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Original Article

Teaching styles and outdoor education to promote non-linear learning

DARIO COLELLA[1], CRISTINA D'ARANDO[2]
[1,2,]Department of Humanities, Cultural Heritage, Education Sciences, University of Foggia, Foggia, ITALY

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Abstract
Introduction. Motor activities carried out in outdoor education contexts contribute to the prevention of non-communicable diseases, promote the increase in levels of physical activity and the learning of motor competencies; moreover, they are significant opportunities for the emotional and social development of children and the transferability of learning in various disciplinary fields.The motor activities carried out in outdoor education promote motor competencies through the contextualized links among motor skills-abilities, knowledge and attitudes of the person, and non-linear, reticular learning methods in which students can independently modify and adapt motor responses in relation to the perception-action-environment relationships. Production teaching styles, oriented towards guided discovery and problem solving, enhance the unusual, creative and personalized motor responses, promote the learning process of each student and constitute mediation factors for the educational process, furthering the interconnections between motor, cognitive, emotional and social functions. Objective. The objective of the contribution is to analyse the interactions between non-linear learning processes and teaching styles, in order to highlight the student-task-environment relationships, through guided discovery and problem solving.The teaching styles favour the connections between the contents and the different ways of learning; the production styles solicit original, creative and transferable motor skills, generating various matrices for subsequent learning. Current didactic research should proceed in two different and complementary directions: the selection and testing of motor tasks, organizational methods and equipment, and the application of teaching styles and strategies which foster the dynamic interaction between teacher-motor task-pupil-context, functional to the learning and development of motor competencies.
Keywords: **children, outdoor education, motor learning,non-linear learning, teaching styles.**

Introduction

The activities carried out in outdoor education offer numerous and varied opportunities to promote the health of children and young people, and prevent non-communicable diseases. According to the position statement (Tremblay et al., 2015), access to active outdoor play, despite its possible risks, is essential for thehealthy development of children. It is recommended to increase children's opportunities for self-directed outdoor play in all contexts: in the family, at school, in neighbourhoods and in equipped outdoor spaces.Worldwide, there is concern about the progressive trend towards lifestyles that promote the development of non-communicable diseases (Guthold et al., 2020).

Obesity and physical inactivity in developmental age are at the fore in this challenge and contrast measures are urged, according to a cultural and organizational approach aimed at different ages, emphasizing the importance of carrying out motor activities in significant socio-cultural contexts (Yuksel et al., 2020). The prevalence of childhood obesity around the world is on the rise. The percentages of children and adolescents who meet the guidelines on physical activity are, in fact, very low and decreasing (Guthold et al., 2020). This is worrying as either habitual physical activity or sedentary habits acquired in childhood tend to be maintained in later ages.

In different educational contexts, the practice of motor and sports activities in developmental age has recently received a significant boost for reasons attributable both to health promotion and the prevention of various diseases through the increase in levels of physical activity, particularly in the projects of "active schools" (Razak et al., 2018; Gray et al.,2015;Holmes 2006), regarding both sports' orientation and the development of interpersonal and social relationships.

Carrying out outdoor motor activities (in equipped urban parks, at the seaside, in the mountains, in the countryside, in school courtyards, etc.) have a great educational value and increases the benefits for motor and psychological development.Many of these benefits will not necessarily be the result of participation, but may be mediated by the kind of the interactions between learners, teachers and parents involved (Lubans et al., 2008;Bailey2006).Practicing motor activities outdoors has significant effects on learning processes as they promote the transferability of interdisciplinary and transversal skills and knowledge in children (Wistoft2013),significantly supporting inclusion processes.

Corresponding Author: DARIO COLELLA, E-mail: dario.colella@unifg.it

The socio-ecological model can provide a frame of reference for interpreting the interaction between individuals and the environment (Solmon 2015), and can serve to analyse how different levels, individual, interpersonal, community and social factors interact to influence the promotion of physical activity in outdoor contexts.

According to the theory of dynamic systems (Magill & Anderson, 2014; Edwards 2011; Newell 1986), motor learning takes on particular importance for studying the relationship between individual, task and environment and how to acquire motor skills. Through production teaching styles (Mosston & Ashoworth, 2008), mediating effects develop and each student can express open and non-linear body-motor experiences (Chow et al., 2007) to get accustomed to the variability of the context and promote interconnections between motor skills.

Outdoor Education and Physical Literacy

The educational process of children develops through numerous and various body-motor experiences, in relation to the opportunities offered by contexts (Mehtälä et al., 2014).This indicates the overcoming of previous approaches on infant development, concerning the standardized succession of well-defined evolutionary stages, in which specific acquisitions and predefined behaviours would correspond to each age.

It is known that the development of children's motor abilities during the developmental age depends on and is influenced by both the growth and maturation processes and the interaction with the environment in which they grow up. The opportunities and environmental conditioning for motor activity interact with the biological substrates of growth and maturation, thus determining children's motor repertoire (Malina 2004).

Motor development is a process by which children acquire motor skills. It is a continuously changing process that involves various factors: 1) neuromuscular maturation; 2) physical growth and behavioural characteristics; 3) time of physical growth, biological maturation and behavioural development; 4) effects of previous motor experiences; 5) new motor experiences.

The *structured* motor experiences take place in various contexts, in the family, at school, in equipped spaces in the neighbourhood with the presence of a teacher, whilst the*unstructured*ones, carried out independently after school, increase the levels of physical activity and contribute to the acquisition and development of motor skills.

Motor activities in the outdoors (Razak et al.,2018; Tremblay2015) allow to experiment, perform and vary the motor repertoire of each child that will contribute to develop the physical literacy process. In particular, outdoor activities promote new and different opportunities to experience the variability of motor tasks: the basic motor skills (crawling, rolling, climbing, walking, running, jumping, throwing-catching, pushing-opposing, etc.) develop like every other function of the person, in a continuous relationship with the external environment.

In so doing, children learn spatial, temporal, quantitative and qualitative concepts, and improve their reciprocal relationships through fundamental motor skills. The executive variants of the fundamental motor skills, *spatial, temporal, quantitative and qualitative*, and their reciprocal relationships allow to experiment, learn and structure a real individual *repertoire* of motor skills, and have significant transversal educational values that involve all school learning (Gallahue et al.,2012).

Particularly in deconstructed motor activities, children independently learn the executive variants of basic motor skills which are then intentionally proposed by the teacher through didactic paths, motor tasks and organizational methods (paths, circuits, games) well-structured methodologically (Magill & Anderson,2014).

The variability of motor tasks allows to gradually learn more and more complex motor skills, solve motor problems in social life, play and sport. Finally,it provides creative and transferable motor answers in the various school disciplines.

Motor skills are acquired through a learning process based on *executive variants* that:

- ✓ favour the succession of children's motor development stages;
- ✓ promote the learning of motor skills and the development of related motor abilities; for example, the variants *forward, backward, right, left, inside-outside, before-after, etc.,* referring to the fundamental motor skills, mainly solicit the ability for spatial-temporal orientation, transversal for each school learning, etc.;
- ✓ allow you to decline, according to the difficulty, the intensity, the variety of contexts, the activities in the school and extracurricular curriculum (playful-recreational activities carried out independently by the students in equipped spaces, in the family, in the introduction to sport);
- ✓ favour a circular process aimed at developing *links* between variants, skills and abilities, developing motor abilities and related psychological factors, such as the perception of the physical self and fun,in a balanced way (Monacis &Colella,2020;Hulteen et al., 2018;Myer et al., 2015).

The variability of outdoor practice promotes the quantitative and qualitative progression of learning by developing motor literacy, from matrices to the most advanced stage of skills and related factors (Martins et al., 2020). The interconnections between motor skills and executive variants emerge spontaneously in children's activities in various contexts, but subsequently require intentional choices from the teacher, significant learning opportunities attributable to non-directive teaching styles and a systematic verification of their evolution.

The *variability* of the practice, the intentional and systematic proposal of executive variants and the request for different ways of performing a task or the proposal of constraints, space-time and quantum-

qualitative (Renshaw & Chow, 2019; Magill & Anderson, 2014; Pesce 2002) promote the understanding of the internal/intrinsic rules of an activity (e.g. a game), the resolution of a problem and the ways of adapting to the situation and the environment.

Learning approaches and educational contexts

The main theoretical approaches on learning and motor control, called *cognitivist* and *ecological*, differ in the ways they consider perception and interpret the relationship between perception and action (Magill & Anderson,2014; Edward 2011).

The most widespread approach is the one called*cognitivist*,which provides for centralized information processing processes and reaffirms the existence of motor programs that guide action and the importance of memory in attributing meaning to stimuli.

The *ecological* approach, more *dynamic*, sees perception as a process through which the individual does not need to resort to memory to seek, discover or immediately identify information already present in the environment and functional to the action; it owes its name to the fact that it considers the complex interaction *individual-task-environment* (Newell1986).

According to the *cognitivist* approach, the decision-making process follows perception and precedes every action. This means analysing the situation, recalling previous motor experiences and the various possible solutions from memory, comparing the different executive possibilities, giving priority to the situation and implementing the chosen action. Decision making, according to this perspective, is a process that takes time: if the number of choices increases, so does the time for the decision (Magill & Anderson, 2014).

The *dynamic* approach considers the *decision* within the perception-action relationship. The interaction between task, subject and environment gains importance without going through the memory.To put it simple, considering the individual differences of the students (anthropometric factors, levels of perceptual-motor abilities, motor repertoire), different actions can be performed in an identical situation.

According to the ecological approach, or the theory of dynamic systems, learning arises directly from the *individual-environment*interaction, and the most significant aspect is precisely the direct connection *perception-action* (Edwards 2011).

The conditions of the learning environment, e.g. outdoors, offer the pupils various opportunities to perform variations of motor skills, adapted to certain situations that may be similar but not identical; for example, it is difficult, perhaps impossible, to repeat two identical situations in which is required tothrow the ball, from the same distance from the basket, in the same place on the court and with the same speed and trajectory, or that two pupils perform the same type of action, etc.

The variability of children's motor responses is conditioned by the situation (near-far, large-small field, heavy-light ball, number of players on the field, etc.) accidentally created by the environment or intentionally proposed by the teacher.

The perception-action interaction is specific to each situation, and the adapted motor ability is the result of the constraints linked to the interaction between the motor *task* (objective), the *individual* (motor repertoire) and the *environment* (terrain, etc.). In particular, the action is systematically altered by environmental constraints (e.g., running downhill, jumping a ditch or climbing a wall) and by the motor skills possessed by the student.Therefore, the technique used in a sport or activity is not as important as the repertoire of skills and executive variants used.

In a traditional teaching environment, in order to make students acquire motor skills, the teacher proposes motor tasks which are linear and predefined, sequential and closed, so to proceed from the easy and known to the difficult and less known, or from the simple to the complex; the students perform numerous repetitions, continually recalling previous motor experiences.

On the contrary, in line with the theory of dynamic systems, it is the changing of conditions that affects different possibilities of motor response; in this case, the motor learning process does not follow a predefined and sequential path, but a non-linear path which is variable and open to the interconnections between motor skills and executive variants (Chow 2013; Schollhorn et al., 2012).

In this regard, according to the *Constraints-Led Approach* (CLA), through the interaction of different constraints - *task-environment-performer* -, the student self-organizes to discover the most effective motor solutions (Renshaw & Chow, 2019). The CLA model provides an approach based on the learning of recurring skills in many pedagogical contexts (school, start to sport, free time) and in various activities (sports games, outdoor education activities, expressiveness and dramatization, etc.).Thus, the learning planning consists in offering students numerous opportunities to analyse the different environments and to experiment, discover, research and perform adaptive and functional motor responses-solutions. In this way, it is possible to appreciate a deep *subject-environment-task* interaction.Theacquisition of motor skills is the result of a functional relationship of adaptation between an organism and its environment (the environment generates a flow of information that offers various situations to learn motor skills) which becomes a *generator* of executive variants and original, unusual and creative responses.

Teaching Styles and non-linear learning

The didactic implications deriving from the theory of dynamic systems enhance learning by *guided discovery* and *problem-solving*: through a process of exploration and discovery, starting from easy, simple and known actions, pupils experiment, perform, vary and learn to use their own motor repertoire in an increasingly broad and coordinated way.

According to the dynamic approach, learning is a process of discovery, autonomous or mediated by the teacher, of environmental opportunities, situations and related motor responses; the tasks proposed by the teacher are based on the discovery of executive variants, on *problem-solving* and on the search for possible solutions.

In order to structure a teaching-learning process that enhances the motor competencies of each student and considers the opportunities offered by the activities carried out in outdoor environments, the teacher must make an intentional selection among various methodological options. In this regard, the *Spectrum of teaching styles*model (Mosston & Ashworth, 2008), indicates the transition from a course in which the teacher expresses the highest degree of responsibility and decision in the choice of activities and executive and organizational methods (*reproduction* styles), to an approach in which, on the contrary, motor decisions and responses mainly concern the pupil and the group (*production* styles).

As for the various motor tasks, the intentional and planned proposal of executive variants is modulated and adapted through the interaction of *teaching styles* (Mosston & Ashworth, 2008). The selection of one or several styles has different effects on the learning processes since it is in relation to children'smotor abilities, the proposed task and the contexts in which the activity takes place (e.g., an equipped park), the constraints imposed by spaces and equipment (team sports baskets or nets, obstacles to overcome, walls to climb on, dimensions of usable spaces, presence of paths, uphill or downhill or slalom, etc.).

In fact, the interaction of teaching styles allows children to: a) promote different ways of accessing skills and knowledge; b) favour the connections between skills, knowledge and behaviours functional to motor competencies; c) foster the relationships between cognitive-motor and social functions, necessary for interdisciplinary learning; d) customize the didactic action (Colella2019).In particular, proposing motor tasks through *production* teaching styles allows to highlight the mediation functions for the motor, cognitive and social development of the child (Robinson et al., 2015; Lubans et al., 2008) by stimulating *non-linear*learning processes based on the variation of constraints (Renshaw & Chow, 2019) concerningspace-time, theirquantitative and qualitative aspects, and their interrelations.

In fact, in an outdoor setting, and preferably using the *guided discovery* and *problem solving* styles, the teacher asks students to perform motor tasks with numerous, original and creative variants, also resulting from the reworking of variants and skills already learned, in different contexts and situations; this allows children to proceed in their own learning path in a reticular and autonomous way, namely open and not completely predefined or sequential, allowing personal and conscious management of space-time andquantitative and qualitative constraints (Magill & Anderson, 2014). The repetition of a task without repeating the same task (Bernstein 1967) favours the achievement of a learning objective through different modalities and paths (fig. 1).

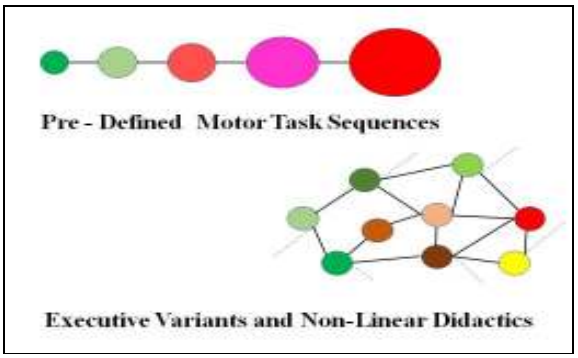

Fig.1- Different Teaching Approaches

On the contrary, crossing the reproductive teaching styles, the proposal of motor tasks predefined by the teacher characterized by a reduced number of executive and hetero-direct variants, solicits in the child closed and sequential motor responses where previous acquisitions, closely related and interdependent, are required for subsequent learning.In other words, when the teacher proposes motor tasks not completely closed and predefined through specific questions, he solicits one or more executive answers/variants, proceedingin accordance with non-linear didactics that favours countless executive and logical connections (Chow 2013; Chow et al., 2007), in order to generate and re-generate *bridges* between learning and *new* links in the individual motor repertoire.

The non-linear didactic approach can characterize the activities that the child spontaneously carries out in outdoor contexts, but it can be intentionally mediated by the teacher to guide the students' learning methods, *for discovery, problem solving* and to promote *self-perception* and *enjoyment*, generating both motor executions

functional to the personal repertoire of motor competencies of each child and the prerequisites and interconnections for subsequent learning (Colella2019).

Teaching motor competencies includes not only the definition of objectives and the selection of motor tasks and activities, but also the adaptation of the methods of interaction and communication with students, to promote learning of skills, knowledge and related factors.Didactic intentionality is required not only to choose motor activities, but also to adapt learning methods to contexts. In fact, through the selection of teaching styles, it is possible to modulate the degree of cognitive, motor and social involvement of the students, the motor commitment time and interdisciplinary and transversal interconnections. Therefore, the styles of *guided discovery* and *problem-solving* focus on the individual, and related operational proposals will have to consider the dynamic and complex interactions that occur between learners, the task assigned and the environmental constraints (Chow2013;Chow & Atencio, 2012).

As far as the *non-linear* pedagogical-didactic approach (Chow 2013) is concerned, the learning process and the execution of students' motor skills are continuously modelled by the constraints resulting from the interactions betweenactivity, environment and individual that generate the variability of the motor proposal.

The use of *non-linear* pedagogical-didactic approaches, based on the variability of tasks and the variation of teaching styles, should be encouraged to stimulate the acquisitionby children of a wide repertoire of motor skills and different learning methods.

The effects of non-linear teaching are as follows:

a) personalization of the motor task (different learning times; duration, difficulty-intensity);
b) autonomy in the choice of executive variants and motor responses: originality and motor creativity;
c) interconnections between learning, interdisciplinarity and transversality;
d) inclusion and didactic obliquity, through various scaffolding (each child has his own level of motor performance);

From this perspective, the learning process becomes more complex, linked to the variations of the constraints emerging from the environment and is the consequence of the interactions between the task, the person and the environment.

Conclusion

Recently, good practices in Physical Education and in motor activities have shown significant progress in terms of selection and review of contents and organizational methods in different educational contexts. On the contrary, studies on teaching methods would require more reflections to improve children's learning process of motor competencies. Furthermore, the expansion of the places for the teaching of physical activities (school, sport, leisure, indoor and outdoor education), the increase in sedentary habits and the uncontrolled use of technologies have limited mature reflection on the modalities of teaching,which becomes an essential hub for the quality of teaching.

In each motor activity lesson, regardless of the contexts in which it takes place, the choice of the modalities through which to organize the didactic setting, opens up well-defined learning windows in the students, that become access routes for the development of disciplinarity, interdisciplinarity and for their interactions.With reference to the teaching of motor competencies in primary school, it can be summarized that:

- ✓ learning tends towards a *non-linear* path,
- ✓ there are several ways to perform a motor task; there is not necessarily an optimal technical solution for a task as children need to find,on their own, a personal and unique solution to the proposed/emerged problem;
- ✓ motor ability can emerge by manipulating the environment, that is, by changing tasks and rules;
- ✓ the teacher's intervention can be carried out effectively through questions, problems, divergent reflections, rather than through instructions or converging questions.

Students must learn to adapt their repertoire of motor skills to the various situations encountered on the field, in the gym or in an outdoor environment; furthermore, inter-individual differences must be valued when teachers plan teaching interventions in any learning context.Being able to produce numerous and different motor responses, as happens when choosing production styles, means equipping students with a wide repertoire of solutions, both quantitative and qualitative, the breadth of which is proportional to the motor opportunities received, e.g. team games, expressiveness and dramatization, gymnastics and, in particular, the ways in which they were proposed.Therefore, while sports training focuses on the repetition of a particular skill or tactical concept, in physical education and introduction to sport, a significant amount of executive variability should be proposed, through repetition *without* repetition (Ceciliani 2016; Chow, 2013;Chow et al., 2007; Pesce 2002). Modifying the *execution* of a motor task, equipment and spaces (e.g., play areas, a tool, duration) can result in modified and adapted game settings; modifying the *proposal* of a task determines different learning methods, since a teaching style *connects* the disciplinary contents with the students' learning methods. This means that teaching styles favour different learning methods and, in particular, *production* styles provide for original, creative and transferable motor executions, generating various matrices for subsequent learning.

Although there is no single way of teaching, *non-linear* teaching provides researchers and teachers with a theoretical framework useful to develop effective and personalized learning projects complemented by the choice of contexts in which to implement them.

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