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EMBODIED COGNITION AND MOTOR ACTIVITY

EMBODIED COGNITION E ATTIVITÀ MOTORIA

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Abstract
The objective of this paper is to review the main studies carried out on the theme of the embodied cognition, outlining the link between neuroscience and motor and sports activities in the most general sense possible. According to the embodied cognition perspective, cognitive processes are not limited to operations that take place within the cognitive system, but include broader body structures and processes of interaction with the environment (Lakoff, Johnson, 1999, Noë, 2004, Chemero, 2009). The embodied cognition approach states that mind and body are not separate and distinct, as Descartes mistakenly thought (Damasio, 1995). Therefore, by merging the studies in the literature in homogeneous sets in terms of research methodology, chronology and points of view on the relationship between embodied cognition and motor activity, this research will attempt to clarify and expand the state of the art on the chosen topic, highlighting some limitations of the literature and imagining future opportunities and directions of the research itself.

Key words
Embodied Cognition, Motor Activities, Sports, Teaching, Neuroscience
Embodied Cognition, Attività Motoria, Sport, Insegnamento, Neuroscienze

Introduction

In the field of neuroscience studies relating to human movement, the concept of embodied cognition is particularly significant. Particularly in the context of sports activities and in the broader area of motor activities, the concept of "embodied" is of key importance as it supports the idea that the mind and the cognitive processes must be analyzed in the context of the mind-body relationships. The embodied cognition approach asserts that our body, including then our brain, contributes to determining our mental and cognitive processes (Borghi, 2013).

The viewpoints of the studies carried out on the subject seem quite varied, ranging from the numerous works on teaching practices, didactic methods and learning from an embodied cognition perspective, to the relationship between inclusion and embodied processes, going through the reinterpretation of practices related to physical education as a school discipline, in the light of the embodied cognition theories. Furthermore, there are studies on the relationship between the broader sense of human movement and the "embodied", in order to delve more specifically into the study of the link between some oriental disciplines, reinterpreted in an embodied key, and the resulting sports skills. Other lines of research concern the relationship between the embodied cognition and the role of sports referees, and the intrinsic link between embodied and sport psychology. Apparently limited are the studies on literature reviews about the subject of embodied cognition, an area within which this research project will be included.

The objectives of this contribution will focus on the analysis of the embodied cognition phenomenon in the context of sport, physical education and human movement in general. After identifying the main sources on the subject and capturing the state of the art of the relationship between embodied cognition and human movement, the idea is to categorize and review the main studies and contributions on the subject, analyzing similarities, methodological differences and any research gaps.

State of the art and literature review

The sources used for this project were divided into preliminary, primary, and secondary. Among the preliminary sources there are several specialized sites generally dealing with neuroscience and the embodied cognition theory, which tend altogether to describe embodied cognition as a theory that, in the field of movement, has finally managed to get rid of Cartesian dualism, supporting the approach that embodied cognition highlights: the idea that the mind must always be analyzed in the context of its relationship with a body, and that the latter is part of the causal chain which leads to the development of a certain cognition assuming different functions and roles within the cognitive activity.

Among the secondary sources we mainly included manuals and technical texts on neuroscience and - of course - on embodied cognition, from the didactic process and teacher's perspective (Gomez Paloma F., 2013), that of sports psychology (Cappuccio M., 2019), or even following the traditional neuroscience theories (Caruana F., Borghi A.M., 2016). Moreover, among these sources, we included some works related to the sports-neuroscience combination (Crepaz P., 2019).

As previously mentioned, among the primary sources there are all the studies and the main research activities carried out on the theme of embodied cognition. The perspectives of the studies carried out on the topic seem to be quite varied. Many works focus on the relationship between the development of motor skills in an embodied cognition perspective, emphasizing how embodied perception can be exploited at a practical level to improve the acquisition of skills and to evaluate differently the training programs in sport (Gray R., 2013), or assuming that the brain has evolved for the control of action rather than for the development of cognition per se (Koziol L.F., et al, 2007), thus presupposing that the area of coordination and movement control is particularly relevant. Moreover, in this area, some work emphasizes that excellent sport skills inspire embodied cognition, that the details of our bodily constitution are not accidental to our mental powers but define them in various inherent ways (Cappucci M.L., 2015),

and that working on sense-motor skills (thus on the relationship between perception and action in sport from an embodied perspective) improves sport skills (Sevdalis V., Wöllner C., 2016).

Another research strand, on the other hand, concerns the relationship between embodied cognition theories and the figure of the match director. Some interesting studies take into account the fact that one of the factors influencing the performance of sports officials, and therefore leading to competence, comes from having practiced firsthand the sports activity in question (Pizzera A., 2014), and also that cognitive judgments are related to motor, visual and refereeing experience at different levels; sports officials should quickly specialize in refereeing and should gain visual-motor experience as athletes or spectators as soon as possible, to then change role and become a sports official (Raab M., 2012).

Another branch of literature concerns the relationship between oriental disciplines and embodied cognition. Such works highlight, for example, the relationships between activities like tai chi, one's postures in motion, and embodied cognition (Thompson E., Wayne M.P., 2018), or that by starting from investigations on embodied cognition and disciplines such as yoga, the latter may reduce stress by influencing the way individuals assess stressors (Francis A. L., Cross Beemer R., 2019). Finally, some studies suggest that a relaxation training in an embodied cognition key generates positive effects on taekwondo performance; therefore, embodied cognition may have an application in the field of competitive sports (Ottoboni G., et al., 2018).

Some more contributions deal with the relationship between sports psychology and embodied cognition. In such research activities the aim is to explore the theoretical significance of research on expertise, attention and mental imagination in athletes from the cognitive psychology and cognitive neuroscience perspectives (Moran A., 2009), or to highlight how some mental representation techniques, combined with the embodied concept, are useful for high-level sport performance (Agurruza I., et al., 2017). Other studies, still focused on the subject of mental representation techniques, relate it all to the environmental condition (Raab M., Araújo D., 2019). There are also many contributions that emphasize the relationship between embodied cognition and the teaching-learning concepts. In particular, these contributions seek to analyze the learning of motor skills, evaluating alternative modes of teaching which are more aligned with embodied theories, and thus are non-prescriptive (Van der Kamp J., 2019); therefore, independently of the exercise modes, they aim to examine teaching methods that adequately challenge students' thoughts and actions, which enrich cognition, are engaging, and use motor activity as a means (Tomporowski, P. D., Pesce, C., 2019). In line with the latest research works reviewed, some studies focus on the specific relationship between physical education at school and the embodied cognition theories, emphasizing that a brain-based physical education setting contributes to a positive development of the student (Olivieri D., 2016), and in particular that, in light of recent neuroscientific research activities, the physical education paths at elementary school should be rethought by designing different training paths for teachers themselves (D'Anna C., Gomez Paloma F., 2019).

A very interesting research area is the connection between embodied and inclusive practices, where numerous studies suggest to undertake inclusive practices and didactic processes by using one's own body, perhaps through motor and recreational-sports activities (Lo Piccolo A., 2019). Other contributions consider the body as the authentic and irreplaceable fulcrum of a complex global system that embraces affective, cognitive, social, pragmatic, political, and cultural dimensions, and therefore the body interaction can become the overarching cornerstone, the synthesis of the educational process of the differently-abled ones (Magnanini A., 2020). Also interesting is the contribution regarding the case study of the mixer ability in rugby, for which the body dimension is related to the inclusive dimension (Damiani P., et al., 2018).

The last set of research activities concerns the connections between embodied cognition and human movement in its most generic sense. Some scholars focus on the communication aspects related to the body, highlighting that part of this communicative decoding is based partially on a simulation of other people's behavior within our nervous system (Grafton S.T., 2009); other studies reconsider the role of the body in receiving information from the environment during

movement (Cox A.M., et al., 2016). Furthermore, other research studies relate and aim to advance the understanding of motor and cognitive patterns, arguing that the two components are intertwined (Raab M., 2017); they also highlight the existence of a real Embodied Education (Ceciliani A.,2018), recognizing to motor activity and sport sciences an educational approach focused on the involvement of the subject as a fundamental actor of the educational processes in which he/she is involved, clearly basing it all on the movement.

Conclusions

Generally speaking, the studies on embodied cognition in relation to human movement, motor activities and sports would seem to deserve further investigation, and therefore the starting hypothesis regarding a more detailed analysis of the reviews on the subject appear to be partly covered, albeit with some limitations. The limits of some contributions highlighted in quantitative terms are factors that can apparently hinder the knowledge process of the area under consideration. Even the considerable methodological differences and approaches in the field of the embodied cognition can be considered very limiting factors. Therefore, some research gaps in the field of embodied cognition appear evident; gaps that, as mentioned before, can become opportunities for further investigation and expansion, starting from the same methodological basis. Analyzing with greater precision only the embodied cognition/motor learning relationship, or knowing exactly how neuroscientific theories are closely related to a particular sports activity with its consequent effects, are just two examples of how this contribution can be used to further develop the starting hypothesis, adding yet another contribution to the link between neuroscience and human movement.

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