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Original Article

Evaluating the integration of the sensory-motor abilities to facilitate teaching-learning processes: a comparison between Italian and Indian models of teaching through the use of VMI test

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Abstract
Nowadays a great number of evidences seems to prove that the movement plays a central role in the integration of different mental processes. The visual-motor feedback may be considered the first sensorial integration of the development. The importance of an effective support to the pre-adolescent development of the sensory-motor integration ability seems one of most important aim that every school system should follow. The aim of this research is to investigate and monitor on international scale if the current Italian and Indian schools systems can adequately support the development of the student's sensory-motor integration ability. According to the data showed in this paper, it is clear that the scores obtained by the Italian and Indian students are lower than the international mean. However if a wider analysis based on a larger and more representative sample of the two Countries should confirm the output of this research, it will be clear that the two school systems cannot effectively support the development of the visual-motor integration abilities of the students. If the trend showed in this work should be confirmed by future and more precise researches, it will be necessary an accurate analysis aimed to identify the possible reasons of this phenomenon and the possible school support, since without them, a whole generation of students will risk to reduce the cultural level of the two nations and to be not competitive on an international level.
Key-words: sensory-motor integration, development, school system.

Introduction

The whole is greater than the sum of its parts (Aristotle)

The above Aristotelian quotation may be considered as the preface to this analysis based on the theory according to which the development of the intelligence and learning takes its roots in the sensory-motor integration ability. Nowadays the idea (initially supported by many authors (Piaget, 1973; Bruner,1964; Hunt, 1961; Vereeken, 1961) according to which the highest levels of the cognitive and behavioral processes require the integration between sensory inputs and motor action is widely documented and widespread. In the first half of the twentieth-century, Piaget stated that there is a considerable continuity between the biological structure and the thought. He believed that the latter is the expression of the environment adaptation and that, as the organism builds tissues and organs, so the thought creates mental structures deriving from the interaction with the environment. In this

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way the author put the sensory-motor ability and their integration at the root of the intelligence development phenomenon. In the 60's Kephart emphasized the importance of the sensory-motor functional integration, underlining that the children who have a good development of their sensory-motor faculty might have troubles with regard to the functional integration of their faculties and so incur in learning deficit (Kephart, 1960). Later studies focused on the importance that the sensory-motor integration has in the activities of the primary school students. Handwriting, for instance, is a main part of the school experience of every child. Most of the time, from 30% to 60%, spent by the children in the classroom is actually used in activities involving fine motor abilities and handwriting is the main one (Marsha & Amundson,1980). The factors that may cause an unreadable handwriting are the incorrect letter writing, writing too small letters ,wrong lining, irregular spacing between words and letters, etc (Taylor, 1987). Many studies have outlined some important pre-requisites for a correct handwriting such as: eye-hand coordination, tools handling, basic stroke formation, alphabet letters recognition, and orientation to written language (Tseng & Cermak,1993). Hence, it seems clear that an insufficient development of the integration of the sensory-motor abilities may cause a low progress at school and so it negatively affects the learning . Nowadays a great number of evidences seems to prove that the movement plays a central role in the integration of different mental processes. Hannaford hypothesized that "Every time we move in an organized manner ,full brain activation and integration occurs ,and the door to learning naturally opens. (Hannaford, 1995)" Therefore, the visual-motor feedback may be considered the first sensorial integration of the development. The importance of an effective support to the pre-adolescent development of the sensory-motor integration ability seems one of most important aim that every school system should follow. However, sometimes this subject is handled with negligence and superficiality and this is due to many factors. It may happens that the educators support the sensory-motor development of the child 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)." Moreover ,the school programs might not pay enough attention to this matter. Other factors ,such as the lack of instruments or structures and the teachers' training, may also affect this subject. However the aim of this analysis is not to investigate the reasons of the real level of efficiency of the schools systems, but to monitor and compare their efficacy according to the international standards and to verify their quality and efficiency.

Aims

The aim of this research is to investigate and monitor on international scale if the current Italian and Indian schools systems can adequately support the development of the student's sensory-motor integration ability. This article has to be considered a pilot study for possible further studies aimed to analyze in a deeper way this complex phenomenon.

Instruments

The instruments used in this research are the VMI test and the VMI sub-test for motor coordination.

- The VMI (Visual-Motor-Integration test) is a paper-and-pencil test which demands the subject to copy a sequence of geometrical figures. This test assesses how the subjects integrate their visual-motor abilities. Furthermore there is no connection between the VMI test and the cultural background. For this reason it is based on geometrical figures that disregard from the cultural aspects and not on the numbers or the letters that have a close link with the cultural background. The VMI test is also one of the best and most precise instrument of assessment for the integration of visual and motor abilities.
- The test of motor coordination is a "paper-and-pencil" test that demands the subject to draw some figures he has been shown with a pencil without departing from the margins. The figures presented in the motor coordination test are the same used in the VMI test to make it as more compatible as possible with it.

The test of motor coordination was developed to minimize the visual component of the VMI test, in order to allow only the evaluation of motor ability. This allows to accurately understand how much and in which way the motor coordination can affect the result of the VMI test. The VMI test and the sub-test for the assessment of motor coordination have been chosen as instruments of analysis for their level of precision and for their international validity.

Standard

The raw results obtained by the VMI test and by the sub-test of motor coordination, have been standardized, according to the procedures of the VMI manual, to allow the comparison among the samples and between the samples and the international evaluation scale. The standard results of the VMI and of the motor-coordination sub-test are equal measurement units with a mean of 100 and a standard deviation of 15; they aren't connected to the age, and they may be mathematically processed, as written in the VMI manual. Although the standard scores have been developed according to researches based on the samples made of American students, they are considered an universal scale of assessment because they have been proved to be coherent and valid on an

international level thanks to the studies carried out in many other countries (like Italy). This rules, conformed to the nature of the test, are internationally recognized and considered good. A percentile scale ,based on the standard scores ,has been made and it is an objective measurement unit of the level of development of the visual-motor abilities of subjects aged from 3 to 15. In other words, the test, even if done only on one single student, must be considered valid and significant, regardless from cultural conditions, to identify the level of development of the visual-motor abilities, showing the score of the subject respect to the mean of the referred standard.

Data of research

Our data are based on a sample of 112 students from Italian primary school and 51 students from Indian primary school, so the total sample is composed of163 students.

The data regarding the students from the Italian primary school come from 5 different schools spread all over the area of Salerno. The data about the Indian students are from two first classes of a primary school.

Methods

the methodology used included the following steps:

1. An integrated school-university plan to share the aims, the methods and the procedures of the research;
2. Teaching the teachers the necessary knowledge to make the VMI and VMI motor coordination tests.
3. Making the VMI and VMI motor coordination tests on the students according to the procedures reported in the manual.
4. Assessment of the tests
5. Analysis and elaboration of the results

Results

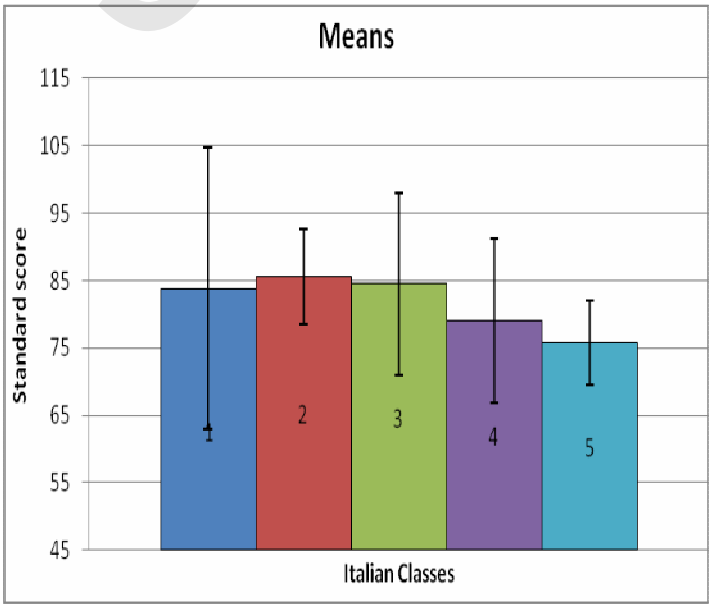
The table no.1 shows the proprieties of the international ranking scale, while the table no. 2 and the graph 1 show means, standard deviations and coefficient of variation of the score of the VIM test obtained from the Italian sample.

International ranking scale	Mean	Standard Deviation
	100	15

Table 1

School	Mean	Standard Deviation	Variation Coefficent
1	83,81	20,90	0,25
2	85,60	7,05	0,08
3	84,47	13,52	0,16
4	79,08	12,14	0,15
5	75,86	6,23	0,08

Table 2

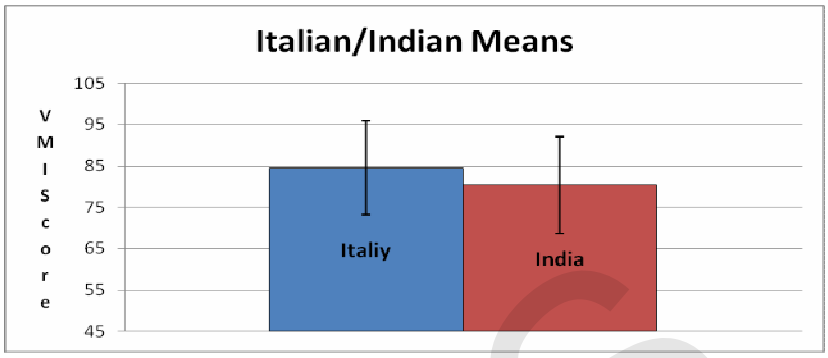


Graph 1

As shown in table no.1 and 2, the means founded in the observed sample are lower than the standard expected mean. The table 3 shows mean, standard deviation and variation coefficient of the Italian and Indian samples, while the graph no. 2 shows a comparison between them.

Sample	Mean	Steandard Deviation	Variation Coefficent
Italy	84,51	11,34	0,13
India	80,39	11,68	0,15

Table 3

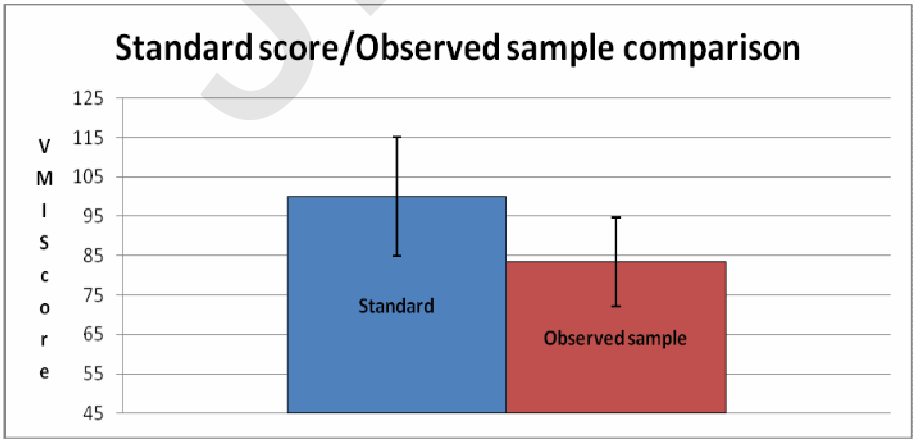


Graph 2

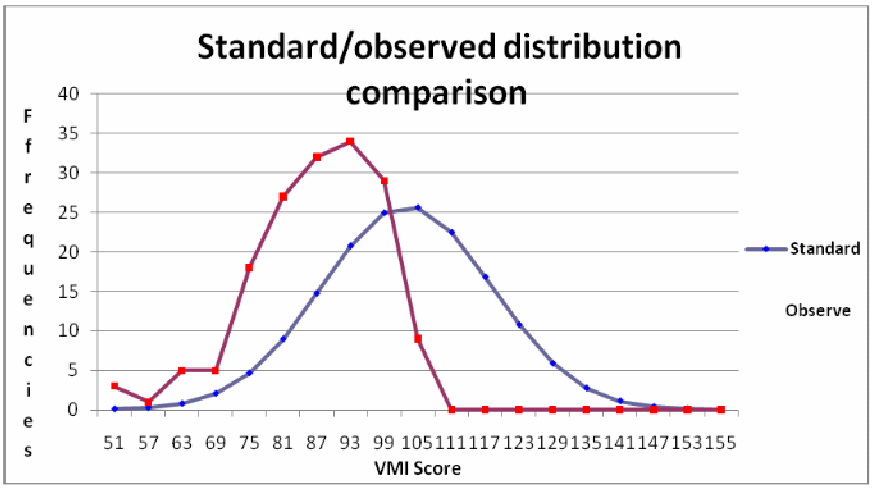
The mean of the Italian sample is slightly better than the mean of Indian sample. The data suggest that on average the Italian students are between the 14° and the 16°percentile in the international scale, while the Indian students are between the 9° and the 10° percentile, so 9,57% out of the international percentile scale. However the two means do not show significant statistical differences and both are lower than the expected mean. Graph no.3 shows a comparison between the whole observed sample and the expected mean.

The observed sample and the international rule have been subjected to the good-adaptability X2 test and to the known variance mean test. These tests have showed that the means of the Italian and Indian samples and the mean of the whole observed sample have significant statistical differences with regard to the international rule (p significantly <0,001). As showed in the graph no. 4, the mean of the observed sample is crushed to the left of the international mean, with the 96,32% of students who got a score under the international mean.

The data show that the score obtained by the VMI test of the Italian and Indian sample are significantly different from the expected score and that these means are significantly under the international mean.



Graph 3



Graph 4

As showed so far covered only the scores of the VMI. With regard to the motor coordination sub-test, the data show a mean lightly higher than the mean of VMI, as showed in table no.4.

	Italy	India	tot
Mean	93,12	81,71	89,03
Standard Deviation	14,25	12,77	16,28
Variation coefficent	0,15	0,16	0,18

Table 4

However, even in this case the means are lower than the expected one. However, the slightly higher mean, got from the two samples inside the motor coordination test compared to the VMI, has to be considered as a standard event. The sub test of the motor coordination minimizes the visual function and it does not require a functional integration like the VMI. It assesses only the motor coordination regardless from the visual function and from the sensory-motor integration, and, generally, it has a higher score output than the VMI

Discussions and conclusions

According to the showed data it is clear that the scores obtained by the Italian and Indian students are lower than the international mean. It is useful to consider some proprieties of the supplied tests.

1. The abilities assessed by the VMI test and its motor coordination sub test are strictly related to the school progress.
   Previous researches have showed that the correlation between the results obtained by the VMI and the other tests on the school progress, is generally high, and this is particularly true for the first classes of the primary school.
   The VMI test is strictly linked to the following abilities:
   - **Reading:** it resulted pretty high when related to the scores of the VMI test (Tarnopol,1981).
   - **Handwriting:** factorials studies have shown that the visual-motor integration is the key-factor for the hand-writing (Polumbinsku, 1986). The correlation between the scores obtained by the VMI test and the handwriting on groups of every age is higher than any other correlation observed between other factors and the hand-writing.
   - **Arithmetic:** The VMI test is particularly related to it, as proved by the trans-cultural researches made by Liu Hung-Hsiang (1972) , Webb and Abe (1985).
2. The VMI test and its sub-test can be considered as a valid predictive tool for the future school progress. The idea that the VMI test and its sub-test are valid predictive tools is supported by a large number of studies (Weerenburg, & Janzen, ,1985). These studies have shown that, the obtained scores of VMI test and its sub-test have a high correlation with the future school career, particularly during the first year of the kindergarten and the primary school.

The VMI can be considered as a good index of the average level of the present and future school progress. Considering the scores obtained by the observed sample and their relation with the international rules, as showed in the previous paragraph, it seems clear that the situation should be considered critical. Although a single research cannot be enough to exhaustively analyze this complex observed phenomenon, the scenario that it describes has to be considered as an important sign of alarm. This analysis is not oriented to identify the causes

of such a low output such as, for example, not suitable school programs or teachers, a teacher training not enough oriented to the development of children visual-motor abilities.

However if a wider analysis based on a larger and more representative sample of the two Countries should confirm the output of this research, it will be clear that the two school systems cannot effectively support the development of the visual-motor integration abilities of the students. If the trend showed in this work should be confirmed by future and more precise researches, it will be necessary an accurate analysis aimed to identify the possible reasons of this phenomenon and the possible school support, since without them, a whole generation of students will risk to reduce the cultural level of the two nations and to be not competitive on an international level.

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