

## The effective time measurement of physical education and its impact on caloric expenditure at primary schoolchildren level Municipality of Colima, Mexico

### Medición del tiempo efectivo de la clase de educación física y su impacto en el gasto calórico en escolares de nivel primaria del municipio de Colima, México

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#### Abstract

The aim of this research was to measure the effective time of physical education and its impact on caloric expenditure. The population was composed by 189 subjects of Mexican schools. They were intentionally selected from the ranking quality of the Ministry of Education of the State of Colima, Mexico. The instruments used were the questionnaire Observing System and Fitness Instruction Time and pedometers, model W2-GN SBB0. Among the most relevant results it shows that 35.10% of the class students remain standing and 28% of the class does not perform motor activities. Regarding the role of the teacher 27.80% of the time is dedicated to observe the class and 26.40% is outside the work area. In relation to the average caloric expenditure was  $164.21 \pm 59.18$ . Significant differences ( $p = .000$ ) between schools were identified, and the position in the ranking ( $p = .804$ ). In conclusion: the level of physical activity during the sessions is insufficient in relation to international standards, as well as the national program, which requires an increase motor performance, over the time spent on classroom management.

#### Keywords

Physical education; physical activity; caloric expenditure.

## Resumen

El objetivo de la presente investigación consistió en medir el tiempo efectivo de la clase de educación física y su impacto en el gasto calórico. La población se conformó por 189 sujetos de centros escolares mexicanos. Fueron seleccionados de manera intencional a partir del *ranking* calidad, de la Secretaría de Educación del estado de Colima, México. Los instrumentos utilizados fueron: el cuestionario del Sistema de Observación de la Aptitud y Tiempo de Instrucciones y podómetros, modelo W2–GN SBB0. Entre los resultados más relevantes se observa que el 35.10% de la clase, los alumnos permanecen de pie y el 28% no realiza actividades motoras. Con relación al papel que desempeña el profesor, el 27.80% del tiempo lo dedica a observar la clase y el 26.40% se encuentra fuera del área de trabajo. En lo relativo al gasto calórico, la media fue  $164.21 \pm 59.18$ . Se identificaron diferencias significativas ( $p=.000$ ) entre escuelas, y en la posición en el *ranking* ( $p=.804$ ). En conclusión: el nivel de actividad física durante la sesiones es insuficiente con relación a los parámetros internacionales, así como al programa nacional, que demanda mayor desempeño motriz por sobre el tiempo dedicado a la gestión de la clase.

## Palabras clave

Educación física; actividad física; gasto calórico.

## Introduction

Physical Education (PE) is a teaching-learning process on the development of healthy habits and lifestyles during school with implementation and development in adulthood and old age. In other words, this discipline remits to the development and training of a basic dimension of human beings, the body and its motor skills. It represents the training that helps people in developing health and to relate to the outside world through the body (FIEP, 2015; Kirk, 2009). In this regard, Teixeira Costa, Abelairas-Gomez, Arufe-Giraldez, Pazos Couto and Barcala-Furelos (2015), find in Physical Education the precise moment of harmonious work of body and mind.

The benefits of Physical Education are diverse from the functionality and intention to grant the teacher to the class; Arufe-Giraldez, Abelairas-Gomez, Barcala-Furelos and Teixeira Costa (2015) found that the positive effect of psychomotor learning affects the involvement of physical activity at younger ages, as well as increased motor development and social skills.

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In Mexico, Physical Education is formed in the education system as a subject of the curriculum under the coordination of the Secretariat of Public Education (SEP). For this government department, it is a pedagogical discipline that contributes to the harmonious development of the individual, through the systematic practice of physical activity; which it is designed to provide the learner elements and motor satisfiers skills, the interest and the need of body movement that possesses with the specific intention to achieve the stimulus and skills development, habits and attitudes; which manifest in the quality of their participation in the walks with in the family, social and productive; requirement of modern society and which are necessary for lifelong learning (Department of Physical Education, 2006).

It should be mentioned that education in Mexico over the years has changed its curriculum approaches, complying with the sociocultural demands of the population and global trends. Currently, the current is based on a competency-based approach since 2007. From this perspective, the national program shows that the competencies that students must learn and develop at the basic education level are: corporeality as a global manifestation of the person, expression and skills development, motor skills and motor control for the development of creative action. Each manifests an intention that interacts and complements each other. Therefore, they are not presented in a sequenced manner; are constructed in parallel and are observed throughout the three cycles (each cycle is equivalent to two degrees). The implementation of this approach supplied a mostly current oriented to physical performance; currently, the implementation of the "global motor skills" approach has led to the education system to question the effectiveness of physical activity and motor skills.

In the Mexican context is scarce reviewing the issue; Hall, Ochoa, Chavez Alarcon, Saenz-Lopez Muñoz and Reyes (2012) evaluated in the north of the country, the intensity and context of the physical education class before and after a training, to Bachelor's degree in physical activity and sport of the Autonomous University of Baja California; research that reveals the need to continue exploring the subject matter, to know in which extent purposes of the current national PE program are fulfilled. Siedentop (1998) expressed: If we carefully analyze the times that coexist in a physical education session, we can prove that commitment

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period of motor or motor skills practice or motor skills practice and physical activity of a student can be really very poor.

At the international level, we find the research of Travieso and Pavon (2006), who shows that the percentage of time use in physical education classes is consumed by different variants such as: training and orientation activities (11%), explanation and demonstration (33%), corrections to the activity (7%), class organization (35%), and analysis and farewell (13%). We can evaluate the results had a trend, where teachers consumed most of the class time explaining, demonstrating and organizing the group, although these classes were improvement, where students knew beforehand the set of elements to work. Garcia, Antonio and Morillas (2010) mention that between 15% and 35% of physical education class time is dedicated to organizational activities. Thus, the organization time varies depending on the characteristics of the activity; this is particularly high during the performance of team sports or gym sessions and very small in activities such as aerobic dance, which had the highest variance regarding the effective time.

*Scientific Technical Journal*

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During physical education classes, the effective time is defined as "the total time that is dedicated to directly perform the various programmed physical activities ". This matter should focus on improving physical activity habits, to influence not only on the total energy expenditure, but liking the activity and, thus, increase the probability of incorporating this aspect into daily life. Several studies have concluded that physical education is the only time in which half of the child population carries out some type of physical activity (Moreno, Concha y Kain, 2012). Depending on the total effective time that is achieved in a physical education class, it will be reflection of the intensity of bodily activities. The intensity is expressed as the degree of effort or energy in which certain action is performed, and as a result, reflected an energy expenditure (Bastos, Gonzalez Boto and Molinero-Gonzalez, 2005).

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### *Physical activity*

Physical activity is one of the main determinants of health related to lifestyle; in general, physical activity is defined as "any voluntary movement produced by skeletal muscles that leads to increased energy expenditure" (WHO, 2009). Thus, when doing activities that seem so simple and daily as walking, running, households itself, biking, among others, allows the body to generate a caloric expenditure, indicating that the individual is performing physical activity.

According to WHO (2011), regular physical activity reduces the risk of suffering from depression, cardiovascular disease, hypertension, diabetes; but above all, it prevents obesity and overweight. It is recommended that children and young people from 5 to 17 years invest — at a minimum— 60 minutes daily in physical activities of moderate to vigorous intensity.

Beyond the international recommendations, it can be inferred that physical activity practiced during physical education session is relevant for generating energy expenditure; and it is therefore essential to achieve a caloric balance and weight control, which is positively related to the impact of good health and quality of life in children, preteens and adolescents (Arias, 2015).

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### *Study design*

The present study addressed a descriptive observational approach with cross-sectional measurement. The selected sample was not probabilistic intentional type, since a selection of individuals was conducted to evaluate according to the criteria of the research needs (Zorrilla, 1999).

### *Participating population*

Six schools in the city of Colima, Mexico were selected. These institutions are public and are chosen for their position in the *ranking* of quality of the ENLACE test of the Secretariat of Education of the State of Colima: two schools, located at the top; two more intermediate positions; and two of the last places of the table. Similarly, with regard to the schedule, they were selected: three afternoon (from 14 to 18 hours) and three full-time (08 to 15 hours).

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The sample was composed by 189 students in 5th and 6th grade: 93 women (49.20%) and 96 men (50.80%) aged between 10 and 13 years.

### **Technique and instruments**

Two units of analysis were used for data collections. The first consisted of measuring the total duration of the physical education class in elementary schools; and second, to quantify the generated caloric expenditure.

#### *Effective time of the physical education class*

The total duration of physical education class in elementary schools was through collecting the simultaneous information of the student's context of the class and how teachers interact with regard to the promotion of physical activity, the SOFIT instrument was used. Codes to classify activity levels which allowed estimating energy expenditure associated with physical activity were used. According to the methodology, it was performed as follows: it was chosen four students at random from each class of physical education (two men and two women) that were observed in rotating sequence of 12 intervals each student for 10 seconds each, repeating the observations throughout the class. The codes are classified into four: 1) lying down, 2) sitting, 3) standing, 4) walking, and 5) very active (that is concerning running or when the student performs more physical activity than corresponding to walk in an ordinary way). The physical activity rate of moderate to vigorous was determined by adding the percentage codes "4) walking", and "5) very active" of total class time. A second aspect that evaluates SOFIT simultaneously with the student's physical activity is the context of the class (McKenzie, Sallis and Nader, 1991). This context is codified in seven categories: M = General content, P = Specific knowledge, K = General Knowledge, F = Physical conditioning, S = skill development, G = Game, O = Other. The time of physical education was timed from the beginning and end of the class, according to the schedule set for the session of 50 minutes. The evaluation was carried out with the observation technique, monitoring the subject with an observation interval of the way his/her body is, 10 seconds to 10 seconds of recording activity code of this phase, during four minutes; at once, began the observation to the next student

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selected. In the context class it was observed the sequence that led the curriculum of physical education, general contents, and general knowledge, then to be codified.

### *Caloric expenditure*

To measure the number of steps and caloric expenditure W2-GNSBB01 pedometer was used.

The pedometer was set to a personalized way for the subject; for this, height, weight and stride length was previously taken. For which, the restricted profile of the International Society for the Advancement of Kinanthropometry (ISAK, 2001) was used. The pedometer W2-GNSBB01 uses a software called "W2 pedometer 2" (version 2023); this, when it is connected to the computer, opens, showing its interface to set it in a personalized form, which offers better control and management of the information received.

### *Statistical analysis*

The process of systematization of data and descriptive statistical analysis was conducted with SPSS (version 21.0). For the analysis of information, measures of central tendency were used; and for intragroup ANOVA Games Howell were used.

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It should be mentioned that the participants had access to the informed consent, which minutely detailed the research protocol which would follow during each of the tests, according to the statement in the Declaration of Helsinki, Medical Association (WMA, 2000) and Mexican Official Standard NOM-012-SSA3-2012; which establishes the criteria for the implementation of research projects for health in humans.

## **Results**

Results are organized into two units of analysis: collecting simultaneous information of the student's context of the class and how teachers interact with regard to the promotion of physical activity; the second one, the measurement of caloric expenditure through the quantification of the steps done during the PE class.

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*Physical activity undertaken during the Physical Education class by students.*

With regard to the classification of the activity: 3.80% of the session time students remain seated, 35.10% are standing, 28% walking, and only 18.10% of vigorous physical activity is carried out, such as running, jumping, crawling, among other activities that have a higher energy requirement than the normal. The highest ranking schools have the increased activity time: 38.50% walk and 31.30% vigorous activities are carried out; likewise, 11.50% of the time there is no activity. For its part, intermediate level schools are the ones with the most waste of time (17.70%) and low level schools have less activity demand, since 9.40% of the time they remain seated and 43.80% standing. Finally, the students of 5<sup>th</sup> grade (41%) are the ones whom most remain standing and those in the 6<sup>th</sup> grade have more activity, such as walking (32.60%) and vigorous activities (22.20%) (Chart 1).

Chart 1. Student's physical activity during the Physical Education class.

	Sitting	Standing	Walking	Vigorous	Waste of time
<b>Total</b>	<b>3.80%</b>	<b>35.10%</b>	<b>28.50%</b>	<b>18.10%</b>	<b>14.60%</b>
<i>Ranking level</i>					
High	2.10%	16.70%	38.50%	31.30%	11.50%
Intermediate	0%	44.80%	22.90%	14.60%	17.70%
Low	9.40%	43.8%	24%	8.30%	14.60%
<i>School grade</i>					
5 <sup>th</sup>	1.40%	41%	24.30%	13.90%	19.40%
6 <sup>th</sup>	6.30%	29.20%	32.60%	22.20%	9.70%

*Teacher's interaction with students*

In the section on the teacher's interaction with students, most of the time the teacher is devoted in observing the class (27.80%) and being outside of the work area (26.40%), so that scarce time is spent to the demonstration (1.70%) and skills development (6.60%). On the other hand, teachers in high-level schools spend their time in observation (39.60%), as well as low-level schools (25%); while in the intermediate level, they add a higher percentage in

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activities outside the work area (32.30%). In addition, at school grade, 5<sup>th</sup> grade teachers spend 36.80% of the class outside the work area and 6% in observation (36.10%) (Chart 2).

Chart 2. Teacher's interaction with students during the Physical Education class.

	Skills development	Demonstration of skills	General Instructions	Management	Observation	Others Tasks	Out of area
<b>Total</b>	<b>6.60%</b>	<b>1.70%</b>	<b>14.20%</b>	<b>11.80%</b>	<b>27.80%</b>	<b>11.5%</b>	<b>26.40%</b>
<i>Ranking level</i>							
High	9.40%	4.20%	9.40%	4.20%	39.60%	10.40%	22.90%
Intermediate	8.30%	1%	21.90%	10.40%	18.80%	7.30%	32.30%
Low	2.10%	0%	11.50%	20.80%	25%	16.70%	24%
<i>School grade</i>							
5 <sup>th</sup>	6.30%	2.10%	16.70%	7.60%	19.40%	11.10%	36.80%
6 <sup>th</sup>	6.90%	1.40%	11.80%	16%	36.10%	11.80%	16%

#### Context of the lesson of physical activity

The following aspect refers to the context of physical activity during the session; in which 28.50% of the class is where activities outside the context of the subject matter and general knowledge of the subject are carried out, and 21.50% of the time is devoted to the general content, concerning the transfer, organization and rest times. In high-level schools, 22.90% of the time is dedicated to general content and only 18.80% in *fitness* activities. Intermediate level spend 26% on general contents and 37.50% do not carry out motor activities, as do low level schools (32.30%). Finally, in 5<sup>th</sup> grade there is a 35.40% of non-motor activities, unlike the 6<sup>th</sup> grade, activities differ in different areas; however, there is more time in which they do not perform motor activities (21.50%) (Chart 3).

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Chart 3. Context of the lesson of activities during the Physical Education class.

	General content	General knowledge	Knowledge of physical activity	Fitness Activity	Skills practice	Game	Others	Activities out of context
<b>Total</b>	<b>21.50%</b>	<b>1.40%</b>	<b>0.30%</b>	<b>10.40%</b>	<b>8%</b>	<b>13.90%</b>	<b>16%</b>	<b>28.50%</b>
<i>Ranking level</i>								
High	22.90%	3.10%	0%	18.80%	15.60%	8.30%	15.60%	15.60%
Intermediate	26%	0%	0%	5.20%	1%	11.50%	18.8%	37.50%
Low	25.60%	1%	1%	7.30%	7.30%	21.90%	13.5%	32.30%
<i>School grade</i>								
5 <sup>th</sup>	25%	0%	0%	4.20%	2.10%	10.40%	22.9%	35.40%
6 <sup>th</sup>	18.10%	2.80%	0.70%	16.70%	13.90%	17.40%	9%	21.50%

Regarding the analysis of caloric expenditure, the average is  $164.21 \pm 59.18$ . Significant differences ( $p=.000$ ) between schools were identified, unlike the position in the ranking ( $p=.804$ ). With respect to the caloric expenditure in relation to the ranking, the schools that are in the first places set out a higher average. In comparison with one of the low-level schools (school 5), it recorded the highest caloric expenditure compared to higher-level schools; however, compared to those of the same standard, there is a difference of up to 73 calories. Therefore, the caloric expenditure cannot be determined by the level of educational quality (Chart 4).

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Chart 4. Caloric expenditure during the class of physical education (by ranking and school).

School	M / ±	Sig.	School	M / ±	Sig.
<b>Total</b>	<b>164.21 ± 59.18</b>				
High ranking	167.01 ± 56.47	.804	School 1	155.38 ± 51.14	.000
			School 2	178.15 ± 59.57	
Intermediate ranking	163.04 ± 59.47		School 3	128.61 ± 37.27	
			School 4	163.04 ± 59.47	
Low ranking	160.21 ± 63.70		School 5	202.18 ± 63.90	
			School 6	129.17 ± 48.00	

## Discussion

### *Effective time of the Physical Education class*

In Mexico, physical education is a pedagogical discipline that contributes to the harmonious development of the individual through the systematic practice of corporal activity; and it is oriented to provide the student with elements and motor satisfactory to ability, interest and need for anatomical movement that has with the specific intention of achieving the stimulation and development of skills, habits and attitudes. Therefore, from its formative essence can contribute to improve active lifestyles, through the acquisition of habits of physical activity (Feu, Salazar, Antunez and De la Cruz, 2016). Nevertheless, the specialized literature indicates that the times of motor commitment and physical activity recommended by international organizations are reduced in the physical education class (Kobel, Kettner, Erkelenz, Kesztyus and Steinacker, 2015; Meyer, Roth, Zahner, Gerber, Puder, Hebestreit and Kriemler, 2013).

In the Mexican case, it is corroborated that the physical commitment of Colima students during the physical education class is lower; of 50 minutes of class, 18.10% (nine minutes) of the time in moderate activity is registered; whereas in the study with children from Mexicali, Mexico, the time spent is 37.30% (18.65 minutes) (Hall *et al.*, 2012); far higher, inclusive with respect to Swiss students (Meyer *et al.*, 2013), who cover 33% (16.50 minutes) of the time of the subject.

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In this sense, the teacher's role in the planning and development of the PE class is essential for the optimum occupation of time. In the case of Colima's students, it is confirmed that the teacher spends most of the time observing and giving instructions; this coincides with the dynamics observed by Travieso and Pavon (2006), whom mentions that the physical education teacher consumes the class time mainly in activities of the session management, such as the organization and demonstration of the activity.

### *Caloric expenditure*

According to international standards the quantified caloric expenditure in Colima's children is poor ( $164.21 \pm 59.18$ ). The practice of systematic physical activity is an element considered to achieve an energy balance in the individual, says WHO (2011). In the same vein, Bastos, Gonzalez-Boto and Molinero-Gonzalez (2005) point out that the time of the physical education session is reduced and is directly reflected in energy expenditure, generating short-term visible health problems and movement (Ortega, Ruiz and Sjöström, 2007).

To enable this physical practice to be effective, at least 150-180 min/week of aerobic exercise at moderate to high intensity should be performed (Atlantis, Barnes and Fiatarone, 2006). The American Heart Association (2006) recommends that children and adolescents should perform aerobic exercises, strength, flexibility, balance, agility and coordination with a minimum of 60 minutes daily, distributed between school and extracurricular (Pate *et al.*, 2006).

### **Conclusion**

The effective time of the Physical Education class in schoolchildren in Colima, Mexico, is insufficient in relation to the recommendations of international organizations according to scientific evidence, and in the Mexican case, the National Physical Education Program. It is clear that students spend most of their time standing up for prompts and only nine minutes on vigorous activities that promotes a poor caloric expenditure.

Therefore, it is necessary to optimize the times and intensities of motor skills practice, through an appropriate selection of activities and teaching approach organization. It will then

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be the task of the physical education teacher to revert — from the direction of the session and the creation of strategies — regarding the time lost in class management.

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