

## Chapter

# Beyond the Gym Floor and the Classroom: Physical Education as a Catalyst for Transdisciplinary Physically Active Learning in the Portuguese Educational Landscape

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## Abstract

This chapter explores the transformative potential of physical education (PE) when integrated into a transdisciplinary and physically active learning (PAL) framework. By moving beyond the traditional confines of the gym and classroom, we examine how PE can serve as a core component of holistic education. The chapter delves into the theoretical underpinnings of transdisciplinary and active learning, highlighting their alignment with the goals of PE. It will provide practical examples and strategies for implementing transdisciplinary PE programs, emphasizing collaboration with other subject areas and the creation of authentic learning experiences. The chapter will also discuss the role of PE in fostering critical thinking, problem-solving, and creativity, while promoting physical literacy and well-being. Ultimately, this chapter aims to inspire educators to reimagine PE as a dynamic and essential component of a comprehensive curriculum.

**Keywords:** physical active learning, health, school, policies, methodologies

## 1. Introduction

The International Standard Classification of Education (ISCED) 1 level of education [1], primary education, is well known for its relevance in the educational process and systems worldwide. It all started (and starts) there, as formal education and the primary basic curriculum for the subsequential educational process and learnings, individual development, and social success [2–6]. The school also works as an integration, cohesion, and inclusion tool for societies. So, over time, the number of studies and knowledge about that role has increased. It has an undeniable role but is also criticized and problematized,

for it can have negative effects on individuals' development and social inclusion as well as their equal future opportunities and access to rights [7–9]. The ISCED 1 level has an imperative roleplay since literature has been indicating its central relevance in developing self-perception, self-motivation, and auto-perceived efficiency, but also in building perceptions and preconceptions on the other and on itself [10–12]. All those factors play essential roles in future positive motivation, engagement, and a positive learning process [11, 12]. Also, at this educational system level, especially for students who have not attended ISCED 0 level, there is an increased risk of educational disadvantage that comes forward, on a contrast among school educational goals, language, and culture versus those indicators on family's background, experiences and opportunities, since it is the first (or the primary) contact with formal education and the educational system [13].

History of education reports, since (at least) the Classic Era of Greeks and Romans, the debates and investments around curriculums that targeted the individual's holistic development and learning and those that targeted specific economic or labor market needs [14–18]. Throughout times, and even today, differences can be observed in the educational systems. They can reflect either a more inclination toward a market and labor integration, defining profiles and specific curriculums that respond to economic and social specificities and needs, or leaning toward humanistic and holistic curriculums that target an integral individual development, freeing possibilities of its exploration and learnings. Those positions pour on educational policies that impact the learning outcomes and curriculum choices for the ISCED 1 level but also reflect (or are reflected) upon the teacher's training curriculum and fundamentals. Independent of the position taken, it has been stable through time that ISCED level 1 has an integrated view of the multidisciplinary curriculum approach and targeted individuals' complete and holistic development [15–19].

For many years, the primary school level profile was defined as basic learning such as reading and writing, rudimentary math, history and culture, and some artistic and physical activities reminiscing classical educational ideals. Today, the expected outcomes of the ISCED 1 level curriculum and learning are much more complex in European countries, implying the acquisition of advanced content and more profound development of skills added to the basic learnings [20]. Some countries have defined policies, legislation, and regulations that allow more curricular flexibility than others, and some have tried to implement educational models and methods that procure access to education as a complex process that includes formal, informal, and non-formal learning—also seen as complex space and context, a system, with a specific organizational culture that is not closed to the surrounding communities and families [18–21].

That does not mean those educational systems are successful at that, partially or globally, as the gap that can occur (and it does) between the policy level and praxis level is well known. The research field of change resistance among school contexts and teacher profiles is underlined here [22]. Portugal is an example of it, as it has launched, since 2018, the inclusive education legislation that targets a new perspective and fundamentals to all educational systems and its practice. Schools were supposed to use curricular flexibility and pedagogic differentiation significantly, throwing the universal measures of inclusive education for all students, but the reality is very heterogeneous. Those policies integrated a municipality decentralization that would allow for the attendance of communitarian specificities that are far from expected and designed. It is to say that it was expected, specifically at ISCED level 1, an integrated view of the different disciplinary areas as one and articulated in the diversity and specifics of its school and students' needs, reaching for their maximum potential [21, 23].

Another relevant aspect is the teacher's view and position, and its training has long been a significant object of study. Europe does not have joint teacher training, revealing very heterogeneous among countries. The ISCED 1 level teachers' training also does not have a consensus. So, significant differences can be found between countries and through time in the same country. Some countries can allow different curriculum paths to access teachers' professionalization [18, 20, 23, 24].

Physical education (PE) is no exception to all exposed anteriorly. Specifically, in ISCED 1 level, the Portuguese example shows that the ISCED level 1 professionalized teachers are responsible for all curricula, including PE. They are in a mono-teaching model, although sometimes two teachers attributed to the same class can be found. Politics regulates didactics' and subjects' duration in the school schedule and the minimum learning targets to obtain. Besides math and Portuguese, which have the most schedule attributed, there is study of the environment ("*estudo do meio*") (includes history, environmental, geography, and sociology), and the less scheduled expressive are PE and artistic expressions. Also, for some years, there has been English learning. After the school schedule, the school full-time project inserts some extracurricular activities on school grounds, targeted to enrich students' development but mainly to provide occupational service until parents finish their work schedules. Reports say most teachers invest in the main didactics in the school schedule and believe PE and artistic expression should be developed in extracurricular activities. Either because they see themselves as not so prepared for those development and educational fields or because they say they are too much pressed to target success in *maths, Portuguese, and estudo do meio*, leaving few times to explore the other curriculum fields correctly. This reflects the teachers' limited knowledge and perspective about the interconnection and flexibility among the curriculum legal design and possibilities, especially at the ISCED1 level.

Despite efforts to increase children's physical activity levels—such as mandating a minimum number of physical education hours in European schools—we continue to see a rise in physical inactivity, along with its associated health and developmental problems [25].

## 2. Physical inactivity

### 2.1 Physical inactivity adverse effects

The terms physical activity, exercise, inactivity, and sedentariness are often used interchangeably to describe different levels of skeletal muscle movement. However, it is crucial to distinguish these concepts to understand their physiological, health, and economic implications. Physical activity, as defined by Carpersen et al. [26], encompasses any bodily movement that increases energy expenditure beyond resting levels. It includes daily activities like gardening, cleaning, and walking. Exercise is a subset of physical activity, characterized by being planned, structured, repetitive, and intended to improve physical fitness. In contrast, physical inactivity and sedentariness refer to insufficient or no physical activity. These terms are frequently misused and should be clearly defined to avoid confusion.

Current child and youth guidelines, from 6 to 18 years, recommend a combination of at least, 60 minutes per day of moderate-to-vigorous physical activity, with muscle-strengthening physical activity on at least 3 days/week [27]. However, despite these recommendations, there is a high prevalence of children and adolescents who do not attain these minimal recommended levels and, thus, remain physically inactive [25].

Physical inactivity is a highly prevalent condition worldwide and a major global public health concern [28]. More than 80% of boys and girls aged 11–17 years spend less than 1 hour/day on moderate-to-vigorous-intensity physical activity. High levels of physical inactivity on childhood are associated with lower socioeconomic status, physically inactive parents, high levels of screen time, parents perception on children competences, and sex [29]. Regardless of country, region, age, and income, the prevalence of girls is higher than boys (~85% and 76%, respectively), further emphasizing the persistence of sex differences in physical activity engagement throughout the lifespan [27].

Insufficient levels of physical activity increase the risk of childhood obesity [30, 31]. Despite the efforts to reduce physical inactivity and its related adverse health effects in the last decade, the prevalence of obesity during childhood increased with advancing age, affecting 8% of preschool children (2–5 years), 18% of school-aged children (6–11 years), and 21% of adolescents (12–19 years) [32]. Moreover, the so-called prevalence of “adult” comorbidities associated with physical inactivity like type 2 diabetes mellitus, hypertension, nonalcoholic fatty liver disease, obstructive sleep apnea, and dyslipidemia also increased among children and youth [32]. Alarmingly, obese children have double the risk of becoming obese adults [32] and of premature death [33].

Apart from the health problems, the economic burden of global physical inactivity ascends to US\$27 billion annually [27] and the most recent World Health Organization Global Status report reiterates that if this trend continues in the next years, the 15% target reduction in inactivity will not be met globally for adults until 2030, reinforcing the need to double the efforts to promote physical activity and exercise programs early on during childhood and adolescence to prevent its adult adverse effects. Programs focused on active recess time at schools, active transport to and from school, physical activity and exercise during leisure and school time will enhance growth development, healthspan and promote psychosocial well-being throughout life.

## **2.2 Physical activity and exercise benefits during childhood**

Physical activity and exercise have multiple acute and long-term benefits across the entire lifespan. Engagement in regular physical activity and exercise training during childhood improves overall growth development, social interaction, and health-related quality of life while decreasing the risk of chronic diseases and mortality [34]. Multiple studies demonstrate that improving cardiorespiratory fitness, muscle mass, and strength has multiple cardiometabolic benefits and is the protective factor against childhood obesity and obesity-related comorbid conditions [35].

Despite the inconsistencies on exercise benefits on weight loss in children and adolescents with obesity, exercise interventions significantly impact body composition, regardless of exercise type (i.e., aerobic, resistance, combined training, or high-intensity interval training). Nonetheless, for greater health benefits, evidence suggests that combined exercise or high-intensity interval training may be more effective in controlling intra-abdominal obesity and cardiovascular risk factors in pediatric populations than aerobic or resistance exercise alone [35]. Acute and long-term exercise promotes significant benefits in the brain, including increased glia, neurons, blood vessels, white matter and dendritic complexity, which in turn are associated with improved cognition [36]. Evidence supports that increased motor unit activation induced by exercise increases neuronal function [37], brain structure and function,

and enhances cognitive performance and academic achievement [38, 39]. These benefits are mediated by improvements in several domains of cognition, metacognition, and increased life skills [40], which are benefits that last until adulthood [36].

Exercise benefits also extend to common childhood disorders such as asthma, attention-deficit/hyperactivity disorder, and autism spectrum disease. The last two conditions raise difficulties in managing class time and activities. Attention-deficit/hyperactivity disorder affects 8–10% of children worldwide, and moderate-to-vigorous aerobic exercise alleviates the traditional cognitive, behavioral, and physical symptoms of this disease [41]. In addition, self-esteem, anxiety, depression, somatic complaints, and academic and classroom behavior were also reported to be improved after regular aerobic exercise in children with this condition [41]. Noteworthy, no adverse event was reported in any studies with clinical populations, indicating that exercise is a safe and well-tolerated treatment option in healthy and in children with neurological disorders [42]. Exercise also has multiple benefits for autism spectrum disorder, a neurodevelopmental condition characterized by severe social skills deficits, deficiencies in language communication, and restricted, repetitive, and stereotyped patterns of behavior, interests, and activities [43]. Recent evidence shows that exercise has beneficial effects on metabolic indicators (i.e., HDL-C, LDL-C, and total cholesterol), autism traits, and parent-perceived quality of life [44].

In summary, from the more traditional types (i.e., aerobic and/or resistance training) to the non-conventional forms (e.g., Tai-Chi-Chuan), evidence highlights that physical activity and exercise enhances growth and maturational development in children while minimizing the risk of cardiometabolic health adverse outcomes during child development. Hence, physical activity and exercise training should be highly encouraged to counteract the increasing prevalence of diseases in modern society during childhood.

### **3. Looking at theoretical frameworks**

#### **3.1 Inter, multi, and transdisciplinarity**

It is common for education settlement through disciplines. Even the present book chapter looks for it as a “mono” discipline—Physical Education. Our work pretends to challenge this narrow view of education, and highlight the potential role of Physical Education in the educational system and for children development [45, 46]. Considering that “interdisciplinary” and “multidisciplinary” are used to promote the development of collaborative work between disciplines, at least in theoretical thinking, where problems are viewed as complex and simultaneously from either different disciplinary perspectives or disciplinary knowledge, and also as manifest in methodologies, tools, or concepts, are transferred to address important questions in a certain field.

The multidisciplinary term refers to many, multiple, or more than one existing discipline [47]. This means that multidisciplinary is settled on knowledge from different disciplines but it still stay within its methodological boundaries to approach a problem or a solution [48]. Despite integration efforts, the unique languages of each discipline persist [49]. The term “inter” suggests reciprocity, mutual exchange, and connection [47]. Interdisciplinary work involves multiple existing disciplines collaborating in a cohesive manner, fostering the creation and adaptation of innovative solutions [48, 49].

These terms consider the added value of using more than one discipline to recognize for research [47, 50] and educational fields [51, 52]. We can see that, in sport sciences and physical education, this integrative approach is not overly contemporary. The European College of Sport Science still points “the promotion and application of world-class, multi- and interdisciplinary science in sport, exercise, physical activity and health.” Even in Portugal, it is not very clear the relevance of transdisciplinary work, on one side, added value of the transdisciplinary nature of learning in the school environment is recognized in item j) of article 3 of Order no. 5907/2017 [53] by mobilizing diverse literacies, multiple skills, both theoretical and practical, and in order to promote scientific knowledge, a critical and interventionist spirit, creativity and collaborative work. On another side, it is still a hostage of interdisciplinary terms, namely, Curriculum articulation and interdisciplinarity, which reflects a procedure of Areas of Curricular Articulation combined with Areas of Curricular Autonomy by the schools. The legislators maintain the focus on interdisciplinary terms rather than seeking transdisciplinarity. For example, the Ordinance no. 181/2019 [54] defines the terms and conditions under which schools, within the scope of autonomy and curricular flexibility, can implement a management of more than 25% of the basic curricular matrices of the educational and training offers of basic and secondary education, Ordinance no. 223-A/2018 [55] that regulates the educational offers of basic education provided for no. Article 10 and Decree-Law no. 55/2018 [56], which establishes the curriculum of basic and secondary education and the guiding principles for the assessment of learning, we can count a total of 14 references to interdisciplinarity, compared to two mentions of transdisciplinarity.

In the last decades, there has been a rising recognition that the transdisciplinary approach encourages the removal of disciplinary frontiers and blinkers and provides a wider knowledge. Transdisciplinary approaches go beyond interdisciplinary and multidisciplinary approaches by integrating knowledge from different disciplines and applying it to real-world problems. This approach can lead to more comprehensive and innovative solutions.

A transdisciplinary perspective broadens our understanding of the world by encouraging a holistic approach to knowledge and recognizing the interconnectedness of texts, contexts, and individuals. Transdisciplinary approaches challenge disciplinary boundaries, focusing on meaning-making in authentic, real-world contexts. Inquiry-based transdisciplinary curricula have been shown to enhance pre-service teachers' collaboration, reflection, and curriculum design skills [57]. Transdisciplinary approaches in teacher education can foster creativity, critical thinking, and problem-solving abilities [58]. While future teachers often believe they can address diversity, some may hold negative views toward inclusive education [59].

We would also like to highlight the Physical Activity Strategy for the WHO European Region 2016–2025 [60] and the Global Action Plan on physical activity (PA) 2018–2030 [61], which present the need to enhance physical activity, strengthen teachers' competence and create school environments that encourage young people to be physically active. As mentioned in the Declaration of Madrid, “No Education without Physical Education” October 27, 1991, amended November 10, 2011 [62], “There is a need to emphasize the holistic approach to Physical Education as a subject for health empowerment and teaching/learning values and ethics.” and “Physical Education makes a major contribution to the motor, cognitive and social development of children and is one of the most important bases of lifelong physical activity.”

### **3.2 Physically active learning**

Physically active learning is a new approach that tries to overcome competing interests between academic pursuits vs. time spent on physical activity while addressing core educational goals [63]. PAL is considered a core component of many whole-school approaches to physical activity [45]. PAL offers a strategy to enhance physical activity opportunities within the school day without compromising academic learning time, which is a common concern among teachers [64]. This approach aligns with other school-wide initiatives, like the active schools model, promoting a more holistic and physically active learning environment [63, 65]. It is pointed out that PAL combines health and educational disciplines, in this case, not only “mono” discipline but also “multi,” “inter,” and transdisciplinary [66].

A multidisciplinary approach of PAL is to take the integration of physical activity (PA) into educational goals, often driven by health considerations, and has primarily originated from the health field. While PA offers numerous benefits, health has historically been the primary motivation [67]. This trend is evident in research on classroom-based PA and PAL, where health-related outcomes often dominate the focus [68]. One contributing factor is the involvement of health researchers in designing interventions for school-based PA programs [69, 70]. Consequently, research methodologies have frequently centered around measuring PA levels and assessing the impact of classroom-based PA on physical fitness, cognitive function, and academic performance [71].

The term PAL inherently suggests an interdisciplinary approach, encompassing both physical activity and learning. This distinction is crucial to understanding PAL as an interdisciplinary field, as it involves not merely combining but synthesizing these two disciplines. While health has traditionally taken precedence over education, there is a growing interest in interdisciplinary research within the broader PA field. This shift reflects a desire to explore more complex and multifaceted opportunities [44].

While transdisciplinary research within the PAL field remains relatively limited, there is a growing interest in transcending traditional research methodologies to advance PAL [72]. This shift is underpinned by a desire to broaden research perspectives, fostering a reciprocal relationship between theory and practice. This approach justifies holistic perspectives on physical activity and active learning methods in education [50, 73, 74]. By adopting a transdisciplinary lens, health and education disciplines can engage in a mutually beneficial exchange between theory and practice. Unlike other research paradigms, transdisciplinary research ensures a continuous interplay and mutual influence between theory and practice [49].

### **3.3 Benefits of transdisciplinary and active learning for primary students**

While the results indicate a positive reception of transdisciplinary methodologies by participants and underscore the benefits in terms of content assimilation, understanding of tasks and objectives, and value of novelty and applicability, certain limitations should be acknowledged. For example, some students encountered difficulties in the use of digital tools, ideation of stories with social content, and utilization of ARASAAC pictograms. While the incorporation of new ICT tools was generally beneficial for the development of students’ learning and communication skills, it is essential to address the observed difficulties and barriers to ensure equitable access and participation for all students [75]. Two practical implications of this study include the potential integration of transdisciplinary methodologies into educational curricula to enhance student engagement and

foster holistic learning. Additionally, the provision of ongoing professional development opportunities for educators focused on transdisciplinary teaching methods, and digital literacy empowers them to create dynamic learning environments that cater to diverse student needs and promote meaningful learning experiences [75].

The potential of teaching and learning general DST/SP concepts through body movement experiences in elementary school, enhancing students' abilities to integrate and transfer knowledge among phenomena studied in natural and social sciences. The proposed transdisciplinary embodied education may offer a truly integrative approach to STEAM teaching [76].

The findings reveal that teachers' sensemaking of PAL is driven by their professional identity and practice. The findings from our study of PAL contribute to this field by confirming the importance of identity in explaining how teachers use a new practice – such as PAL – that lies beyond their established subject competence in their everyday teaching practice [77]. Modest levels of PAL increased activity levels. No evidence was found to suggest PAL had a negative effect on children's academic outcomes, and PAL could positively impact children's concentration [78].

### **3.4 Alignment of transdisciplinary and physical active learning with the Portuguese PE goals**

Nowadays, when we intend to develop educational activity, it is necessary to know the Profile of Students Leaving Compulsory Education (Dispatch no. 6478/2017) [79] and the Essential Learning (Order no. 6944-A/2018) [80], approves the Essential Learning for basic education). So, we need to consider the Student Profile Competency Areas: (a) Information and communication, (b) critical thinking and creative thinking, (c) personal development and autonomy, (d) esthetic and artistic sensitivity, (f) body awareness and mastery, (g) languages and texts, (h) reasoning and problem-solving, (i) interpersonal relationships, (j) well-being, health and the environment, and (k) scientific, technical and technological knowledge.

The Portuguese Physical Education curriculum aims to foster holistic child development, promoting physical, cognitive, social, and emotional well-being. Transdisciplinary and PAL approaches offer promising avenues to achieve these goals. The present chapter provides a reflection on the possible alignment of these approaches with the Portuguese PE curriculum, highlighting potential synergies and areas for improvement. This means that we can develop transdisciplinary PAL, emphasizing the interconnectedness of different aspects of learning and aligning it with the Portuguese curriculum's focus on holistic child development. At the same time, we can lead the students to engage in a variety of physical activities, and students develop essential movement skills, knowledge, and attitudes. Also, transdisciplinary learning encourages critical thinking, problem-solving, and creativity, all of which are vital cognitive skills that align with the Portuguese Student Profile Competency Areas. Active learning and collaborative activities inherent in transdisciplinary approaches foster social and emotional skills, such as teamwork, communication, empathy, and self-esteem.

## **4. Let us walk the talk: Implement transdisciplinary and physical active learning in primary schools**

There is an inherent complexity required to change and sustain personal behaviors, and the teachers' PAL behaviors are no exception [80]. The authors suggest that

teachers must receive the necessary training, resources, and support to develop the capability to implement and adapt PAL. Also, PAL training programs should continue as teachers' develop their experience and capability. Furthermore, the content should be updated and refreshed to become more complex and challenging over time. Additionally, it is important to engage all levels of the school community (e.g., educational assistants, school managers, and parents) for PAL to be fully integrated into a broader school system [73, 81].

For example, some activities related to language disciplines. One example of lessons emphasized drill and practice of factual information is the "Spelling Freeze Tag." It required students to run around an outdoor area marked by cones. When tagged, they would "freeze" in place and be quizzed by a classmate on a list of spelling words. Correct answers would release the student to continue running, while incorrect answers led to another word. This activity served as a review of factual knowledge [82].

In **Table 1**, we present some examples of transdisciplinarity between Physical Education and Mathematics. Pereira [83] analyzed the potential of Physical Education and Mathematics through exploratory work with ludic-motor activities developed with a group of primary school children and a group of preschool children. The relationship between Physical Education and Maths was explored through games, which benefiting the children's learning in a playful way. With regard to the work carried out in primary school, four tasks were developed in accordance with the curricula for this level of education. **Table 1** shows the objectives worked on in each of the subject areas in the four tasks implemented.

According to Pereira [83], the tasks developed were successful because the objectives set were achieved, and the children participated actively, with motivation and commitment, always contributing to learning. Specifically in the Fun rubber bands task, which consisted of introducing new concepts, the author considered the result quite surprising and positive. The author point out that, when carrying out the tasks, the children were more relaxed, enthusiastic and cheerful than in the classroom. Initially, they thought it was just a moment of play, but when they finished they realized that the tasks contained concepts covered in the classroom. In this type of task, the children were able to maintain moments of attention and assimilation. Maths can be linked to PE through activities that articulated these two domains with the aim of promoting the learning of mathematical notions, and related to the content to be covered (**Table 2**).

According the using PE to learn Maths provided a different and applied view of the content. The students were able to acquire the mathematical concepts worked on in the different activities and realize their importance. The physical exercise improves pupils' interest in acquiring mathematical knowledge, as pupils are more enthusiastic and committed to carrying out a dynamic task that seems like a game, making it a good teaching strategy for achieving more significant learning. The proposed objectives are achieved, as it was possible to break away from the traditional way of teaching maths and the students were committed and enthusiastic when carrying out the activities. The benefits of the activities were demonstrated and the students realized that they were working on maths in a different way [76, 78, 82, 83].

Costa et al. [84] present a teaching proposal for a third grade class, using Portuguese Traditional Games (PTG) for children, with the aim of promoting Financial Literacy (FL). Financial Education (FE) is reflected in various Ministry of Education documents and also in the field of "Geometry and Measurement." There are references to "money," and the objectives are to learn about Euro notes and coins, as well as to add and subtract amounts of money. The authors, therefore, proposed

Task	PE objectives	Maths objectives
The king's beads	<ul style="list-style-type: none"> <li>• Developing reaction and execution speed;</li> <li>• Interacting between pairs;</li> <li>• Co-operating between pairs.</li> </ul>	<ul style="list-style-type: none"> <li>• Performing additions and subtractions mentally – logical reasoning and mental calculation;</li> <li>• Communicate orally to describe and explain procedures, reasoning, and conclusions;</li> <li>• Recognize and memorize basic addition and subtraction facts;</li> <li>• Identify, interpret, and describe spatial relationships, situating themselves in space in relation to others and objects.</li> </ul>
The naughty monkey	<ul style="list-style-type: none"> <li>• Developing general dynamic coordination and muscle strength;</li> <li>• Developing hand-eye coordination;</li> <li>• Developing orientation and spatial-temporal perception;</li> <li>• Developing balance;</li> <li>• Developing fundamental motor skills: jumping and throwing with precision.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate mental calculation – methods for carrying out addition and subtraction with two parts, each containing one digit;</li> <li>• Developing spatial orientation;</li> <li>• Taking into account the space of the houses.</li> </ul>
Bar to geometric figures	<ul style="list-style-type: none"> <li>• Developing the fundamental motor skill: running;</li> <li>• Developing reaction speed;</li> <li>• Develop global motor coordination;</li> <li>• Technical action: grabbing;</li> <li>• Developing spatial orientation;</li> <li>• Co-operating with colleagues and the team.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the characteristics of each geometric figure – sides, vertices and shape;</li> <li>• Orally identify the characteristics of the geometric figure that corresponds to it;</li> <li>• Associate the description of each figure with its image.</li> </ul>
Fun rubber bands	<ul style="list-style-type: none"> <li>• Explore geometric figures by discovering them through the movement of their own body;</li> <li>• Moving the lower and upper limbs;</li> <li>• Coordinating the motor movements of the body's limbs;</li> <li>• Interact as a team.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify the five geometric figures: square, rectangle, triangle, circle and pentagon;</li> <li>• Identify the characteristics of each geometric figure;</li> <li>• Build the five geometric figures with the elastic bands as a group;</li> <li>• Building geometric figures individually with their bodies.</li> </ul>

**Table 1.**  
*PE and Maths objectives worked on the various tasks.*

five activities within the PTG: the Handkerchief Bar, Monkey, Cans, Donkey, and Bag Race. These were presented in the form of stages, in line with the progressions considered necessary for a greater understanding of the financial system.

According to the author [77], PTG, within the scope of Physical-Motor Expression and Education, in addition to their recreational, social, emotional, and physical-motor benefits, is a way of promoting diverse learning and cognitive development in children. If, on the one hand, the children experience innovative and unfamiliar PTG situations, on the other hand, all the interdisciplinary work carried out undoubtedly adds something positive to the teaching and learning process. They also emphasize that the PTG presented could develop content from other curricular areas, such as languages (**Table 3**) and sciences (**Table 4**).

Task	PE objectives	Maths objectives
Long jump	<ul style="list-style-type: none"> <li>• Raise the functional level of conditional and coordinative abilities;</li> <li>• Coordinating movements;</li> <li>• Jumping with both feet;</li> <li>• Control the reception.</li> </ul>	<ul style="list-style-type: none"> <li>• Apply the units of measurement of the Metric System;</li> <li>• Measure the two long jumps;</li> <li>• Reading the jumps;</li> <li>• Find the difference and the sum of the jumps;</li> <li>• Convert cm into mm.</li> </ul>
Human scale	<ul style="list-style-type: none"> <li>• Raise the functional level of conditional and coordinative abilities;</li> <li>• Controlling posture;</li> <li>• Balance with support.</li> </ul>	<ul style="list-style-type: none"> <li>• Apply the units of mass of the Metric System;</li> <li>• Identifying different weights;</li> <li>• Comparing different weights;</li> <li>• Learning to weigh.</li> </ul>
Human clock	<ul style="list-style-type: none"> <li>• Raise the functional level of conditional and coordinative abilities;</li> <li>• Flexibility;</li> <li>• Controlling posture;</li> <li>• Controlling spatial orientation.</li> </ul>	<ul style="list-style-type: none"> <li>• Applying time units;</li> <li>• Reading the time;</li> <li>• Identifying minutes and seconds;</li> <li>• Adding time measures;</li> <li>• Subtract time measures.</li> </ul>

**Table 2.**  
*PE and Maths objectives worked on the various tasks.*

Task	PE objectives	Language objectives
Olympic Games Challenge ( <i>Students will participate in a series of physical activities inspired by the Olympic Games. They will compete in events such as running, jumping, throwing, and swimming. The goal is to promote physical fitness, teamwork, and sportsmanship while incorporating language learning objectives.</i> )	<ul style="list-style-type: none"> <li>• Improve overall physical fitness and coordination</li> <li>• Develop sportsmanship and teamwork skills</li> <li>• Enhance cardiovascular endurance and strength</li> </ul>	<ul style="list-style-type: none"> <li>• Improve vocabulary related to sports and physical activities</li> <li>• Practice speaking skills through discussions and commentary</li> <li>• Develop writing skills through creating event reports or reflections on the experience</li> </ul>
Around the World in 80 Minutes ( <i>Students will embark on a virtual journey around the world, exploring different countries and cultures through physical activities. They will learn about the geography, history, and customs of each country while participating in traditional games and dances.</i> )	<ul style="list-style-type: none"> <li>• Improve flexibility, balance, and body control through yoga or tai chi-inspired movements</li> <li>• Develop coordination and rhythm through traditional dances</li> <li>• Enhance cardiovascular fitness through activities like running or jumping rope</li> </ul>	<ul style="list-style-type: none"> <li>• Improve vocabulary related to geography, history, and culture</li> <li>• Practice speaking skills through conversations about different countries</li> <li>• Develop writing skills through creating travel journals or postcards</li> </ul>
Science Explorers ( <i>Students will become scientists and explore different scientific concepts through physical experiments and activities. They will learn about biology, chemistry, physics, and other scientific disciplines while engaging in hands-on activities.</i> )	<ul style="list-style-type: none"> <li>• Develop problem-solving and critical thinking skills</li> <li>• Enhance fine motor skills through laboratory experiments</li> <li>• Improve cardiovascular fitness through active experiments</li> </ul>	<ul style="list-style-type: none"> <li>• Improve vocabulary related to scientific concepts and terminology</li> <li>• Practice speaking skills through discussions and presentations</li> <li>• Develop writing skills through creating scientific reports or lab journals</li> </ul>

**Table 3.**  
*PE and language objectives worked on the various tasks.*

Task	PE objectives	Sciences objectives
Science Olympics ( <i>Students will compete in a series of scientific challenges inspired by the Olympic Games. They will participate in events such as chemistry lab races, physics problem-solving competitions, and biology identification contests. The goal is to promote scientific inquiry, teamwork, and problem-solving skills.</i> )	<ul style="list-style-type: none"> <li>• Improve overall physical fitness and coordination</li> <li>• Develop problem-solving and critical thinking skills</li> <li>• Enhance cardiovascular endurance and strength</li> </ul>	<ul style="list-style-type: none"> <li>• Apply scientific concepts and knowledge to solve real-world problems</li> <li>• Develop teamwork and collaboration skills</li> <li>• Foster a love for science and inquiry</li> </ul>
Eco-Explorer ( <i>Students will become eco-explorers and investigate their local environment. They will conduct experiments, collect data, and analyze their findings to understand the natural world. They will also learn about environmental issues and explore ways to protect the planet.</i> )	<ul style="list-style-type: none"> <li>• Enhance fine motor skills through data collection and analysis</li> <li>• Develop observation skills and spatial awareness</li> <li>• Enhance cardiovascular fitness through activities like hiking or biking</li> </ul>	<ul style="list-style-type: none"> <li>• Understand the interconnectedness of ecosystems and the importance of biodiversity</li> <li>• Develop data analysis and interpretation skills</li> <li>• Foster a sense of environmental responsibility</li> </ul>
Inventors of the Future ( <i>Students will become inventors and design and create their own inventions. They will learn about the engineering design process and apply their knowledge to solve real-world problems. They will also collaborate with their classmates to develop innovative solutions.</i> )	<ul style="list-style-type: none"> <li>• Develop problem-solving and critical thinking skills</li> <li>• Enhance fine motor skills through laboratory experiments</li> <li>• Improve hand-eye coordination and spatial awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Understand the engineering design process and apply it to solve problems</li> <li>• Develop teamwork and collaboration skills</li> <li>• Foster creativity and innovation</li> </ul>

**Table 4.**  
PE and sciences objectives worked on the various tasks.

From our research, further works involving the learning of languages (Native or Foreign) and sciences through physical active learning methods should be address, since it lacks literature referent to it. We dare to make a few suggestions.

## 5. Conclusion

The integration of physically active learning and transdisciplinary educational processes remains an underdeveloped and infrequent practice in many educational institutions. Therefore, there is a pressing need to promote these pedagogical approaches, extending physical education and physical activity beyond the confines of the gymnasium and classroom. This involves the establishment of diverse physically active learning activities across various school settings. In Portugal, the primary school teacher plays a pivotal role, as instruction is typically delivered by a single educator responsible for both physical education and other knowledge areas. It has been observed that teachers may be more inclined to engage with PAL when the emphasis is placed on its educational or academic benefits, rather than solely focusing on health or physical education outcomes.

To enhance the effectiveness of teacher education programs, particularly for early childhood and primary school educators, it is essential to incorporate the development of professional competencies, autonomy, and familiarity with PAL and transdisciplinary methodologies. This can be achieved by providing opportunities for reflection and meaning-making within the curriculum. Moreover, establishing

a Physically Active School necessitates the implementation of a whole-school adaptive sub-system capable of navigating the complexities involved in creating systemic change. An iterative design process that includes multiple stakeholders—such as school leaders, parents, and community members—who are attuned to the various layers of influence within and beyond the school environment will significantly enhance the effectiveness of systematic, physically active pedagogical initiatives.

Throughout this chapter, we have emphasized the potential of physical education to facilitate an increase in physical activity while simultaneously enriching students' academic experiences across the curriculum, thereby underscoring the value of transdisciplinary educational processes. However, several additional considerations warrant further exploration and reflection in future research: the role of technology in supporting transdisciplinary and physically active learning, the development of effective assessment strategies for these educational approaches, the significance of parental and community engagement, and the necessity of equipping teachers with the competencies and training required for implementing transdisciplinary and physically active learning strategies.

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## **Conflict of interest**

The authors declare no conflict of interest.

## **Notes/thanks/other declarations**

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