Energy expenditure implications in the use of teaching methodologies: possible influence of the laboratory focused on body and movement in improving wellness in primary school students

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INTRODUCTION

Recent theoretical considerations on the *embodiment* of the cognition (Varela et al., 1991; Lakoff & Johnson,1999; Raymond & Gibbs, 2005) have led, over the last decades in Italy, to a "re-conceptualization" of teaching practices in educational contexts in favor of an enhancement of the bodily-kinaestesic dimension in the educational processes; the body and its movement potentialities are not considered only as a privileged instrument of the education to access to knowledge, but the means through which the quality of relationships and lifestyles of the person, in a state of mental well-being, is realized as the result of the integration of physical and biological elements as well as cultural, social and psychological ones (Siedentop & Tannehill, 2000).

In this regard, recent international studies (Stewart et all., 2004; Faircloughet all.,2006; Bailey et all., 2009) have drawn attention to the importance of motor activities inside the school to ensure the development of healthy and effective motor behavior of children.

In Italy, the importance attributed to these aspects is highlighted in the latest Guidelines from the Ministry of Education (2007) that recall the need that the curriculum of the primary school shall include experiences leading to a correct and healthy lifestyle, that means the prevention of diseases

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related to hypokinesia, through the enhancement of school and extra-school motor and sport experiences.

The subject area "*body, exercise and sport*" in the Italian National Guidelines shows the close relationship of motor and sports activities with psycho-physical balance that is essential to the achievement of healthy conditions, identifying in the motor, recreational and sports activities an instrument of prevention of diseases.

To achieve these aims, the teacher's role is to propose a teaching model that shapes the formation of learners and that is oriented, in the meanwhile, by methodological choices aimed to the improvement of cognitive functions with a focus on the wellbeing conditions that facilitate their success.

In this perspective, the motor laboratory is a methodological teaching strategy alternative to the traditional teaching methods, that is, in favor of the cognitive mechanisms, being as well an effective way to achieve a more balanced energy expenditure during the school time.

The Italian schools meet the needs, emerged also on a theoretical level, through the integration of motor and sports activities in the didactic practice, through projects aimed to strengthen and to implement this kind of activities (Note GEN. DIR. Student, N. 1201 del 17-12-2008) attended by children aged from 6 to 11 (ISTAT, 2008. Multipurpose survey "The daily life of children and teens. Year 2008").

In this perspective, teaching methods that use movement experience through the laboratory can be alternative to the traditional methodologies; the motor laboratory can be seen as a form of support to the cognitive mechanisms, as well as an effective way to achieve a more balanced energy consumption during school time.

One of the indicators of movement activities is the caloric consumption, equivalent to the energy expenditure used for the development of motor activities. In this sense there is a clear difference in the calorimetric results between tasks using the body and movement and traditional methods also directed to the acquisition of knowledge derived from other disciplinary areas and traditions that use predominantly the verbal or written form as teaching-learning strategies.

In fact, every activity and every teaching action in the presence of the same disciplinary objective may be performed using different methodological strategies that for their peculiarities can be *static* or *dynamic* producing different functional effects on students. Then, each teacher can become free interpreter influencing not only the knowledge of a particular topic but also the mechanisms of energy consumption, often unconsciously and with inadequate effects.

The research model proposed and presented in this paper is aimed, in fact, to encourage awareness in teachers that movement activities in primary schools can be effective as other forms of teaching

but they can have as well a positive effect on physiological parameters traditionally not involved in the teaching of the disciplines in the educational field.

In light of these considerations, the purpose of this research was to analyze the relationship between teaching methods based on motor and sports activities and caloric consumption, seeking to determine the difference in energy expenditure between traditional approaches adopted by teachers and teaching methods based on laboratory activities using the body and movement, trying to identify measurable trends in the presence of a common objective derived from other subject areas.

METHODS

The methodology is based on an integrated model of action research and experimental research.

The action research required a path of confrontation, communication, co-planning and co-action (Sibilio et al., 2008) which was created following the setting of a working group made of primary school teachers (school that in Italy is for students from 6 to 11 aged, lasting five years) and researchers of the University of Salerno to plan the experimental phase of the research.

Then, it was planned the "training of the working group", that is the training for teachers involved in the research, which discussed on the traditional teaching methods used in the schools, suggesting new didactic strategies using the body and movement as an alternative means of access to knowledge.

The training phase has allowed at the same time the acquisition of knowledge of the instruments to employ during the research, so as to make them easy to use.

The moment of confrontation experienced during the training activities has encouraged the full involvement of all the working group, researchers and school teachers, that have shared all the phases, from the design to the final evaluation, negotiating, from time to time, the choices to promote the development of research.

The research on the field has also required the adoption of instruments and methodologies appropriate to the context of the Italian school that has some peculiarities that do not allow the use of certain procedures traditionally used in sports (Sibilio, 2008). It was therefore essential the use of measuring instruments of the caloric expenditure in a manner appropriate to the Italian primary school.

The adopted research protocol then required some procedural choices:

- creation of a synergy between school and university which was achieved through a specific protocol of agreement, to support the effectiveness of the research in all its stages and to ensure its insertion in the school ordinary activities;
- sharing with the school of the way to introduce the research activity in the educational offer.

SAMPLE

The research was carried out using as sample a group of students attending a primary school of the Campania Region (Italy) agreed with the Department of the Science of Education of the University of Salerno, for a total of 50 students from 3 classes, of which 1 of year two class , 2 of year three class, 1 of year four class.

PROCEDURE

The actions performed at the schools for the experimental phase have been the following:

1. an integrated school-university plan to share the aims of the research, the methods and the procedures;
2. arrangement of an informative report to collect data on age, weight, height, diets, or any sports done as well as information about students' lifestyles of the.
3. training to teachers how to use the portable multi sensor monitoring system (calorimeter).
4. a 45 minutes lesson given by teachers to students on a common pre-established topic provided by the Italian Ministry of Education using the trasmissive method.
5. evaluation of students'energy expenditure during the lesson, using the calorimeter put on the right arm of each student before the lesson;
6. teachers' training, by the University of Salerno, on methodological aspects of teaching through motor and sport activities in the primary school;
7. a 45 minutes lesson given by teachers on the same common topic using motor laboratory, accordingly to the specific methodological directions acquired during the training
8. Evaluation of the students' energy expenditure during the lesson, through a portable multi-sensor monitoring system (calorimeter).

INSTRUMENTS

For the evaluation of differences in caloric consumption during the proposed activities; it was used the Body Media Body Monitoring System (Jakicic, 2004; Arvidsson, 2007). This system includes Multi SenseWear Armband sensor that has been applied to the arm of pupils without causing discomfort. The Armband collected a continuous series of physiological data which were subsequently analyzed, graphically displayed and presented in a report which highlighted the energy expenditure of the students during the proposed activities. The analysis of collected data was made possible by the use of a software InnerView which minimized the errors caused by subjective interference in the process of detection and subsequent data processing.

RESULTS

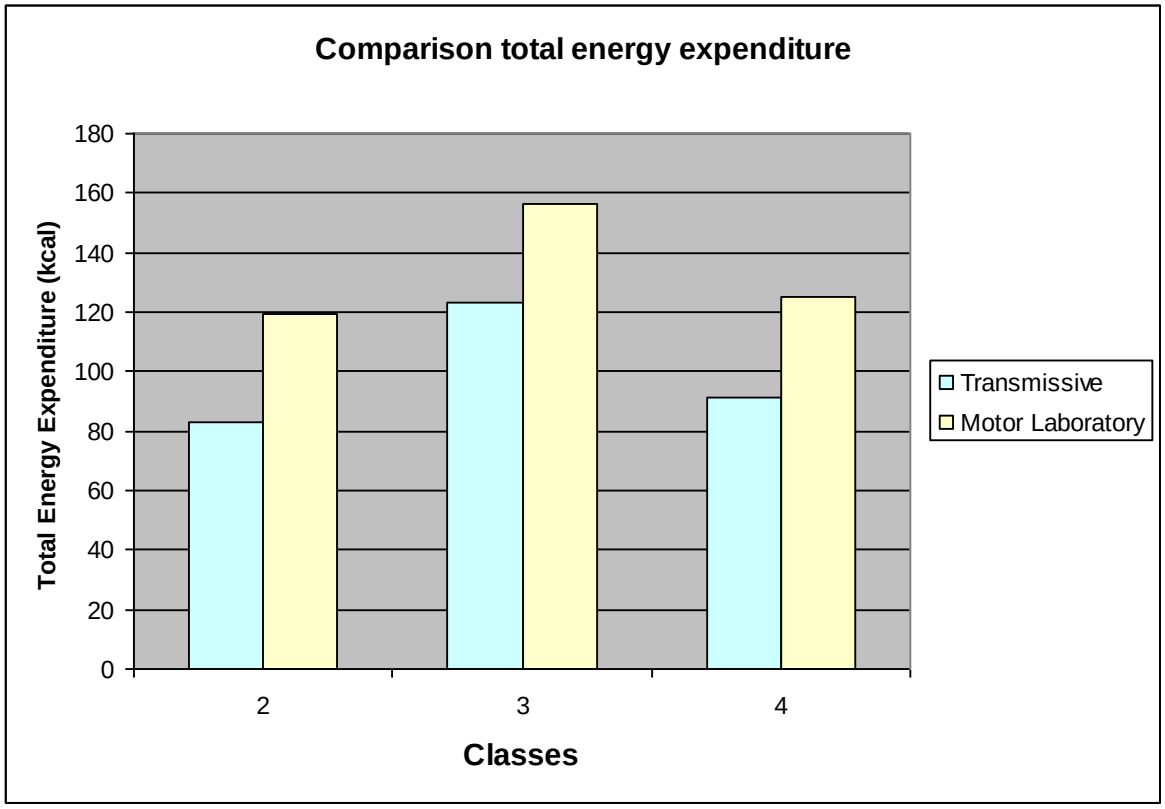
In a vertical bar graph has been reported the average values of the total energy expenditure (TEE) and the average of the Active energy expenditure (AEE) for each class, varying according to the method used by the teacher. This made possible to compare the means of the TEE and the means of

the AEE in terms of the effects due to the different treatment modalities; these have been developed at two different levels corresponding to the coding (Transmissive Method and Motor Laboratory) of the independent variable (factor) that is teaching methodology. Then, for each class, the relationship AEE /TEE for each mode of treatment were also calculated, in order to evaluate and compare the change in Active expenditure compared with total expenditure related to the teaching methodology. The sources of variability have been, in addition to the effect of treatment, differences in individuals or classes, as well as effects beyond the control of other intervening variables.

On the results it was observed that:

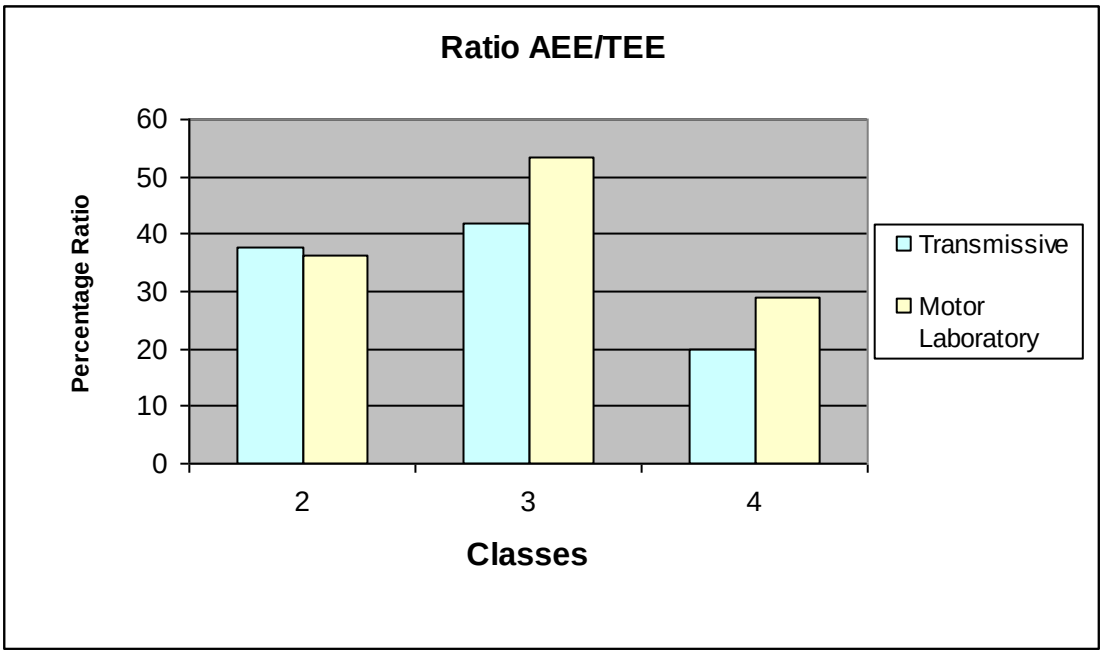
1. the Motor Laboratory on average makes values of total energy expenditure significantly greater than the Transmissive Methodology;
2. the Motor Laboratory on average makes significantly equal values for the Active Energy Expenditure and significantly higher than the Transmissive method.

GRAPH I



Comparing the AEE and TEE in each class, from the graphs it was observed that all the classes in the Motor Laboratory required for physical activity a greater percentage of TEE than the Transmissive mode.

Graph II



Regarding the relationship between the amount of energy spent on physical activity and the total one, in the class 2 this ratio is similar for the two methods, whereas in classes 3 and 4 it is much higher in the case of motor laboratory.

DISCUSSION AND CONCLUSION

The comparison of the two teaching methods (transmissive and motor laboratory), applied at the spatial area (geometrical figures), has allowed to observe different effects in terms of energy expenditure of the students during the learning activities.

The use of motor laboratory has given as results, in the students of the classes who participated in the research, an energy expenditure higher than the application of transmissive methods.

With the exception of class 2, in the other two classes, the rate of expenditure due to the effective active energy expenditure was much higher with the application of motor laboratory compared to the trasmissive method.

Moreover, the learning outcomes showed the possibility to use effective forms of teaching not necessarily focused on oral communication, graphs or images.

In conclusion, whenever possible, the use of teaching approaches focusing on the experience of motor laboratory to *construe* knowledge in primary school ensures acceptable educational outcomes

as well as systematic movement activities that produce energy expenditure and improve the lifestyle and psychological well-being of pupils making the time spent at school less sedentary.

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