INFLUENCE OF THE PHYSICAL ACTIVITY ON MOTOR PERFORMANCE OF CHILDREN WITH LEARNING DIFFICULTIES

Influência da atividade física no desempenho motor de crianças com queixas de dificuldades de aprendizagem

Daniela Bento Soares [1], Eline Porto [2], Ademir de Marco [1], Cíntia Alves Salgado Azoni [3], Iuri Victor Capelatto [1]

ABSTRACT

Purpose: to analyze the motor performance of children with complains about learning difficulties after the intervention of a motor activity program. **Methods:** twenty-two children (13 with complains and 9 without) among 7 to 11 years old have taken part in this study and they were submitted to a motor evaluation; 14 children were selected for 12 sessions of the motor program related to fencing and circus activity. The data were analyzed with descriptive and inferential statistics. **Results:** only children with complains about learning difficulties who were submitted to intervention obtained progression percentage higher than 20%; children, with and without difficulties, who took part in the intervention showed progression between 10 and 20%. The progression average in specific abilities and total progression index were higher for children with complains. **Conclusion:** It is indicated the intervention of Physical Education experts assisting children with difficulties, motivating them to do physical activity.

KEYWORDS: Child; Motor Activity; Physical Education and Training; Learning

INTRODUCTION

The development of each person can be greatly influenced by the environment in which it is inserted, with the possibility of these influences being positive or negative[1]. According to this ecological theory, the medium becomes to have a role as important as the biological aspects in relation to the individual, from the assumption that change both in equal measure. When the characteristics of the offer positive role models and learning facilitators, development, encompassing the physical, cognitive and social spheres, among others, is more effusive manner, especially during childhood[2]. It is believe that this influence of the environment on a child's life may have biases in psychological, motor, social and biological profiles. The brain plasticity stands out in the biological process, as this is a clear link between their experiences and the neurological development of human beings.

One of the most complex processes due to the plasticity of the nervous system, learning is only possible by educational role through environment imposition[3]. An interesting fact that can be noticed is that different types of learning involve not only different but also the neural circuits underlying neural mechanisms[4]. Therefore, we hypothesize that regardless of the specificity of learning which the child undergoes, general neural changes can occur, stimulating neurological development in general. Specifically regarding to motor learning, one can assume that new motor skills acquired can stimulate the acquisition of other skills related to other areas, just as deficits in other segments may influence the motor fitness of an individual. Studies have shown that regular physical exercise can stimulate brain plasticity[5].

(1) Universidade Estadual de Campinas, Campinas, SP, Brasil.

(2) Universidade Metodista de Piracicaba, Piracicaba, SP, Brasil.

(3) Universidade Federal do Rio Grande do Norte, Natal, RN, Brasil.

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Learning is a large and complex cognitive brain function. Skills in areas as reading, writing and mathematics show specific requirements[6,7], however, children from the same age group not necessarily show compatible level of neuropsychological maturation. Many of the children of the first series just need more time to acquire the basic skills related to language; these temporal problems are common and reflect the normal variability of maturation.

At least 50% of students with learning problems have developmental disorder of motor coordination, suggesting that there may have vulnerability of neural work area, responsible for integrating sensory-motor information[8]. This population presents difficulties in bimanual coordination, manual dexterity and fine motor skills, which explains the occurrence of dysgraphia[9]. The difficulty in repeating rhythms during kindergarten is closely related to learning to read for literacy[10]. It has been demonstrated that there are motor deficits in children with dyslexia and proficient in reading, and observe a statistically significant correlation with respect to chronological age of the children and their school performance[11].

Medina-Papst and Marques[12] emphasize the importance of the development of the motor skills and aspects allied to its application in school tasks since the deficiencies in certain fields of development can influence learning in general. Moreover, they reaffirm Physical Education with a major role in the school, in that it can structure a suitable environment for the child to reflect on his actions and practical experience, assisting and promoting human development, especially motor development.

It is known that problems related to complaints of learning disability can lead to changes in affective-emotional, motivational, interpersonal relationship, and low scores on self-concept, due to its role in the dynamics of the individual's personality[13]. Children who have experienced school failure experiences have low expectations of success, little persistence and lowered self-esteem.

For the above reasons, the present study aimed to evaluate and compare motor performance of children with and without complaints of difficulty in learning, after intervention with targeted physical education classes.

METHODS

This study was characterized as exploratory nature and sought to identify relationships between variables. The research in question was approved by the Research Ethics Committee at the home institution, under the document number 155.319, of November 27, 2012 and those responsible for participating children signed an Informed Consent.

Sample characterization

Twenty-two children joined this study, divided into four groups as following: G1 – Children with learning disability complaints that underwent trough the intervention; G2 – Children with learning disability complaints that did not undergo trough the intervention; G3 – Children without learning disability complaints that underwent trough the intervention; and G4 – Children without learning disability complaints that did not undergo trough the intervention. The participating children were pointed out by teachers and pedagogical tutors, indicating those with difficulty and without learning disabilities It was considered that this statement presents the daily observation and psycho pedagogical supervision lead by school personnel and therefore being validated as educational experts. These professionals based their selection on a comparative analysis of the children's room and their development throughout the school year. For the adjustment of children in different groups, the choice was randomized.

Table 1, Sample Characterization, indicates how the division of subjects among the groups described occurred and the number of people in each division.

Table 1 – Sample Characterization

Group	Number of members	Age Group*
G1	8	9 years and 3 months
G2	5	8 years and 10 months
G3	6	8 years and 7 months
G4	3	8 years and 6 months
Total	22	8 years and 9 months

* Average calculated based on the age at the final evaluation.

All children were enrolled in a public school in Campinas-SP between the second and fifth year of elementary school.

Inclusion criteria were: age between 7 and 11 years old, learning difficulties (for G1 and G2), no complaint of learning difficulty (for G3 and G4). Exclusion criteria were considered: being under the influence of psychoactive drugs / anticonvulsants, psychotropic or antidepressant; children with primary sensory or motor problems or any other neurological and / or psychiatric primary diagnosis of learning disorders.

Thus, this study presents itself as a pilot, which results may indicate evidence of the importance of physical activity in schools and its concern of alerting teachers, physical education teachers and other professionals working with multidisciplinary treatment involving difficulties and learning disabilities. Although there was a small number of subjects in the sample, the groups highlighted above attend the purposes given.

Materials

With the teachers, there was an interview in which the educators indicated that most students had difficulties in the classroom and those who were noted for their good results. Parents and / or guardians responded to semi-structured interview in order to detect the characteristics of children and other information that would be attached to the motor and school performance. Finally, the participants held motor evaluation, through the Motor Development Scale (MDS), from Rosa Neto[11].

The MDS is an individual battery of tests, with test duration of approximately 40 minutes. It is indicated for children with learning difficulties in school, delays in psychomotor development, speaking difficulties, writing, calculation and other neurological, mental or sensory changes. The test administration follows the order of the fine motor skills, global motor function, balance, body structure, spatial organization, temporal organization and laterality. The tests are performed according to the chronological age of the child. The selected intervention group participated in a program of extra physical education classes, in the modalities of fencing and circuses. The proposed sessions were of approximately forty minutes once a week for three months, resulting in twelve classes.

The dynamics were similar to conventional practices, with adapted implements, constructed by the students themselves with materials provided by the researcher or previously made by the school; this way, the practices proposed in the intervention, fencing and circuses could be replied in different places. Classes were recorded in the form of photographs, for the preparation of a field journal, and further evaluation of the entire teaching applied. The entire program was handed over to the Physical Education teacher to continue to be applied after studying the proposals with the same students who participated in the intervention. It was delivered to the school principal and teachers a report containing a detailed description of the classes, the results of motor assessments of all children, the discussions, photos of activities, manufacturing of toys, how-to assembly manual as the sword of the newspaper, juggling ball and references of sites that bring ideas to the making of the classes. Individual results were handed to the children, including the remaining sections of the report described above and the toys.

Table 2 – Psychomotor functions related to modalities

Class	Modality	Content
21/09	Fencing	Presentation mode and balance
24/09	Fencing	Fine coordination, balance and agility
28/09	Fencing	Fine Coordination
01/10	Fencing	Spatial Location
08/10	Fencing	Gross coordination, balance, agility
19/10	Fencing	Gross and Fine coordination, balance, agility
22/10	Fencing	Gross and Fine coordination, balance, agility
29/10	Fencing	Gross and Fine coordination, balance, agility
04/11	Circus	Gross and Fine coordination, balance, agility
12/11	Circus	Gross and Fine coordination, balance, agility
23/11	Circus	Gross coordination, balance, agility
26/11	Circus	Gross coordination, balance, agility

Statistical Treatment

After collection, the data were tabulated and analyzed according to the standard protocol. Then these data were compared using descriptive and inferential statistics through the Program IBM SPSS Statistics 21.0 for Windows ® (Statistical Package for Social Sciences). They were evaluated by Pearson's correlation and Kruskal-Wallis test, both considering a statistically significant result when the p value is equal to or less than 0.05.

RESULTS

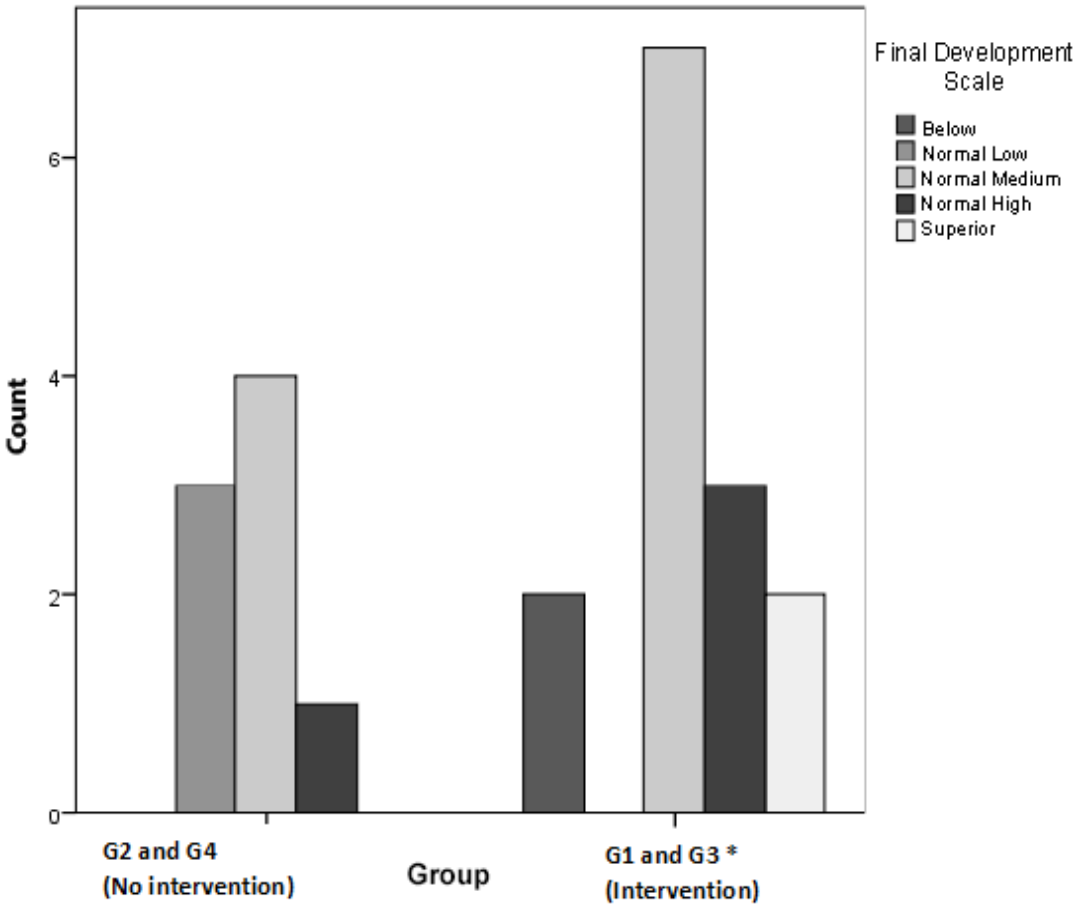
Compared with the result of motor assessment, the percentages of progression achieved between the first assessment and the last evaluation after the intervention was analyzed. Only children in G1 (eight members -11.1%) achieved percentage greater than 20% progression. In addition, only children who participated in the intervention (14 children, 63.6% related to G1 and G3) had progression between 10 to 20% between the first assessment and the last evaluation, as can be seen in Table 3, below.

Table 3 – Percentage of progression of motor evaluation groups

Group	Percentage of progression				Pearson correlation (r)	Sig. (P value)
	Slight Setback	Progress of 0 to 10%	Progress 10 to 20%	Progress greater than 20%		
G1	5.6%	16.7%	11.1%	11.1%	0.393	0.053
G2		11.1%				
G3		27.8%	5.6%			
G4	5.6%	5.6%				
Total	11.1%	61.1%	16.7%	11.1%		

Label: *Pearson correlation test*; p <0.05; Sig:. Significance.

Figure 1 presents the Final Development Scale, as this indicates that the overall performance of the child in the assessment tool, the groups that participated (G1 and G3) and not participated in the intervention (G2 and G4). The number of participants who ranked Normal Medium, High and Normal Superior in the group that underwent intervention is higher and statistically significant (p = 0.001) than the group without intervention, with a positive correlation between them (r = 0.619).



Label: *Pearson correlation test*; p <0.05; Sig:. Significance. * r = 0.619; "P-value" = 0.001; 22 points in the sample.

Figure 1 – Comparison of Final Development Scale achieved by the groups that did not participate in the intervention (G2 and G4) and who participated in the intervention (G1 and G3) (Graph generated by SPSS)

Table 4 shows the results of the initial motor assessment – represented by the term pre-test – and final – post-test – without the intervention of the groups (G2, and G4) and with intervention (G1 and G3). It can be noted that both groups analyzed showed significant differences between the initial and final motor performance and the results show statistically significant differences (p <0.01), but the intervention group that had obtained a final average post-test (104.708) greater than the average for the group without intervention (97.4286).

Table 4 – Comparison between intervention and no intervention groups with the overall results of motor assessment

Variables		Average	Standard deviation	Pearson correlation	Sig. (P value)
Without intervention	Pre-Test	96.8250	8.53091	0.997 *	0.000 **
	Post-Test	97.4286	7.49332		
Intervention	Pre-Test	96.2290	14.46677	0.880 *	0.000 **
	Post-Test	104.708	15.5202001		

Label: *Pearson correlation test*; Sig: significance,. * Correlation is significant at the 0.01 level (1 end); ** P <0.01.

Table 5, in which appears the comparison of these variables for the groups of learning difficult complaints (represented by G1 and G2) and without complaints (represented by G3 and G4), also shows a statistically significant difference (p = 0.002) between the initial and final results of motor assessment for the group complaining of learning disability. The group without difficulties also showed statistically significant difference, but with a value of p greater (p = 0.02).

Table 5 – Comparison between the groups with and without complaints of abuse learning difficulty with the general results of the motor assessment

Learning Disability		Average	Standard deviation	Pearson correlation	Sig. (P value)
No Complaint	Pre-Test	103.1425	9.63423	1	
	Post-Test	106.7800	11.39485	.730	0.020 *
Complaining	Pre-Test	84.7000	11.19911	1	
	Post-Test	95.3477	15.14336	.810	0.002 **

Label: *Pearson correlation test*; Sig: significance,. * Correlation is significant at the 0.05 level (1 end). ** Correlation is significant at the 0.01 level (1 end).

Tables 6, 7, 8 and 9 show comparisons between groups for the contents of progression of balance skills, motor skills, body structure, speed (flexibility) and also to the overall progression.

Table 6 can be seen the comparison between the groups that participated in the intervention, difficulty in learning complaints (G1) and without complaints (G3). It is noticed that the average progression of balance skills, fine motor skills, body schema and speed, and also the rate of overall progression were higher for the group of children with difficulty learning complaints. In the last two figures cited, respectively, the average values are seven times and six times higher for the group with complaints in relation to the group without complaints.

Table 6 – Comparison of G1 with G3 referring to the Balance Progression, Progression of Fine Motor, Body Schema Progression / Speed and Total Progression variables

Variable	Group	Average	Standard deviation	Sig. (P value)
Index of Balance Progression	G1	18.2639	24.11425	0.816
	G3	12.8704	18.76606	
Index of Fine Motor Progression	G1	21.4158	18.19398	0.736
	G3	19.8325	18.88679	
Index of Body Schema Progression / Speed	G1	7.1810	16.05514	0.738
	G3	1.7917	19.33764	
Percentage of Total Progression	G1	12.6988	12.20737	0.184
	G3	6.6776	4.3298	

Label: *Kruskal-Wallis test*; p <0.05; Sig: significance,. G1: Children with learning difficulties complaints and who underwent intervention; G3: Children without learning difficulties complaints or attention who underwent intervention.

Table 7 it was observed the comparisons of the groups that did not participate in the intervention (G2 and G4). The G2 has learning difficulty complaints and the G4 does not have it. Only in Percentage of Total Progression and Progression Index of Body Schema Progression / Speed the G2 improvement was statistically significant compared to the group that has no difficulties.

Table 7 – Comparison of G2 with G4 referring to the Balance Progression, Progression of Fine Motor, Body Schema Progression / Speed and Total Progression variables

Variable	Group	Average	Standard deviation	Sig. (P value)
Index of Balance Progression	G2	20.7792	9.18320	0.29
	G4	8.3333	9.12871	
Index of Fine Motor Progression	G2	11.1345	25.84802	0.293
	G4	14.2857	15.64922	
Index of Body Schema Progression / Speed	G2	14.5833	2.94628	0.009 **
	G4	0.0000	0.00000	
Percentage of Total Progression	G2	3.0537	1.25470	0,035 *
	G4	-0.7469	1.3811	

Label: *Kruskal-Wallis test*; Sig: significance,. G2: Children with learning difficulties complaints who have not received the intervention; G4: Children without learning or attention complaints who have not received the intervention. * P≤0.05; ** P <0.01.

In comparison the two groups of children presenting learning difficulties (being that participated in the intervention G1 and G2 did not undergo intervention), one realizes that the G1 could progress better than the G2 in fine motor skills and overall progression, although no statistically significant difference, but not in balance and body schema and speed, as can be seen in Table 8 below.

Table 8 – Comparison of G1 with G2 referring to Progression of Balance, Progression of Fine Motor, Body Schema Progression / Speed and Total Progression variables

Variables	Group	Average	Standard deviation	Significant (p-value)
Index of Balance Progression	G1	18.2639	24.11425	0.773
	G2	20.7792	9.18320	
Index of Fine Motor Progression	G1	21.4158	18.19398	0.089
	G2	-11.1345	25.84802	
Index of Body Schema Progression / Speed	G1	7.1810	16.05514	0.476
	G2	14.5833	2.94628	
Percentage of Total Progression	G1	12.6988	12.2074	0.397
	G2	3.0537	1.25470	

Label: *Kruskal-Wallis test*; p <0.05; Sig: significance,. G1: Children with learning difficulties complaints who underwent intervention; G2: Children with learning difficulties who have not received the intervention.

Finally, Table 9 shows the results of the groups that have no complaint of learning disability (who participated in the intervention G3 and G4 did not participate). The data show that G3 average is greater than G4 in all skills, whereas it is presented a statistically significant difference (p = 0.002) in the percentage of overall progression.

Table 9 – Comparison with G3 G4 referring to the Balance Progression, Progression of Fine Motor, Body Schema Progression / Speed and Total Progression variables

Variables	Group	Average	Standard deviation	Significant (p-value)
Index of Balance Progression	G3	12.8704	18.76606	0.738
	G4	8.3333	9.12871	
Index of Fine Motor Progression	G3	19.8325	18.88679	0.200
	G4	14.2857	15.64922	
Index of Body Schema Progression / Speed	G3	1.7917	19.33764	0.524
	G4	0.0000	0.00000	
Percentage of Total Progression	G3	6.6776	4.3298	0.002 **
	G4	- 7469	1.38109	

Label: *Kruskal-Wallis test*; Sig: significance,. ** P <0.01; G3: Children without learning difficulties complaints who underwent intervention; G4: Children without learning difficulties complaints who have not received the intervention.

DISCUSSION

Based on the results there were some differences in the assessment of children who passed through the motor intervention than those who have not had this experience. The data presented in the previous section show that only children presenting learning difficulties complaints who underwent intervention (G1) achieved percentage greater than 20% progression; Furthermore, only children who participated in the intervention (G1 and G3) had progression between 10-20%. This information indicates that participation in extra physical education classes were sufficient to maximize motor performance of participating children. These results also demonstrate that children complaining of learning disability have benefited most, suggesting that this type of intervention may be a way to assist them in improving their clinical profile. This discussion is consistent with the claim that Capellini et al.[8], Chaix et al.[14] and Haslum and Miler[15] which reported that children presenting learning difficulties also have motor problems that can be diminished with stimulation of the same order. It can also raise the hypothesis that the great improvement of children learning difficulty complaints in school compared to those without complaints may have occurred, possibly for the first time, these children participated in physical education classes with reduced number of students and activities focused on skills presenting lags in which the emphasis was not to allow any child to feel inferior to others. During classes, It was taken care that the opportunity was given to all participants and was not demanded performance, ie, the attempt to perform a given task was more important than the result itself. Thus, just as predicted Carneiro et al.[13], the good result may have been the result of attention to children and their individual difficulties. These precepts are also in accordance with Medina-Papst and Marques[12], Alano et al.[16] and Silva and Beltrame[17], which highlight the importance of affection and attention in the process of rehabilitation of children, in which we can include extra physical education classes as potential proposals for children with learning difficulties and also in learning disorders.

It is possible to verify that there were slight regression in two children of the groups analyzed G1 and G4. In G1, the percentage shown represents two participants – a boy who, during the survey period, participated in neuropsychological assessment in which detected mild mental retardation and a girl, also has suspected intellectual disability and was referred for psychological evaluation to detect possible problems. This may explain why they present negative results at the study table. As for the children who presented the G4 regression, the hypothesis is that this occurred by poor motor stimulation, noting that this group has not gone through the intervention of this research.

The literature indicates that it is essential to offer all children diverse environments and stimuli that provide means of solving problems, regardless of having or not motor disability. Moreover, it is common knowledge that physical exercise contributes widely to socialization, psycho-emotional development, fostering self-confidence and self-esteem, especially during childhood[18].

Final Development Scale, the overall performance of children in the evaluation instrument, it is noted that the number of participants who reached the rank Normal Medium, High and Normal Superior in the group that underwent intervention is larger and statistically meaningful than the group without intervention, demonstrating that this was beneficial for better development of motor skills. In comparing the groups that underwent an intervention, you can see that the final average in the post-test was higher than the mean of the group without intervention. There was also a statistically significant difference between the initial and final results of motor assessment for the group complaining of difficulty in learning, in relation to the group without learning disabilities. The results infer that the intervention was more beneficial for children with poor school performance.

In comparison to the groups that participated in the intervention (G1 and G3) with each other, it is observed that the average progression of balance skills, fine motor skills, body schema, speed and also the overall progression index were higher for the group of children with complaints of difficulty learning. In the last two figures cited, respectively, the average values are seven times and six times higher for the group with complaints. These data confirm the hypothesis that children with learning difficulty complaints have lower motor performance in these skills to what is expected, as indicated by Alano et al[16] and Silva and Beltrame[17], however, upon stimulation with the intervention showed better performances, demonstrating that adequate physical education classes and targeting children with difficulties can make your equal or better performance when compared to children without learning difficulties.

Compared to children who did not undergo intervention, the group of children presenting learning difficulties had a significant improvement in relation to the skills of body schema, and speed and overall progression towards children without difficulties. This can be explained because children without difficulty have obtained good results in the first assessment and, consequently, its progression without stimulation is not as significant when compared with children with difficulties, as the latter had low performance in the first assessment.

These last mentioned results, it could be observed that children with learning disabilities and those who did not undergo specific stimulation could improve in body schema and overall progression. However, the improvement in motor function was better in children with difficulties who have gone through specific motor intervention. It can also be seen that the improvement was significant (quantitatively analyzing the averages obtained progression) in children who underwent an intervention in the overall progression.

Comparing only the groups of children without complaint of learning difficulty, however, one can observe that the group who participated in the intervention (G3) had better outcomes than the control group (G4) in all skills, with a significant difference in overall progression, which confirms that participation in exercise programs are important for all children[12].

The high incidence of moderately significant correlations between the results is explained by the small number of subjects participating in this study. Thus, there is no claim that the effects of the presented program will be repeated on the same research model with other children, because the data may or may not follow linearity. However, these results are important to encourage the discussion about the importance of this type of intervention with this population and design new studies of the same shape, with the largest number of reviews. It is observed in the literature articles that evaluate the motor fitness of children with difficulty in school complaints, but no research like this that considers ways to improve the performance of children in this situation with motor interventions that are carried out within the school context, in physical education classes, should also be performed.

This statement becomes true when observed, for example, that the results regarding to a inferior motor performance of children who have learning difficulty complaints corroborate Silva and Beltrame[17], whereas these authors claim that 30 to 50% % of children with motor difficulties, have also complained of difficulty associated with learning. As is indicated by the literature, children with learning disabilities evaluated also showed deficits in motor coordination skills[8], encompassed in this study as a global movement, and the skills of bimanual coordination, manual dexterity and motor skills thin[9]. After the intervention, children in this condition showed better results and even greater percentages than those without complaints of difficulty in school, which can demonstrate that they have a great potential for age-appropriate development.

Can be hypothesize that this satisfactory result was due to an intervention designed for stimulation

of motor coordination skills, with a choice of physical exercises that required the development of these. For this, it was necessary to choose guiding themes that could keep children stimulated in the realization of bodily practices. This factor helped to maintain the low level of absenteeism and also add cultural content aimed at children, who did not previously know the theme covered. All these factors could be observed during class and were transcribed in the field diaries.

It was observed that participation in group activities encouraged the socialization of children and the development of affective ties among participants, factors that themselves could provide better experiences at school.

Concludes, therefore, that appropriate motor intervention can improve the performance of motor skills needed for school learning and that it is possible to make a more effective action in a physical education class, which assists both children with difficulties as for children who do not have difficulties, motivating them to do physical exercise.

CONCLUSION

After verifying that children who have taken part in an intervention showed statistically higher and significant performance in motor evaluation and for those who joined physical education classes, the improvement was even greater for those with complaints of learning difficulties. It can be concluded that the proper motor intervention can enhance the motor performance on children in this age group and be even more significant for children with complaints of learning difficulty.

It is important to highlight that although the number of participants does not allow generalizations about the subject, the results of this research demonstrate the validity and importance of educational projects focusing in dedication motor activities, contributing to the integral development of children in basic education. This study alerts the scientific community to this aspect and proposes deepen researches in this theme.

RESUMO

Objetivo: avaliar e comparar o desempenho motor de crianças com e sem dificuldade de aprendizagem após intervenção com aulas de Educação Física direcionada. **Métodos:** fizeram parte da pesquisa 22 crianças (13 com queixa e 9 sem queixa de dificuldade de aprendizagem) com idade entre 7 e 11 anos, submetidas à avaliação motora; 14 crianças selecionadas para intervenção realizaram 12 sessões de práticas voltadas à esgrima e atividades circenses. Os dados foram analisados por meio de estatística descritiva e inferencial. **Resultados:** apenas as crianças com queixas de dificuldades de aprendizagem e que foram submetidas à intervenção alcançaram porcentagem de progressão total na avaliação motora maior que 20%; somente as crianças que participaram da intervenção apresentaram esta progressão entre 10 a 20%. As médias de progressão de habilidades específicas e o índice de progressão total foram maiores para o grupo de crianças com queixa de dificuldade de aprendizagem. **Conclusão:** indica-se que são possíveis intervenções de profissionais da Educação Física visando auxiliar crianças com dificuldades de aprendizagem e, motivando-as para à prática de atividades físicas.

DESCRITORES: Criança; Atividade Motora; Educação Física e Treinamento; Aprendizagem

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Mailing address:
Daniela Bento Soares
Rua Coronel Manoel de Morais, 317 – apto 61
Campinas – SP – Brasil
CEP: 13073-022
E-mail: danibsoares@hotmail.com