
CLASS CONTEXT, TEACHER'S BEHAVIOR AND PHYSICAL ACTIVITY LEVELS DURING PHYSICAL EDUCATION CLASSES**CONTEXTO DA AULA, COMPORTAMENTO DO PROFESSOR E NÍVEIS DE ATIVIDADE FÍSICA DURANTE AULAS DE EDUCAÇÃO FÍSICA****Josieli Regina Brey¹, Alessandra Cardozo Machado Suga¹, Alexandre Augusto de Paula da Silva¹ and Ciro Romelio Rodriguez-Añez¹**¹Federal Technological University of Paraná, Curitiba-PR, Brasil.**RESUMO**

O objetivo deste estudo foi testar a associação entre o contexto da aula e o comportamento do professor com o nível de atividade física (AF) de escolares dos anos iniciais do ensino fundamental durante aulas de educação física (EF). Foram avaliadas 18 aulas de EF de seis escolas. O contexto da aula e o comportamento do professor foram avaliados por meio de observação sistemática (SOFIT) enquanto o nível de AF dos escolares foi mensurado por acelerometria. Os dados foram tratados pela estatística descritiva e apresentados como proporção do tempo da aula em comportamento sedentário e nos diferentes níveis de AF. A associação entre contexto da aula e comportamento do professor com os diferentes níveis de AF foi testada pela regressão logística binária. Os escolares passaram mais tempo durante a aula de EF em AFs de intensidade leve (40,8%) e vigorosa (40,9%). A proporção do tempo da aula destinado aos contextos jogo estruturado (35,8%), prática de habilidades (23,2%) e gerenciamento (21,7%) representou 80,7% do tempo total. Os comportamentos mais frequentes do professor foram: instruções gerais (45,5%), gerenciamento (28,7%) e observando (18,3%). Verificou-se que a proporção do tempo dos escolares em comportamento sedentário e nos diferentes níveis de AF durante a aula de EF variaram de acordo com o contexto da aula e o comportamento do professor.

Palavras-chave: Aula de Educação Física. Contexto da Aula. Comportamento do Professor. Atividade Física. Crianças.**ABSTRACT**

This study aimed at evaluating the association between class context and the teacher's behavior with the physical activity (PA) level of Elementary School students during Physical Education (PE) classes. Eighteen PE classes from six schools were assessed. Class context and the teacher's behavior were measured based on systematic observation, that is, by using the System for Observing Fitness Instruction Time (SOFIT), whereas the students' PA level was measured with accelerometry. Data were treated with descriptive statistics and shown as the percentage of the class time spent in sedentary behavior and at different PA levels. The association between class context and the teacher's behavior with different PA levels was assessed by applying binary logistic regression. The percentage of students with regard to the structured games (35.8%), skill practice (23.2%) and management (21.7%) represented 80.7% of PE class total time. General instructions (45.5%), management (28.7%) and observation (18.3%) were the most frequent teacher's types of behavior seen. It was found that the percentage of time students spent in sedentary behavior and at different PA levels during PE classes varied according to the class context and the teachers' behavior.

Keywords: Class context. Teacher's behavior. Physical activity. Elementary school students. Physical Education.**Introduction**

Physical activity provides numerous health benefits for all ages¹⁻³. Interventions to promote physical activity at school are part of one out of the five strategies recommended by the Community Preventive Services Task Force (CPSTF), which are effective to increase the population's physical activity levels⁴. During the period children stay at school, there are important moments that provide them with active behavior⁵, such as the Physical Education classes, during which children can develop different skills through different activities, for example, gymnastics, games, sport, fights and dance, in addition to acquiring knowledge on physically active behavior throughout life⁶. Thus, school Physical Education has been recognized for its importance in the sense of promoting physical activity at schools⁷.

In Brazil, school Physical Education classes are part of the pedagogical curricular context, whose purposes go beyond motor skills and/or developing physical fitness because

they involve the development of group perception and social interactions⁸. In order to be effective, the Physical Education classes demand some components, such as the availability of places and equipment, well-trained teachers, a structured curriculum and adequate weekly class attendance⁹. In addition, ensuring the effectiveness of classes will only be possible if students attend and effectively participate in classes, and the activities are extrapolated beyond the Physical Education class, that is, they should involve the periods before, during and after school schedule¹⁰.

The classes must be aligned with health-related purposes so that the children achieve the same goals. Therefore, classes should provide the children with fun activities that teach behavioral skills, general movements and encourage present and future physical activity and fitness. In order to assess whether the classes are meeting their purposes, evaluating teaching and learning processes is needed, and this includes what students do and how classes are conducted by teachers¹⁰.

The assessment of the teacher's behavior during Physical Education classes has been performed with Preschoolers, Elementary students, and High School students¹¹⁻¹⁵. However, no studies that evaluated public elementary school students have been found in Brazil.

Performing investigations in different contexts to know the possible organizational and cultural variations of each place are very important. The schools that have teachers graduated in Physical Education compared to those that do not have such professionals might show differences in the way children are stimulated.

There are some objective methods considered to be accurate for measuring physical activity, such as accelerometry; however, they capture neither the class context nor the teacher's behavior. Thus, the amount or percentage related to the time children spend at different levels of physical activity according to the class context or the teacher's behavior is not known. Therefore, the present study aimed at evaluating the association between class context and the teacher's behavior with the physical activity level of Elementary School students during Physical Education classes measured by using accelerometry.

Methods

Study design

This is a cross-sectional descriptive associational study based on school cluster sampling as part of a project known as *Crescer Ativo e Saudável* (Growing Actively and Healthily) carried out in the city of São José dos Pinhais-PR. This project was approved by the Committee on Ethical Research with Humans of a Brazilian university referred to as *Universidade Tecnológica Federal do Paraná* (UTFPR), under opinion no. 3.365.489.

Selection of the participants

São José dos Pinhais is a city in the metropolitan region of Curitiba, it has a territorial area of 948.52 km² and 302.759 inhabitants and is classified as the sixth most populous city in the state of Paraná¹⁶. The present study used convenience sampling, thus, six schools were selected among the 20 participants of the project that would allow the characterization of different regions of the city.

In order to meet the age range of children in the early years of Elementary School, three classes were selected in each of the six schools; one from the 1st grade, one from the 3rd and one from the 5th grade. All children attending these classes were invited to participate, and consent from parents and students were obtained. Six children were randomly selected per class to use the accelerometer on the day of data collection (three boys and three girls).

Procedures

Every day of the week, the researchers placed the accelerometers at the beginning of the school period and removed them from all the children selected at the end, but not only on the day of the Physical Education class. This measure was taken to reduce the effect of reactivity to the equipment during the days when Physical Education classes took place. Since there were only six accelerometers for each class, the non-selected children used a replica. Both the accelerometer and the replica were placed inside a small case on a belt to be worn around the waist and sealed so that the children could not identify the differences.

Physical Education classes took place only once a week according to the schools' planning; these classes were video-recorded. In order to facilitate the identification of the children, they received a colored and numbered waistcoat before the beginning of each class. All classes were video-recorded with two cameras (GoPro® HERO4) sat atop a tripod at the corners of the space intended for the class, which would allow to capture the entire area. The recording started when the students entered the space chosen by the teacher to give the class, and concluded when the students left. One Physical Education class from each group of students was evaluated, with a total of 18 classes. Eleven teachers taught the classes; they agreed to participate and signed the consent form. Thus, some teachers participated in more than one class.

Instruments

Physical activity assessment

The physical activity level of the students was measured by using accelerometers model wGT3X-BT (ActiGraph; Pensacola, FL). The devices were fixed to the right side of the students' hips with an elastic belt, programmed to record at 100 Hz. Accelerometers are considered to be gold standard instruments to obtain information about sedentary behavior and physical activity in free-living conditions¹⁷.

Assessment of class context and the teacher's behavior

In order to assess class context and the teacher's behavior, a direct observation instrument was used, that is, the System for Observing Fitness Instruction Time (SOFIT)¹⁸. This instrument, through systematic observations, allows assessing the students' level of physical activity, class context and the teacher's behavior during Physical Education classes⁸. The SOFIT protocol provides that the observation and recording periods are alternated every 10 seconds (three observation periods per minute). Considering the present study, the observation period was modified so that samples were taken in periods of 15 seconds without intervals (four observation periods per minute). The video recording allowed a pause for registering the class context and the teacher's behavior until the end of the lesson without losing the time intervals for recording in the original protocol.

The class context was coded in one out of the six categories provided by the protocol to represent how the class was being taught: 1) management; 2) specific knowledge on Physical Education; 3) physical fitness; 4) skill practice; 5) structured game, and 6) others (free play). Simultaneously, the teacher's behavior was also codified at the same time interval in one of the six categories provided, that is, 1) fitness promotion; 2) fitness demonstration; 3) general instructions; 4) management; 5) observation, and 6) other tasks. Coding was performed by a single observer according to the technical description of the SOFIT training manual¹⁹.

Study variables

The children's descriptive variables comprised sex (male/female), age in full years calculated by $[(\text{date of assessment} - \text{date of birth}) / 365.25]$, class (1st, 3rd and 5th grades), body mass index according to the classification by Cole et al.²⁰ (low weight, normal weight,

overweight and obese). Regarding the teachers' variables, their sex (male/female) and education (Physical Education/Others - Pedagogy, Mathematics, Languages, Teaching) were recorded.

Dependent variables

The dependent variables consisted of sedentary behavior and physical activity levels, that is, light, moderate and vigorous intensity. The data obtained by the accelerometer were processed by using the software Actilife 6.8.0 and transformed into epochs of 15 seconds to be paired with the observation periods. Sedentary behavior and physical activity were categorized based on the values of the accelerometer vector magnitude and classified according to the following cutoff points: sedentary category (≤ 46 counts), low-intensity physical activity (47-606 counts), moderate (607-817 counts) and vigorous-intensity category (≥ 818 counts). Such cutoff points were established due to their use and validation for the Brazilian population²¹.

Independent variables

The independent variables consisted of the actions in the class context (management, specific knowledge, physical fitness, skill practice, structured game and free play), and the teacher's behavior as well (fitness promotion, fitness demonstration, general instructions, management, observation and other tasks). The operationalization of this variable was obtained in a dichotomous way (no/yes) at each interval of 15 seconds, during the class length.

Statistical analysis

The observations with regard to the class context and the teacher's behavior were tabulated in Excel and synchronized with the periods of sedentary behavior and the different physical activity levels of the children obtained by accelerometry. Descriptive statistics (mean, standard deviation, absolute and relative frequencies) were used to describe the sample and the class characteristics. The chi-squared test for heterogeneity, chi-square for linear trend and Fisher's exact tests were used to evaluate the association between class context and the teacher's behavior with the sedentary behavior and physical activity level of the children during the Physical Education class. Afterwards, the binary logistic regression was used for the crude and adjusted models. The different variables, that is, class, teacher's sex and teacher's education were included in the adjusted model. All analyzes were performed by using the SPSS 23.0 statistical package with a significance level at $p < 0.05$.

Results

Eighteen classes were assessed, one from each group of students (1st, 3rd and 5th grades) in each school selected. The practical class length ranged from 13 to 50 minutes (mean = 31.5 ± 3.9 minutes), according to the dynamics of each teacher; and the number of students per class ranged from 15 to 46 (mean = 24 ± 8.6 students). The classes were given by 11 different teachers, with an average age of 41.9 years. Only one of them was male. Two teachers were graduated in Physical Education; the others were graduated in Pedagogy.

One out of the 108 children initially selected did not show up on the day of the Physical Education class and was considered a sample loss (0.9%). The 107 children actually observed provided 13.631 periods of 15 seconds of observation. Among those evaluated, the majority were girls (51.4%), a greater percentage of children were aged 6 and 10 or more (20.6% and 22.4% respectively); approximately two thirds with Eutrophic Nutritional Status (60.7%), equally distributed in the 1st, 3rd and 5th grades.

The students remained on average 2.1 minutes (6.7%) in sedentary behavior, 12.9 minutes (40.8%) in low-intensity physical activity, 3.6 minutes (11.5%) in moderate activity,

and 12.9 minutes (40.9%) in vigorous activity. Considering all intensities, the time percentage was different between girls and boys (Table 1).

Table 1. Characteristics of the sample comprised of children from São José dos Pinhais, Paraná, Brazil, 2019 (n = 107)

Variable	Category	Male		Female		p	Total	
		n	%	n	%		n	%
Individual Characteristics								
Sex	-	52	48.6	55	51.4	-	107	100.0
Age (years old)	5	6	11.5	7	12.7	0.657 ^t	13	12.1
	6	10	19.2	12	21.8		22	20.6
	7	9	17.3	8	14.5		17	15.9
	8	7	13.5	7	12.7		14	13.1
	9	6	11.5	11	20.0		17	15.9
	≥ 10	14	26.9	10	18.2		24	22.4
Body Mass Index*	Low weight	1	1.9	6	10.9	0.371 ^t	7	6.5
	Normal weight	36	69.2	29	52.7		65	60.7
	Overweight	11	21.2	7	12.7		18	16.8
	Obese	4	7.7	13	23.6		17	15.9
Class	1 st	17	32.7	19	34.5	0.013^t	36	33.6
	3 rd	18	34.6	18	32.7		36	33.6
	5 th	17	32.7	18	32.7		35	32.7
Mean period of time in minutes spent in the different physical activity levels estimated from the epochs**								
PA level		Min	%	Min	%		Min	%
Sedentary		2.3	7.5	1.8	6.0	0.001	2.1	6.7
Light		12.4	39.4	13.3	42.2	0.001	12.9	40.8
Moderate		3.4	10.9	3.8	12.1	0.021	3.6	11.5
Vigorous		13.3	42.3	12.4	39.6	0.002	12.9	40.9

Note.: * Classification by Cole *et al.*²⁰; **Romanzini's classification²¹; p<0.05

Source: The authors

Regarding the class context, the teachers spent more time with structured games (35.8%), skill practice (23.2%) and management (21.7%). Considering the teacher's behavior, they spent most of the time on general instructions (45.5%) class management (28.7%) and students' observation (18.3%).

When assessing the time spent in sedentary behavior and in each of the physical activity intensities (low, moderate and vigorous) in the different class contexts, it was seen that during the period when specific knowledge (7%) and physical fitness (7.7%) were the context, most of the time the students remained in sedentary behavior (14.8%, p<0.001 and 10.6%, p<0.001). When structured game (35.8%) and others (free play) (4.6%) were the context, a greater percentage of this time was filled with vigorous-intensity physical activities (44.7%, p<0.001 and 76.6%, p<0.001).

When evaluating the teacher's behavior during Physical Education class in relation to the time the students spent on different motor behavior, it was seen that when the teacher provided the students with fitness demonstration (6.2%) and management (28.7%), the students spent more time on low-intensity physical activity (47.3%, p<0.001 and 44.7%, p<0.001). Considering observation (18.3%) and other tasks (0.5%), a greater percentage of that time was filled with vigorous-intensity physical activities (52.4, p<0.001 and 69.7%, p<0.001) (Table 2).

Table 2. Average minutes and percentage of physical activity intensities with regard to the different class contexts and teacher's behavior during Physical Education classes in São José dos Pinhais, Paraná, Brazil, 2019 (n=13.631)

Class context	Physical activity intensities								p	Total	
	Sedentary		Light		Moderate		Vigorous			min	%
	min	%	min	%	min	%	min	%		min	%
Management	0.6	27.6	3.4	26.1	0.8	22.8	2.1	16.1	0,139 ^t	6,9	21,7
Specific knowledge	0.3	14.8	1.3	10.4	0.2	6.3	0.3	2.4	<0.001 ^t	2,2	7,0
Physical fitness	0.2	10.6	1.1	8,9	0.2	5.5	0.8	6.6	<0.001 ^t	2,4	7,7
Skill practice	0.3	15.3	3.3	25.4	0.9	25.9	2.8	21.6	0.204 ^t	7,3	23,2
Structured game	0.6	30.3	3.6	27.7	1.3	36.2	5.8	44.7	<0.001 ^t	11,3	35,8
Others – free play	0.0	2.2	0.2	12.9	0.1	8.3	1.1	76.6	<0.001 ^t	1,5	4,6
Teacher's behavior											
Fitness promotion	0.0	9.8	0.1	45.5	0.0	5.3	0.1	39.4	0.168 ^t	0,3	1,0
Fitness demonstration	0.2	9.6	0.9	47.3	0.2	9.3	0.7	33.8	<0.001 ^t	1,9	6,2
General instructions	1.0	7.0	5.9	40.9	1.7	12.0	5.7	40.0	0.114 ^t	14,3	45,5
Management	0.7	7.3	4.0	44.7	1.1	11.9	3.3	36.1	<0.001 ^t	9,0	28,7
Observation	0.2	4.2	1.9	32.7	0.6	10.7	3.0	52.4	<0.001 ^t	5,8	18,3
Other tasks	0.0	1.5	0.0	18.2	0.0	10.6	0.1	69.7	<0.001 ^t	0,2	0,5

Note: t = Chi-squared test for tendency; p<0.05

Source: The authors

The percentage of time the children spent in sedentary behavior, low-intensity, moderate and vigorous-intensity physical activities in each of the categories with regard to the class context and the teacher's behavior for boys and girls are shown in Tables 3 and 4, respectively.

Table 3. Comparison between the percentages of physical activity with class context and the teacher's behavior during the Physical Education classes, male (n = 6704)

Variable	Category	Physical activity intensities											
		Sedentary			Light			Moderate			Vigorous		
		n	%	p	n	%	p	n	%	p	n	%	p
Class context													
Management	No	364	6.9	0.001	1939	36.9	<0.001	569	10.8	0.817	2383	45.3	<0.001
	Yes	137	9.5		700	48.3		160	11.0		452	31.2	
Specific knowledge	No	420	6.7	<0.001	2351	37.7	<0.001	686	11.0	0.213	2777	44.5	<0.001
	Yes	81	17.2		288	61.3		43	9.1		58	12.3	
Physical fitness	No	453	7.3	0.086	2402	38.8	0.001	679	11.0	0.411	2659	42.9	<0.001
	Yes	48	9.4		237	46.4		50	9.8		176	34.4	
Skill practice	No	434	8.5	<0.001	1978	38.6	0.026	526	10.3	0.004	2183	42.6	0.311
	Yes	67	4.2		661	41.8		203	12.8		652	41.2	
Structured game	No	334	7.6	0.469	1910	43.7	<0.001	475	10.9	0.987	1651	37.8	<0.001
	Yes	167	7.2		729	31.2		254	10.9		1184	50.7	
Others (free play)	No	500	7.9	<0.001^f	2615	41.2	<0.001	710	11.2	0.001	2522	39.7	<0.001
	Yes	1	0.3		24	6.7		19	5.3		313	87.7	
The teacher's behavior													
Promotion	No	493	7.4	0.45 ^f	2609	39.3	0.217	725	10.9	0.312 ^f	2813	42.4	0.198
	Yes	8	12.5		30	46.9		4	6.3		22	34.4	
Demonstration	No	462	7.3	0.109	2450	38.9	0.005	683	10.9	0.831	2698	42.9	<0.001
	Yes	39	9.5		189	46.0		46	11.2		137	33.3	
General instructions	No	257	7.0	0.101	1403	38.2	0.030	385	10.5	0.253	1629	44.3	<0.001
	Yes	244	8.1		1236	40.8		344	11.4		1206	39.8	
Management	No	350	7.3	0.478	1803	37.8	<0.001	519	10.9	0.976	2104	44.1	<0.001
	Yes	151	7.8		836	43.4		210	10.9		731	37.9	
Observation	No	442	8.1	<0.001	2297	42.0	<0.001	607	11.1	0.225	2126	38.9	<0.001
	Yes	59	4.8		342	27.8		122	9.9		709	57.5	
Other tasks	No	501	7.5	0.115 ^f	2633	39.5	0.002	726	10.9	0.795 ^f	2805	42.1	<0.001
	Yes	0	0.0		6	15.4		3	7.7		30	76.9	

Note: ^f = Fisher's exact test

Source: The authors

Table 4. Comparison between the percentages of physical activity with class context and the teacher's behavior during Physical Education classes, female (n = 6.917)

Variable	Category	Physical activity intensities											
		Sedentary			Light			Moderate			Vigorous		
		n	%	p	n	%	p	n	%	p	n	%	p
Class context													
Management	No	301	5.6	0.002	2173	40.2	<0.001	640	11.8	0.183	2292	42.4	<0.001
	Yes	116	7.7		751	49.7		198	13.1		446	29.5	
Specific knowledge	No	362	5.6	<0.001	2631	40.9	<0.001	783	12.2	0.685	2664	41.4	<0.001
	Yes	55	11.5		293	61.4		55	11.5		74	15.5	
Physical fitness	No	368	5.8	<0.001	2666	41.8	0.003	802	12.6	<0.001	2548	39.9	0.053
	Yes	49	9.2		258	48.4		36	6.8		190	35.6	
Skill practice	No	344	6.4	0.007	2171	40.7	<0.001	635	11.9	0.320	2185	41.0	<0.001
	Yes	73	4.6		753	47.6		203	12.8		553	35.0	
Structured game	No	306	7.0	<0.001	2112	48.3	<0.001	525	12.0	0.700	1432	32.7	<0.001
	Yes	111	4.4		812	31.9		313	12.3		1306	51.4	
Others (free play)	No	404	6.1	0.377	2867	43.1	<0.001	805	12.1	0.983	2569	38.7	<0.001
	Yes	13	4.8		57	21.0		33	12.1		169	62.1	
The teacher's behavior													
Promotion	No	412	6.0	0.645	2894	42.3	0.757	835	12.2	0.059 ^f	2708	39.5	0.442
	Yes	5	7.4		30	44.1		3	4.4		30	44.1	
Demonstration	No	375	5.8	0.001	2716	41.9	0.007	806	12.4	0.002	2591	39.9	0.020
	Yes	42	9.8		208	48.5		32	7.5		147	34.3	
General instructions	No	227	6.0	0.954	1625	43.3	0.069	438	11.7	0.207	1466	39.0	0.305
	Yes	190	6.0		1299	41.1		400	12.7		1272	40.2	
Management	No	284	5.7	0.121	2014	40.8	<0.001	584	11.8	0.233	2059	41.7	<0.001
	Yes	133	6.7		910	46.1		254	12.9		679	34.4	
Observation	No	371	6.6	<0.001	2453	43.3	<0.001	693	12.2	0.493	2144	37.9	<0.001
	Yes	46	3.7		471	37.5		145	11.5		594	47.3	
Other tasks	No	416	6.0	1.000 ^f	2918	42.4	0.035	834	12.1	0.561 ^f	2722	39.5	0.036
	Yes	1	3.7		6	22.2		4	14.8		16	59.3	

Note: ^f = Fisher's exact test

Source: the authors

The crude and adjusted regression analyzes with regard to the class context and teacher's behavior for boys and girls are shown in Table 5.

Considering the adjusted regression analysis for the variables class, sex and teacher's education, the class contexts 'management' (OR: 1.37; CI_{95%}:1.11-1.69), 'specific knowledge' (OR: 3.07; CI_{95%}:2.33-3.96) and 'physical fitness' (OR: 1.83; CI_{95%}:1.32-2.53) were positively associated with the students' sedentary behavior. Regarding the low-intensity physical activity, the adjusted regression analysis pointed out that the contexts 'management' (OR: 1.61; CI_{95%}:1.43-1.81), 'specific knowledge' (OR: 2.64; CI_{95%}:2.18-3.20) and 'physical fitness' (OR: 1.30; CI_{95%}:1.09-1.56), were positively associated with this intensity. The categories 'structured game' (OR: 0.59; CI_{95%}:0.53-0.65) and 'others' (OR: 0.11; CI_{95%}:0.07-0.17) were inversely associated. Regarding moderate-intensity physical activity, the adjusted associations showed a positive association for 'skill practice' (OR: 1.35; CI_{95%}:1.13-1.61) and a negative one for 'others' (OR: 0.44; CI_{95%}:0.27-0.71). Considering the vigorous-intensity physical activity, the adjusted associations showed a positive association for the contexts 'structured game' (OR: 1.69; CI_{95%}:1.53-1.88) and 'others' (OR: 10.20; CI_{95%}:7.34-13.95), and a negative one for 'management' (OR: 0.54; CI_{95%}:0.48-0.62), 'specific knowledge' (OR: 0.17; CI_{95%}:0.13-0.22) and 'physical fitness' (OR: 0.69; CI_{95%}:0.53-0.88).

Regarding the adjusted regression analyzes for the teacher's behavior, the category 'demonstration' (OR: 2.24; CI_{95%}:1.57-3.23) was positively associated with the sedentary behavior of the students, whereas the category 'observation' (OR: 0.67; CI_{95%}:0.50-0.90) showed an inverse association. Considering low-intensity physical activity, the categories 'demonstration' (OR: 0.76; CI_{95%}:0.62-0.94), 'observation' (OR: 0.56; CI_{95%}:0.49-0.65) and 'other tasks' (OR: 0.26; CI_{95%}:0.11-0.63) were negatively associated with moderate physical activity, whereas 'management' (OR: 1.28; CI_{95%}: 1.15-1.43) was positively associated. Regarding moderate physical activity, none of the categories related to the teacher's behavior showed an association in the crude or adjusted model. Considering the vigorous physical activity, the categories 'other tasks' (OR: 4.64; CI_{95%}:2.19-9.84) and 'observation' (OR: 1.98; CI_{95%}:1.74-2.26) were positively associated with this intensity, whereas 'demonstration' (OR: 0.62; CI_{95%}:0.50-0.77) and 'general instructions' (OR: 0.89; CI_{95%}:0.81-0.99) showed a negative association.

Considering the adjusted regression analysis for the girls, when the class contexts were 'management' (OR: 1.36; CI_{95%}: 1.09-1.70), 'specific knowledge' (OR: 2.28; CI_{95%}: 1.69-3.09) and 'physical fitness' (OR: 1.85; CI_{95%}: 1.34-2.54) the association was positive with regard to sedentary behavior, whereas it was negative for 'skill practice' (OR: 0.75; CI_{95%}: 0.58-0.98) and 'structured game' (OR: 0.56; CI_{95%}: 0.44-0.70).

Regarding the light-intensity activity, the class contexts 'management' (OR: 1.45; CI_{95%}: 1.29-1.63), 'specific knowledge' (OR: 2.28; CI_{95%}: 1.93-2.83), 'physical fitness' (OR: 1.34; CI_{95%}: 1.12-1.61) and 'skill practice' (OR: 1.41; CI_{95%}: 1.25-1.58) showed a positive association, whereas 'structured game' (OR: 0.47; CI_{95%}: 0.43-0.53) and 'others' (OR: 0.35; CI_{95%}: 0.26-0.47) showed a negative association. Considering moderate-intensity physical activity, only the class context 'physical fitness' (OR: 0.49; CI_{95%}: 0.35-0.70) was negatively associated with this intensity. Regarding vigorous physical activity, the categories 'others' (OR: 2.63; CI_{95%}: 2.05-3.39) and 'structured game' (OR: 2.34; CI_{95%}: 1.11-2.59) were positively associated, whereas 'management' (OR: 0.58; CI_{95%}: 0.51-0.65), 'specific knowledge' (OR: 0.26; CI_{95%}: 0.20-0.33), 'physical fitness' (OR: 0.80; CI_{95%}: 0.66-0.97) and 'skill practice' (OR: 0.72; CI_{95%}: 0.64-0.82) were negatively associated.

Considering the adjusted regression analyzes related to the teacher's behavior, the category 'demonstration' (OR: 1.92; CI_{95%}: 1.36-2.71) was positively associated with sedentary behavior, whereas 'observation' (OR: 0.45; CI_{95%}: 0.33-0.762) was negatively associated. Regarding light-intensity physical activity, two categories related to the teacher's behavior were positively associated with this intensity, that is, 'demonstration' (OR: 1.31; CI_{95%}: 1.07-1.60) and 'management' (OR: 1.24; CI_{95%}: 1.12-1.38), whereas two others were negatively associated, that is, 'observation' (OR: 0.72; CI_{95%}: 0.63-0.82) and 'other tasks' (OR: 0.38; CI_{95%}: 0.15-0.94). Considering moderate-intensity physical activity, two categories were negatively associated with this intensity, that is, 'promotion' (OR: 0.30; CI_{95%}: 0.09-0.97) and 'demonstration' (OR: 0.56; CI_{95%}: 0.39-0.82). Regarding vigorous physical activity, two categories were positively associated with this intensity, that is, 'observation' (OR: 1.66; CI_{95%}: 1.46-1.89) and 'other tasks' (OR: 2.26; CI_{95%}: 1.04-4.90), and two categories were negatively associated, that is, 'demonstration' (OR: 0.77; CI_{95%}: 0.62-0.95) and 'management' (OR: 0.73; CI_{95%}: 0.66-0.82).

Discussion

The present study aimed at evaluating the association between class context class and the teacher's behavior with the physical activity level of Elementary School students during Physical Education classes. The combined use of objective measures for assessing physical activity, class characteristics and the teacher's behavior was one of the strengths of this study. It was found that the time spent in sedentary behavior and at different levels of physical activity during the Physical Education class varied according to the class context and the behavior of the teachers.

The children remained half (52.4%) of the time of the Physical Education class from moderate to vigorous physical activity (MVPA - 16.5 minutes), and the average class length consisted of 31.5 minutes. These findings are similar to those observed in Elementary Physical Education classes in Hong Kong, where the mean length of the classes was 31.7 minutes, and time spent in MVPA was 15.8 minutes (51%)¹⁵. Thus, the percentage of Physical Education class time of 50% in moderate-to-vigorous physical activities suggested by both, the USA Healthy People 2010²² and the Institute of Medicine²³ was met. This result is positive, especially because Physical Education classes for children rarely reach such a physical activity level. For example, a review that included 44 studies carried out in Elementary School found that children remained on average only 37.4±15.7% of the class time in MVPA²⁴. Another positive result of

the present study was that the children remained in sedentary behavior for a short period of time, that is, only 2.1 minutes, which represented 6.7% of the class length.

The percentage of boys and girls with regard to intensity was different. Considering sedentary behavior, a higher percentage of boys was seen. Regarding low-intensity physical activity, there was a greater percentage of girls, and for moderate-to-vigorous physical activity, a greater percentage of boys was seen. Although the boys showed a higher percentage of time in vigorous physical activity compared to girls, this difference is minimal, just one minute. This shows that both boys and girls had the same opportunities to engage in moderate-to-vigorous physical activity.

‘Structured play’ and ‘skill practice’ were the most often observed contexts during Physical Education classes; ‘management’ showed a reasonable percentage of the time. When observing this context, it was seen that the teacher usually organized the space alone, without involving the students in this task, who normally remained sat or stood up. ‘General instructions’ and ‘management’ were highlighted when considering the teacher’s behavior.

The children's sedentary behavior and physical activity levels were different in practically all categories of the class context, with the exception of ‘management’ and ‘skill practice’. Regarding ‘structured games’ and ‘others’, the largest percentage of this time was spent on vigorous physical activity.

The physical activity levels also showed to be variable in relation to the teacher's behavior, that is, the percentages of low-intensity physical activity were higher when the teacher was showing fitness and managing. In addition, when they observed or performed other tasks, the largest percentage of time was spent in vigorous physical activity, which highlights that the category ‘other tasks’ was seen only in a small portion of the class (0.5%).

‘General instructions’ was the most prevalent teacher’s behavior, and when such behavior occurred, the time between sedentary behavior and physical activity levels was equally distributed, which shows that the teacher provided the students with instructions at several periods of time during the class, with no difference between the intensities for this behavior.

The present study showed that the teachers were actively involved in instruction during 45% of the intervals. These indices are similar to those found when using the same observation instrument with highly trained Physical Education specialists in a study carried out in the USA²⁵, as well as for Physical Education teachers in a shorter study performed in Hong Kong using a different tool²⁶.

More recently, Weaver et al.²⁷ assessed the teachers’ behavior and its influence on the students' moderate-to-vigorous physical activity, also measured with accelerometry and by using the SOFIT⁺ observation system. The study found that the teachers' behavior, such as showing and instructing (50.1%) were the most prevalent²⁷.

The chances of students assume sedentary behavior were greater when considering ‘management’, ‘specific knowledge’, and ‘physical fitness’ as the class contexts. It is noteworthy that stretching was highlighted when observing fitness; such an activity was generally performed stood up with a predominant movement of the arms, making it difficult to capture this activity by the accelerometer. The chances of assuming sedentary behavior were less when the class context was ‘skill practice’ for both sexes. The chance for boys to assume sedentary behavior was lower when ‘free play’ was the context (97% less).

When the teacher assumed an observational behavior, the chances of students to assume sedentary behavior were 45% lower. The results suggest that a smaller percentage of time occurs in sedentary behavior when the class context is ‘free play’ and the teacher's behavior is ‘observation’. Although this is the best scenario to decrease sedentary behavior, the Physical Education class has other purposes. The fact that what had happened before the ‘free play’ context was not controlled is a limitation of the present study. The instructions provided before this context are likely to have caused these differences.

Regarding both, boys and girls, 'structured game' and 'free play' were the most favorable contexts so as vigorous physical activity occurred. During 'free play', the chances of boys and girls to engage in this intensity were 10, and twice greater, respectively. Considering the 'structured game' context, this increase was 2.5 times greater for the girls in the sense of getting involved in vigorous-intensity physical activity.

Conclusions

The Elementary School students observed in the present study participated in Physical Education classes of good quality. This includes the amount of time they spent in moderate-to-vigorous physical activity, that is, a little more than half the class time, and also the percentage of class time intended to 'skill practice' and 'structured game'. However, the time provided for Physical Education class in the school curriculum is short and may represent the only time available for the children to practice physical activity during the week. It is suggested that further studies are carried out in order to control the sequence according to which the teacher's behavior takes place, or even to compare schools with higher and lower workload intended for Physical Education classes.

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Received on Dec, 13, 2019.

Reviewed on Apr, 05, 2020.

Accepted on Apr, 06, 2020.

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