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THE EFFECT OF MOTOR ACTIVITY ON ATTENTION

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Abstract
Purpose: influence of motor activity, based on the reduction and control of muscular tone, on scholastic attention.
Methods: in the method adopted, children were subject to a session of proprioceptive exercises prior to undergoing a dictation test. The number of errors made during the dictation test was analyzed to see whether the children made fewer errors than in dictation tests not preceded by a session of psychomotor exercises.
Results: the final results firmly demonstrate that motor activity conducted shortly before an attention test is capable of modifying the results of the test itself.
Conclusion:a T-Test further demonstrated that the effect of motor activity on performance is independent of sex. After having established this factor, sequence of administration and effect of time were also taking into consideration. It was determined that the effect of motor activity on a child's performance is independent of both.
Key words: proprioception, motor activity, attention span,school.

Introduction

By now the scientific community agrees that the human body is the fundamental element through which children learn about the world and develop their psychophysical identity. As underlined by Piaget, Wallon, Erikson (Weiner), and more recently by Brignola et al., there is a direct relationship between motor development and cognitive development, especially in children of elementary school age. This does not however mean that children without access to adequate physical development are incapable of attaining an adequate cognitive integrity (Biancalana 2007). As emphasized by Edelman's theory of neural Darwinism, the sensorimotor experience is the foundation of knowledge of self and of the world. According to Vayer, a well-structured body scheme is also the basis of social communication, considering that communication is nothing more than language of the body. Le Boulch instead believes that bodily awareness is the fundamental condition to acquiring certain behaviors, such as perceptual organization and motor learning as well as all interpersonal and emotional activities.

The goal of the experiment was to verify the possible positive influence that motor activity, based on the reduction of muscular tone and body awareness, has on attention, one of the necessary requirements for children during school hours.

The study was carried out on a total of 79 children ranging in age from 7 to 8 years old from four classes at the F. Trillini Comprehensive School in Osimo, Italy. The research was carried out from April 2012 to June 2012.

Methods

In order to evaluate the effects that our proposed motor activity was capable of producing on attention span, "instrument" *dictation*, in which a number of potential errors was inserted, was used. Said potential errors were agreed upon, together with the teachers, after the initial level of each class was determined. During the dictation test, the children sat in their usual seats. The evaluation was scheduled once a week on a predetermined day and was preferably carried out at the same time: 9:00-10:00 and 10:00-11:00. All of the classes were subjected to two situations: 1. *Dictation only; 2. Motor training followed by dictation.*

On the days when the classes had to carry out both motor training and dictation, the dictation test was always administered immediately after motor training at a minimum time gap of 3 minutes and a maximum time gap of 8 minutes.

The proposed motor activity was based on respiration, muscular relaxation and awareness of the body and the outside environment. Each class underwent a total of five evaluations structured as follows: a lesson in which the level of the class was determined, two lessons in which only the dictation test was given and two lessons of motor training followed by the administration of a dictation test.

The dictation tests were developed together with the teachers in order to ensure that they were actually suitable for the participating students. The dictation tests were standardized to include a number of potential errors (30) including double letters, accents and apostrophes, as well as specific phenomena of the Italian language like "*gn, gl, sc*".

The aim was to verify whether dictation tests preceded by motor training produced fewer errors

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with respect to dictation tests not preceded by motor training.

Results

Through this experiment we tried to confirm that motor activity conducted prior to a dictation test is capable of modifying the results of the dictation test itself. For this reason, the variable studied was the number of errors made per dictation test. (Table 1.1)

Four classes with an overall cross-section of 79 subjects were used for the experiment. The classes were divided as follows: 22 in the first class, 23 in the second class, 19 in the third class and 15 in the fourth class. This can be seen in the second column from the left of table 1.2 (N° of students per class).

The third column from the left of table 1.2 indicates the initial average of errors per class, that is, respectively: 12,7 – 6,9 – 11,6 – 8,6, thus demonstrating, from the beginning, an incongruity among the four classes. Despite such incongruity, the children within each class were also very diverse. This can be seen in the column of table 1.2 titled standard deviation, whose values are respectively: 11,7 – 6,4 – 10,3 – 6,8. The fact that that these values are comparable to the initial averages signifies that, while some children do not make any errors, others make more than 23. In order to determine whether the classes were significantly different in principle, which would have invalidated the experimental design, an ANOVA test was used to verify whether there was a difference between the averages of the four classes (Table 1.3). The ANOVA Test compared the averages of the four classes and showed a statistical significance of more than 0,05, as indicated in table 1.3, in the first column from the right. A statistical significance of 0,147 means that, while the four classes were inconsistent, they were not significantly different.

Once it was determined that there was not a substantial and significant difference among the four classes, we evaluated whether sex has an effect on competency since it is well-known that at certain ages, females may have certain scholastic advantages over males. (Table 1.4)

Taking into consideration the four classes together, with a total of 48 males and 31 females, we found that the averages were respectively 9,8 with a standard deviation of 8,4 for the males and 10,1 with a standard deviation of 10,7 for the females.

We compared the two cross-sections by carrying out a T-Test, whose results are contained in table 1.5. From the T-Test we obtained a statistical significance of 0,88, which is extremely far from 0,05. We can therefore confirm that differential competency does not exist between males and females.

At this point we will proceed in introducing the experimental design. Each class was visited four times. Table 1.6 summarizes the treatment of each of the classes during the different evaluations: a 1 indicates that the class was subjected to motor training, while a 2 indicates that there was no motor training. In both cases, the standardized dictation test was administered.

The first class, as indicated in the aforementioned table, was subjected to the series 1212, and thus motor training-dictation, dictation only, motor training-dictation, dictation only. On the same or subsequent days, the second class was subjected to the series 1221, and thus motor training-dictation, dictation only, dictation only, motor training-dictation. The third class was subjected to the series 2112, and thus dictation only, motor training-dictation, motor training-dictation, dictation only. Finally, the fourth class was subjected to the series 2121, and thus dictation only, motor training-dictation, dictation only, motor training-dictation. The first column from the right (table 1.6), whose sum is always the same, shows the number of subjects undergoing these four treatments.

We used another Test called repeated measures ANOVA in order to evaluate whether or not time and sex influence the improvement of the children. That is to say, the time factor indicated with 1 was evaluated to see if it was statistically significant in the four trends taken into consideration (1,2,3,4); if factor 1, time, is statistically significant, that is, if there is a trend in the series of the four measurements, then the children improve or worsen systematically in relation to time. In this case, the analysis carried out took into consideration the following variables: sex, time and treatment order, as indicated in table 1.6. The questions asked were: is sex important in the improvements? Is the amount of time passed important? Is the order of administration of the treatments important (1212,1221,2112,2121)? There were not one, but four dependent variables in this case since they were repeated measurements, meaning that the number of errors made by each child was evaluated four times. (Table 1.7)

Is factor 1, time, significant? That is to say, does the number of errors, independent of sex and treatment type, increase or decrease? The result obtained demonstrates that time is not significant because the value is always higher than 0,05, as indicated in the first column from the right (Table 1.7). If instead time is organized by treatment order and, therefore, by test (motor training) or by control (no motor training), is it significant? Yes, in this case it is. In the multivariate, the result does not depend on the amount of time passed but, instead, on whether the class was subjected to treatment or not since the value is always lower than 0,0001, as indicated in the first column from the factor 1 line * treatment_order (Table 1.7). Therefore, this data is extremely significant, thus revealing that there is an indicative association, independent of the amount of time passed, between the performance of the children - intended as the number of errors made - and

whether physical activity was carried out or not before the administration of the dictation test. However, does the effect of time differ from one sex to the other? That is, do males and females mature in different ways? Probably yes in the long run, but in the extremely short range of time considered, from April to June, the effect is not significant. This is indicated in table 1.7 in the line titled factor 1*sexM0F1.

The significance of treatment order was also evaluated to see whether its effect differs between the sexes. That is, does the fact that both sexes undergo motor activity provide a different improvement in males and females? These results were also not significant, meaning that the improvement obtained when motor activity was carried out does not have a greater or lesser effect in relation to the sexes. That is to say, males and females do not improve one with respect to the other.

Table 1.1 N° errors

Factor 1	Dependent Variable
1	N° ERRORS 1
2	N° ERRORS 2
3	N° ERRORS 3
4	N° ERRORS 4

Table 1.2 Partitioning of the students/classes

Initial ERR

	N° students per class	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	22	12,7	11,7	2,49843	7,577	17,9685	1	48
2	23	6,9	6,4	1,33945	4,1352	9,6909	0	26
3	19	11,6	10,3	2,36471	6,6635	16,5997	0	41
4	15	8,6	6,8	1,76419	4,8162	12,3838	1	19
Total	79	10	9,3	1,0525	7,9046	12,0954	0	48

Table 1.3 ANOVA Test

TEST ANOVA
Initial ERR

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	468,289	3	156,096	1,841	0,147
Within Groups	6.357,71	75	84,769		
Total	6.826,00	78			

Table Scholastic Level in relation to sex

Group Statistics

	SEX (M=0/F=1)	N	Mean	Std. Deviation	Std. Error Mean
Initial ERR	0	48	9,8	8,4	1,22207
	1	31	10,1	10,7	1,9274

Table 1.5 Significance between sexes

Independent Samples Test						
		Levene's Test for Equality of Variances		T-Test for Equality of Means		
		F	Sig.	T	df	Sig. (2-tailed)
Initial ERR	Equal variances assumed	1,568	0,214	-0,147	77	0,88
	Equal variances not assumed			-0,14	53,46	0,89

Table 1.6 Sex, time, and treatment order variables

		N
Treat._Order	1212	19
	1221	20
	2112	13
	2121	14
SEX (M=0/F=1)	0	40
	1	26

Table 1.7 Dependent variable with respect to the 4 administrations

Measure: time						
Source		Type III Sum of Squares	Std. Error	Mean Square	F	Sig.
factor1	Sphericity Assumed	12,714		4,238	0,293	0,83
	Greenhouse-Geisser	12,714	2,028	5,079	0,293	0,794
	Huynh-Feldt	12,714	2,076	4,323	0,293	0,826
	Lower-bound	12,714	2,258	12,714	0,293	0,59
factor1 * Treat._ Order	Sphericity Assumed	1.211,37	2	134,596	9,319	0
	Greenhouse-Geisser	1.211,37	1,952	161,315	9,319	0
	Huynh-Feldt	1.211,37	1,998	137,305	9,319	0
	Lower-bound	1.211,37	2,173	403,789	9,319	0
factor1 * SEXM0F1	Sphericity Assumed	68,884	2	22,961	1,59	0,194
	Greenhouse-Geisser	68,884	2,622	27,519	1,59	0,201
	Huynh-Feldt	68,884	2,685	23,424	1,59	0,195
	Lower-bound	68,884	2,92	68,884	1,59	0,212

	Sphericity Assumed	104,389	2	11,599	0,803	0,614
factor1 * Treat_Order * SEXM0F1	Greenhouse-Geisser	104,389	2,582	13,901	0,803	0,594
	Huynh-Feldt	104,389	2,644	11,832	0,803	0,612
	Lower-bound	104,389	2,875	34,796	0,803	0,497
	Sphericity Assumed	2.513,08	2	14,443		
Error (factor1)	Greenhouse-Geisser	2.513,08	145,181	17,31		
	Huynh-Feldt	2.513,08	170,567	14,734		
	Lower-bound	2.513,08	58	43,329		

Discussion

The work has been compared with other studies which always support the benefits of physical exercise on mental task in classroom. Among these studies there's Hill, Williams, Aucott, Milne, Thomson, Greig, Munro, Mon-Williams M.'s work, "Exercising attention within the classroom"; it was performed in six primary schools with 1224 students participating with age between 8 and 11 years, where during a week physical exercise and phycometric have been proposed together: on the contrary during next week phycometric test has been carried out without physical exercise. The final results highlighted a significant impact of physical exercise on student performance. Another work is Hedges, Adolph, Amso, Bavelier, Fiez, Krubitzer, McAuley, Newcombe, Fitzpatrick, Ghajar J 's "Play, attention, and learning: How do play and timing shape the development of attention and influence classroom learning?"; with a series of questions it tried to reproduce the connection between play, attention and learning. This report must be study in deep yet in order to explore all the question about play, abilities, human activity and cognitive functions.

Conclusion

Based on our analysis, we can conclude that the effect of motor activity is independent of class, sex, treatment order and time. This demonstrates that there is a strong effect for a short period following the execution of motor activity, independent of the type of class. In fact, the initial incongruity of the four classes, as well as the inconsistency of the children within each class, was evaluated. The results demonstrated that, even though the four classes were inconsistent, they were not significantly different initially. A T-test helped to demonstrate that the effect of motor activity on performance is also independent of sex, thus establishing the absence of a different preparation between males and females. Once this had been proven, the effect of treatment order and time was taken into consideration. Even in this case, it was demonstrated that the effect of motor activity on a child's performance was independent from both. In conclusion, based on the results obtained, one can confirm that the initial hypothesis was sufficiently upheld, thus demonstrating that motor activity carried out prior to an attention test is capable of modifying the result of the test itself.

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