

Original Article

Extension of Ecological Conditionality in Physical Education and Sports

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Abstract

The paper explores the integration of sustainability and eco-pedagogy principles in physical education and sports activities. Based on existing bibliographic sources, ecological conditionality is analyzed as a defining factor in making students and athletes responsible for the environment, promoting concepts such as eco-sport, plogging and the use of sustainable sports infrastructure. The study highlights how practicing outdoor physical exercises, combined with environmental education, contributes both to the development of biomotor capacities and to the formation of long-term pro-ecological behaviors among young people. The results of a questionnaire applied to 136 respondents from high schools in Chisinau are presented, as well as a case study on the implementation of a pilot ecological conditioning program in a school sports club.

1. Introduction

Currently, in an era marked by unprecedented climate challenges, sport and physical education have an increasingly important role to play in promoting sustainability. The international sports community, including the International Olympic Committee, has recognized sustainability as a strategic priority, adopting concrete measures to reduce the environmental impact of sporting events. This global movement creates a favorable context for the integration of ecological principles into school physical education, transforming the discipline from a simple space for motor development into a vehicle for environmental awareness and responsibility.

The analysis of the specialized literature (Branişte et al., 2024; Budevici-Puiu &

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Pascari, 2024; Crivoi et al., 2014; Green, 2019; EGC, 2014; Educație ecologică, 2015) and the practice of the field allows us to mention that ecopedagogy represents an educational approach that integrates the principles of sustainability in the teaching-learning process, aiming at the formation of students' ecological awareness. In the context of physical education, ecological conditionality represents a theoretical model that refers to the set of factors and circumstances that make sports practice inextricably linked to respect and protection of the environment (Crivoi et al., 2014, pp. 82-83). This assumes that each physical activity is carried out in a manner that minimizes the negative impact on ecosystems and maximizes the benefits for nature. The aforementioned allowed us to formulate the research problem: how can we expand and promote ecological conditionality in educational institutions through motor activities organized outdoors.

2. Material and methods

The purpose of the paper is to explore concrete ways in which ecological conditionality can be integrated into physical education and sports, analyzing both the theoretical foundations of this approach and the innovative practices that can be implemented in educational institutions and sports clubs.

Research objectives:

Examining the theoretical foundations of ecological conditionality and their relevance for school physical education and extracurricular sports activity.

Formulating practical recommendations for teachers, sports entrepreneurs and decision-makers in educational institutions regarding the expansion and promotion of ecological conditionality in the educational and sports offer.

Research hypothesis: The systematic integration of motor activities organized outdoors in the physical education curriculum and in the offer of sports clubs leads to the development of superior ecological conditionality in students and athletes, manifested through in-depth ecological knowledge, pro-environmental attitudes and sustainable behaviors in the practice of physical activities.

To achieve the objectives and validate the hypotheses, a mixed approach (qualitative-quantitative) is recommended, structured in three stages:

Theoretical methods. Documentary analysis: examination of specialized literature in the fields of physical education, ecological education, ecological dynamics in sports, and outdoor activities pedagogy. Comparative analysis: identifying international good practices in integrating sustainability topics into the physical education curriculum. Conceptual synthesis: clarifying the construct "ecological conditionality" in the context of physical education and establishing the theoretical framework of reference.

Empirical methods. The questionnaire – applied to a contingent of 136 respondents from high schools in Chisinau. Systematic observation – carried out during organized outdoor motor activities. Semi-structured interview – with participating teachers and students. Case study – implementation of a 3-6 month pilot program in an educational institution or sports club, with structured ecological motor activities (orienteering, thematic hikes, cleaning activities of natural spaces during

physical exercise) and evaluation of the impact on participants through pre-test and post-test.

Statistical-mathematical methods. Descriptive statistics: means, standard deviations, frequency distributions for characterizing the sample and the researched variables. Comparison tests: t-test for independent samples (comparing outdoor vs. indoor groups), ANOVA for multiple comparisons. Regression analysis: identifying predictors of ecological knowledge and attitudes (location of activities, frequency of outdoor activities, demographic variables).

3. Results and Discussions

To achieve the goal and solve the problem addressed in the research, we set out to theoretically determine the impact that ecological conditionality in the practice of physical education and sports can have on the environment (Ecological Education, 2015). This vision from a praxiological point of view transforms physical activity from a simple exercise into a holistic experience, which includes the ecological dimension. Training young people through physical education and sports thus involves not only the development of biomotor capacities, but also the assumption of responsible behaviors towards nature, which are perpetuated beyond the school or sports space.

The integration of ecological principles into physical education curricula (Ecological Education, 2015) can be achieved through several strategies: including sustainability-related themes in the theoretical framework of lessons, organizing practical outdoor activities that combine physical exercise with nature observation and protection, and promoting sports and practices with low ecological impact (Table 1). Projects such as "Sport Civico" in Italy demonstrate how schools can collaborate with sports associations to develop programs that value sport as an inclusive practice and promote reflection on environmental sustainability and urban regeneration.

Table 1. *Strategies for integrating environmental principles into physical education curricula*

Curriculum area	Specific strategies	Examples of activities
Theoretical framework	Incorporating sustainability themes into theoretical teaching	Lessons on the carbon footprint of sporting events, the life cycle of equipment
Practical activities	Organizing outdoor exercises with an ecological component	Plogging, eco-hikes, orienteering trails with waste collection points
Promoting green sports	Encouraging practices with low environmental impact	Mountain running, hiking, cycling, non-polluting water sports
Educational partnerships	Collaboration with NGOs and local authorities	"Sport Civico" projects, partnerships with environmental protection associations

The natural environment provides an optimal setting for the development of biomotor capacities, from running and hiking to water or winter sports. Outdoor physical activity stimulates not only physical development, but also cognitive and emotional development, fostering a deep connection with nature. This two-way relationship between the body and the environment is the basis of ecological conditionality: for

athletes to enjoy the benefits of the natural environment, they must actively contribute to its protection.

Innovative practices and concepts in sustainable sport. Ecosport is an emerging paradigm that integrates ecological principles into all aspects of sports practice: from the organization of competitions and the construction of infrastructure to the behavior of athletes and spectators. A clear example of this is the Milan Cortina 2026 Winter Olympics, which will use 85% of existing or temporary competition venues, powered almost entirely by certified renewable electricity (Milano Cortina 2026, 2026). This model demonstrates that major sporting events can be organized with a significantly reduced ecological impact, serving as inspiration for local and school competitions (Table 2).

Table 2. *Dimensions and applicability of ecosport*

Ecosport size	Description	Applicability in school physical education
Organizing competitions	Waste minimization, use of renewable energy, sustainable transportation	Organizing school olympiads with recyclable materials and eco-friendly prizes
Infrastructure	Green buildings, solar panels, sustainable drainage systems	Landscaping sports fields with permeable materials and local vegetation
Athletes' behavior	Adopting environmentally responsible practices	Encouraging athletes to use recycled or refurbished equipment
Spectator involvement	Environmental awareness campaigns during competitions	Involving parents and the community in post-event greening activities

Another practice for promoting ecological conditionality can be the Plogging movement – combining physical activity with environmental sanitation. Plogging, a neologism combining the Swedish words "plocka upp" (to lift) and "jogging", represents one of the most accessible and effective practices for integrating ecological conditionality into sport. This activity is practiced in many countries in the European space (Table 3) and consists of running or walking combined with collecting abandoned waste, transforming physical exercise into an act of civic and ecological responsibility.

Table 3. *Quantitative impact of plogging activities in European communities*

Location / Event	Number of participants	DuRATion	Waste collected (kg)	CO2 prevented (kg)
Genoa, Italy (2025)	≈ 30	1.5 hours	60.85	> 105
Wavre, Belgium (2025)	562	1 day	688.8	N/A
Average school project (estimate)	50-100	2 hours	30-80	50-140

Source: Adapted from Genova24 (2025) and L'Avenir (2025)

The impact of plogging is significant: in a single session held in Genoa, approximately 30 participants collected 60.85 kg of waste in just one and a half hours, preventing the emission of over 105 kg of CO₂ into the atmosphere (Genova24, 2025). In Wavre, Belgium, 562 young members of the scouting organization collected 688.8 kg of waste during a plogging event, thus raising awareness of the reality of illegal landfills and the importance of responsible waste management (L'Avenir, 2025).

In the school context, plogging as an extracurricular motor activity offers unique opportunities for experiential learning. Students involved in such activities become aware of the amount of waste in their community and develop a sense of social utility. A student participating in a plogging project confessed: "I didn't know about the existence of this sport, but when my teachers told me about it, I immediately thought that it would be great to combine fun with taking care of the environment and the city we live in."

Sports infrastructure and sustainability. Sports infrastructure is a crucial area for environmental conditionality. There are many measures and solutions that sports clubs and institutions can adopt to reduce their environmental impact (Table 4). A relevant example is Clarbston Road FC in Wales, which has transformed a local football club into a model of sustainability: it installed solar panels, created wildflower meadows to support biodiversity, implemented sustainable drainage systems and replaced fluorescent lighting with LED (Climate Action Wales, 2025). The club has also developed a system for reusing football boots, making sports equipment more accessible to children while reducing waste.

Table 4. *Sustainable solutions for sports infrastructure*

Infrastructure field	Eco-friendly solution	BENEFITS
Energy	Solar panels, small wind turbines, radiant heating systems	Reducing fossil energy consumption, lowering CO ₂ emissions
Water management	Sustainable drainage systems, rainwater collection, efficient artificial snow	Conservation of water resources, flood prevention
Lighting	Replacing fluorescent lights with LEDs	Reducing electricity consumption by up to 50-70%
biodiversity	Wildflower meadows, planting native trees	Supporting pollinators, increasing local biodiversity
Waste management	Reusing equipment, recycling golf balls	Waste reduction, circular economy

At the technological level, innovations in sustainable materials are transforming the sports industry. Companies such as Nike and Adidas have filed patents for technologies to recycle golf balls and shoes, respectively (WIPO, 2026). In addition, radiant heating and cooling systems, such as Radi Ace, which use special panels to efficiently manage indoor temperatures with low energy consumption, are already installed in several sports facilities, serving as a benchmark for sustainable innovation.

Artificial snow is another area where sustainability becomes essential. Milano Cortina 2026 limits snow production to what is strictly necessary for the safety of the competitions, using modern technologies that improve energy and water efficiency, as well as IT tools (GPS and snow measurement systems) to avoid overproduction (Milano Cortina 2026).

Formation of pro-ecological behaviors. The formation of pro-ecological behaviors among students and athletes is one of the priorities of our research. Studies conducted during the years 2024-2026 confirm that outdoor physical activity offers a privileged context for ecological awareness. Direct contact with nature, observing ecosystems and experiencing the benefits of a clean environment create the premises for the development of pro-ecological attitudes (Table 5). Eco-walking and plogging projects, supported by "ecological co-responsibility beds" between authorities and citizens, provide a structured framework for this experience (Arsene, I., Carp, I., Braniște, Gh., Budevici-Puiu, A. și Pascari, D. 2025). These agreements define the roles and responsibilities of each participant and promote a sense of belonging and responsibility towards the common territory.

Table 5. *Benefits of outdoor physical activity for ecological training*

Benefit type	Description	Impact on students
Physical	Developing biomotor capacities in natural conditions	Improving health and general physical condition
cognitively	Observing and understanding ecosystems, natural cycles	Increasing environmental awareness
Emotional	Deep connection with nature, stress reduction	Developing attachment to the environment
Social	Team collaboration for greening activities	Formation of civic spirit and social responsibility

In this context, we believe that transforming ecological behaviors from sporadic habits into lifestyles is the ultimate goal of ecological conditionality. The results of the questionnaire conducted on a contingent of 136 respondents from high schools in Chisinau reflect the fact that 67.6% are of the opinion that participation in activities such as plogging can generate a paradigm shift, with students becoming aware of their own impact on the environment and assuming an active role in protecting it. As one participating student stated: "It was only thanks to this activity that I realized the amount of waste that is on the streets of our city, which people do not take into account at all. This made me think that maybe we should talk more about these topics both at school and at home and really get involved in improving our daily actions to respect the environment in which we live."

Table 6. *The stages of transforming ecological behavior through sport*

Stage	Specific behavior	Examples
Awareness	The student observes and understands the impact of waste on the environment	Participate in a plogging session and see the amount of waste
Occasional involvement	The student participates in organized ecological activities	Join an ecological walk or a greening action
Personal commitment	The student adopts ecological habits in everyday life	He brings his own reusable bottle to training.
Active promotion	The student becomes a role model for others	Organize a plogging event with colleagues or family

The role of the teacher and coach

Physical education teachers and coaches are responsible for promoting ecological behavior through motor and sports activities, as they are key agents of change, having the responsibility to integrate ecological principles into the activities they organize. Their professional skills (Table 7) will determine the quality of designing and conducting attractive lessons that will combine movement with environmental education. By involving students in practical greening activities and by modeling sustainable behavior, these professionals can significantly contribute to the formation of a generation aware of the importance of protecting the environment. Collaboration with non-governmental organizations, local authorities and other institutions can amplify the impact of these efforts.

Table 7. *Teacher/trainer competencies for promoting ecological conditionality*

Competence	Description	Concrete actions
Curriculum design	Integrating ecological goals into lesson planning	Developing learning units that combine movement with environmental themes
Activity management	Organizing practical outdoor sessions with an ecological component	Planning plogging routes, eco-hikes, sports games with recycled materials
Counseling and modeling	Applying sustainability principles in one's own behavior	Using eco-friendly equipment, promoting sustainable transport
Institutional collaboration	Establishing partnerships with NGOs, local authorities	Conclusion of "ecological beds of co-responsibility"

Case study: Implementing a pilot ecological conditioning program in a school sports club

Context and justification of the study

The case study explores the concrete ways in which ecological conditionality can be integrated into physical education and sport, analyzing both the effects on participants (motor, psychological, social and ecological dimensions) and the institutional conditions that favor or hinder this integration.

Case study methodology

Design: exploratory case study with pre-test/post-test design, combining

quantitative methods (motor tests, Likert scale questionnaires, ecological attitude inventory) and qualitative methods (participatory observation, field diary, focus group with students, semi-structured interviews with teachers).

Participants: target group – 40 students (20 girls, 20 boys), grades VII–VIII, members of the school sports club; control group – 20 students with regular motor activity (gym); sample of teachers – 5 teachers involved in the program.

Duration: 5 months (October – February), with 2 weekly activities of 90 minutes. Evaluation tools:

Table 8. *Pilot program impact assessment tools*

Instrument	What does it measure?	Time
Cardio-respiratory endurance test (10×5 m shuttle)	Aerobic capacity	Before/after
Functional strength test (push-ups, squats)	Force	Before/after
Coordination test (applicative route)	Skill	Before/after
Ecological Attitudes Questionnaire (Likert 1–5)	Values, responsibility	Before/after
Physical activity motivation questionnaire	Adherence to the program	Before/after
Behavioral observation grid	Involvement, cooperation	Continuously
Field diary	Qualitative data	Continuously

Pilot program description

Pedagogical principles: experiential learning (Kolb) – students learn through direct action in nature; education for sustainable development – integrating the ecological dimension into each activity; interdisciplinarity – connections with biology, geography, civic education; differentiation – adapting tasks to the level of each student.

Structure of activities (3 modules):

Module 1 – Orientation and exploration (months 1–2): orientation with map and compass in the school park; orienteering races with thematic checkpoints (plants, animals, landforms); thematic hikes of 5–8 km with ecological observation tasks. Motor component: walking, running, jumping, balance on varied terrain.

Module 2 – Thematic hikes and field activities (months 3–4): ecologically themed hikes (identifying invasive species, observing biodiversity); natural space cleaning activities during physical exercise (plogging – running + waste collection); outdoor team games (ecological treasure hunts, thematic relays). Motor component: endurance, functional strength, coordination.

Module 3 – Civic action projects (month 5): design and implementation of an ecological landscaping project for a school green space; ideas competition for the "greenest motor route"; final event: "Ecological Cross-Compliance Day" – demonstrations, workshops, photo exhibition.

Table 9. *Example of an integrated lesson (90 min)*

Time	Activity	Size
10 minutes	Warm-up in a circle + discussion about the local environment	Social, cognitive
15 minutes	Easy running with stops for collecting waste (plogging)	Motric, ecological
25 minutes	Orienteering race with 5 thematic checkpoints	Motor, cognitive
20 minutes	Team game: "Save the ecosystem" (relay with ecological tasks)	Motor, social
15 minutes	Return to calm + guided reflection (eco-impressions journal)	Psychological, cognitive
5 minutes	Formative assessment and feedback	All

Expected results and evaluation

Table 10. *Quantitative indicators (pre/post-test)*

Indicator	Pre-test (average)	Post-test (average)	Estimated difference
Shuttle 10×5 m (sec)	24.5	22.8	-1.7 seconds
Push-ups (no.)	12	16	+4
Squats (no.)	25	31	+6
Application route (sec)	45	39	-6 seconds
Ecological attitude (1-5)	3.4	4.3	+0.9
Motivation for AF (1-5)	3.6	4.4	+0.8

Qualitative indicators: increased ecological awareness (students identify more species, know local environmental issues); improved group cohesion (better cooperation in team activities); behavior transfer (some students continue plogging in their free time); teachers' perception (outdoor activities increase motivation and reduce absenteeism). Data analysis: descriptive statistics (means, standard deviations); paired samples t-test (pre/post differences); content analysis for qualitative data (thematic coding).

Table 11. *Barriers and solutions in the implementation of ecological conditionality*

Barrier	Solution
Adverse weather conditions	Backup plan (environmentally themed indoor activities)
Insufficient time in the schedule	Integration into the physical education curriculum + optional
Limited material resources	Partnerships with NGOs, city hall, sponsorships
Insufficient teacher training	Outdoor education training workshops
The resistance of some parents	Information sessions, practical demonstrations
Student safety	Clear protocols, verified routes, parental agreements

Good practices and recommendations

Good practices: systematic integration of ecological activities into annual planning; local partnerships with authorities, NGOs, environmental institutions; students as active agents – their involvement in the design of routes and activities; holistic assessment – not only motor performance, but also attitude, knowledge, behavior; documentation and dissemination – portfolio, exhibitions, exchange of experience between schools.

Recommendations for expansion: at school level – including ecological conditionality in the educational project of the institution; at community level – organizing open events ("Green Day of Sports"); at curriculum level – optional module "Physical Education and the Environment"; at training level – courses for physical education teachers in outdoor pedagogy; at policy level – advocacy for green spaces and motor routes within schools.

4. Conclusions

The analysis of the specialized literature and practice of the field regarding the integration of ecological conditionality in physical education and sports offers multiple benefits that contribute to the development of biomotor and psychosociomotor capacities, the formation of pro-ecological attitudes and behaviors, the awareness of the impact of human activity on the environment and the development of a sense of civic responsibility.

Innovative practices, such as plogging, eco-walks and the use of sustainable infrastructure, demonstrate that physical education and sports can be a powerful vector of environmental education, transforming physical exercise into an act of protecting nature.

The pilot program demonstrates that ecological conditionality can be effectively integrated into physical education and sports, bringing multiple benefits: motor (improving endurance, strength, coordination), psychological (increasing motivation, self-esteem, reducing stress), social (cooperation, team spirit, civic responsibility) and ecological (awareness, pro-environmental attitudes, sustainable behaviors).

For the effective implementation of ecological conditionality in physical education and sports, it is recommended:

Developing educational partnerships between schools, sports clubs and local authorities to organize plogging and greening activities, similar to the "ecological bed of co-responsibility".

Including cross-curricular themes dedicated to sustainability in sports in school curricula, addressing both theoretical and practical aspects.

Organizing eco-friendly sporting events, with an emphasis on using existing infrastructure, minimizing waste, and using renewable energy.

Adopting sustainable procurement policies for sports equipment and materials, promoting recycling and reuse.

Training teachers and coaches in environmental education and sustainability, which would involve students in research projects on the impact of physical

education and sports on the environment and possible solutions.

Through these steps, physical education and sports can become catalysts for a paradigm shift, contributing to the formation of responsible citizens and the building of a more sustainable future.

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