

# CONTRIBUTION OF DIFFERENT CONTENTS OF PHYSICAL EDUCATION CLASSES IN ELEMENTARY SCHOOL I FOR THE DEVELOPMENT OF BASIC MOTOR SKILLS



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## ABSTRACT

**Introduction and objective:** This study investigated the contribution of physical education (PE) classes in elementary school I for the development of basic motor skills of children from two public schools in the same neighborhood of São Paulo city, and if the practice of extreme sports besides the PE classes could differently contribute to the development of those skills. **Methods:** Nineteen children ( $9.5 \pm 0.3$  years) who had two weekly PE classes composed the control group (CG) and 22 children ( $9.6 \pm 0.5$  years) who had two weekly PE classes and three extreme sports classes composed the experimental group (EG). All children were videotaped while performing locomotor and object control motor skill subtests from the Test of Gross Motor Development (TGMD-2). The videos were analyzed and raw scores were obtained according to the quality of the observed movement, and equivalent motor age was also estimated for both subtests. **Results:** The results indicated that the EG presented higher raw scores compared to CG in the locomotor subtest and both groups presented similar scores in the object control subtest. Moreover, EG presented higher equivalent motor age in the locomotor subtest compared to CG and neither group presented differences between equivalent motor age and chronological age in the object control subtest. **Conclusion:** Based on these results we conclude that PE classes in elementary school appropriately contributed to the development of basic motor skills, since neither group presented difference between equivalent motor age and chronological age, and that extreme sports classes contributed even more for the development of locomotor skills.

**Keywords:** motor development, extreme sports, motor evaluation, TGMD-2.

## INTRODUCTION

Motor development can be understood as alterations in the motor behavior during one's life and the processes which compose the basis of these alterations<sup>1</sup>. Among the motor skills which can be considered within the developmental context, the basic motor skills are those which involve the trunk, arms and legs great muscular groups. These skills include postural tasks to keep the body in specific orientations concerning the environment, locomotion to transport the body through space and the manipulative tasks to explore and interact with the objects in the environment. The development of these skills enables the development of fine or specialized motor skills<sup>2</sup>, which are used in specific situations of sport, dance and recreational activities<sup>3</sup>.

The human motor development in the first half of the XX century was understood as being derived from maturational alterations in the central nervous system<sup>4</sup>, being hence exclusively intrinsic to the body and with little influence from the environment. More recently, motor development has been understood as a dynamics process resulting from the interaction of the demands of the task, environmental conditions and the characteristics of the performer<sup>2,5</sup>. Based on this more updated view of motor development, we can suggest that opportunities of structured practice, resulting from the environment manipulation and the duty of the physical education professional (PE), could favor the development of the basic motor skills in a more suitable manner.

When the development of basic motor skills is considered as the grounding for the development of specific skills, providing better conditions for a more active life, such as effective participation in physical activity and sports programs, it is of utmost importance that the contribution of PE classes in the elementary school I is investigated for the acquisition and refinement of the basic motor skills.

It is not an easy or common task to evaluate the motor development in the school environment among the professional of the field, and studies which investigate the most appropriate way should be carried out. Cools *et al.*<sup>6</sup> compared seven tests used to evaluate the motor development in the school context and stated the main characteristics of each one with the aim to clarify the advantages and disadvantages found when each of them are applied. Among the tests selected by these authors, we chose for the present study the *Test of Gross Motor Development, Second Edition* (test of development of gross motor skills) – TGMD-2<sup>7</sup>, which comprises the age group investigated in this study and assesses the developmental process. Thus, information about this test is presented as follows.

The TGMD was proposed to examine the quality of the movement concerning the basic motor skills for the first time in 1985, and more recently, the second version of this test (TGMD-2) was proposed<sup>7</sup>. This test is composed of two subtests: locomotor subtest and object control subtest, and each one contains six basic

motor skills. The locomotor subtest includes running, galloping, jumping on one foot, jumping over an object, jumping horizontally and lateral dislocation. The object control subtest includes hitting a stationed ball, bouncing with no dislocation, receiving, kicking, throwing over and throwing low. All of these skills are independently assessed through pre-established criteria and when the subject meets these criteria, one point is given, otherwise no point is given. The attributed points are summed and the total value of points obtained for each subtest reflects the pattern of the movement performed. This value may be considered for example, as a raw score, or, in case of interest, the motor age equivalent can be defined from the raw score of each subtest<sup>7</sup>.

Many researchers of the field have used the TGMD-2 to investigate the motor development of children (evaluation) without<sup>8-11</sup> or with<sup>12-15</sup> special needs, groups of children submitted to different programs of physical activity (comparison)<sup>16,17</sup>, as well as the effects of a given intervention period<sup>9,18-20</sup>. Generally speaking, these studies confirmed that the children present developmental level lower than the reference norms<sup>7</sup> and that different programs of physical activity and intervention periods improve the developmental level of the children. However, the majority of these studies, except for Cotrim<sup>9,10</sup>, does not inform whether the children had physical education classes in elementary school I and, if they do so, if the classes were taught by professionals of the field. Thus, the issue raised is whether the level of motor development of children who had PE classes in elementary school I with professionals of the field and if the practice of a specific extracurricular activity in school termed extreme sport, in addition to these PE classes, would lead to a differentiated developmental level.

The mentioned extracurricular activity (extreme sports) was chosen because it presents a very specific motor repertoire which the children usually do not experience in their routine, and which does not require or predispose practice aimed to high level performance. Nevertheless, more important for the present study was that the activity used could be performed by children at elementary school I without promotion of specialization or restriction of motor performance, being hence possible to be practiced by all children. Thus, the aims of this study were to investigate the development of basic motor skills of children who had PE classes in elementary school I and whether the practice of extreme sports in addition to the PE classes would promote different development of these skills.

## METHODS

### Sample

Forty-one children aged between nine and 11 years and enrolled on the fourth year of the elementary school I of the state sector of two schools situated in Pirituba, São Paulo, SP, participated in this study. Out of this total, 19 children (10 boys and nine girls) studied in the Professor Raul Antonio Fragoso school and composed the experimental group (EG), and 22 children (15 boys and seven girls) studied in the Pio XII school and composed the control group (CG). The first school was chosen for being a full-time school in which the students had two PE weekly classes, with the professional of the field, and three extreme sports weekly classes which were part of a project proposed by the same teacher who taught the PE classes. The second school was chosen for being a part-time school where the students

had only two PE weekly classes, also with a professional from the field, and for being in the same neighborhood of the first school, and consequently, including a population with similar socio-economical characteristics in which the majority was within the range of one and half and less than three minimum wages of income, according to the Data Analysis State System Foundation<sup>21</sup>.

Still concerning the children from the EG, the three extreme sports weekly classes included skateboarding, rollerskating, climbing and parkour activities. Data about chronological age, mass, stature and boy mass index (BMI) of the children who participated in the study are presented in table 1.

Inclusion criteria were: to be regularly enrolled in the mentioned schools from the first year of the elementary school I; to be present in the school where they studied at the time set by the examiners of the study to perform the proposed motor tests; to present the Free an Clarified Consent Form signed by their legal tutor, which was previously approved by the Ethics in Research Committee of the Institution.

Table 1. Mean ( $\pm$  standard deviation) of age, body mass, height and body mass index (BMI) of the control group (CG) and experimental group (EG).

Group	Age (years)	Mass (kg)	Height (m)*	BMI (kg/cm <sup>2</sup> )*
CG (n = 19)	9.5 $\pm$ 0.3	34.4 $\pm$ 8.1	1.47 $\pm$ 0.1	15.7 $\pm$ 2.5
EG (n = 22)	9.6 $\pm$ 0.5	32.8 $\pm$ 7.5	1.35 $\pm$ 0.1	17.8 $\pm$ 2.9

\* Difference between groups (p < 0.05)

### Procedures

The children who met the inclusion criteria of the study had their mass and height checked before being filmed while performing the motor tasks which composed the locomotor and object control subtests proposed by Ulrich<sup>7</sup>. In order to speed up with the children's footage, two digital cameras (Sony, Model DCR-HC96) were used, each of them being perpendicularly positioned to the area marked for the performance of the locomotor and object control subtests, respectively, in two distinct areas in which these children normally participated in the PE classes in their respective schools. Thus, two children were simultaneously filmed, each one performing one of the subtests. The instructions and demonstrations of each motor task were presented by one of the examiners for each child individually, who performed a practical trial to guarantee he/she had understood what was supposed to be done, and immediately after that, performed two trials considered for subsequent analysis.

### Data analysis

The images obtained from the footage were independently analyzed by three evaluators suitably trained according to the performance criteria<sup>7</sup>, namely, one of the study's investigators and two evaluators who did not have any previous about the aims of the study. Each evaluator recorded the raw scores corresponding to the performance presented by each child on the last two trials performed of each motor task on individual sheets. These scores were subsequently added, and each child could reach a total of 48 points in each subtest. In order to verify the agreement among evaluators (AAE), the scores attributed by each evaluator were recorded and the ratio between the number of

agreements (A) by the sum of agreements and disagreements (D) was calculated ( $AAE = A/(A+D)$ ), as proposed by Thomas and Nelson<sup>22</sup> and performed in other studies<sup>8,9</sup>. Table 2 presents the agreement values among the three evaluators of the locomotor and object control subtests, which indicate a high agreement level.

The equivalent motor age, which indicates the child's developmental level, was determined according to a normative table from the raw scores obtained in each subtest<sup>7</sup>. It is worth mentioning that this author defined different raw scores between genders for the object control subtest but did not make gender distinction for the locomotor subtest. Such fact eliminates the need to separate the children from the investigated groups by gender in this study.

**Table 2.** Minimum, maximum and mean values ( $\pm$  SD) concerning the agreement among the three evaluators of the locomotor and object control subtests of the TGMD-2 of the children who composed the control group (CG) and the experimental group (EG).

Group	Subtest	Minimum value	Maximum value	Mean $\pm$ SD
CG	Locomotor	0.88	0.98	0.92 $\pm$ 0.03
	Object control	0.84	0.98	0.92 $\pm$ 0.03
EG	Locomotor	0.88	1.00	0.94 $\pm$ 0.03
	Object control	0.84	1.00	0.93 $\pm$ 0.04

## STATISTICAL ANALYSIS

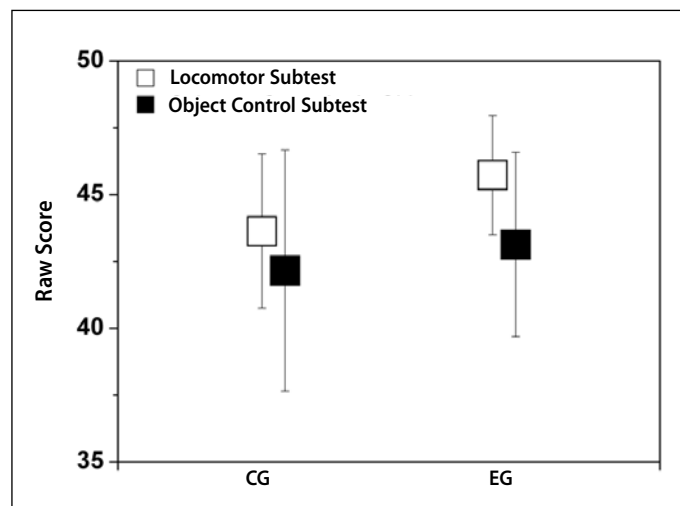
In order to verify possible differences between the groups, a analysis of variance (ANOVA) and three multiple analyses of variance (MANOVA) were applied, having the groups as factor (CG and EG). The dependent variables were: chronological age for ANOVA; mass, stature and BMI for the first MANOVA; raw score of the locomotor and object control subtests for the second MANOVA; and equivalent motor age for the locomotor and object control subtests for the third MANOVA. Univariate analyses were applied whenever necessary. In order to verify differences between chronological age and equivalent motor age, four paired *t* Student's tests were applied for the locomotor and object control subtests in each group, respectively. The significance level was kept at 0.05 for all statistical tests, which were performed with the Statistical Package for the Social Sciences software – SPSS (version 10.0, SPSS Inc.).

## RESULTS

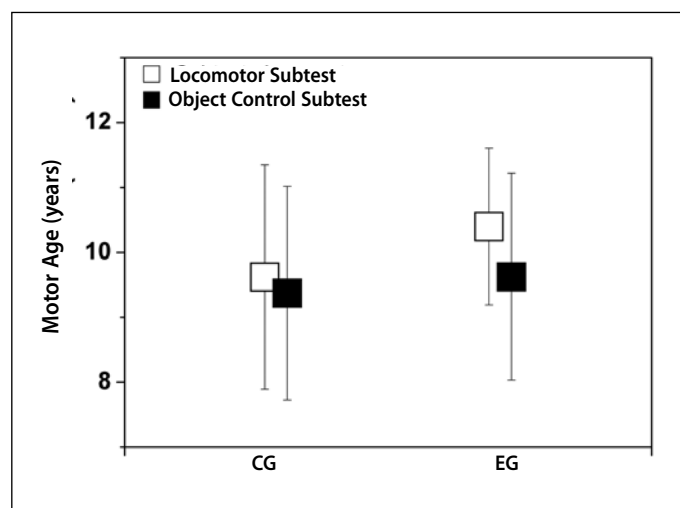
Table 1 presents mean values ( $\pm$  standard deviation) concerning chronological age, mass, stature and BMI of the two groups (EG and CG). ANOVA revealed that chronological age was similar between groups,  $F_{1,39} = 0.59$ ,  $p > 0.1$ . Concerning mass, stature and BMI, MANOVA revealed difference between groups, Wilks' Lambda = 0.41,  $F_{3,37} = 17.35$ ,  $p < 0.001$ . Univariate tests revealed that CG and EG presented similar body mass,  $F_{1,39} = 0.45$ ,  $p > 0.5$ , that CG presented higher stature,  $F_{1,39} = 28.15$ ,  $p < 0.001$ , and lower BMI,  $F_{1,39} = 5.67$ ,  $p < 0.05$  than EG.

Figures 1 and 2 presented the mean values ( $\pm$  standard deviation) of the raw scores and equivalent motor age, respectively, for the locomotor and object control subtests of the TGMD-2. Concerning the raw score, MANOVA revealed difference between groups, Wilks' Lambda = 0.82,  $F_{2,38} = 4.26$ ,  $p < 0.05$ . Univariate tests revealed that CG presented lower score than EG in the locomotor subtest,  $F_{1,39} = 6.85$ ,  $p < 0.05$ , and that the two groups

presented similar scores in the object control subtest,  $F_{1,39} = 0.62$ ,  $p > 0.1$  (figure 1). Regarding equivalent motor age, MANOVA did not reveal difference between groups for the locomotor and object control subtests, Wilks' Lambda = 0.92,  $F_{2,38} = 1.57$ ,  $p > 0.1$  (figure 2).



**Figure 1.** Mean ( $\pm$  standard deviation) of the raw scores concerning the locomotor and object control subtests of the TGMD-2 of the control group (CG) and experimental group (EG).



**Figure 2.** Mean ( $\pm$  standard deviation) of the equivalent motor age concerning the locomotor and object control subtests of the TGMD-2 of the control group (CG) and experimental group (EG).

Finally, *t* tests did not reveal difference for the CG between chronological age and equivalent motor age for the locomotor,  $t_{18} = -0.20$ ,  $p > 0.5$  and object control,  $t_{18} = 0.50$ ,  $p > 0.5$  subtests. Regarding the EG, the *t* tests revealed advanced equivalent motor age compared to the chronological age for the locomotor subtest,  $t_{21} = -2.41$ ,  $p < 0.05$ , but no difference between chronological age and equivalent motor age for the object control subtest,  $t_{21} = 0.06$ ,  $p > 0.1$ .

## DISCUSSION

This study investigated the development of basic motor skills of children who has PE classes in elementary school I and whether the practice of extreme sports in addition to the PE classes would promote different development of these skills. Generally

speaking, the results indicated that the children at the end of the elementary school I presented development of basic motor skills compatible with chronological age. Moreover, the extreme sports classes joined with the regular PE classes, provided development of the locomotor skills beyond expectation, evidencing hence that the practice of such activities promotes additional development of motor development. The results observed in the present study indicate the importance of systematic practice of activities as PE classes and additional classes during the elementary school I years for the full development of even basic motor skills.

The results of the present study corroborate results of recent studies<sup>9-11</sup>, which, using the TGMD-2 observed that the children presented the expected development for their chronological age. In the present study, the children who had only regular PE classes and the ones who had supplementation of extracurricular activities of extreme sports presented development according to their chronological age.

On the other hand, the results presented here are different from the results of some few studies which have examined the motor development of children within the same age group (nine and 11 years old), when motor delay of the examined children was observed in the respective studies<sup>16,17</sup>. A possible explanation for this discrepancy in the results observed in these studies may derive from the experiences the children had on the first years of elementary school. Cotrim *et al.*<sup>10</sup> identified differences in the level of development of basic motor skills of children who had regular PE classes during elementary school I and of children who did not have regular classes. Therefore, developmental differences may be derived from previous experiences the students had, considering that the basic motor skills do not develop naturally<sup>3,5</sup>, where the teacher plays a crucial role in this process<sup>23</sup>. The results of the present study corroborate these proposals, considering that the children who had regular PE classes presented, at the end of elementary school I, development of the basic motor skills according to the expectation. This study also investigated the contribution of activities named extreme sports, such as extracurricular activities and joined with the PE classes in school for the development of basic motor skills of the children. Contrary to studies which investigated other alternative practices, such as minivolleyball<sup>16</sup>, capoeira<sup>17</sup> and which presented equivalent motor age lower than chronological age, the children who experienced extracurricular practice of extreme sports in addition to regular PE classes presented equivalent motor age expected for the object control skills and higher than chronological age for the locomotor subtest. The confirmation that practice of the mentioned extracurricular activity may be related to the promotion of specific development may be attributed to the fact that the content of these classes predominantly comprehends locomotor skills. Differently, the extreme sports activities do not involve the use and handling of objects and implements related with the manipulative skills evaluated in the object control subtest and therefore, the practice of activities by children during elementary school I did not cause any additional benefit for the development of the object control skills. Thus, the extracurricular activities named extreme sports joined with the regular PE classes provide development beyond expectation for age; however, for those skills which compose the

motor basis of the practice of extreme sports, which were the locomotor skills. It is important to consider some specific aspects of the present study concerning PE classes taught in elementary schools I. Firstly, the effects of extracurricular activities in the development of basic motor skills in children were observed in other studies as special programs<sup>19,24</sup>, specific activities practice<sup>6,17</sup>; however, only recently the possible effects derived from the availability of PE classes taught in elementary schools I have been observed<sup>9,10</sup>. Thus, the present study increases the knowledge on the possible effects of structured practice in the motor development, since it involved the combination of regular PE classes and practice of extracurricular activities (extreme sports). Another aspect which should be discussed is the importance and even the need for regular activities during elementary school I, providing structured and organized practice with specific content aiming the development of basic motor skills in the school context. The results of the present study joined with the results observed in recent studies<sup>10,11</sup>, clearly indicate that children at about 10 years of age are able to demonstrate motor proficiency in the performance of basic motor skills, as long as they have experienced regular activities aimed at the development of these motor skills. Nevertheless, not every child has the opportunity to live such experiences outside the school environment. Therefore, the inclusion of regular PE classes in elementary schools I, which can be joined with other activities, is crucial for the expected development of basic motor skills<sup>10</sup>.

Considering that the proficiency level to perform basic motor skills can be crucial for the involvement in physical activities and programs and even in future regular PE classes<sup>3,5,10</sup>, regular PE classes, joined or not with extracurricular activities in school, are essential in the perspective of keeping the child, future adolescent an adult, active in the years to come. Involvement in physical activities or programs has been mentioned as one of the ways to at least minimize the deleterious effects of the modern society, such as stress and obesity. Therefore, the children of the present study who gained proficiency, according to the expectation, in the performance of basic motor skills, would be able to remain engaged in future activities, avoiding hence, the phenomenon called motor proficiency<sup>3,5</sup>, which could hamper the involvement in such future activities.

The present study presents some limitations which must be mentioned here. The first one is that it does not present a true experimental outlining and the activities are not totally controlled and manipulated by the technicians. Despite of that, care was taken to guarantee that all children in both groups were enrolled in their respective schools in all the years of the elementary school I in the same region of the city to guarantee homogeneity of the groups, and that they had the opportunity to engage in the same activities, in the respective groups. Another possible limitation may be due to the suggestion that the extracurricular activities named in the present study extreme sports, may be considered risky to be practiced by children in elementary schools. In fact, the extreme sports are complex and require a lot of care and differentiate procedures. Nevertheless, they involve unique motor practice and experiences for children, who may greatly broaden their motor repertoire at least in the set of motor skills, as observed

in the present study. Thus, instead of avoiding or not providing the practice of such motor experiences, its practice should be planned and organized accordingly, making the risk of its practice similar to the risk of the practice of any other activity. Finally, the extreme sports activities certainly provide differentiated involvement and motivation, becoming a unique stimulus so that the children have involvement in the proposed activities.

Based on the results found in this study, we can conclude that PE classes in the four first years of elementary school I, taught by professional of the PE field, contributed for the expected development of basic motor skills. Moreover, extreme sports

classes developed in the school context, joined with the PE classes, contributed to performance beyond the expectation for the age between nine and 11 years concerning the development of locomotor skills. Thus, it is worth mentioning the importance of PE classes in the first years of elementary school I, taught by professional of the field, who should offer their students the opportunity of organized and structured practice.

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All authors have declared there is not any potential conflict of interests concerning this article.

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