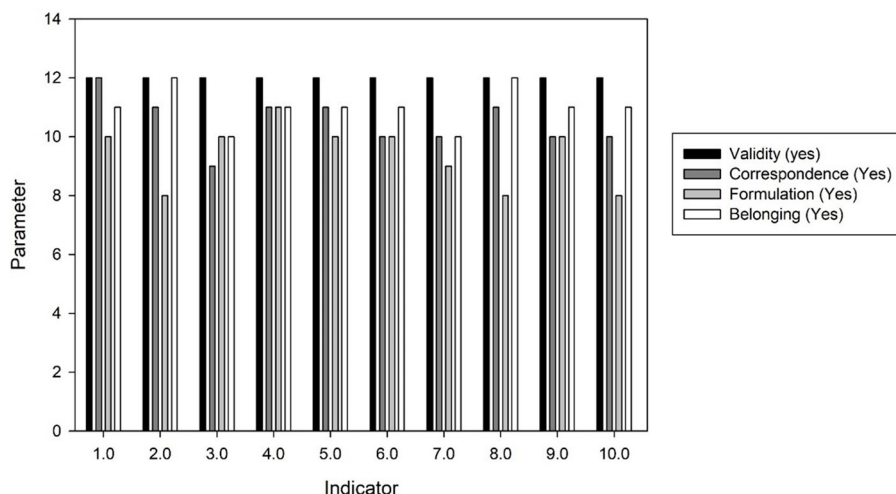


FIGURE 1 Results from the 12 experts' assessments on the validity, correspondence, formulation and belonging of the 10 MEANPE indicators. The figure contains all the positive answers for each indicator.

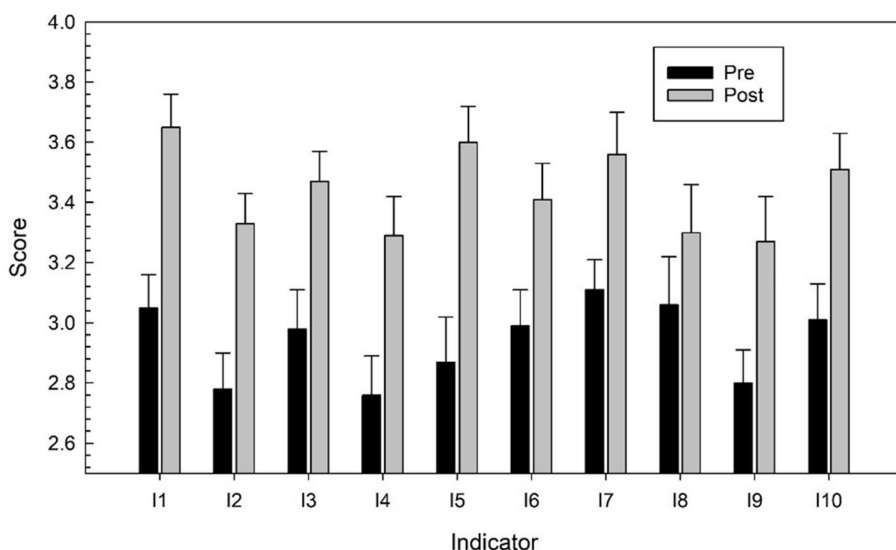


FIGURE 2 Average score for each of the 10 indicators of the rubric (I1–I10), including confidence intervals, pre vs. post analysis.

significant at a 99% confidence level for all 10 indicators making up the MEANPE rubric.

4 Discussion

Seventy-one percent of countries across Europe have reported monitoring the quality of physical education classes in primary schools, including screening, quality audits and how the instructional approaches foster targets as part of the curriculum. These countries stated that training in health-physical activity is either a mandatory or optional module in the curriculum for physical education teachers. “Good-quality physical education” is

a “planned, progressive, inclusive learning experience that forms part of the curriculum in early years, primary and secondary education,” with learning experiences being “a means of growth and for individual and collective expression” (World Health Organization Regional Office for Europe, 2018), enhancing individuals’ development. To ensure children receive meaningful physical education, approaches must consider activities that are inclusive and appropriate for and within their capabilities, thus activating cognitive understanding and cultural context, as well as fostering positive social and emotional skills and attitudes that can lead to a more successful and enjoyable active life (UNESCO, 2015). Meaningful physical education is then understood as the “what, why and how” physical activities deliver personal significance

TABLE 2 Linear regression results for the 10 indicators (I1–I10) post coefficient of the rubric.

	Coeff. "post"	SE	t	P-value	R ²	N
Indicator 1	0.3704 ^a	0.0576	6.98	0.000	0.1282	253
Indicator 2	0.3441 ^a	0.0703	4.56	0.000	0.0674	255
Indicator 3	0.2896 ^a	0.0709	4.62	0.001	0.0388	254
Indicator 5	0.3286 ^a	0.0710	4.78	0.000	0.0845	249
Indicator 6	0.3609 ^a	0.0689	4.37	0.000	0.0591	255
Indicator 7	0.3738 ^a	0.0646	4.27	0.000	0.0779	250
Indicator 8	0.3065 ^a	0.0755	4.29	0.000	0.0580	254
Indicator 9	0.3905 ^a	0.0767	4.86	0.000	0.0583	253
Indicator 10	0.2451 ^a	0.0773	3.43	0.002	0.0395	253

Source: Authors' elaboration.

^aSignificant at 99% confidence level.

(Kretchmar, 2007), including not only personal development but interactions with others, artifacts, content, and pedagogies (Beni et al., 2017).

Following an analysis of several curricula worldwide: Lithuania, Spain (Catalonia, Andalusia and the Basque Country), Uruguay, Armenia, Tanzania, Ethiopia, France and Italy, along with the help of a panel of international experts on the didactics of physical education and sport pedagogy, we came up with six categories that drive meaningful physical education in primary school education: (i) students solving motor physical situations, (ii) links between physical education and health, (iii) how physical activities can be used to communicate content and emotions, (iv) individual and group skills and competences a student can acquire during collective physical activities, (v) physical education as a form of leisure, and (vi) fostering creative and choreographic interpretations through physical education. In addition, we developed a rubric (MEANPE) to analyse the ability of new PST to develop meaningful activities for physical education in primary schools. The relevance and applicability of the 10 indicators in the rubric's first draft were rated overwhelmingly positive. Some minor changes to the language and definitions for the terms employed were suggested as ways to further improve the rubric. While using specific rubrics to analyse educational processes and approaches (usually focused on the unique perspective of evaluation), has increased, more recently rubrics are also being used to better define the narratives and methodologies to safeguard the principles of learning and the expectations that lie behind them (Redy and Andrade, 2010; Lleixà et al., 2016; Alsina et al., 2017; Blázquez, 2020). In our research, analyzing the application and use of the pilot or initial version of our rubric by PST before and after developing and implementing their physical education activities based on cooperation (Cañabate et al., 2021), supported the statistically significant differences in the PST scores, demonstrating that the MEANPE rubric is a valid instrument for measuring meaningful physical education in primary schools.

Indicators 3 (show healthy habits in the practice of physical activities and in daily life), 7 (participate actively in individual and group games and sport showing respect for the rules and classmates), and 8 (practice physical activity linked to the environment from a sustainable education approach) are based

on cooperative instruction. Cooperative learning is grounded on the principles of social relationships, personal involvement and individual responsibility which underpin meaningful physical education (Cohen and Zach, 2013; Cañabate et al., 2021). Cooperative learning is a pedagogical practice theoretically supported by cognitive learning and social interdependence, commitment to the values of fairness, social responsibility, and mutual trust among learners. As defined in Indicators 7 and 8, meaningful physical activity relies on individuals cooperating with a sense of personal responsibility, and interacting with their peers, society, and the environment (Cañabate et al., 2021).

Meaningful physical education envisages a transformation of teaching (Quennerstedt, 2019; Colomer et al., 2020), the development of new research programmes (Kirk and Haerens, 2014), and a change in perspectives, i.e., toward disrupting the *status quo* of contemporary physical education curriculum design (Wallhead et al., 2021). Finally, meaningful physical education demands for a new assessment culture (Dochy et al., 2006). During the implementation of the MEANPE rubric and the instructional approaches taken by the PST in the schools, experienced physical education teachers expressed an interest in using the MEANPE rubric themselves thanks to the reflective and democratic principles it is based on and its concept-based practical direction concerning meaningful experiences (Fletcher and Ní Chróinín, 2022).

Within education for sustainable development, students acquire competences that will enable them to tackle constantly changing global challenges, and allow them to evaluate risks, dangers and uncertainties, analyse complex systems, assess the impacts their own activities have and, finally, be able to envisage and develop sustainable, change-promoting solutions (Colomer et al., 2020). When education for sustainable development is rooted in contextualized knowledge for establishing sustainable development goals, it directly addresses sustainable competences (such as cooperation) along with specific subject-related skills (Mohd-Yusof et al., 2015; Cáceres-Jenses et al., 2021). That is of particular interest when sustainable development goals and outcomes link to societal responsibility, institutions, and cooperatives (Bhowmik, 2021). Thus, future generations of young students will become active agents for societal change (De La Vega-Leinert et al., 2009), adopting new ways of working that

will promote multidimensionality through collaboration and an interdisciplinary outlook (Michalopoulou et al., 2019; Berasategi et al., 2020). Meaningful physical education also considers how cooperative learning can address gender differences and inequalities (i.e., Agenda 2030 Goals 5 and 10 for sustainable development). Likewise, the two categories of cooperative learning—positive interdependence and the promotion of student feedback—may help to reduce inequalities in cooperative groups.

Therefore, this kind of intervention in teacher education would complete the cycle of its assessment and usefulness by generalizing its use not only for shaping university students' formative education processes, but also for experienced teachers already working in primary school institutions. In addition, physical activity impacts on the children's interaction with the outside world (Teixeira Costa et al., 2015). Therefore, meaningful physical interaction may address not only fostering the individuals' competences but also benefiting broader societal goals toward sustainability (Merma-Molina et al., 2023).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by University of Girona, Agreement UdG/EC2021/04. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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Author contributions

DC: Funding acquisition, Investigation, Project administration, Resources, Supervision, Writing—original draft. RB: Data curation, Formal analysis, Investigation, Methodology, Supervision, Writing—original draft. EH: Formal analysis, Investigation, Methodology, Writing—original draft. JC: Conceptualization, Data curation, Formal analysis, Validation, Visualization, Writing—original draft, Writing—review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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