THE EDUCATIONAL POTENTIALITIES OF MOTOR AND SPORTS-PLAYFUL ACTIVITIES TO FACILITATE THE ACCESS TO KNOWLEDGE IN PRIMARY SCHOOL

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Abstract

The purpose of this study is to verify the influence of teaching methods focused on sports-playful and motor activities to get knowledge in the field of botany as required by the Italian Ministerial Guidelines and Programmes that, in 2007, highlighted the possible relationship between body and movement in their several different forms as access to knowledge. It was supposed that it is possible to develop a motor and sports-playful teaching activity such as *orienteering* to get knowledge in the field of botany and that the use of a multi-sensory and a non-formal "learning context", as a green space, might improve the processes of knowledge in the field of botany. The sample used for the research involved 320 students and the instrument used to evaluate the effects on learning was the Test of Memory and Learning by C.R. Reynolds and E.D. Bigler. The data were analyzed using One Way Anova with *t* Student test for two independent group. The experimental teaching method highlighted significant differences between the experimental group and control group, requiring further deeper studies and investigations on the subject.

Key words: *teaching methods, primary school, sports-playful activities*

Introduction

The latest (still in force) Guidelines of the Italian Ministry of Education for the *Curriculo* of the First Education Cycle in 2007 highlighted the possible relationship between body and movement in their several different forms as access to knowledge.

The ministerial document is a testimony of the development of the educational aspect of motor and sports-playful activities in Italian primary schools and provides a new vision of motor activities which defines the body "rather than as an object of the world, as a means of our communication with it" (Merleau Ponty, 2002). Consequently a new interpretative key for the study of the relationship between cognitive experiences and motor aspects in primary schools is introduced, so that it is possible to combine different theory systems (Rizzolatti, 2006; Berthoz, 2002) that are apparently in contrast but basically complementary.

The research is part of the studies that investigate the possible relationship between the learning mechanisms and the bodily and multi-sensory experiences for the construction of knowledge in schools.

The scientific paradigm requires the integration and concurrence of several different paradigmatic systems coming from philosophical, psycho-pedagogical, educational and neurobiological research traditions.

The relationship between teaching, corporeity and access to knowledge does require a necessary harmonization between theoretical and argumentative research, teaching research and experimental research in an epistemologically coherent framework.

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[2] Paola Aiello edited the data analysis and the results of the research
[3] Nadia Carlomagno edited the theoretical framework of the research

In recent years a new neuro-scientific approach to the study of learning mechanisms has emerged. It has gradually given an original role both to the body and the movement to make knowledge accessible.

The study of the interaction between movement, perception and memory according to an anti-dualistic perspective which is antithetical to the Cartesian model (Damasio, 2005; Edelman, 2006) has produced a profound conceptual change that has transformed the analysis of the cognitive functions of the person in an integrated study of the innate biological characteristics and their permeability to the environment.

In this perspective, consciousness can be seen as "embodied", thus expressing his own actual physicality, depending on the type of hardware in which mental processes are implemented and "situated" as well as contextualized to the environment the body interacts with (Gibbs, 2005). In this perspective, the body is the subject of a mediation with reality, the agent of a decoding process that allows the person to store and systematize the information into categories that form the prerequisite of knowledge.

From a philosophical point of view this approach is ascribable to Merlau-Ponty's phenomenology of perception that considers the experience as the ability to bring out the origins of meaning, allowing us to make assumptions about the causes and regulating mechanisms of several different phenomena *we must discover the origin of the object at the very center of our experience* (Merleau-Ponty, 1962, p. 62) *it is upon our experience of the world that our logical operations concerned with significance must be based* (Merleau-Ponty, 1962, p. 295).

From a psycho-pedagogical point of view, Piaget stressed the role of sensory-motor integration in the processes of knowledge, highlighting that it proceeds from action. The studies by Piaget highlighted that a child, since the earliest stages of his/her development, thanks to the sensory-motor experience, activates a cognitive system that allows him/her to sort out the flow of information coming from the outside, conquering the whole universe that surrounds him/her, through perception and movement (Piaget, 1952).

The theoretical approach by Piaget is a prerequisite for the acknowledgement of the intellective aspect within the motor action itself, for the possible interpretation of the different meanings of the corporeity, for the discovery of the learning potentialities of the body and the movement that have been the subject of the research on cognitive pluralism by Howard Gardner.

In this dynamically cognitive key that does not ignore the context and the characteristics of the subject, it is necessarily required to combine the argumentative-theoretical and empirical analysis (Damasio, 2005; Goleman, 1997) with experimental studies in the field (Rizzolatti, 2006; Berthoz, 2000; Hebb, 1949).

Neurobiological studies on the synaptic connectivity (LeDoux, 2002) focused on the relationship between perception and memory, highlighting a possible relationship between movement, afferent systems and memory in the learning processes. The body, affected by sensory-perceptive, tactile and kinesthetic stimuli, changes its approach to knowledge using alternative senses to the classical canonry as means of collecting emotionally engaging information, representing an essential substrate for a constructive process of learning and memory (LeDoux, 2002). In particular, the studies by Hebb on the functioning of mnemonic systems have highlighted the role of emotionally significant experiences, such as those focused on the involvement of the body, to "drag" and "stabilize" some information, fostering the process of associative learning. This allows the use of integrating different perceptions, creating a neurological network that, although based on an operating system of a genetic configuration acquires a subjective interaction with the environment (Siegel, 1999). Indeed, it is only the constant, harmonic, multi-sensorial and balanced interaction with the environment that makes the individual able to incorporate, learn and find solutions that allow a broader and more "easy" adaptation to what surrounds it. (Rizzolatti, 2006).

In the experimental field, the relationship between perception, memory and action makes possible to identify motility not only as "the physical aspect and dynamic action" but also as the instrument that comes closest to a `sixth sense' for its ability to anticipate the action (Berthoz, 2002). In this perspective the research on mirror neurons by Giacomo Rizzolatti is included. It shows the possible relationship between the vision of a gesture, of a specific action or object, and "the immediate and automatic selection of its characteristics that allows us to interact with it" (Rizzolatti, 2006, p. 35).

From a teaching point of view, these experimental-theoretical assumptions are reflected in the justification of some theoretical models that have inspired and supported the studies of meta-cognition by Ausbel and Novak.

This strand of research has investigated the importance of the interaction between thinking (cognition), feelings (emotions) and (motor and psychomotor) actions in the process of attribution of meaning to the knowledge (Novak & Gowin, 1984).

The outlined theoretical approach is the paradigm that supports teaching methods to be used at school that consider the body as "subject, object and instrument of knowledge" (Sibilio, 2008), enhancing the function of multi-sensory teaching methods that use the body as mediator of cognitive processes.

In this perspective, any laboratory bodily-experienced teaching activities, *weave a network connecting the different intelligences and direct harmoniously and effectively the action of the capacity to be put into play when coping with a problematic situation, encouraging, from time to time, mechanisms of synergy which take place on the ground of the motricity* (Sibilio, 2002). The motor-laboratorial methodology at school, using a systemic approach to learning, integrates bio and neuro-physiological as well as psychological aspects and environmental characteristics exceeding the boundary between "nature" and "nurture" (Plomin, 1986).

The use of the motor-laboratorial methodology harmoniously and functionally integrates with the paths of interdisciplinary research, the experiences of action-research (McNiff & Whithehead, 2006) and empirical research to be carried out with educational institutions in compliance with the principles of the cooperative participation, the orientation to action and the purpose of improving and changing educational conditions.

This unique approach allows cognitive processes to redefine the relationship between disciplinary content and "how" to access to knowledge, defining an unexplored area of research that goes beyond the rigid boundaries of traditional disciplines, drawing from interdisciplinary fields such as motor and sport ones that use the body and movement both as tools and subjects of learning.

Objective

To verify the didactic potentialities of motor and sport-playful activities for the access to knowledge in primary school through a laboratory of orienteering in order to get knowledge in the field of botany.

Methods

The research was put in a project financed by the Funds of the University of Salerno in 2007 and it previously required the subscription to specific long term agreements for the research with two primary schools in Fisciano (Salerno) and Giugliano (Naples).

The choice of the objectives of the research derived from the needs of the teachers of the two primary schools who highlighted the need to improve teaching methods of the botany learning as planned in the *curriculo* of the third and fourth school years of the primary school. The sample used for the research involved 320 students of a school in Fisciano (SA) and the 4° Teaching District of Giugliano (NA) for a total of 8 year three classes (4 from Fisciano and 4 from Giugliano) and 8 year four classes (4 from Fisciano and 4 from Giugliano). The sample was divided into two groups: an experimental group and a control one. 4 year three classes were drawn out from the control group and 4 from the experimental one. 80 students of the control group and 76 students of the experimental one (for a total of 156 students) did the test. 4 year four classes were drawn out from the control group and 4 from the experimental one. 80 students of the control group and 76 students of the experimental one (for a total of 156 students) did the test. The age range of the participants was 8 ± 1 (year three class) and 9 ± 1 (four year class).

This research was carried out in 3 phases:
a) In the first phase a theoretical-argumentative research was carried out to define a scientific interdisciplinary framework on the function of the body and movement as keys of the access to knowledge and tools to facilitate training processes.

The outlined theoretical framework has provided a scientific support to the hypothesis according to which it is possible to develop a motor and sports-play teaching activity on *orienteering* to get knowledge in the field of botany.

The choice of the *orienteering* as "laboratorial environment" was justified by the following characteristics:

- Strong multi-sensory approach of the experience
- Strong meta-cognitive approach of the experience
- Ability to combine motor activity with the knowledge of the places, plants and pathways through the concurrence of several sensory systems;
- Ability to educationally enhance situations related to the natural environment that can be emotionally meaningful to the students;
- Ability to match the activities with the bonds required by the type of research (action-research)

b) In the second phase was carried out a study on the relationship between teaching methods and access to knowledge in the field of botany in the Italian primary school through:
- the analysis of the Teaching Programmes and the Ministerial Guidelines of 2007;
- analysis of the teachers' training courses in primary schools, with particular reference to the construction of the methodological skills necessary to the use of body to get knowledge in teaching;
- analysis of teaching research methods compatible with the bonds of the primary school and the objectives of the research.
The work highlighted the need to adopt the methodology of action-research.
- identification of survey instruments in compliance with the objectives of the research and which may be useful to the assessment of the outcomes.
The study suggested the possible use of subtests no. 9, 10, and 11 of the Test of Memory and Learning by C.R. Reynolds and E.D. Bigler which point out the features which are compatible with the school and consistent with the objectives and the pattern of the research.

c) In the third phase an action-research was carried out inside each school and the following actions were performed:
1. Teachers' training on teaching methodologies required by the research (teaching focused on the body through the use of the orienteering laboratory)
2. School-university sharing of the teaching experience and of the drawing up of a teaching- methodological protocol.
3. Carrying out of a teaching laboratory focused on the orienteering.

To carry out the experience, a not-structured environment was chosen as setting of the experimentation: the park; on the contrary, the classroom was used for the traditional teaching of the control group. The teaching laboratory on "orienteering", that was the stimulus, was led directly by the teachers of the classrooms who had been previously trained on the teaching laboratory methodology focused on motor and sports-play experience. The children of the experimental group were blindfolded and, using the vicarious senses (touch, smell, hearing), explored the plants in a multi-sensory way. In particular, the children of the experimental group coupled the path with the "orienteering" (pre-sports motor activity for an active orientation). In parallel, those of the control group attended a "traditional" lesson in the classroom, where the same subjects of the first route were discussed only through pictures and explanations that relate to a limited part of the perceptual system (hearing, sight).

Subsequently, both groups were tested to acquire data to measure the effect of treatment on the experimental group.
4. Handing out of subtests no. 9, 10, and 11 of Test of memory and learning by C.R. Reynolds and E.D. Bigler .
The Test of memory and learning by C.R. Reynolds and E.D. Bingler was handed out. Specifically, the aspects of memory that were tested are the following:

– The verbal memory functions by *paired words recall*;
– The spatial and visual sequential memory that evaluate non-verbal features.

The selected subtests were the following:

- the subtest no. 9 “Paired recall” (PR): verbal learning task of associated words pairs which consists in asking the subject to recall the words of the couple as the examiner provides the first word of each couple, to calculate measures of immediate, associative, and learning recall;
- the subtest no. 10 "Memory for location (MFL)": non-verbal task that has made possible an assessment of spatial memory, requiring the subject to reproduce an ordered series of movements of the hand in the same temporal sequence in which they have been presented by the examiner ;
- the subtest no. 11 "Manual imitation"(MI) which provides a psychomotor assessment based on the display of the stimulus (motor model) of the sequential memory, asking the subject to reproduce an ordered series of movements of the hand in the same temporal sequence in which they have been presented by the examiner.

The results of the research were finally statistically analyzed to assess any differences between the experimental group and the control group.

Data Analysis

The data were statistically analyzed in order to verify significant differences between the experimental group and control group, showing that the experimental teaching method might be connected to the emerged differences between the two groups.
The differences were evaluated for the experimental and control groups.
The data were analyzed using One Way Anova with *t* Student test for two independent groups.
The working hypothesis predicted that the experimental laboratory method would have increased significantly the number of correct answers.
So in the verification of the hypothesis was formulated the null hypothesis of equality of the means and the alternative hypothesis of difference between them.
The hypotheses were tested with levels of significance at 5% and 1%.
For each level of significance were reported critical values of the t Student both for year three and year four classes. Being equal sized the two samples, the critical t value at 5% was t = 1.645 and the critical value at 1% was t = 2.326 .

Results

As regards as test no. 9 (*Paired recall*):

- For year three class (Table 1) the *t* value was 2.358. It exceeds both the t critical at 5% and that of 1%, so that the null hypothesis of equal means in the two groups (experimental and control groups) can be rejected. The alternative hypothesis can be accepted and it is possible to say at 99% that the experimental method significantly changed the mean of correct answers;
- For year three class (Table 1) the *t* value was 2.997, exceeding both the t critical at 5% and 1%, so that the null hypothesis of equal means in the two groups (experimental and control groups) can be rejected and the alternative hypothesis can be accepted. It is possible to say at 99% that the experimental method significantly changed the mean of correct answers.

As regards as subtest no.10 (*Memory for Location*):

- For year three classes (Table 1) the *t* value was 2.536. It exceeds both the t critical at 5% and 1%, so that the null hypothesis of equal means can be rejected in the two groups (experimental and control groups) and the alternative hypothesis can be accepted. It is possible to say at 99% that the experimental method significantly changed the mean of correct answers;

- For year four classes (Table 2) the *t* value was 4.181. It exceeds both the t critical at 5% and 1% so that the null hypothesis of equal means in the two groups (experimental and control groups) can be rejected and the alternative hypothesis can be accepted. It is possible to say at 99% that the experimental method significantly changed the mean of correct answers

As regards as the sub test no. 11 (*Manual imitation*):

• For year three classes (Table 1) the *t* value was 5.037. It exceeds both the t critical at 5% and 1%, so that the null hypothesis of equal means in the two groups (experimental and control groups) can be rejected and the alternative hypothesis can be accepted. It is possible to say at 99% that the experimental method significantly changed the mean of correct answers.

• For year four classes (Table 2) the *t* value was 2.147: It exceeds the t critical at 5%, so that it is possible to reject the null hypothesis of equal means in the two groups (experimental and control groups) and the alternative hypothesis can be accepted. It is possible to say at 95 %, that the experimental method significantly changed the mean of correct answers;

At 99% it must be said that the experimental method does not change significantly the mean of correct answers and that any observed difference should be attributed only to chance.

In conclusion, it is possible to say that in all cases, with significance at least at 5%, the experimental method produced a higher mean of correct answers, and, apart from the test of manual imitation for year four classes, it can be said also with significance at 1%.

Table 1.

Experimental Laboratory Method
Year three classes
N = 156
T_{crit} 5% = 1.645
T_{crit} 1% = 2.326

Subtest	T_{test}	Null Hypothesis	
		5%	1%
9	2.358	Rejected	Rejected
10	2.536	Rejected	Rejected
11	5.037	Rejected	Rejected

Table 2.

Experimental Laboratory Method
Year four classes
N = 156
T_{crit} 5% = 1.645
T_{crit} 1% = 2.326

Subtest	T_{test}	Null Hypothesis	
		5%	1%
9	2.997	Rejected	Rejected
10	4.181	Rejected	Rejected
11	2.147	Rejected	Accepted

Discussion and Conclusion

Primary School in Italy is the place where knowledge takes roots in experience ("doing and acting"), and the two systematically combine, but also the place where the early, formal, semantic syntactic, disciplinary and interdisciplinary ways of organizing such reflexively obtained knowledge is conceived". (National Guidelines for Customized Study Programmes in Primary School in 2007. Addendum b).

The purpose of this study was to verify the influence of teaching methods focused on sports-playful and motor activities to get knowledge in the field of botany as required by the Italian Ministerial Guidelines and Programmes.

It was supposed that motor and sport experiences, using a multi-sensory and a non-formal "learning context", as a green space, might improve the processes of knowledge in the field of botany.

The educational setting scheduled an unusual place as a resource for learning and the use of potentially "alternative" senses, as a way to gather emotionally involving information, represented an essential basis for a constructive process of memorization and learning.

"Such memory and learning processes translate into a network of neural, behavioural and mental components, whose diverse combinations mould knowledge and behavior of an organism through its interaction with the world, thus helping it to adjust and survive" (Tulving, 1962).

The comparison between the experimental group and control one with regard to the differences on the investigated cognitive abilities, in particular, on the verbal and non-verbal memory, were measured using the Test of Memory and Learning, which allowed a quantitative measurement. The significance of the difference between the means was statistically obtained comparing the scores of the two groups, made it to say that the result is not random.

It is therefore allowed to infer that the laboratory method used with the experimental group may have influenced this difference.

The results of the research require further deeper studies and investigations on the subject, aware of the complexity of the study and learning evaluation in subjects in the age of development, which cannot fail to take into account the individual characteristics, the cultural and social background, the singular processes of development) of the participants and the complexity of the investigated object. The study is part of the educational research and it refers to the concepts of the science that do not mean to "explain" but to "understand" and "interpret" the investigated phenomena (Dilthey, Makkreel, Rodi 1989).

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