Article

Motor performance, reading, writing and arithmetic competence in Elementary School I

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Abstract
This cross-sectional study, arising from a master's research, aimed to investigate the motor performance in a group of Elementary School I students classified in lower levels of reading, writing and arithmetic competence tests. Students from the 2nd, 3rd, 4th and 5th grades of the Municipal Elementary School in São Paulo, of both genders, aged between 7 and 11 years, participated in the research. The 104 participants were evaluated through three tests referring to reading, writing, and arithmetic to obtain the sample group for this work. Respectively, the Written Test under Dictation- reduced version (PED-vr), Word and Pseudoword Reading Competence Test (TCLPP) and the Test of Arithmetic (PA) were used as evaluations. The final group consisted of 35 students who presented a standard score between 70 and 84, considered low, or a standard score below 70, considered very low in any test. This group was then evaluated by the Motor Development Scale - MDS, to verify motor performance. The results showed a high concentration of students with low competence in reading, writing, and arithmetic tests in MDS's lower and much lower classifications. The correlations between the academic tests and the MDS were more evidenced between the temporal and spatial

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organization areas. It was concluded that the students who presented low competence in the evaluated tests also showed worse results in motor performance.

Keywords: Learning, Teaching, Motor Skill.

1. Introduction

The Law of Guidelines and Bases of National Education 9394/96 (Lei de Diretrizes e Bases da Educação Nacional [LDB]), specifically in its 2nd article, defines that education has as its purpose the full development of the student. Article 3 presents the principles that guide teaching. Item I deals with the equality of conditions for access and permanence in school (BRASIL, 1996).

Equality of conditions implies the recognition of diversities in the learning process. Diversity is highlighted here as being inherent to the rhythm of each student and respect for their individuality.

Every time a student does not learn, that is, does not respond to school demands. He experiences a feeling of defeat, making his learning process even more complex and even his staying at school. However, article 13, items III and IV, of LDB 9394/96, defines that the teacher is responsible for ensuring the student's learning and creating strategies for lower achievement (BRASIL, 1996).

The development of strategies has as a determining point the recognition, by the teacher, of the difficulties presented by these low-achieving students, as well as the possible causes and, finally, the implementation of programs that minimize learning problems. However, school practice as it stands today is very far from what would be the ideal model.

According to Dazzani et al. (2014), even considering that the school is basically a space for learning and training at different levels, it acts in the opposite direction. It becomes a place that favors the exclusion of those who cannot learn, perpetuating a school failure model.

In line with Fraga and Costa (2014), one of the factors cited among adolescents that can lead to school dropouts is learning difficulties. About 70% of the studied group did not finish elementary school, having only the 4th grade. The authors elucidate the importance of reviewing educational practices to consider no uniformity in learning, as inequalities among students have been present since the early school years.

It can be taken as a basis the Elementary Schools that receive these new 6-year-old students, coming or not from Kindergarten, without the requirements for the initial years of schooling, such as visuospatial skills, executive functions (CAMERON et al ., 2016), among others, and that for teachers become significant challenges. Oliveira et al. (2012) and Navarro et al. (2016), in their studies, wrote about the teacher's understanding of the student's difficulties in learning when they make a mixture of complaints that involve situations of aggression, conflicts with the group, disrespect for the teacher, apathy, in such a way that behavior and not learning become one unit.

Motricity is included in these requirements. The investigation of the relation between learning difficulties and motor development, their causes and forms of intervention has been the object of study by several researchers. These studies show that children with learning difficulties tend to demonstrate motor delays compared to children without them and that there is a relation between motor skills and cognitive development. (ROSA NETO et al., 2007; FERREIRA et al., 2015; TAVARES; CARDOSO, 2016).

From birth, motor development occurs progressively throughout childhood and has its biological component added to individual experiences. There are milestones in the child's motor development that are the reference for the evolutionary stages. With each achievement, the child becomes able to perform a more elaborate next movement.

This progressive acquisition results in various motor skills, providing the child with adequate postural control, locomotion, and manual dexterity. The Central Nervous System (CNS) allows for functional and voluntary motor responses in the child. Global motor development occurs in the cephalocaudal direction, ensuring posture, movement and balance to the body. On the other hand, fine motor development follows a near-distal orientation, through which the child performs, for example, activities such as picking up and manipulating objects until reaching more complex levels of execution, such as writing, a requirement for educational learning. Endogenous, genetic, neurohormonal, and exogenous factors regulate motor development (MORAES; MALUF, 2015; ALVA et al., 2015).

Motor development in psychomotricity is based on the association between motor skills and the psyche, which integrates emotions, sensations, affections, perceptions, projections, representations and mental constructions. Endogenous and genetic factors contribute to the child's motor development, as well as social experiences. The latter becomes a predominant factor in this process. The adult is the element that provides the ideal conditions for the child's learning, involving affective, emotional and cultural aspects. It is in this context that the child expresses himself and explores the environment. Therefore, there is no way to dissociate motricity from psychomotricity since movement results from an isolated motor action and everything involved (LE BOULCH, 1992; FONSECA, 2008).

According to Adolph and Franchak (2017), motor development is enriched by the experiences offered by the environment to the child from an early age. The care and practices applied to the child encourage the improvement and the emergence of new motor behaviors. There is a feedback in which the child, by his perception, absorbs information from the environment and, as a result – in terms of movement – exhibits motor behavior, and this feeds back the perception. From this process, new acquisitions emerge in the perceptual, cognitive and social spheres. The authors also highlight that changes in motor development can compromise future motor skills to be acquired.

Santos and Vieira (2013) contribute to this understanding of motor development by describing that, initially, children have simple movements and, over time, these are transformed into more elaborate and complex ones. When playing, the child explores the environment by the movement itself. The authors add that children with alterations in motor development can impact their social relationships. In school terms, they are often excluded from their groups because of these delays. This reinforces the importance of motor development in social interaction and affective and emotional aspects.

Rosa Neto et al. (2010) corroborate on the sequential process of motor development and add that, at the beginning of schooling, there is a refinement of motor skills, and the child appropriates his body itself. Finally, he conquers several skills that contribute to motor development and educational learning, characterizing a dynamic process.

In turn, Carvalho, Ciasca and Rodrigues (2015) mention that, regarding the psychomotor aspect, the literature presents a relation between this and the difficulties at school, specifically concerning reading, writing and arithmetic. Understanding the complexity of learning, there is a need for an interdisciplinary approach to observe all the factors involved: cognitive, academic, family, behavioral and psychomotor factors.

According to Fonseca (2016), children with learning difficulties usually show changes in the primary motor organization (tonicity, posture, balance and locomotion) and, consequently, in the psychomotor organization (lateralization, directionality, body image, space-time structuring and praxis).

Given this, and understanding that there should be no dissociation between motor skills and educational learning, it is up to the school to develop activities that encourage psychomotor development. Therefore, it is necessary to promote the training of teachers (SANDRONI; CIASCA; RODRIGUES, 2015). This training favors the understanding of the child's evolution process and, as far as possible, the identification of any problems in their motor development. This allows for early intervention in cases of evolutionary delays and stimulation programs for children with learning problems.

From this look at the issue of motricity, it is necessary to ask how motor delays can influence school learning. Therefore, the present research aimed to investigate the motor performance in a group of Elementary School I students classified in lower levels of reading, writing and arithmetic competence tests.

The research used psychometric instruments to measure students' school and motor performance with a cross-sectional and correlational design. The subsequent quantitative analysis of the data followed a rigorous process. The results obtained from the possible relations between the variables were also analyzed qualitatively, aiming to contribute to school practices.

2. Development

The Ethics Committee approved the present study[7] with opinion number 2,134,303 in June 2017.

Initially, the research had 104 participants, all enrolled in the public education system, of both sexes, aged between 7 and 11 years, attending the 2nd, 3rd, 4th and 5th grades of Elementary School in a Municipal School in São Paulo.

The inclusion criteria were students who, after applying the reading, writing and arithmetic tests, obtained a standard score below 70 points, classified as "very low", or from 70 to 84 points, classified as "low" according to the normed pattern of scoring tables, indicating low performance in reading, writing and arithmetic competence.

The criteria of exclusion were students with congenital malformations and deformities of the musculoskeletal system, according to the International

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Classification of Diseases (ICD 10), and/or neurodevelopmental disorders such as communication disorders, intellectual disabilities, autistic spectrum disorder, and deficit disorder of attention/hyperactivity disorder, described in the Diagnostic and Statistical Manual of Mental Disorders of the American Psychiatric Association – DSM 5, clinically diagnosed by specialists, verified in the school records.

To obtain the sample group for this work, all were evaluated by different psychometric instruments referring to the reading, writing and arithmetic performance survey. With the results in hand, the sample group consisted of 35 students who presented the standard score in one or more tests, ≤84 points, and were later evaluated using the Motor Development Scale (MDS).

2.1 Instruments

The instruments were applied in the following order:

1 – Written Test under Dictation- reduced version (Prova de Escrita sob Ditado - versão reduzida [PED-vr]) - by Seabra, Dias and Capovilla (2013): composed of 36 items that vary in terms of lexicality, regularity of correspondence, frequency and length. The lexicality can be presented by words or pseudowords (words created logically but without meaning). Regarding the regularity of graphophonemic correspondences, items can be regular, irregular or of position rule. As for frequency, they can be high or low frequency; and the length can refer to two-syllable or tri-syllable items. This test allowed the assessment of writing skills under dictation;

2 - Word and Pseudoword Reading Competence Test (Teste de Competência de Leitura de Palavras e Pseudopalavaras [TCLPP]) - developed by Seabra and Capovilla (2010): aims to assess silent reading competence. Consisting of 70 test items, each contains a picture and associated word or pseudoword. They are presented as regular correct – (corretas regulares [CR]): orthographically and semantically correct and graphophonemically regular words; irregular correct – (corretas irregulares [CI]): orthographically and semantically correct and graphophonemically irregular words, semantic neighbors – (vizinhas semânticas [VS]): orthographically correct but semantically incorrect words), visual neighbors (vizinhas visuais [VV]): orthographically incorrect pseudowords, with visual changes), phonological neighbors (vizinhas fonolóficas [VF]): orthographically incorrect pseudowords, with phonological changes), homophone pseudowords (pseudopalavras homófonas [PH]): orthographically incorrect although homophones, there are semantically correct words) and strange pseudowords – (pseudopalavras estranhas [PE]) (orthographically incorrect and strange pseudowords both phonologically and visually);

3 - Arithmetic Test (Prova de Aritmética [PA]) - elaborated by Seabra, Dias and Capovilla (2013): divided into six subtests. The first subtest comprises the writing of numbers in words, the second is about numerical counting, the third deals with the relation between major-minor, the fourth involves the four arithmetic operations, the fifth is on the calculations presented orally and the sixth and last subtest is about problem-solving. The test assesses arithmetic competence, covering the domains of numerical processing and calculation.

According to the normed criteria of these tests, the classification of students was obtained by the standard score achieved, being very low for a score lower than 70; low, for a score of 70 to 84; average, for a score between 85 and

114; high, for a score of 115 to 129; and very high, for a score greater than or equal to 130;

4 - Motor Development Scale (MDS) - by Rosa Neto (2015): assesses motor skills. It involves a comprehensive set of tests with graded difficulties and complexities, which thoroughly verify motor development in different areas. These graduated complexities vary according to the chronological age of the appraisee. The scale covers the categories of fine motor skills (hand-eye coordination), global motor skills (coordination), balance (static posture), body schema (imitation of posture and speed), spatial organization (space perception), temporal organization (language and temporal structures) and laterality (hands, eyes and feet).

The MDS allows the identification of Motor Age (MA), General Motor Age (GMA), Negative or Positive Age (NA/PA), Motor Quotient (MQ) and General Motor Quotient (GMQ). Likewise, it is possible to obtain results achieved in the fine motor skills (MQ1), global motor skills (MQ2), balance (MQ3), body schema (MQ4), spatial organization (MQ5) and temporal organization (MQ6) tests.

Based on the results obtained, it is possible to infer whether the student has risk factors for their motor development. Regarding Elementary School, students aged 6 to 11 years who were classified as "low normal" have a mild risk factor; "lower", moderate risk, and "much lower", severe risk, according to the MDS criteria. According to the author, Mild risk factors have a subtle impact on the student's development. For moderate and severe risk factors, an assessment by a multidisciplinary team is recommended (ROSA NETO, 2015).

2.2 Procedures

Preliminarily, an authorization for the research was requested to the Regional Board of Education, to which the school reports, under the legal determinations of the Municipal Department of Education. With the consent, data collection occurred after the School Principal, the parents or guardians, and the students were informed about the research content and signed the Institution's Free and Informed Consent Form (FICF) and the Consent Form authorizing the research.

To ensure that everyone involved in the study was fully aware of the procedures used, guaranteeing the participants autonomy, as one of the guidelines of Bioethics, a total of five meetings were held at the school with pedagogical advisors, teachers and students' parents to clarify the study and elucidate possible doubts.

In the first phase of the research, the tests were applied in a pre-established order, starting with the Writing Test under Dictation - reduced version (PED-vr), collectively, in each of the classes on different days. According to the instructions of this instrument, the items were read aloud and written by the students on a lined sheet, divided into three columns.

Sequentially, the Word and Pseudoword Reading Competence Test (TCLPP) was applied, also in each of the classrooms with the monitoring of the teachers. The procedure for the Arithmetic Test (PA) followed the same criteria as the previous ones, always respecting one week between each test. The tests were applied in the first classes of the day, avoiding possible tiredness of the students during the school period, and the time allotted for each one of them was 30 minutes.

With the information obtained from these three tests, the final group of students in this study was reached, then submitted to a motor assessment by the MDS.

In the second phase, MDS by Rosa Neto (2015) was used, applied individually, in a place designated by the School's management, in an approximate time of 35 minutes. Before applying the MDS, the researcher performed training supervised by the author. In addition, it had two assistants trained to better record the data, which were done in a specific form. It is noteworthy that, according to the guidelines provided in the manual for using the scale, motor tests for children with learning difficulties were applied from level 5 onwards, in all areas, advancing until the time when the child could not perform as expected for the activity.

All statistical analyzes were processed using SPSS v. 20 software, Minitab 16 and Excel Office 2010. Pearson's Correlation was applied to measure the degree of the relation among writing, reading and arithmetic assessments with the MDS scores in inferential statistics.

3. Results

Initially, the group consisting of 104 children was evaluated by academic tests in reading, writing and arithmetic. It is noted that the results classified as "Average" were predominant in the sample for all three tests. The frequency of students with "Very Low" and "Low" classifications was similar in the dictation and arithmetic tests. Students' performance in the reading test (TCLPP) was the best among the three tests (Table 1).

Table 1. Students' performance on reading, writing and arithmetic tests (N=104).

Classification	TCLPP	Dictation	Arithmetic
Very low	3.85%	15.15%	12.75%
Low	2.88%	11.11%	10.78%
Average	60.58%	64.65%	46.08%
High	32.69%	9.09%	25.49%
Very high	0.00%	0.00%	4.90%

Source: Authors.

From this initial assessment, 35 students were reached with low or very low performance in at least one of the tests (reading, writing and arithmetic). Table 2 presents the descriptive analysis of the quantitative variables. Only dictation has high variability among all the variables, as the coefficient of variation (CV) is above 50%, indicating that the data are heterogeneous.

Table 2. Descriptive statistics of the results obtained by the sample group in the tests (n=35).

	Average	Median	Standard Deviation	CV*	Min	Max	Ci**
Age	9.6	10.0	0.9	10%	8.0	11.0	0.3
Dictation	64.7	78.0	34.5	53%	0.0	113.0	1.4
Arithmetic	79.1	77.0	26.2	33%	22.0	127.0	8.7
TCLPP	100.0	102.0	14.0	14%	54.0	118.0	4.6
GMQ	77.2	77.9	9.1	12%	53.5	99.0	3.0
MQ1	81.5	80.7	17.8	22%	42.1	133.3	5.9
MQ2	83.7	82.8	14.4	17%	52.6	111.9	4.8
MQ3	82.5	84.3	18.3	22%	42.1	115.4	6.1
MQ4	78.6	80.7	14.8	19%	33.6	100.0	4.9
MQ5	69.6	69.2	13.5	19%	41.0	100.9	4,5
MQ6	67.6	63.2	18.2	27%	31.6	112.1	6.0

Source: Authors.

Abbreviations: General Motor Quotient (GMQ); Motor Quotient 1 (MQ1) fine motor; Motor Quotient 2 (MQ2) global motor; Motor Quotient 3 (MQ3) equilibrium; Motor Quotient 4 (MQ4) body schema; Motor Quotient 5 (MQ5) spatial organization and Motor Quotient 6 (MQ6) temporal organization. * The coefficient of variation (CV)
** Confidence Interval (CI)

The results obtained by the 35 students in the tests indicated that, in the arithmetic test, most of the group got a classification between very low (34.3%) and low (31.4%). In the PA subtests, the performance was worse in the calculation concerning numerical processing, with 62.9% in those classifications. In the dictation test, 42.9% of the students scored very low and 28.6% low. Regarding reading, in the TCLPP, 77.1% of the group obtained an average rating. It can be considered that this finding occurred because there was differentiated work carried out with students in the reading room. The items children had greater difficulty with were semantic neighbors, visual neighbors and phonological neighbors types.

In MDS, classifications were much lower (14.3%) and lower (48.6%). This concentration is due to the large volume of students who had a low performance in the tests of the spatial organization (MQ5), 82.8%, and temporal organization (MQ6), 77.1%. Specifically, in the spatial organization, what hindered the tests' progress was that the students did not recognize right and left, including those of the 5th grade. In the temporal organization, it was challenging to acknowledge the temporal structures. Not so markedly, there was also a low performance in fine motor skills (MQ1), with 48.5%, and the children had great difficulty in advancing beyond level 8 of this test.

Pearson's correlation was used for the total sample and for the group segmented by sex to measure the degree of relation between academic variables and MDS scores. The value of r describes the magnitude of the effect. The classification of this magnitude is defined as: small for 0.10<r<0.29, medium for 0.30<r<0.49 and large for 0.50<r<1.00 (COHEN, 1988). In this correlation analysis, the p-value ≤0.05 was adopted as statistically significant. Correlations were established among the standard scores of the reading, writing and arithmetic tests with the results of the motor quotients of the MDS.

Table 3 shows the correlation between MDS and academic tests (reading, writing and arithmetic). The arithmetic test is positively related to the general motor quotient (GMQ), r = 0.37, p = 0.030, and also with the temporal organization (MQ6), r = 0.46, p = 0.006. In both associations, the magnitude of the effect found is medium.

In dictation there was also a positive correlation with the temporal organization (MQ6), r = 0.39, p = 0.021, and the effect found is of medium magnitude. In the TCLPP, the results pointed to a positive correlation with the general motor quotient (GMQ) r = 0.41, p = 0.013, with the spatial orientation (MQ5), r = 0.43, p = 0.011, and with the organization temporal (MQ6), r = 0.48, p = 0.003. These associations with TCLPP also had an average effect magnitude.

Table 3. Correlation between MDS and students' reading, writing and arithmetic tests (n=35).

MDS		Dictation	Arithmetic	TCLPP
GMQ	Run(r)	0.210	0.367	0.414
	P-value	0.226	0.030*	0.013*
MQ1	Run(r)	0.007	0.144	0.202
	P-value	0.970	0.410	0.244
MQ2	Run(r)	0.040	0.212	0.211
	P-value	0.822	0.221	0.223
MQ3	Run(r)	-0.167	-0.021	-0.046
	P-value	0.337	0.907	0.792
MQ4	Run(r)	0.170	0.247	0.149
	P-value	0.328	0.153	0.394
MQ5	Run(r)	0.309	0.201	0.426
	P-value	0.070	0.246	0.011*
MQ6	Run(r)	0.389	0.459	0.480
	P-value	0.021*	0.006*	0.003**

Source: Authors.

* p < 0.05; ** p < 0.005

]The group stratified by sex was distributed by 45.7% female and 54.3% male. The correlation shown in Table 4, with a large magnitude effect, corresponds to the group of girls. For this group, in the dictation test there were positive correlations with the general motor quotient (GMQ), r = 0.506, p = 0.046, with the body schema (MQ4), r = 0.565, p = 0.023, and with the spatial organization (MQ5), r = 0.583, p = 0.018.

In the arithmetic test there is a positive correlation with the body schema (MQ4), r = 0.635, p = 0.008. In the TCLPP there are also positive correlations with the general motor quotient (GMQ), r = 0.797, p = 0.001, and with the spatial organization (MQ5), r = 0.705, p = 0.002. The TCLPP is positively associated with global motricity (MQ2), r =0.561, p = 0.024, with body schema (MQ4), r = 0.662, p = 0.005, and with temporal organization (MQ 6), r = 0.628 , p = 0.009. The magnitude effect for the described associations was considered large (COHEN, 1988).

Table 4. Correlation between MDS and reading, writing and arithmetic tests for the group of girls (n=16).

	MDS	**Dictation**	**Arithmetic**	**TCLPP**
GMQ	Run(r)	0.506	0.347	0.797
	P-value	0.046*	0.188	<0.001***
MQ1	Run(r)	0.28	-0.012	0.442
	P-value	0.294	0.963	0.087
MQ2	Run(r)	0.424	0.313	0.561
	P-value	0.102	0.238	0.024*
MQ3	Run(r)	-0.316	0.055	0.003
	P-value	0.233	0.839	0.991
MQ4	Run(r)	0.565	0.635	0.662
	P-value	0.023*	0.008*	0.005*
MQ5	Run(r)	0.583	-0.021	0.705
	P-value	0.018*	0.939	0.002**
MQ6	Run(r)	0.419	0.424	0.628
	P-value	0.106	0.102	0.009*

Source: Authors.

* p < 0.05; ** p < 0.005; *** p < 0.001

After analyzing the statistical data, as shown in Table 5, in the group of boys, the arithmetic test showed a positive correlation with the spatial organization (MQ5), r = 0.502, p = 0.02, with a large magnitude effect. There is a positive association between the arithmetic test and the temporal organization (MQ6), r = 0.467, p = 0.04. It is observed that the magnitude of the effect is medium.

Table 5. Correlation between MDS and reading, writing and arithmetic tests for the group of boys (n=19).

MDS		**Dictation**	**Arithmetic**	**TCLPP**
GMQ	Run(r)	-0.057	0.419	-0.08
	P-value	0.816	0.074	0.746
MQ1	Run(r)	-0.284	0.312	-0.161
	P-value	0.239	0.194	0.511
MQ2	Run(r)	-0.216	0.182	-0.103
	P-value	0.374	0.455	0.673
MQ3	Run(r)	-0.069	-0.068	-0.096
	P-value	0.778	0.781	0.697
MQ4	Run(r)	-0.058	0.027	-0.292
	P-value	0.813	0.912	0.226
MQ5	Run(r)	0.098	0.502	0.12
	P-value	0.69	0.028*	0.626
MQ6	Run(r)	0.338	0.467	0.29
	P-value	0.158	0.044*	0.228

Source: Authors.

* $p < 0.05$

In the distribution of 35 students, according to the MDS criteria, it was found that 14.3% were in the much lower classification; 48.6%, in the lower one; 34.3%, in the normal low; 2.9% in the normal average. According to the scale's guidelines, concentration in the very low, low, and normal low ranges is considered a severe, moderate, and mild risk factor, respectively.

4. Discussion

This work aimed to establish the relation between motor performance and competence in academic tests. The results found here indicate that many of the students who had a low performance in reading, writing and arithmetic tests also had low performance in the motor assessment, placing them in the "much lower", "inferior," and "normal low" ranges, considered, according to MDS parameters, in the risk group. When severe and moderate risk factors are found, there is a recommendation for students to be evaluated by a multidisciplinary team (ROSA NETO, 2015).

These results are supported by the findings of Silva et al. (2012) in a survey of 19 students with a mean age of 10.3 years, using the Movement Assessment Battery for Children – MABC, to investigate motor difficulties in students with low school performance. The authors found that students with low academic performance had motor problems classified as borderline or defined in the sample.

From a statistical point of view, the correlations found were not expressive if analyzed in the entire group. This result is possible because the studied group comprises only low-performance children in at least one of the tests. However, when analyzing groups segmented by sex, some correlations between the tests and MDS stand out. Explicitly considering the female group, the motor quotient for body schema (MQ4) obtained a correlation considered moderate with the dictation, arithmetic and TCLPP tests.

Regarding the relation between low academic performance and body schema, in a study carried out with 39 children aged 6 to 10 years, with complaints of learning difficulties, it was found that the group presented a delay in the motor age of the body schema - MQ4 (ROSA NETO et al., 2011). However, it is essential to emphasize the differences in segmentation between these studies, and the correlations obtained here considered the results separately for boys and girls.

In the body schema tests, it was observed that at the level referring to speed, whose proposed activity was to make traces within delimited spaces at a predetermined time, the girls demonstrated a concern with the aesthetics of the tracing, to the detriment of the execution time. It can be hypothesized that this factor contributed to the differences in performance between boys and girls. It was also verified, still in the female group, correlations between the spatial organization (MQ5) with the dictation test and also with the TCLPP, and a correlation between the temporal organization (MQ6) and the reading test (TCLPP).

The male group correlated spatial organization (MQ5) and temporal organization (MQ6) with the arithmetic test. These results are consistent for the male group and divergent for the female group, as obtained in the studies by Fernandes, Dantas and Carvalhal (2014), carried out with 37 students aged between 7 and 12 years with learning difficulties in calculus, using the Battery Psychomotor – BPM, when they obtained a significant correlation between the spatiotemporal structure and the result of the assessment in mathematics.

In this study, the areas of motricity, referring to the spatial and temporal organization and body schema, presented a more expressive correlation with academic tasks. These findings corroborate Silva, Oliveira and Ciasca's (2017) studies with 26 students between 7 and 9 years old. The experimental group, composed of students with learning complaints, showed a worse performance in the MDS tests concerning the spatial organization, temporal organization and body schema.

The differences found in the correlations between the female and male groups may be due to the different motor performances. Carvalhal and Raposo (2007), in a study carried out with 141 students aged between 7 and 8 years belonging to a Basic Education school, point out significant differences in the performance of boys and girls in locomotor and manipulative skills, attributing them to sociocultural influences on motor development.

Regarding the low performance in the tests of spatial organization, the difficulty in recognizing right and left had an impact on the results in this area and the MDS. This situation was also described by Rosa Neto et al. (2010) in a survey of 101 students with learning difficulties. Faced with these data, it is worth reflecting on the acquisition of right/left concepts and understanding regarding the spatial notion since both are closely linked. However, it was observed in the present study that this conceptualization and spatial naming, which is currently absent, may not have been part of early childhood education activities. This theme, therefore, should be the object of future research. The spatial organization is present in the writing acquisition process, according to Laux, Oliveira and Corazza (2016), who, when studying dysgraphic students, indicated the importance of organizing writing in space, respecting the spacing of letters and words.

Concerning the relation between reading, writing and motor skills found in this study in the correlations obtained between dictation, TCLPP and motor tests, a study by Barbosa and Souza (2017) addresses the relation between psychomotor aspects and acquisition of reading and writing. Specifically, about spatial orientation, the authors describe its role in the discrimination of letters, such as "p" and "q" and "b" and "d", in the organization of the page in writing, in the direction of writing itself, in the sequencing and continuity of a sentence or text in the reading process as requirements for literacy. Anyway, a more in-depth study of these correlations is necessary.

The academic tests applied in this research revealed a higher percentage of students with low performance in the dictation tests, followed by arithmetic and then reading. This pattern of result is the same found in the study by Silva and Beltrame (2011), carried out with 406 students aged between 7 and 10 years with or without indications of learning difficulties, when they were evaluated by the School Performance Test (Teste de Desempenho Escolar [TDE]).

It is observed, in this work, that there is a concentration of students within a range considered for risk factors in development. There may be some students in this group with neurodevelopmental disorders who have not been diagnosed. Here, we reflect on the importance of MDS in this assessment process, as it exposes a set of complementary information that will serve to support a multidisciplinary assessment and plan future actions.

Some points still deserve to be discussed. In the motor assessment process, MDS allowed a quantitative analysis of the students and brought qualitative aspects, contributing to drawing a profile of those assessed. Many characteristics and behaviors were demonstrated at each assessment stage, such as synkinesias, anxiety, fear, insecurity, and even self-criticism, providing a wealth of information that contributed to data analysis.

Some limitations were highlighted in this study and should also be considered for future investigations: the lack of data collected directly from family members, the reduced number of participants, the restriction to the origin of the studied sample being from a single public school.

5. Final considerations

There was a large concentration of students with low competence in reading, writing and arithmetic tests in the lower and much lower classifications of the MDS, suggesting that children with low educational performance can be stimulated by programs that include activities both related to pedagogical content and bodily experiences, aimed at motor development.

The impaired motor areas were concentrated in the spatial and temporal organization for both sexes, indicating the motor functions that may be more related to learning.

The correlation found among reading, writing, arithmetic and motor skills was more evident in groups segmented by sex. It is concluded that students who presented low competence in the assessed tests also showed worse results in motor performance.

This work raised the need for the continuous teacher training process, showing the importance of inserting content on the relation of motor aspects and learning based on scientific research that can be a source of value for the teacher, providing content favorable to school learning.

It is noteworthy that all results were treated confidentially, respecting scientific research's ethical and legal principles.

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