

Didactics of volleyball into the educate program for coaches/trainers/technicians of Italian Federation of Volleyball (FIPAV)

RAIOLA GAETANO

University of Salerno, Italian Federation of Volleyball (FIPAV), Italy

Published online: March 31, 2012

(Accepted for publication March 10 2012)

Abstracts

This study 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 method have been considered in the education about sport activity. Actually, there is not a deep theoretical and argumentative study on the question of didactics approach to teach, so this study focuses on the new scientific evidences to verify if they are applied on team sport and, first of all, of volleyball.

It uses an integrated method that joins theoretical approach on scientific paradigms on motor control and learning and deductive-argumentative approach on the specific didactics.

Results do not carry out any particular aspects connected neither to the new neurological theories applied motor control and learning and related didactics. All documents of educate program for coaches, technicians and trainers does not provide any reference of open loop, closed loop and generalized program and its affect on the learning by cognitive approach. In the same way, they does not provide any reference on mirror neurons system, motor imagery and freedom degrees by ecological and dynamic approach.

In conclusion this study takes in evidence no update according to new paradigm on theory on motor control and relating methodology to conduct on consequent didactics. It may be useful to deepen further the study by the scientists and experts for the necessary updates to fill up the vacuum.

Key words: closed loop, open loop, generalized program, mirror neurons system, freedom degrees, motor imagery, cognitive, ecological and dynamic approach.

Introduction

This study 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 theories and methods of volleyball training. In this section it analyzes the current state of the art 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 present in the educational documents that will be analyzed can be traced back to such theories. They are synthesized in Cognitive, Ecological and Dynamic approach.

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, that allow the system to correct the movement at timing execution. The closed-loop motor control theory (Adams 1971) assumes that the movements are sufficiently slow to allow correction during implementation, based on the data from the feedback. The longer the execution time, the wider the opportunity to use the motor control circuits based on feedback.

In other word, when motion is quicker of nerve impulses conduction, 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 2000) 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 three motor control theory, open-loop, closed-loop and generalized motor program, are the basis of the cognitive approach.

The ecological approach, opposite approach of 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 develop the ability to dictate the specific stimuli.

In the 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 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 & Marsualt 2003).

The dynamic approach, the other one, considers the evolution of the 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. (Federal Sports Commission CFS, 2001).

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 the motor program by reducing the variability in execution through the repetition method and other didactics such as exercise varied, segmented and randomized.

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 (DOFs) by Nikolay Bernstein (1967), or "motor equivalence problem", 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. Any one of these smaller movements, if altered, affect the movement as a whole. The "degrees of freedom theory", as well known "Bernstein problem" in motor control field, states that there are multiple ways for humans to perform an action, made by movement, in order to achieve the same goal. In other words, under normal circumstances, no simple one-to-one correspondence exists between a motor problem (or task) and a motor solution to the problem. "It is clear that the basic difficulties for co-ordination consist precisely in the extreme abundance of degrees of freedom, with which the nervous centre is not at first in a position to deal." (Bernstein, 1967). How the nervous system selects of an indefinite (DOFs) is an overarching difficulty in understanding motor control and motor learning because of the abundance of them.

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.

Open loop, closed loop and generalized motor program are three of the most important theory of motor control and learning, nowadays it must includes a new theory that can better explain the motor learning, that is the 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 the human brain have shown the existence of mirror neurons system similar to that discovered in monkeys while the "Group of Parma of Giacomo Rizzolatti" 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, Fogassi & Gallese, 2001)

"Whenever we see someone perform 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, 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. As wrote Maurice Merleau Ponty, (1945) in *Phenomenologie de la perception*, there is not a sub sequential process, but an unique one where in the same time happens the act.

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 the brain areas recruited and activated neuronal circuits (Halsband, 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. So, it has to talk about on contents and didactics of movement in educate program of coaches, technicians and trainer of volleyball.

In the education documents, there is not any elements or aspects to balance for ripening psycho-physical skills, without integration for an unique process to improve the competencies through the solicitation of a harmonious development of the body and mind together applied to volleyball.

Actually, there is not a deep study on the question of volleyball didactics about scientific aspects of motor control and learning, so this study focuses on the new scientific evidences to verify if they are applied on didactics and teaching method in the official educate programme of Italian Federation of Volleyball (FIPAV). Thus the first step is to analyze the educate documents so, to aim if there is update on new scientific contents. The purpose is to identify if in educate program documents for coaches, technicians and trainer there is the scientific basis of movement and so if it talks about on relating didactics, specifically on motor control theory and consequent approach to apply to volleyball. The documents that have been analyzed are:

- Educate programme for the first level course (as known student coach) and its added educate first level for young athletes
- Educate programme for the second level course (as known first degree) and its added educate second level for young athletes
- Educate programme for the third level course (as known second degree) and its added educate third level for young athletes
- Educate programme for the fourth level course (as known third degree)

Methods

The methodological approach is complex. It uses an integrated method that joins, in one hand, a theoretical one on scientific paradigms on motor control and learning. In the other hand, to conduct in an argumentative approach to talk about new discoveries on motor control and learning applied in didactics of volleyball. So, in one way it is the theoretical research that analyzes the elements and aspects of the scientific theories and, in the other way, to deduct the if the teaching methods is applied to volleyball are properly. Theoretical and argumentative research analyzes methodological and didactic patterns of physical activities according to the main pedagogical, psychological and physiological theories to, finally, to compare all the data and to deduct the consequent didactics.

Results

The programs indicates the general purpose of educational and methodological suggestions such as: teamwork for the individualization of training, 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 the coach/trainer/technician in the search for variations of intensity, size, rhythm, performance, dynamics, succession and combination.

The physical activity section 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 sport area is enhanced at least as other fields. The coach/trainer/technician's role is slightly active tending in some cases to director of operations. Programs have no more a list of exercises, but the general educational objectives, leaving to professionalism of the expert. Coach/trainer/technician have to apply the procedures, methodologies, time and materials, evaluation and remain free of references.

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 movement body. In the same way, there are not any elements related the didactics and teaching methods.

It takes in light the relation between the teaching and the learning in an unicum. Basically, it does not refer to any element related to the theories of motor control or to the recent scientific discoveries.

Motor control 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 and to put together in freedom degrees in the directions of the ecological and dynamic-ecological approach to didactics.

Discussion

As for preschool documents (Raiola, 2011a) and primary school one (Raiola, 2011b), also in documents related to educate program for coach/trainer/technician there are not elements and/or methods to establish the application of motor control system in its three scientific ways and forms: closed loop, open loop, generalized program to address for cognitive approach; in this direction there are not any elements and methods on the theory of freedom of degrees and mirror neurons, commonly known motor imagery, to address for ecological and ecological-dynamic approach. 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. All documents does not provide any reference of motor imagery, open loop, closed loop and generalized program and its affect on learning. Furthermore, there is not any elements on didactics related of the new scientific discoveries. Physical activity forms the crux of any major physical education programs at every levels. Regular physical activity and the attitudes toward it can only be developed in the sport activity. As children make the transformation into adults, many developmental changes occur (Pethkar, Naik & Sonawane, 2011). So on the 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. In this way, volleyball has the same characteristics for the principle physical activity with further added aspects of socialization such as bodily communication. “It needs to make an appropriate framework inside university studies with contribution of Italian Federation of Volleyball that includes the basis of the functions of gestures, signs and mimicking in order to construct the competence of gestures required to become expert coach of volleyball or specialist performance analyst. In the same time, into the framework must be included theoretical and practical steps that explains how to teach and training the anticipation skills and how to address the players to utilize the anticipation skills to win the confrontation with the opponent. Finally, the framework have to educate teachers, coaches and technicians on specific theoretical, argumentative, technical, tactical and practical knowledge with ecological approach that integrates also motor and sport activities as expertise.” (Raiola 2011c). “The overall study has highlighted that the results attributed to Bodily Communication have an evident weight on the final score and have similar patterns during the matches. These results can be considered, therefore, in a class by itself as the points assigned to each skill. They have their own characteristics and accidents. The data of the 3 skills can be approved for a new categorization of data points. The Bodily Communication in the analysis of qualitative performance in volleyball is dedicated to all aspects of individual tactics, when it is extemporaneous, or tactics of team if it is analyzed, designed, programmed and then trained in its development “ (Raiola et al., 2011d). The importance of an effective support to the development of the sensory-motor integration ability seems one of most important aim that every sport system should follow. However, it may happens that the coach/trainer/technician 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. This method is inefficient because “these abilities cannot be considered like a muscle to train but like a knowledge that must be taught. (Beery, 2000).”

Conclusion

In the analyzed documents do not appear to be guidelines which may be of guidance and support to teachers for coach/trainer/technician in their sport 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 and sports sciences 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. A detailed review of the psycho-pedagogical principles at the basis of the educate documents is needed, with the purpose to insert clear links to the theories on motor learning, motor control and human movement. 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 the experts for the necessary updates to fill up the vacuum.

References

- Adams J.A. (1971) A closed-loop theory of motor learning. *Journal of Motor. Behavior*, 3:111-15
- Atkeson, C.G. (1989) Learning arm kinematics and dynamics. *Annu. Rev. Neurosci*, 3, 171–176.
- Beery, K.E.(2000),VMI Visual Motor Integration,Giunti
- Bernstein, N.A. (1967). *The co-ordination and regulation of movements*. Oxford : Pergamon Press
- Carnus, S, & Marsault C. (2003) *Repenser l'EPS à partir de l'approche ecologique – Rivista EPS*, édition revue EPS - N° 302 pag. 13, Paris, France
- Commissione Federale dello sport. (2001). *Basi teoriche e didattiche dell'educazione fisica 2001, – volume 1 – pag. 81, Commissione Federale dello sport CFS*
- Davids, K, Bennett, S & Button, C. (2001). Skill acquisition in sport: some applications of an evolving practice ecology. *Journal of sport science*, 15, 621-640; Hodges N.J. E
- Decety, J. (1996). The neurophysiological basis of motor imagery. *Behavioural Brain Research*, 77
- Edelman G M, (1987) *Neural Darwinism. The theory of Neuronal group Selection*, Basic Books, New York.,
- Gallese V., Fadiga L., Fogassi L & Rizzolatti G., Action recognition in the premotor cortex, *Brain*, 119 (1996), 593-609.
- Gallese, V, & Lakoff, G. (2005). The Brain's concepts: the role of the Sensory-motor system in conceptual knowledge. *Cognitive Neuropsychology*, 22(3/4), 455-479
- Gibson J.J. (1979). *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin
- Haken H. (1977) *Synergetics. an introduction*. Springer
- Halsband, U., Lange, R. K.(2006) Motor learning in man: A review of functional and clinical studies. *Journal of Physiology – Paris*, 99, 414–424.
- Hutchins, E. (1995). *Cognitions in the wild*. Cambridge, MA: MIT Press
- Iacoboni, M. (2008). *I neuroni specchio. Come capiamo ciò che fanno gli altri*. Bollati Boringhieri
- Lafleur, M.& Jackson, P., (2002), Motor learning produces parallel dynamic functional changes during the execution and imagination of sequential foot movement. *Neuroimage*, 16, 142-157.
- Lotze, M & Halsband,U, Motor imagery, *Journal of Physiology-Paris*, Volume 99, Issues 4-6, Brain Imaging in Neurosciences - An Interdisciplinary Approach, June 2006, Pages 386-395
- Merleau-Ponty, M. (1945). *Phenomenologie de la perception*, Gallimard, Paris
- Pethkar, V, Shraddha Naik, S & Sonawane, S. (2010). Attitudes toward physical activity and its measurement. *Journal of Physical Education and Sport Vol 29, 4,December, 2010*, pp. 30 -36
- Raiola, G. (2011a). Study between neurophysiological aspects and regulation documents on preschool in Italy. *Journal of Physical Education and Sport Vol 11, no 1*, pp.42 47
- Raiola, G. (2011b). A study on Italian primary school rules: neurophysiological and didactics aspects in physical education and sport. *Journal of Physical Education and Sport Vol. 11, no. 2*, pp.153 158
- Raiola, G. (2011c) Theoretical, argumentative and empirical volleyball study on body communication and its relation to anticipation skills. *New perspectives of coaching formation, Acta Kinesiologica Vol. 5, Issue 2; December 25*,
- Raiola G., Di Tore A., Gomez Paloma F., Sibilio M., (2011), A Pilot Study about the Incidence of Communication Skills on the Results of Volleyball Matches over a Full Season, *Selçuk Üniversitesi Beden Eğitimi ve Spor Bilim Dergisi*, vol. 3, issue 3
- Rizzolatti G., Fadiga L., Gallese V., Fogassi L., (1996), Premotor cortex and the recognition of motor actions,*Cogn. Brain Res.*, 3, 131-141.
- Rizzolatti G., Fogassi L., Gallese V. Neurophysiological mechanisms underlying the understanding and imitation of action. *Nature Reviews Neuroscience* 2 (2001) 661-670.
- Schmidt, R.A. (1975) A schema theory of discrete motor skill learning. *PsychologicalReview*, 82, 225-26
- Schmidt, RA & Wrisberg, C. (2000). *Apprendimento Motorio e Prestazione*. Roma: Società Stampa Sportiva

Regulation references

- Educate programme for the first level (as known student coach) and its added educate first level for young athletes, (2009) FIPAV, Roma, Italy
- Educate programme for the second level (as known first degree) and its added educate second level for young athletes, (2009) FIPAV, Roma, Italy
- Educate programme for the third level (as known second degree) and its added educate third level for young athletes, (2009) FIPAV, Roma, Italy
- Educate programme for the fourth level (as known third degree), (2009) FIPAV, Roma, Italy