

Original Article

Motor learning and didactics into physical education and sport documents in middle school-first cycle of education in Italy

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Abstracts

Since 2003 in Italy, the education of physical activity into school has been changing continuously by the Minister of Education University and Research and it is updated every three or four years, as well as it happens for the other subjects. At the same time, new discoveries on the brain aspects of the mechanism of how the students learn the motor and sports skills change the traditional vision. So, there is a new question on teaching method and didactics on physical education and sport to aim a better outcomes. Actually, there is not a accurate theoretical study on this question, thus this work will deep on new scientific evidences to verify if they are applied on didactics and teaching method and if these aspects are in current ministerial document for the middle school, final frame of first cycle of education. The first step is to analyze the documents and regulation rules and the second one is to describe the recent paradigm on the basis of movement and, finally, to evaluate if the motor learning contents are update according to the new scientific evidences. It uses an integrated method that joins, in one hand, a historical and documentary approach to describe the evolution steps, particularly on theoretical paradigms on motor learning didactics. In the other hand, it uses an argumentative deductive approach to talk about on new discoveries on motor control and learning. Results do not carry out any particular aspects connected to the new theories applied motor control and learning. All ministerial documents do not provide any reference of specificity of motor control system and its classification. Furthermore, there are not any innovative elements on didactics and teaching methods according to scientific paradigms. It appears a repetitively traditional corpus of documents that must be changed. Physical education and sport documents need a new vision to address a new approach to didactics. It may be useful to examine closely the study by the experts for the necessary deepening to fill the vacuum.

Key words: teaching method, cognitive and ecological-dynamic approach, indicazioni per il curricolo, learning objectives.

Introduction

Since 2003 in Italy, the education of physical activity has been changing continuously by the Minister of Education University and Research (MIUR) and it is updated every three or four years as well as it happens for every subject in the school. At the same time, new discoveries on the brain aspects of the mechanism of how the motor and sports skills are learned, ask for a new teaching method to improve a better didactics. Actually, there is not an accurate study on the question of didactics and what it is the teaching method in middle school, as a part of the first cycle of education, and this relation to other type of school and to sports association for the same age (6-14 years old). In preschool regulation documents (Raiola, 2011a) and in primary school one (Raiola, 2011b) there are no elements and/or methods to establish the application of new discoveries of motor control system in its multiple scientific theories: closed loop motor control, open loop motor control, motor imagery, freedom degrees. The recent work has analyzed the didactics into the educate program in one of the most important sports team that is practised in the middle school (Raiola 2012a). So, it could consequentially be logic to continue the investigation along the way to examine the regulation documents of the subsequent degree of the first cycle of education. So this work aims to determine whether the new acquisitions in the field of research on movement and the consequent impact on the paradigms of learning and teaching have been considered in drafting the ministerial documents that regulate and direct the middle school, commonly called lower school, that is the final step of the first cycle of education in Italy.

In this first part of the work, we must talk about contents of ministerial document and its development over a defined period of time.

In Programs of '63 and '79, physical education in the peculiarity of its activities and its techniques helps to promote balanced ripening psycho-physical, intellectual and moral of pre-adolescent student and improve his integration into the society through the solicitation of a harmonious development of the body. In National Guidelines of 2004 with the law 53/2003 and the decree new terms entered in the pedagogical-didactic language: personalized study plans (PSPs), personalized plans of Educational Activities (PPAE), Profile, cultural and professional education (PECUP), National Guidelines, Recommendations, civil

coexistence, polyarchy, horizontal and vertical subsidiarity, Learning Units (AU). Although the targets are enriched with adjectives: general, specific learning (OSA); knowledge become declarative, conditional, procedural, while skills became "mainstreaming" and "specific". Appear terms such as portfolios, laboratory and "Larsa", the prevailing teacher, the tutor, external evaluation (by INValSI) and internal evaluation. These were terms that should be reported to the theory underlying the reform of the school, but also to methodologies by which carry out the reform.

Here are some significant excerpts from the section on physical education.

"The specific learning objectives of the educational Secondary School of First Instance, in view of the maturation profile of the educational, cultural and professional of the student at the conclusion of the first cycle of education, uses specific learning objectives indicated for the first two years and the third class in the tables attached to design units of learning. These depart from suitable and meaningful educational goals for individual students, with defined learning standards, and are developed through appropriate paths in method and content, and evaluate at the end, both the level of knowledge and acquired skills, whether and how they have developed the personal skills of each student (Article no. 8 of Presidential Decree no. 275/1999). The specific objectives of learning indicated in the accompanying tables are sorted by subject, on the one hand, and 'educations' that are converging into their education to civil society, on the other. "

Consolidation of coordination skills.	Using effective capacity in normal execution (coupling and combination of movements, differentiation, balance, orientation, rhythm, reaction, transformation, ...)
Level of development and improvement of the conditional capacity (strength, speed, endurance, articular mobility).	- Use rational work plans for the increase in capacity conditional, according to the their levels of maturity, development and learning.
[...]	[...]

In the indication per the curriculum "Guidelines for the curriculum for Preschool and the first cycle of education", issued by the Minister Giuseppe Fioroni by Ministerial Decree 31 July 2007, cancels most of teaching methods proposed by the National Guidelines, built on basis of article no. 8 of Presidential Decree 275/1999 and enacted in accordance with law-delegates no. 53/2003 the new indications all called "Indicazioni per il curricolo". New Indications plot lines and criteria for the attainment of educational goals and learning objectives for the preschool and the first cycle, temporary replacing the previously proposed transient indications to schools in recent years. The "Indicazioni per il curricolo" said that "In respect for and valuing school autonomy, the indications form the framework for designing curriculum entrusted to the schools. Indications are an open text, which the professional community is called to take into context, by making specific choices about content, methods, organization and evaluation."

The construction process of the curriculum cannot be separated by a critical reconsideration of the essential elements of the educational relationship. In essence, the curriculum must be built in the school, and not issued by the centre to be applied, allowing the "agreement between the central instance, regulative and uniform, and local instance, pragmatic and flexible. In this sense, the construction of the curriculum involves a consideration of the school as a place for research and educational innovation, in a dialectical relationship with the requests from the scientific, social and ethical community that characterize the horizon of shared values represented at both central and local level.

In this second section we analyze the current state of the affair of how and why the body and movement are central in the learning process, through methodological and didactic choices in teaching activities at whose foundation there is scientific evidence. "Conceptual knowledge is embodied, that is mapped in our sensory-motor system. This not just provides the structure to the conceptual content, but characterizes the semantic content of concepts according to the way we function in the world with our bodies." (Gallese & Lakoff, 2005). Below is presented a brief summary of the main currents of thinking in the context of motor control and learning, in order to evaluate the resulting of teaching methods, and so to verify if the indications presented in the educational documents can be traced back to such theories. They are synthesized in Cognitive approach and Ecological-Dynamic one.

Humans have, in the brain, a series of motor programs, or sequences of commands that, in the central nervous system, coordinate the execution of movements. According to a first formulation, processing of information from sense organs, particularly proprioceptors, allows the system to correct the movement at timing execution. The closed-loop motor control theory (Adams 1968) assumes that the movements are sufficiently slow to allow correction during implementation, based on the data from the feedback. The movement is sufficiently slow when every information on movement, scientific called feedback, could be processed by mind in two hundreds milliseconds and so it is used by the effectors . The longer the execution time, the wider the

opportunity to use the motor control circuits based on feedback and comparison between memory trace and perceptual trace. Memory trace is the ideal motor program to take place and effect as well as is in the mind without errors while Perceptual trace is the real motor program that is effected with the errors (Adams 1975). Comparison is the process which the mind to determine the differences between to ideal motor program and real one to carry out the errors by the feedbacks. In other word, when motion is quicker than of nerve impulses conduction (up two milliseconds), the movement is not susceptible of correction in progress and is programmed completely in the central nervous system due to the inability of the brain to process information and data below the time threshold of two hundred milliseconds according to open loop motor control theory (Schmidt 1985, Keele et al. 1986). Learning movement consists of developing cognitive structures, known as motor program, through information processing. These processes allow the opportunity to compare in real time, by closed-loop motor control, or later, by open-loop motor control theory, obtain results, triggering a process of adjustment and refinement of movement. Its structure is such that allows the performer to adjust the movement in order to meet the changing needs of the environment. In this way, the generalized motor program (Schmidt, Wrisberg 2004) joins the feedback and comparator between memory trace and perceptual trace, as occurs in closed-loop, and the innate properties of motor centralized program and the exceeding the limit of time threshold of two hundreds of milliseconds to elaborate, the perception, as occurs in open-loop. All of these three motor control theory, open-loop, closed-loop and generalized motor program, are the basis of the cognitive approach. Cognitive approach is used by prescriptive style teaching and has its basis on the preeminent role of the voluntary and determined movement on the environment.

The ecological approach, opposite approach of to cognitive one, does not consider necessary to use prescribing mental structures: the action is directly available to those who act in their own environment, the self-organization that do not require the use of a motor program (Edelman, 1987).

In this approach, learning is defined as an education of attention (Gibson, 1986). Learning means to optimize the processes of perception and develops the ability to dictate the specific stimuli.

In two these approaches presented here, the perception of the context is different and the learning process is defined differently. In cognitive approach, motor learning means to stabilize an efficient motor program according to special processing information. In ecological-dynamic approach, motor learning is to seek the adaptability of the movement as resulting by the diversity of the environment and the specificity of the individual (Carnus & Marsault 2003). This approach, the other one, considers evolution of behaviour of complex systems, where a complex system is a set, where the body moves, composed of multiple interacting factors made by body segments. In the dynamic perspective learning is to build and stabilize a new state not included in the initial coordination dynamics of the system.

The direct consequence of the cognitive theory in educational applications is a prescriptive approach, with a teacher who directs the structure of motor programs, with increasing complexity, and the optimization of their parameters. The aim of the exercises will be to stabilize and improve motor program by reducing the variability in execution through the repetition method and other didactics such as exercise varied, segmented, randomized and idea motion training.

Teaching, in ecological approach, is designed to stimulate the emergence of spontaneous solutions, called heuristics to motor problems, taking advantage of variability in executive search process that implements a mobility solution that passes through the continuous variation of motor gestures. Mainly, the basis of this approach is the freedom degrees theory or Bernstein's problem by Nikolay Alexdrovic Bernstein (1967) that introduces, for the first time, the interaction of single movement in the holistic vision. His research showed that most movements, like hitting a chisel with a hammer, are composed of smaller movements by three steps to learn the movement. Any one of these smaller movements, if altered, affect the movement as a whole. The three steps are: reductions freedom degrees, exploration freedom degrees and capitalization freedom degrees. The first one consists to immobilize one or plus articulations to execute by repetitions the same action, the second one occurs when in consequence to immobilize one articulation to explore other movements to aim the same outcomes or to give freedom some of articulations that before are immobilized. The last one is when it organizes the whole movement with the feedbacks by reduction freedom and exploration degrees to perform the movement by repetitions which are differently among them because one movement is different to others. For this reason, Bernstein called this phenomenon "repetition without repetitions" (Bernstein, 1991). Later, this motor control system has been considered as motor imagery (Lotze & Halsband, 2006).

The knowledge of structural and functional organization of the motor system has evolved and deepened in recent years, gradually abandoning the idea of a brain where the processing of sensory information was entrusted to different and dedicated cortical areas, according to a model in which sensory and motor information are very interdependent (Latash, 2004).

A central role in this reversal of perspectives is due to the discovery of mirror neurons, early in monkeys and later in humans.

Open loop and closed loop are two of the most important theory of motor control and learning, nowadays it must includes a new theory that can better explain the motor learning. It is motor imagery theory.

Before to talk about it, it has to introduce some new neurological discoveries: Mirror neurons system. "Mirror neurons are for neuroscience what the DNA was for biology" (Vilayanur Ramachandran, in Iacoboni, 2008). Studies in human brain have shown the existence of mirror neurons system similar to that discovered in monkeys while the "Group of Parma of Giacomo Rizzolatti" (1996) has noted that they responded both when the monkey performed directly the movement of reaching the food, either when was another individual to perform the action by recording the activity of certain neurons of motor area called F5 in grasping tasks in the brain of a monkey, a group of researchers (Rizzolatti et al., 2001)

"Whenever we see someone performing an action, in addition to activation of the visual areas, there is a concurrent activation of motor cortical circuits that are normally active during the execution of these actions. In other words, the observation of an action involves the simulation of the same. The fact that the motor system is active not only during the run, but also during observation of actions, suggests that exists a relationship between control and action representation" (Gallese et al., 1996). The discovery of a same group of neurons involved in both perception and action dismisses the idea of specialized brain areas and implies interdependence between perception, cognition and motor system and motor learning produces parallel dynamic functional changes during the execution and imagination of sequential foot movement (Lafleur & Jackson 2002).

The first phase of motor learning is characterized by imperfect movements, a high dependence on feedback and a large cognitive and attention load (Atkeson, 1989). The evolution and stabilization of learned movements is reflected in neuroanatomical level, on a change in brain areas recruited and activated neuronal circuits (Halsband & Lange, 2006).

While the immediate repetition of an observed action is supported almost exclusively by the mirror neuron system, learning by imitation requires the intervention of the prefrontal lobe, particularly in the area 46 of Brodmann, and some areas of the cortex anterior mesial. The area 46, generally associated with functions related to working memory, in this case plays a role in combining elementary motor acts in more complex motor patterns. During the learning process, in fact, mirror neurons are responsible for the allocation of the observed action into individual pieces, which are then reassembled into a sequence so that appropriate action is reproduced as close as possible to that observed (Zwicker et al. 2011).

Actually, there is not a deep theoretical study on the question of didactics so this study focuses on the new scientific evidences to verify if they are applied on didactics and teaching methods. Thus the first step is to analyze the documents and regulation rules so, to aim if there is update on new scientific contents. The purpose is to identify if in ministerial documents on middle school as part of first cycle of education, on physical education if there is the new scientific basis of movement and the relating didactics.

Actually, there is not a deep theoretical study on the question of didactics, so this work would deep the new scientific evidences to verify if they are applied on didactics and teaching method about the current ministerial document into the middle school. Thus the first step is to analyze the documents and regulation rules and the second one to evaluate if the motor learning contents are update according to new scientific evidence.

Methods

It uses an integrated method that joins, in one hand, a historical and documentary approach to describe the evolution steps, particularly on theoretical paradigms on didactics on motor learning. In other hand, it uses an argumentative deductive approach to talk about on new discoveries on motor control and learning. Thus, the methodological approach is complex because to get in touch in parallel way the historical and documentary document and the scientific paradigms on motor control and learning and its didactics. In other words, it conducts the theoretical, argumentative and deductive study in two different fields, official documents and scientific paradigms, but utilizing the same vision. It is an integration of different types of research into a single model with an integrated and ecological way. So, in one way it is the historical and documentary approach that analyzes the contents and methodological teaching of physical activities and sports in lower school obtained by laws and ministerial papers. In other way it is the theoretical, argumentative, deductive approach that analyzes the patterns of physical activities according to the main pedagogical, psychological and physiological theories. Finally, comparing all the data to deduct the results on specificity of motor learning.

Results

The programs for lower school, already called medium school, dated May 11, 1963, refers specifically to the premise that physical education programs indicates the general purpose of educational and methodological suggestions such as: teamwork for the individualization of teaching, the prevalence of the use of the command by invitation and discretion in proposed order of exercises; clear preference for the use of natural movement and ample space to professionalism of teachers in the search for variations of intensity, size, rhythm, performance, dynamics, succession and combination.

The Physical Education section of Lower School Programs of 1979 is longer than the past one and, for the first time, speaks on motor education in cognitive aspects connected to physical education and sport in the developmental process. It contains a strong appeal for a didactic guided by the free doing and acting and the

provision of appropriate learning environments for a rich and extensive stimulation. The field of knowledge is divided by areas and the body and movement area is enhanced at least as other fields. The teacher's role is slightly active tending in some cases to director of operations.

New programs have no more a list of exercises, but the general educational objectives, leaving to professionalism of the teacher, mediated by the collegial bodies, to define methods, routes, time and materials, as well as testing and evaluation. Teachers have to apply the procedures, methodologies, time and materials, evaluation and remain free of reference parameters.

Documents don not have inside the new discoveries on motor control system and there are no scientific elements on neuroscience applied to movement and the learning process through the body.

The document 2004, Attachment A - National Guideline for the Programs of studies of the first cycle of education National Guidelines for Personalized Programs of the Educational Activities in the first cycle of education, Specific Learning Objectives, Recommendation to put into practice the National Guidelines for Personalized Programs of the Educational Activities, is a very innovative regulation tool to teach properly to a new discoveries on individual learning process. It takes in light the relation between teaching and learning in an unicum. The format is wrote in double column, where on the left there is specified knowledge and on the right related ability in motor and sports science, as a sort of a new scientific paradigm of physical education and sports in primary and lower school. Thus, it is a mere list of objectives to be achieved in the form of motor skills and there is no single reference to teaching. Basically, it does not refer to any element related to the theories of motor control or to the recent scientific discoveries.

The document 2007, The Guidelines for the curriculum of the first cycle of education, resumes the contents of the document Guidelines for preschool, primary and middle school. These contents are contextualized in a disciplinary process that goes from childhood to the end of the first education cycle. It widens the sense of continuity of teaching action without indicating specific teaching methods. Motor control and learning does not indicate and it does not address to new scientific scenarios on movement in the light of the discovery of mirror neurons or the other motor control system theories

The document 2009, Revision of the educational organization, regulated directions for the first cycle of the school recommends to trust in two last documents: 2007, the Guidelines for the curriculum of the first cycle of education and 2004, National Guideline for the Programs of studies of the first cycle of education National Guidelines for Personalized Programs of the Educational Activities in the first cycle of education, Specific Learning Objectives, Recommendation to put into practice the National Guidelines for Personalized Programs of the Educational Activities. It does not explain the innovation in new rules, but it postpones to a new experimental study the final revision and does not hint anything. Also in this document, there is not a content on the theories of motor control and, consequently, no one scientific specificity about body and movement as a cultural aspects.

As for preschool and primary school, also in documents related to middle school-first cycle of education, there are no elements and/or methods to establish application of motor control system in its these scientific ways and forms: closed loop, open loop, generalized program, freedom degrees and motor imagery. Obviously, we must talk about motor skills and learning in other subjects. The big vacuum is the absolute absence of psychological and pedagogical aspects on movement that could have the theoretical aspect of new discoveries.

Finally the results do not carry out any particular aspects connected to the new neurological theories applied motor control and learning and didactics including the teaching methods. All ministerial documents does not provide any reference of motor imagery, open loop, closed loop and generalized program and its affect on learning according to cognitive approach. Furthermore, there is not any elements on didactics related and the different methods to teach in cognitive way. In other way, the ministerial document does not provide any reference of freedom degrees theory and motor imagery one according to ecological-dynamic approach. Furthermore, there is not any elements on didactics related and the different methods to teach in ecological-dynamic way.

Conclusion/Discussion

Physical activity forms the crux of any major physical education programs at school levels. Regular physical activity and the attitudes toward it can only be developed in the school years. As children make the transformation into adults, many developmental changes occur (Pethkar et al., 2011). So on teaching process in the motor field should fix methodological strategies based on some ontological considerations. [...]. It is necessary an epistemological consideration to assume clear ontological positions to deal with the teaching of the motor activities in the educational field.

The importance of an effective support to the development of the sensory-motor integration ability seems one of most important aim that every school system should follow. However, it may happens that the educators support the sensory-motor development of the student by obsolete methodologies, like the use of exercises based on the simple repetition of actions involving the visual and motor ability. In the analyzed

documents do not appear being guidelines which may be of guidance and support to teachers in their school activities.

By results set forth above, appears as the documents are free of cultural references on learning motor and motor control, and this results in a total lack of knowledge of general and specific aspects of human movement, motor control and psychological aspects. The unique formulation and overall knowledge is useful for the holistic approach, but not realizes the goal of basic knowledge in a specific field.

The identification of a specific epistemological structure, and the resulting educational applications, constitutes an essential step if the physical education at school wants to see recognition of its autonomy and centrality.

From the disciplinary structure, flows a deepening of the paradigm of the discipline respect to the structuring of a coherent theoretical framework and the definition of procedures and methodologies in education.

“Amendments in the national curriculum and changes in physical education teaching methodology seem crucial. Apart from gaining competences pertaining to a particular graduate's profile, development of creative skills, and shaping the proper attitude and behaviour seem vital” (Buchta, 2011).

A detailed review of the psycho-pedagogical principles at the basis of ministerial documents is needed, with the purpose to insert clear links to theories on motor learning, motor control and human movement (Ambretti et al., 2011). Furthermore, in accordance to education way and to performance one, could be useful to evaluate motor skills in relation to didactics for a specific sports game, as well as in volleyball (Raiola & Di Tore, 2012).

Finally, the whole datum is in opposite way to update regulation documents according to new paradigm on theory and methodology on physical education. It may be useful to deepen further the study by experts for the necessary updates to fill up the vacuum

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