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Can Dynamic Breaks improve the intensity of Physical Education classes? A teaching experience of a preservice teacher as a practitioner researcher

¿Pueden las pausas dinámicas mejorar la intensidad de las clases de Educación Física? Una experiencia de enseñanza de un estudiante como investigador de sus prácticas

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Abstract. Youth Physical Activity promotion has been identified as a global health priority by the World Health Organization. School is one of the places where it is possible to literate youth about active and healthy life. Physical Education classes are a cornerstone to promote daily physical activity, but most of these classes don't meet the recommendations of spending at least 50% of the time in moderate-to-vigorous physical activity. Sports such as volleyball, gymnastics and others seem to produce lower-intensity classes than basketball, football and handball. This teaching experience aims to explore the contribution of introducing dynamic breaks in Physical Education classes according to content (volleyball and gymnastics) and gender on time spent in moderate-to-vigorous physical activity. Twenty students, aged between 16 and 18 years old, participated in eight monitored Physical Education classes. In the first four, data was collected without dynamic breaks, introducing them in the four following classes. The students wore POLAR heart rate monitors to measure their moderate-to-vigorous physical activity time. All data was analysed using the Wilcoxon test. Dynamic breaks significantly increased students time spent in moderate-to-vigorous physical activity in both contents, especially in girls. Dynamic breaks can be a valuable strategy to increase the Physical Education classes' intensity.
Keywords: Physical Activity; Physical Fitness; School; Teaching Content, Pedagogical Experience.

Resumen. La promoción de la actividad física entre los jóvenes ha sido identificada como una prioridad sanitaria mundial por la Organización Mundial de la Salud y la escuela es el uno de los lugares donde es posible alfabetizar los jóvenes para una vida activa y saludable. De hecho, las clases de Educación Física son estructurales para fomentar la actividad física diaria, pero la mayoría de las clases no cumplen las recomendaciones de pasar, al menos, el 50% del tiempo en actividad física moderada a vigorosa. Deportes como el voleibol, la gimnasia y otros parecen producir clases de menor intensidad en comparación con las de baloncesto, fútbol y balonmano. El objetivo de esta experiencia de enseñanza es explorar la contribución de la introducción de pausas dinámicas en las clases de Educación Física según el contenido (voleibol y gimnasia) y el género, sobre el tiempo dedicado a la actividad física moderada a vigorosa. Veinte estudiantes, entre 16 y 18 años, participaron en ocho clases de Educación Física monitorizadas. En las cuatro primeras, se recogieron datos sin pausas dinámicas, introduciéndolas en las cuatro clases siguientes. Los estudiantes llevaban monitores POLAR de frecuencia cardíaca para medir el tiempo de actividad física moderada a vigorosa. Los datos se analizaron mediante la prueba de Wilcoxon. El uso de pausas dinámicas incrementó significativamente el tiempo de actividad física moderada a vigorosa de los estudiantes en ambos contenidos, especialmente en las chicas. Las pausas dinámicas pueden ser una estrategia útil para aumentar la intensidad de las clases de Educación Física.
Palabras Clave: Actividad Física; Aptitud Física; Escuela; Contenido Didáctico; Experiencia Pedagógica

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Introduction

Physical inactivity has been increasing and threatens to reach worrying contours, leading the World Health Organization (2020) to consider the promotion of Physical Activity (PA) as a global health priority. According to Guthold et al. (2020), in a study carried out in 146 countries, with the purpose to describe the prevalence and trends of insufficient PA among school-going adolescents, 81% of young people aged between 11 and 17 years old do not perform a daily minimum of 60 minutes of moderate to vigorous physical activity (MVPA), as recommended by WHO (2020). In fact, Portugal is one of the European countries with the lowest levels of PA and the highest levels of physical inactivity, which led the government to also define PA as a priority to health (Shinn et al., 2020).

Regular PA at appropriate levels has positive effects on young people's physical health, as shown by cardiovascular and metabolic markers, more muscle strength and reduced body fat (Sallis et al., 2012), as well as increased well-being and self-esteem (Budzynski-Seymour et al., 2020; Zubala et al., 2017), playing a preventive role in the risk factors management that potentially lead to chronic diseases (Anderson & Durstine, 2019). PA also seems to be related to how the brain works and children with higher daily PA seem to have greater attention resources, faster cognitive processing speed and better results on standardized academic tests (Budzynski-Seymour et al., 2020).

School is a crucial part of young people's lives and actually has educational concerns with health, taking them to acquire tools, knowledge and behaviors that enhance active lifestyles (WHO, 2020). Therefore, the school can bring unique conditions for PA promotion and healthy behaviors (Sevil et al., 2019), although the influence to adopt healthy behaviors throughout life has not been shown (Dobbins et al., 2013). Despite this educational potential for these issues, the extensive curriculum, focused on academic performance, is positioned as the main barrier to promote school PA, taking time and curricular importance from the Physical Education (PE) subject (Hills et al., 2015). In fact,

PE classes can contribute to young people's daily PA, being, for many students, the only space where they are physically active during their week. In this sense, students in PE classes should be involved in MVPA levels for, at least, 50% of class time (Harris, 2015). However, several studies show that these recommendations are not usually met. (Silva et al., 2018; Truelove et al., 2020; Vega et al., 2020).

The number of students per class, class organization and student motivation, among other aspects, can lead to lower PA levels during PE classes (Abad & Cañada, 2014). However, the content taught seems to influence class intensity (Hellin et al., 2019). Fairclough and Stratton (2006) identified that the percentage of time spent in MVPA is higher when the content is related to physical fitness development activities and invasive team sports, comparatively with classes where content is gymnastics, dance or non-invasive sports, such as volleyball or badminton. Hellin et al. (2019) added that classes whose content is football are, usually, more intense than those of badminton. Other studies have also shown that the development of physical fitness is a good tool to increase the intensity of PE classes (Laurson et al. 2008; Smith et al., 2014)

Verstraete et al. (2007) consider that a health-related PE curriculum can substantially raise PA levels in PE classes and the quality of the professionals and lessons can be crucial points to increasing PA. Abad and Cañada (2014) identified several strategies that intend to design PE classes with higher PA levels, for example: (i) Class organization promoting motor activity, such as avoiding waiting for lines and constituting fixed working groups in the class, and (ii) exercise selection, creating, whenever possible, situations that simultaneously combine motor learning and the development of physical fitness.

Several others interventions have been carried out to increase the intensity of PE classes, many of them using High Intensity Interval Training (HIIT) methodologies (Gill et al., 2019; Segovia & Gutiérrez, 2020), with positive results in increasing the time spent in MVPA (da Silva Bento et al., 2021). Diaz et al, (2020), in their trial with preschool students, sought to adapt the CATCH pedagogical model and achieved positive results at the level of class intensity. Considering also the influence of teaching content on class intensity, Oh (2022) explored the potential of new contents to increase students' participation and PA levels. Despite all these interventions using different ways with the same goal, the teacher also has a very important role to play in achieving the recommended time in MVPA levels, which leads López (2021) to consider that training and capacity building of PE teachers can be crucial to promote higher levels of PA in their classes. Still, Hills et al. (2015) suggest that it is important to explore different strategies to archive higher levels of intensity in PE classes.

Kenney (2015) considers heart rate (HR) as one of the simplest and most informative physiological responses to measure cardiovascular stress and tension, being a good indicator of the relative intensity of exercise. The use of HR monitors at school is not new, Partridge et al. (2011) highlighted the relevance of exercise monitoring in the appropriate HR zones and providing this information to teachers and students, with data interpretation demonstrating if the MVPA recommendations for PE classes are attending. Students using HR monitors are usually involved in the process, excited to see their data, show more responsibility building their own learning and are more motivated to exercise (Lee et al., 2015). Furthermore, Sarradel et al. (2011) also identified that girls achieve higher levels of HR during team sports and fitness activities, while boys achieve them in tennis and fitness activities, which may be a predictor that HR differs according to gender and type of activity. Guthold et al. (2020) in their study also pointed out that there appear to be differences in PA levels according to gender, as does Tanaka et al. (2018) who concluded that boys spend significantly more time in MVPA during PE lessons compared to girls. Even so, there seems to be no consensus in the literature regarding the influence of gender on PA levels, for example, Delextrat et al. (2020) in their pilot study developed with 307 participants, found no relationship between gender and PA levels.

Given the importance of increasing PA levels in PE classes, the present teaching experience aimed to analyse the effect and effectiveness of introducing dynamic breaks (DB) in less intense content PE classes, on time spent in MVPA. Additionally, it was also intended to characterize the classes' intensity levels without DB and the intensity of the lessons according to gender.

Materials and methods

Context of the study

The teaching experience was carried out by a preservice teacher in their school placement and supported by an experienced cooperating teacher that participate in the planning process and is present in all classes. The preservice teacher was attending a teacher training program at a university in northern Portugal.

The teaching experience was developed in the class assigned to the preservice teacher, and neither the students nor the pre-service teacher had any experience using DB.

Participants

Twenty students participated in this teaching experience, 15 girls and five boys of a 12th grade class of a school in the metropolitan area of Porto, aged between 16 and 18 years old ($\overline{X}$=17,15). The participants as chosen for convenience, as the researcher was the teacher's class. The mean values of boys age were 17.4 (± 0.54) years old, the average height was 184.8 cm (± 5.06) and the weight 77.4 kg (± 11.85). For girls, the mean value of age was 17.06 (± 0.45) years old, the height 163.93 cm (± 13.61) and the weight 64.68 kg (± 13.61).

All participants signed an informed consent form representing their voluntary participation. In the case of underage students, the consent was also signed by their legal

guardians. All were informed about the right to withdraw from the study at any time without any prejudice. All data was processed anonymously.

Classes structure with and without dynamic breaks

Gymnastics and volleyball class structure was previously designed and maintained throughout eight consecutive classes, two per week. Each lesson had 80 minutes of useful time.

Gymnastics class structure included an initial warm-up, a circuit organized in the main part, learning different gymnastic elements and, finally, a closure part dedicated to physical fitness development. Volleyball class structure included a warm-up, two individual technical drills, two small-sided cooperation as the main part and a final part aiming to develop physical fitness (see Table 1).

Table 1.
Structure of PE classes with and without the introduction of dynamic breaks. Source: Author.

	Structure	Time
Classes Without DB	Warm-up	15 min
	Main Part	50 min
	Physical fitness	15 min
	Structure	Time
Classes With DB	Warm-up	15 min
	Main part	15 min
	Dynamic Breaks	5 min
	Main part	10 min
	Dynamic Breaks	5 min
	Main part	15 min
	Physical fitness	15 min

Source: Author.

The DB consisted of two five minutes moments with 10 minutes apart, during the main part of the class (Table 1), when the students left the current teaching subject task and dedicated themselves to the physical fitness tasks assigned. They were composed of the following exercises: Jump rope; Running; Jumping Jack; Bear Walk and Crab Walk. These were selected due to their rhythmic and aerobic nature, involving large muscle groups and, therefore, recommended to improve cardiorespiratory fitness (CRF) (ACSM, 2018). The combination of strength and aerobic exercises enhances the development of young people CRF (Minatto et al., 2016).

Students' motivation when they perform the tasks is an important feature that increases the intensity of the class. In this respect, jumping rope was included because it is an attractive and pleasurable activity, which, normally, creates a nostalgic feeling associated with childhood (Ha et al., 2015). Other studies even demonstrate the effectiveness of jump rope at different ages and levels of physical condition (Boyko & Karnyukhina, 2018; Shkola et al., 2022), boosted at school, contributing to improvements in PA, endurance, strength, speed and agility (Eler & Acar, 2018; Shkola et al., 2022).

During DB, half of the time was spent jumping rope, one min was spent running, 30 sec doing jumping jacks, 30 sec doing crab walk and another 30 seconds doing bear walk. The students were organized in two groups, diving the class in two. Every 30 seconds, the teacher beeps for the students to switch roles (Figure 1).

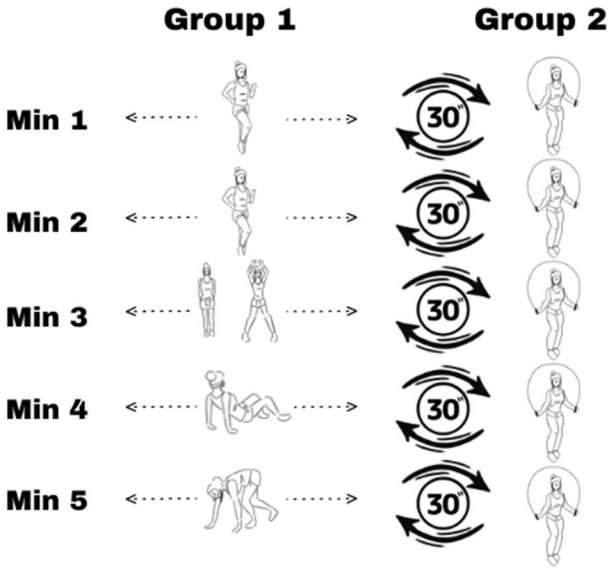

Figure 1. Dynamic breaks procedure. Source: author.

Data Collection

Anthropometric measurements were taken of all participants. Height (cm) was recorded with the student leaning against the wall, looking straight ahead and with arms extended along the trunk. Weight (kg) was recorded using a simple digital scale.

In each class, the students used H6 and H7 POLAR HR monitors. All monitors were programmed according to each student's age, weight, height and the maximum heart rate of each student which has been calculated automatically by the POLAR Team app, configured through a mobile device, allowing data collection since the begging of the class and access to each student's HR in real time. At the end of each class, the app session was closed, the HR monitors removed and the data transferred to a computer for further analysis.

The effectiveness of this instrument has been tested and validated for the controlling and monitoring of intensity exercise (Stahl et al., 2016). HR zone one represents 50-60% of HRmax; Zone two represents 60-70% of HRmax; Zone three represents 70-80% of HRmax; Zone four represents 80-90% of HR max; Zone five represents 90-100% of HRmax.

The data were collected in eight consecutive classes and the collection procedure was divided in two stages. In the first one, considering the first four classes, data were collected considering MVPA time in two consecutive gymnastics classes and two consecutive volleyball classes, which are subjects with, usually, lower intensity (Fairclough & Stratton, 2006). At the second moment, the procedure was the same, but with the introduction of two DB of five minutes in each class, as explained above.

The selected lessons of both contents were in the middle of the teaching unit. The DB procedure had already been experienced by the students in two other content lessons, without any collection of data.

Data analysis

An exploratory data analysis was performed and descriptive statistics (mean, mode and standard deviation) and relative frequency calculated. Data normality was verified using the Shapiro-Wilk test. Wilcoxon's non-parametric test was used to analyse the differences between the variables considered in the PA levels of the class, with a significance level of $p \leq 0.05$. Data processing was performed using the IBM SPSS statistical program (v. 27.0.1 for Windows).

Due to problems in use or registration failures, the collected data has been removed.

It is important to emphasize that the data analysis of this teaching experience does not intend to generalize but only to give some insights to further studies to improve the quality of PE classes, namely at the level of intensity.

Results

MVPA levels in classes with and without DB (Table 2)

In classes without DB introduction, the average time spent in MVPA in gymnastics was 57.50% (±19.53) and in volleyball 55.33% (± 27.61). In gymnastics, the implementation of DB led to an increase in time spent in MVPA, from 57.5% (± 19.53) to 70.35% (± 23.28), being the different statistically significant (p=0.03). In the volleyball classes, there was an increase in the time spent in MVPA, from 55.33% (± 27.61) to 77.19% (± 23.19), which was also statistically significant (p= 0.01).

Table 2.
Percentage of time spent in MVPA levels in Gymnastics and Volleyball classes with and without dynamic breaks.

	Gymnastics		Volleyball	
	$\bar{x}$ ± SD	p value (Wo/DB - W/DB)	$\bar{x}$ ± SD	p value (Wo/DB - W/DB)
Without DB	57,5 ± 19,53 N=18	0,01*	55,33 ± 27,61 N=18	0,033*
With DB	70,35 ± 23,28 N=17		77,19 ± 23,19 N=16	

*$\bar{x}$ = mean; SD = standard derivation; N = number of participants; Wo/DB = Classes Without dynamic breaks; W/DB = Classes With dynamic breaks; p (Wo/DB - W/DB) = p value for compare classes with and without dynamic breaks; *statistically significant difference.
Source: Author.

MVPA levels in classes with and without DB according to gender (Table 3)

In gymnastics, with the introduction of DB, boys increased the percentage of time spent in MVPA, from 58.80% (± 30.35) to 69.20% (± 24.95), but the difference is not statistically significant (p=0.08). In gymnastics, with the introduction of DB, girls increased significantly (p= 0.01) the percentage of time spent in MVPA, from 57,00% (± 21.45) to 70.83% (± 18.10).

With the introduction of DB in volleyball, boys increased, but not significantly (p= 0.06) the percentage of time spent in MVPA from 70,00% (± 20.29) to 81.50% (± 25.10). With the introduction of DB in volleyball, girls increased the percentage of time spent in MVPA, from 51.14% (± 28.59) to 75.75% (± 23.51), this difference being marginally significant (p = 0.05).

Table 3.
Percentage of time spent in MVPA levels, as a function of gender, in classes of different contents with and without the use of dynamic breaks.

		Boys N=5		Girls N=15	
		$\bar{x}$ ± SD	p value (Wo/DB - W/DB)	$\bar{x}$ ± SD	p value (Wo/DB - W/DB)
Gymnastics	Wo DB	58,8 ± 30,35 N=5	0,08	57 ± 21,45 N=13	0,014*
	W DB	69,2 ± 24,95 N=5		70,83 ± 18,10 N=12	
Volleyball	Wo DB	70 ± 20,29 N=4	0,068	51,14 ± 28,59 N=14	0,05*
	W DB	81,5 ± 25,10 N=4		75,75 ± 23,51 N=12	

*$\bar{x}$ = mean; SD = standard derivation; N = number of participants; Wo/DB = Classes Without dynamic breaks; W/DB = Classes With dynamic breaks; p (Wo/DB - W/DB) = p value for compare classes with and without dynamic breaks; *statistically significant difference.
Source: Author.

Discussion

The purpose of this teaching experience is to explore the contribution of introducing DB in PE classes to increase their intensity; so, the intention is not to generalise the results obtained but rather to respond to the abovementioned objectives.

Neil-Sztramko et al. (2021), in their recent systematic review, identify that school-based PA interventions may have a small to moderate effect on physical fitness among both children and adolescents. The same authors emphasise interventions with a specific focus on increasing the intensity of lessons as those that can have the greatest effect on the development of students' physical fitness.

Considering this aspect, we notice that high intensity PA levels during the classes are important, even for the development of students' physical fitness, one of the main goals of PE.

The obtained results regarding students' time spent in MVPA, observed in classes without DB are unexpectedly higher than the recommended 50%, both in gymnastics 57.50% (±19.53) and volleyball 55.33% (± 27.61). These values are clearly above the mean values recorded by Hollis et al. (2017) in the studies analysed in the systematic review. On the other hand, it is possible to find studies where the PA recommendations for PE classes are fulfilled, such as the case of Gao et al. (2009) who showed average of time spent in MVPA of 55.43%.

The results presented in the analysed classes may be jus-

tified by the concerns raised in planning and operationalization, related to organization, namely because we always tried to take advantage of all the available space, avoiding waiting lines and creating small groups to increase the number of repetitions for each student. There are also concerns about the choice of exercises, choosing, whenever possible, to select and construct exercises with double valence, that is, that aim at the integration of coordinative aspects and that are intense from a physical point of view, associated with the optimization of instruction, short and clear. These strategies, according to Abad and Cañada (2014), seem to positively influence the intensity of PE classes.

To develop CRF, the WHO (2020) and ACSM (2018) recommend that the stimulus should be applied at least three times a week, in an intensity between 64% and 90% of HRmax, for at least 25 minutes. In this study, these recommendations were achieved twice a week for more than 50 minutes.

In both teaching contents, the percentage of average time spent in MVPA was around 55% in classes without DB, while when DB was introduced, the time spent on MVPA rose to over 70%. According to Peralta et al. (2020), PE classes seem to contribute to the development of the CRF of young people and this improvement seems to depend on factors such as weight and age. However, the same author points out that intensity is the main factor contributing to the development of this aptitude, being that more intense classes point to a strong impact on the increase of CRF. Considering the intensity of these classes, where students spent more than 70% of the time in MVPA, twice a week, it can be considered that this stimulus, when extended in time, can be seen as a means of developing CRF. Although this study is not the focus of this research, it might be interesting to consider, in future experiences, the follow-up of this type of intervention, with an CRF evaluation program. This allows not only to observe the classes' intensity, but also its effect on the development of the students' CRF.

It is possible to observe that the use of DB in PE classes, in the teaching subjects that were studied, can lead to a significant increase in the average time spent in MVPA, in girls. However, when it comes to boys, this increase is not statistically significant. This data may be justified by the fact that classes without DB already have high levels of MVPA, especially in boys, as reported by Tanaka et al. (2018), who considers that boys activity levels in PE classes are higher than in girls. Furthermore, Guthold et al. (2020) consider that there seems to be significant differences in PA levels according to gender. Yet, we believe that in this specific case, the differences are not due to gender, but essentially to the different levels of students' physical fitness. In the addressed class, the boys' physical fitness levels are quite high, contrary to what happens with most girls. Mayorga-Vega and Viciana (2015) identify that students with lower aptitude levels tend to have higher levels of MVPA in PE classes. In the study carried out by Resaland et al. (2011), it is described that the impact of programs applied for the development of physical fitness are greater in students who have lower fitness levels. In both cases, the evidence seems to be justified by physiological factors. Guijarro Romero et al. (2020) even states that intermittent fitness development units only improve the CRF of students with an unhealthy profile.

According to Hoffman (2014), exercise is an important stimulus to increase the systolic volume, whether at rest or in maximal efforts. This relates to an enlarged ventricular chamber, caused by the chronic increase in ventricular filling common to resistance exercise. The same author shows that endurance athletes can show a systolic volume up to 60% greater than a sedentary individual. These adaptations allow increased efficiency of the cardiovascular system, which leads trained individuals to have a lower HR both at rest and in submaximal efforts.

Reviewing in detail the collected data in this study, only on five occasions were the MVPA recommendations not fulfilled, with the introduction of DB. These were recorded by four different students, two boys and two girls, all showing very high levels of physical fitness, shown in the number of routes performed in the 20m Shuttle Run test and in regular PA performed outside the context of this study. And this confirms the above. The identification of these cases and the respective individualization of training, as suggested by Guijarro-Romero et al. (2020), can be crucial for everyone to reach their intended PA levels.

Through the observation of the results, it is still possible to identify that the use of DB in volleyball classes had a greater impact on the increase in time spent in MVPA, compared to gymnastic classes. This fact is possibly explained by the technical level of the players, characterized by a predominantly static game, in support and with little continuity. The importance of developing the technique in this learning phase is also conducive to less intense exercises. The use of greater muscular strength in Gymnastics can increase the observed intensity levels. However, further studies are needed to help understand this event.

Similar interventions were done aiming to increase the PA levels in PE classes, namely using HIIT programmes (Gill et al., 2019; Segovia & Gutiérrez, 2020) and had very positive results (da Silva Bento et al., 2021). Although, none of these interventions are related with the type of content taught in class, that is one of the factors that can contribute a lot to intensity level (Hellin et al., 2019). Our intervention seems to be relevant to the topic because the programme was been applied in classes with contents considered with lower intensity and even so has had very positive effects on the increase of intensity. Therefore, DB appear as another very interesting strategy to increase the intensity of the lessons, using only two five-minute moments during the lesson.

Conclusion

The concern with the planning and operation of the class, combined with the construction of exercises that aim

to integrate the coordination and energy production aspects, seems to be sufficient to maintain high levels of MVPA during PE classes.

The introduction of DB, in classes with less intensive teaching materials, appears to be an effective strategy to increase the percentage of time spent by students in MVPA levels. Even so, in girls, it's where a greater increase in intensity was observed. DB structure, contemplating the combination of aerobic and strength exercises, seems to be a good strategy for the development of CRF due to the observed increase in intensity. It will also be important for the teacher to find strategies that seek to enhance the PA of students with higher levels of physical fitness.

The sample size and the absence of a control group are the biggest limitations of the study, as it does not allow us to conclude that the differences presented are only connected to the use of DB. Nerveless these limitations, this teaching experience brings important insights to be followed by quasi-experimental studies with group control and biggest simple size.

Although the data with measurement errors was previously eliminated, it is possible that other measurements are not so accurate as desired because of students being constantly touching the monitor during the class. It would be relevant to guarantee adjustable electrode bands, especially for the thinnest students.

In future studies, it would be interesting to carry out an analysis, using different teachers, schools, teaching subjects and years of schooling and having a control group.

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