

## Context and Intensity of Primary School Physical Education Classes in Brazilian Schoolchildren

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### ABSTRACT

**Background:** Studies reported small proportions of moderate-to-vigorous physical activity (MVPA) in physical education (PE) classes conducted with children, but there is little information regarding PE class characteristics that might affect a lack of intense PA.

**Objective:** To compare the intensity of PE classes with different contextual characteristics.

**Methods:** Twelve PE classes of children from 2nd to 5th grades (7 to 11-year-olds) were observed. Contexts were classified as Management, Game Play, Free Play, Fitness, and Skill Practice. Children wore accelerometers and MVPA was estimated. The proportion of time on each context and MVPA of each PE class was analyzed.

**Results:** Game Play was the most observed context, and Management was observed in all classes, but with smaller proportions. Fitness was not observed, while Free Play and Skill Practice were rarely observed. Children spent 25% or less of PE class time in MVPA, and accumulated more MVPA in classes where Game Play was predominant.

**Conclusion:** A quarter or less of PE class time had MVPA. Game Play was the most frequent and intense context. Implementing more fitness and skill practice could increase PE classes' intensity and expand children's motor experiences. Reducing time in Management could also benefit children's participation in MVPA.

**KEYWORDS:** Children; Public Health; Accelerometer; Child Behavior; Students; Motor Activity.

### INTRODUCTION

The benefits of physical activities (PA) for children are well documented, however, studies have shown that children are not physically active [1, 2]. Health-related governmental organizations have emphasized the importance of promoting PA in young populations, and the World Health Organization has highlighted that the school is an ideal place to promote

health among children and adolescents [3-6]. Physical education classes (PE) are one of the most important opportunities for children to engage in physical activities in schools [7, 8]. In addition to facilitating different and important bodily experiences as part of child education, PE helps them to achieve the daily recommended goals: at least 60 minutes of moderate-

to-vigorous intensity physical activity (MVPA) [3, 4, 9].

Having a range of different contexts in PE classes gives children opportunities to learn through movements and helps them to develop better physical competences, which are crucial for motor development and contribute to children's self-efficacy and confidence to engage in physical activities [9, 10]. The Brazilian guidelines for physical education propose that children should engage in dance, sports, gymnastics, games, and martial arts and experiment with a diversity of movements in different environments in PE classes [11].

Elementary school is mandatory in Brazil and children usually stay for a four-hour duration comprising five 45-minutes classes and a 15-minutes recess five days a week. Other countries have different school schedules where children may spend most of their waking hours in schools [12-14]. According to specific recommendations, children should be engaged in MVPA for more than half of the learning time of PE classes [9, 15].

Even though PE classes are the most active period in school, research has shown that children accumulate less than the recommended time spent doing MVPA in PE classes and in school-time as a whole [12, 16-18]. Although many reports have highlighted small proportions of MVPA in PE classes, it would also be informative to detail the specific context of the PE classes that might affect this lack of intense PA. Analyzing the contexts of PE classes might give an insight into the PA levels observed, as studies report that a great proportion of PE classes are spent in sedentary or light intensity activities, such as class management or knowledge [16, 19]. Despite the importance of these contexts, they should not be the main focus of PE classes.

The present study addresses two important issues: first, the description of the contexts that prevail in the PE classes; second, the intensity pattern of the classes in the presence of these contexts. Information regarding these topics might be important to develop novel intervention strategies to increase PE classes' intensity and benefit children's motor development. Thus, the objective of this study was to describe the PE classes' context and intensity in 7 to 11-year-old schoolchildren in a city in southern Brazil.

## MATERIAL AND METHODS

We used data from the CAAFE project ([www.cafe.ufsc.br](http://www.cafe.ufsc.br)) entitled "Development and evaluation of a system for monitoring food intake and physical activity of schoolchildren aged 7 to 10 years - CAAFE" [20]. The study was conducted in the city of Florianopolis, from March to May 2013. Florianopolis

is the capital of the state of Santa Catarina in southern Brazil. Participants gave oral consent and their parents signed a written consent form. No financial reward was offered. The project was approved by the Ethics Committee on Human Research at the Federal University of Santa Catarina (UFSC) under protocol 2250/11. Intentional sampling included five public schools selected by the Municipal Education Department in different regions of the city (Central, North, South, and East) in order to represent students from different socio-economic backgrounds. Six classes from 2<sup>nd</sup> to 5<sup>th</sup> grades were selected by the principal of each school, making a total of 30 classes. Children in Brazil who attend 2<sup>nd</sup> to 5<sup>th</sup> grade are expected to be 7-8 years old in the 2<sup>nd</sup> grade, 8-9 years old in the 3<sup>rd</sup> grade, 9-10 years old in the 4<sup>th</sup> grade and, 10-11 years old in the 5<sup>th</sup> grade.

For the present study, data of twelve PE classes was retrieved, including time (in minutes) children spent on MVPA in these classes and the context they were inserted when being physically active. To measure MVPA, children wore accelerometers (Actigraph Gt3x+) for two days, but only data from the second day was used to prevent reactivity [21]. The accelerometers measure acceleration during sampling periods named epochs which vary in length (usually between 1 and 60s). The intensity of the acceleration on each epoch is then classified by validated cut-off-points in activity intensity categories (e.g. 15s in moderate intensity, and 15s in light intensity). Children wore the accelerometers on the right hip, secured by an elastic band during school-time. Data was analyzed in 15 seconds epochs using cut-off points (2296 counts per minute for MVPA) validated for children and recommended to classify the intensity of activities equivalent to four Metabolic Equivalents (MET) or above in children [22, 23].

The PE class' contexts were observed by trained researchers and captured by an audio recording, adapted from the System for Observing Fitness Instruction Time (SOFIT) [24]. The contexts were classified in the categories of the original instrument, based on the activities performed by children during class time, as can be seen in Table 1 [24, 25]. Researchers were instructed to avoid interference in the running of the class and to be positioned in strategic places.

Observation time (minutes), the class size (number of students), and the setting where the PE classes took place (indoor or outdoor) were also retrieved. Each observation (PE class) was plotted on a graph to estimate the proportion of time spent on each context. For each observation we also added information regarding the proportion of learning time in MVPA on the same graphic.

**Table 1:** Characteristics of different contexts of Physical Education classes.

Variables		Contextualization [25]
<b>Sedentary Settings</b>		
Management	<b>General Content</b>	This context is characterized by when no physical education content is being undertaken. Organizational activities such as team selection, taking attendance, discussing about topics unrelated to physical education are examples of this context
	<b>Knowledge Content</b>	This context refers to activities where children are being taught theoretical knowledge regarding physical education while not being physically active. This context is usually related to teaching concepts, history, rules, strategy of sports and other physical education content.
<b>Active Settings</b>		
<b>Fitness</b>		This context is characterized by activities with the intention to enhance one or more component of the student's physical fitness, such as flexibility, cardiovascular endurance, strength. Stretching, running, doing crunches, push-ups, tests or calisthenics are examples of activities related to this context.
<b>Skill Practice</b>		This context refers to learning and exercising typical movements used in sports, as ball handling, passes, and dance steps. Tactical drills are also included on this context.
<b>Game Play</b>		This context is defined by when children are involved in structured games, usually without the interference of the instructor. Playing soccer, volleyball, dodgeball, and tag are examples of this context.
<b>Free Play</b>		This context refers to when instruction is optional and students have the free will to participate or not in activities of their liking. This context is similar to recess time, where the teacher influence is null or very little.

## RESULTS

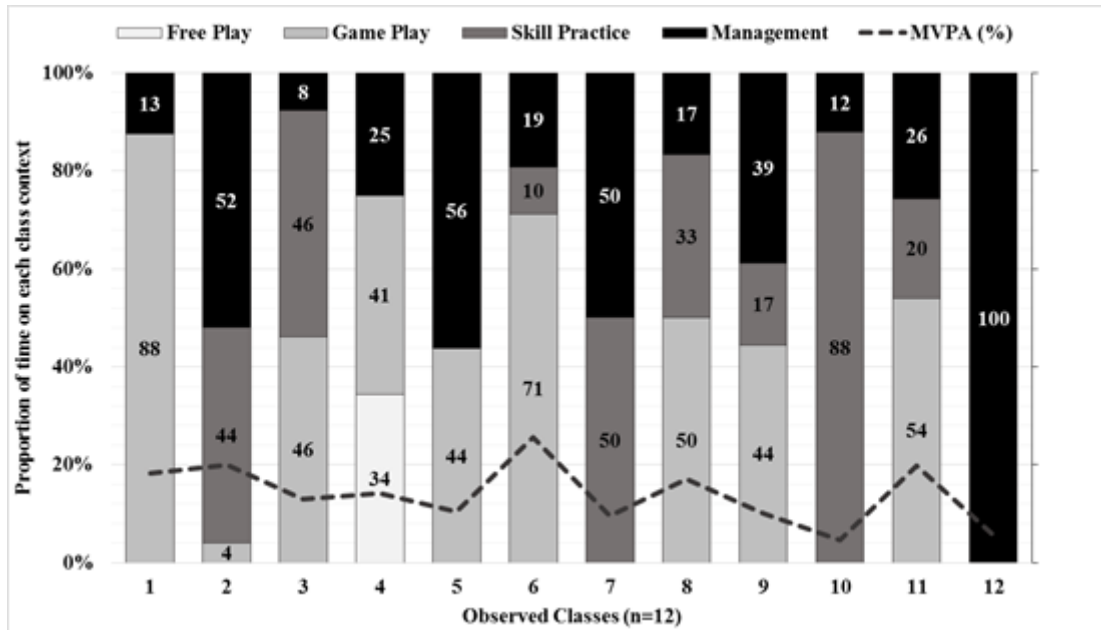
Twelve classes were observed, and 327 children ( $9.37 \pm 1.24$  years old, 52% girls) provided valid accelerometer data. Table 2 shows the characteristics of the observed classes. For each school year, three classes were observed, of which three had a duration of 90 minutes (two consecutive PE classes), three had a duration of 30 minutes (specific school policy), and the remaining six had a duration of 45 minutes. Nine out of twelve classes were undertaken in an outdoor environment and eight of the observed classes were composed of less than 30 students.

**Table 2:** Characteristics of the observed Physical Education Classes by school year. Florianopolis, Brazil. 2012.

Variables	Total		2nd Year		3rd Year		4th Year		5th Year	
	(n=12)		(n=3)		(n=3)		(n=3)		(n=3)	
	n	%	n	%	n	%	n	%	n	%
Class location (%)										
Indoor	3	25.0	2	66.6	0	0.0	1	33.4	0	0.0
Outdoor	9	75.0	1	33.4	3	100.0	2	66.6	3	100.0
Class size (number of students)										
< 30	8	66.6	3	100.0	2	66.6	1	33.4	2	66.6
30-39	4	33.4	0	0.0	1	33.4	2	66.6	1	33.4
Observed class time (minutes)										
0-19	3	25.0	0	0.0	1	33.3	0	0.0	2	66.6
20-29	2	16.6	0	0.0	1	33.4	1	33.4	0	0.0
30-39	3	25.0	2	66.6	1	33.3	0	0.0	0	0.0
40-49	1	8.4	0	0.0	0	0.0	1	33.3	0	0.0
50-73	3	25.0	1	33.4	0	0.0	1	33.3	1	33.4

The most observed contexts were the Game Play on 37% of the class time, followed by the Management context present on 35%. The contexts of Skill Practice and Free Play were attributable to 26% and 3% of PE classes' duration, respectively, with the Fitness context not being observed. Figure 1 shows the proportion of time spent on different contexts according to each observed class.

Classes where Game Play was the most prevalent context were also the most active among the observed classes (Figure 1). The proportion of time in MVPA in the observed classes ranged from 4.7% to 25.5%. Classes where the Management was the prevalent context varied in intensity as well, with MVPA proportions ranging from 5.7% to 20.0%.



**Figure 1:** Proportion (%) of observed contexts and the proportion of moderate-to-vigorous intensity physical activities performed in Physical Education classes of students from 2nd to 5th grades. Florianopolis, Brazil. 2012.

## DISCUSSION

This study identified that in PE classes of Brazilian 7 to 11-year-old schoolchildren the most prevalent context was the Game Play, followed by the Management context, while lower proportions of PE classes' learning time were attributable to Fitness, Free Play, and Skill Practice contexts. Our findings differ to those from previous studies conducted in other countries and Brazil, which showed different proportions of the aforementioned contexts in PE classes [16, 19, 26, 27]. Such differences might be attributable to the year the study was conducted, as well as the differences observed in the sample's age [19, 26]. Other factors that might affect the intensity and context of PE classes are the countries' climate, school curriculum and PE teacher specialization [7].

Our results also showed that children spent a low proportion of PE classes in MVPA, and among the observed classes, none reached the recommended proportion of time (50%) in MVPA [9, 15]. In addition, children spent more than 25% of their PE class time in MVPA in only one out of twelve observations. The findings are alarming considering that PE classes are supposed to be the most active period in the school setting [7, 8]. The low proportion of time in MVPA (4-25%) observed in this study was lower than the proportion shown by a recent meta-analysis which demonstrated that in studies where MVPA was measured with activity monitors, children spent a third of learning time at this intensity[17].

Most activities were conducted in an outdoor environment with less than 30 students. Although the infrastructure, activity settings in schools, and the adequate number of stu-

dents per class are all favorable factors for more active PE classes, not all schools provide optimal space and equipment for teachers and students [27, 28]. In the present study we observed that most classes were practical and that may be due to the courts and appropriate settings for activities such as organized sports to be conducted at the teachers' discretion, while indoor classes could have been conducted to teach theoretical knowledge or in order to avoid constraints such as rain or cold weather.

Game Play was the most frequently observed context, so it contributed to enhancing the level of activity in the classes. This finding corroborates research conducted in other countries which found that Game Play is also the most common context in PE classes, and the most physically intense [19, 26, 29]. This is an important finding since children can benefit in many ways from activities such as sports, where they can practice recently learned technical movements in practical situations. It also promotes interactions with a great number of peers in a fun way at the same time as being physically active [9].

Despite not being prevalent in many classes, the Management context was observed in all 12 classes, and the range of intensity for this context was large. Other studies also showed a large proportion of PE class time spent on such activities and this may be due to the need to move the class to the courts and back, explain the activities, and teach rules and history among other subjects [16, 19, 26]. Although such activities are an intrinsic part of the class, more efforts to make the explanations quicker and to insert the theoretical knowledge in

practical classes could allow the children to experience other activities like games and fitness, and thus contribute to greater PA levels. A higher proportion of MVPA in classes where Management was prevalent also suggests that inserting activities for a smaller proportion of classes (e.g., activities related to fitness for 20% of class time) could be enough to benefit children's PA level and promote knowledge at the same time.

Regarding the absence of the Fitness context, international and Brazilian studies also found small proportions of this context in PE classes [16, 19, 26, 30]. The Brazilian Guidelines for Physical Education highlight the need to engage pupils in a diversity of body movements such as jumping, throwing, running, and playing with balls, bats, and ropes in activities such as sports, dance, martial arts, and others; however, the need to improve physical fitness is not emphasized [11].

The Free Play context was observed just once in 12 PE classes, with a small proportion of MVPA attributable to this context. Other studies have shown a higher proportion of this context in PE classes in Brazilian schools, ranging from 17.9% to 68% [16, 30]. International studies demonstrated a lower proportion of time on this context, ranging from 0.3% to 14.1% [26, 27]. Most reports focus on PE classes of older students and when compared to the students of the present study this may play a part in the small proportion of time spent on this context in our sample. Older children have improved physical literacy and already have a greater spectrum of activities which can be used to engage in free play. By contrast, younger children might still be learning and benefit from more structured activities organized by the teachers [10].

Skill Practice was observed in eight classes, but only one class was focused on this context. Other studies also showed a small proportion of time on this context, ranging from the complete absence of this context to proportions of 5% and 13% [9, 16, 26]. This leads us to believe that this context is usually part of the class, but not the main part, as children might learn and practice some skills such as ball-handling for a part of the class, before actually practicing it in a structured game context for a longer period of time. This is in accordance with the Brazilian Guidelines for Physical Education, which support the practice and learning of new movements in different contexts, such as in pairs, and small and larger groups [11].

One of the strengths of the present study is that we highlight the employment of objective measurement of activity intensity and direct observation of class contexts, which are rigorous instruments used to evaluate physical activity. In addition, few studies have addressed PE classes of children as young as 7 to 11-year-olds, and information regarding the intensity and

context of these classes is scarce.

The present study has some limitations, such as the number of observed classes (three classes by degree), which may not represent PE classes across the school year or the teacher's schedule. Secondly, the number of observed classes limits the possibilities to perform a robust statistical analysis. Thirdly, differences in the school systems of Brazil and other countries can confound some comparisons and limits the generalization of our results. Finally, the measurement of MVPA in proportion of class time restrain the discretion between more vigorous from moderate activities, which benefit children differently. An alternative to this method is to analyze energy expenditure of children on different activities and contextual characteristics of PE classes using heart rate measurements [31].

## CONCLUSION

We observed a low MVPA proportion in PE classes among 7 to 11-year-old schoolchildren from public schools. Game Play was the most frequently observed context in PE classes, followed by Management. We believe that a greater proportion of class time could be spent on more intense activities with the insertion of Skills Practice and Fitness-related activities, which were observed just a few times or not at all. Future studies could address the influence of contexts in the development of basic skills in children, and test interventions to evaluate the impact of inserting more diverse contexts in PE classes.

**Ethics:** The project was approved by the Ethics Committee on Human Research at the Federal University of Santa Catarina (protocol 2250/11).

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