

EFFECTS OF A TEACHER TRAINING INTERVENTION ON TEACHERS' AND STUDENTS' MOTIVATION TO PHYSICAL EDUCATION CLASS

EFEITOS DE UMA INTERVENÇÃO DE FORMAÇÃO DE PROFESSORES NA MOTIVAÇÃO DE PROFESSORES E ALUNOS PARA A AULA DE EDUCAÇÃO FÍSICA

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RESUMO

O presente estudo avaliou os efeitos de uma intervenção com professores, baseada na Teoria da Autodeterminação, sobre a motivação de professores e alunos para a aula de educação física (EF). É um estudo quase-experimental do tipo antes e depois com 4 professores de EF e 611 alunos. Foi elaborado um manual e realizadas sessões de formação de professores. Análise estatística incluiu testes t pareados e medidas repetidas através do modelo linear geral e da regressão linear de efeito misto. Um aumento significativo no escore de motivação de professores e alunos foi observado após a intervenção. Entre os professores verificou-se um aumento na motivação auto-determinada. Entre os alunos houve interação significativa entre tempo por grupo (Motivação Extrínseca Regulação Identificada (F=5,6), Motivação Extrínseca Regulação Externa (F=7,41), Amotivação (F=5,32) e Motivação Autodeterminada (F=4,87). Além disso, a Motivação Intrínseca diminuiu significativamente com a idade para rapazes ($\beta = -0.151$) e moças ($\beta = -0.121$), bem como a Motivação Externa Regulação Introjada para moças ($\beta = -0.141$). Sessões de formação podem apoiar os professores no planejamento resultando no aumento da motivação dos professores e alunos nas aulas de EF. No entanto, esta estratégia não foi suficiente para melhorar a motivação intrínseca no período investigado.

Palavras-chave: Educação física. Motivação. Intervenção.

ABSTRACT

The present study evaluated the effects of a teacher training intervention, based on Self-Determination Theory, on teachers' and students' motivation in physical education class. This is a pre-post quasi-experimental study with 4 physical education teachers and 611 students from four public schools. A handbook was developed and teacher training sessions were conducted. Statistical analysis consisted of paired t-tests and general linear model repeated measures to assess teachers' self-determined motivation and linear mixed effect regression to evaluate students' motivation. A significant increase in teachers' and students' motivation score was observed after the intervention. Among teacher, we verified an increase in self-determined motivation. Among students there were significant interaction time by group in Extrinsic Motivation Identified Regulation (F=5.6), Extrinsic Motivation External Regulation (F=7.41), Amotivation (F=5.32) and Self-determined Motivation (F=4.87). Also, Intrinsic Motivation significantly declined with age for boys ($\beta = -0.151$) and girls ($\beta = -0.121$) as well as Extrinsic Motivation Introjected Regulation for girls $\beta = (-0.141)$. Training sessions can support teachers in planning lessons resulting in increasing teacher and students' motivation in physical education classes. However, this strategy was not enough to improve intrinsic motivation during the investigated period.

Keywords: Physical Education. Motivation. Intervention.

Introduction

Providing physical education (PE) classes in schools is an important strategy for children and adolescents development and may offer opportunity to engage in more physical activity, psychological and social gains¹. Moreover, a favorable school environment and positive experiences in physical education class could promote healthy lifestyles and include other structured activities for regular practice of physical activity^{1,2}. However, beside this knowledge the participation in PE classes in Brazil is low. The National Survey of School Child Health (PeNSE) showed that only 37.3% of the students attend the PE classes given twice a week, even though the classes are compulsory³.

Students reported that infrastructure-related problems, school administration, and the classes sports content are some reasons to not participate in PE classes⁴. Another reason not mentioned in these surveys is the low students' motivation. Motivation is recognized as an important factor related to meaningful student engagement and participation in PE classes^{5,6}. The Self-Determination Theory has been used as a theoretical tool to understand motivation by assessing the intensity and direction of the behavior towards teaching and the practice of physical activity at school⁷.

According to Deci and Ryan⁷ motivation variations are represented and established within a self-determination continuum, which includes: intrinsic motivation (interest, enjoyment, inherent, satisfaction); Extrinsic motivation Integrated Regulation (congruence, awareness, synthesis with self); Extrinsic motivation Identified Regulation (personal importance, conscious valuing); Extrinsic motivation Introjected Regulation (self-control, ego-involvement, internal rewards and punishments); Extrinsic motivation External Regulation (compliance, external rewards and punishments) and amotivation (nonintentional, non-valuing, incompetence, lack of control). The empirical literature contains few studies that assess extrinsic motivation of the integrated regulation type in adolescents; this regulation is seen more often in adults, possibly because of an underdeveloped sense of the self in adolescents^{8,9}.

Self-determined forms of extrinsic motivation (identified and integrated regulation) have been combined with intrinsic regulation to form autonomous motivation¹⁰. Autonomous motivation occurs when people feel identified with the value of the activities and have integrated the internalizations into their own sense of self¹¹. Autonomous motivation is expected to lead to many positive outcomes such as long-term persistence, healthier behavior, and more effective performance¹¹. In contrast, controlled motivation consists of the non-self-determined types of extrinsic motivation, including introjected regulation (i.e. acting to avoid guilt or gain pride) and external regulation (i.e. acting to satisfy an external contingency)⁷.

Studies based on the Self-Determination Theory conducted in educational environments suggest that teacher motivation can influence student motivation through the creation of an optimally motivating learning environment, which increases class attendance, concentration, and the effort to perform the physical education activities^{12,13}. Furthermore, teachers who teach in a way that increases self-determined motivation can increase opportunities for students to be motivated^{14,15}. Also, some studies demonstrated that autonomous motivation is associated with higher levels of self-reported physical activity, both during⁶ and outside the PE class¹⁶.

Interventions that use Self-Determination Theory have been implemented in schools with a variety of objectives, but most have focused on increasing physical activity^{17,18}. Intervention studies focusing on the motivation of Physical Education teachers and students are scarce, especially adolescents. Therefore, based on the principles of the Self-Determination Theory the present study aims to analyze the effects of a teacher training intervention teachers and students' motivation to physical education class.

Methods

Study design and participants

This quasi-experimental study was conducted in Recife, located in Northeast region of Brazil. The flow chart in Figure 1, as recommended by the TREND statement¹⁹, describes the different phases and design of the study. Schools had to meet all of the following inclusion criteria: full-time physical education teachers and schools which should have appropriate environment and materials to conduct physical education classes. Six public High schools met the eligibility criteria and were invited to participate in the study. Four indicated agreement

and were accepted into the study. Four Teachers (one each school) and 611 students (all classes) were assessed at the baseline in the beginning of the school year (February, 2012). The post-test was completed following the intervention (June, 2012).

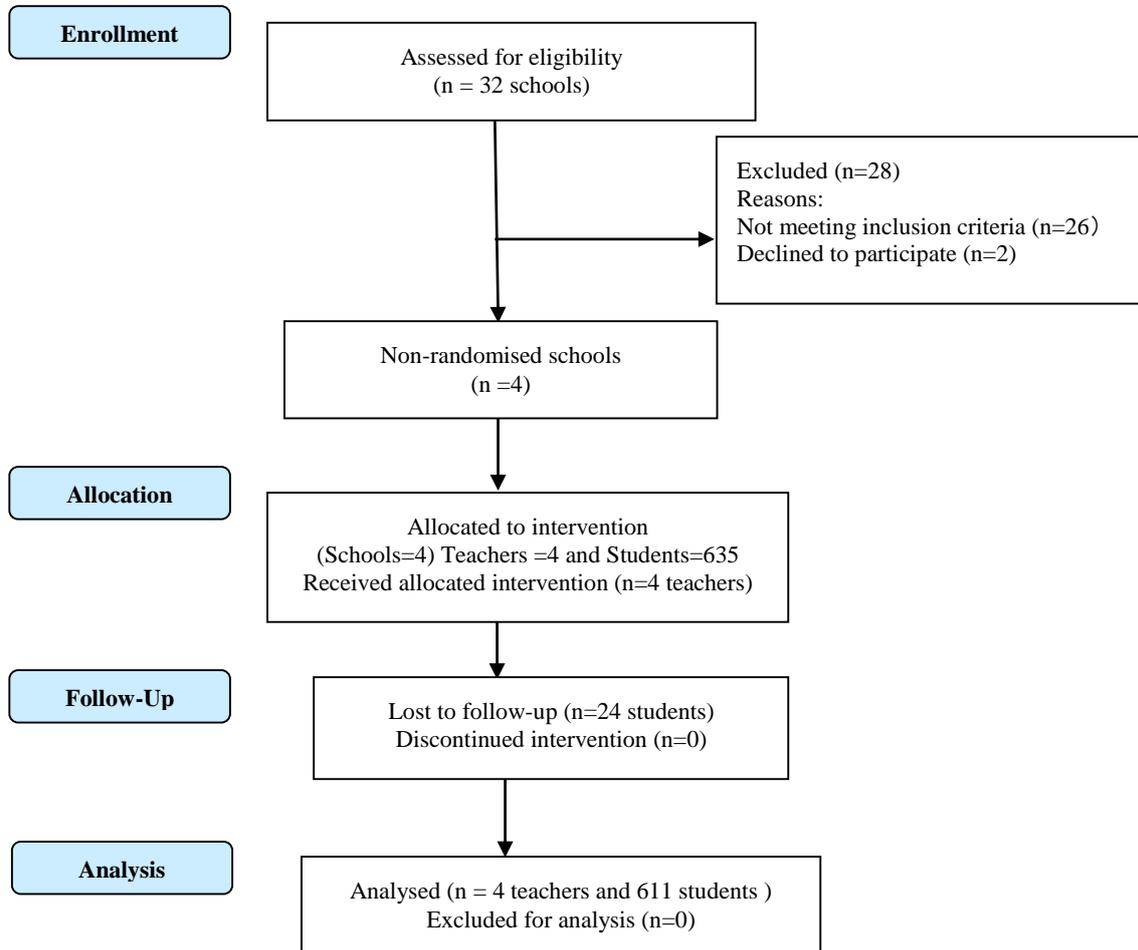


Figure 1. Flow chart of the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) shows the number of the participants through each stage of the study

Source: Authors

The research protocol was approved by the Human Research Ethics Committee of the Cancer Hospital of Pernambuco under protocol number 33/2011 and CAAE 0027.0.447.000-11. The teachers and students signed an informed consent form before joining the study. Students aged less than 18 years joined the study after their parents or guardians signed an informed consent form

Intervention

Four physical education teachers (one at each school) received the intervention which was designed to offer teacher training. All classes at each school were taught by a single teacher. The principal researcher drew up a handbook focused on the importance of the teacher in the teaching process, the way to organize PE activities based on a content selection and methodology according to the principles of the Self-Determination Theory (basic psychological needs). The researcher is an expert physical education teacher with experience in leading trainings for physical education teachers.

The teachers were provided with this handbook before the training workshop. Four individual training workshops (March to May) were conducted in each school. These trainings were delivered by a member of the research team. Each session lasted approximately 45 minutes, 10 minutes for discussing the handbook content, 15 minutes to share their practices and 20 minutes to plan the class.

The first session regarded the importance of physical activity, its health benefits, and the role of physical education in promoting physical activity. Additionally, we presented the results of studies on the reasons students skip physical education classes. The second session began with a presentation of the concepts of basic psychological needs. We also discussed the importance of the teacher in the teaching process to improve learning and increase student motivation. The characteristics and role of motivated teachers were also particularly emphasized. During the third session, we discussed with the teachers a way to organize physical education based on content selection and teaching style. Proposals for student assessment during class were also presented. The last session, we suggested contents to help each teacher to use some teaching strategies in their classes. The emphasis during training was to show the importance of physical education for the students' development and health and value the teacher's role in the development of a quality class and the importance to interact with the students. All teachers participated in all individual sessions.

Measures

The teachers' and students' economic level was determined by a Brazilian instrument with eight economic level classifications (A1, A2, B1, B2, C1, C2, D, and E)²⁰. This economic classification is based on the quantity of household possessions as TV set, radio, washing machine, videocassette/DVD player, fridge, freezer, bathroom, car and educational level of householder. Each level corresponds to an approximate mean value of family income in US dollars (1 dollar =1.80 reais in 2012), as follows: A1=US\$3.041, A2=US\$2.051, B1=US\$1.087, B2=US\$629, C1=US\$373, C2=US\$223, D=US\$151 and E=US\$86.

The evaluation of the teacher's knowledge about the teaching of physical education to high school students, lesson planning, content and teaching styles used in the classroom was obtained through a form (appendix 1) with 15 open ended questions (i.e: How often you plan your classes? How do you teach? How do you evaluate your classes, etc). In addition, at least two lessons from each teacher were observed by the researchers before and after the intervention. The teachers' motivational profile at work was assessed by the Work Motivation Inventory. This scale was used to know and report the teachers' motivation before and after the intervention. This scale was created by Blais et al.²¹ and has acceptable validity and accuracy. This instrument contains 24 items subdivided into six motivational dimensions, each containing four questions: Intrinsic Motivation (IM), Extrinsic Motivation Integrated Regulation (EMInR), Extrinsic Motivation Identified Regulation (EMIdR), Extrinsic Motivation Introjected Regulation (EMIJR), Extrinsic Motivation External Regulation (EMER), and Amotivation (AMOT). This instrument has an initial question: "*why do you teach?*" followed by 24 7-point Likert scale-type items: 1 - does not correspond in any way; 2 - corresponds very little; 3 - corresponds a little; 4 - corresponds moderately; 5 - corresponds well; 6 - corresponds very well; 7 - corresponds completely/exactly. Specifically, each subscale score was multiplied by an assigned weight according to its position on the self-determination continuum. The product scores were then added together to form a self-determination score. Self-determination was scored with the following weights as suggested by Taylor, Ntoumanis, and Standage²² (2008): 3 (three) for Intrinsic Motivation, 2 (two) for Integrated Regulation, 1 (one) for Identified Regulation, -1 (negative one) for Introjected Regulation, -2 (negative two) for External Regulation, and -3 (negative three) for

Amotivation. The scale was translated into Brazilian Portuguese and culturally adapted according to the standards proposed by Reichenheim and Moraes²³.

The Perceived Locus of Causality Questionnaire, developed by Goudas, Biddle, and Fox²⁴ assessed students' motivation to participate in physical education classes. This instrument was translated into Brazilian Portuguese and culturally adapted by Tenório et al.²⁵. This scale is subdivided into five dimensions: intrinsic motivation, extrinsic motivation identified regulation, extrinsic motivation introjected regulation, extrinsic motivation external regulation, and amotivation (Cronbach's alpha: 0,71 to 0,79). Each one consists of four items, totaling 20. We calculated a self-determination score to reflect the student self-determination, using the same process used to calculate teacher motivation. 7-point Likert scale-type items as follows: 1 – fully disagree; 2 – disagree very much; 3 – generally disagree; 4 – do not agree nor disagree; 5 – generally agree; 6 – agree very much; 7 – fully agree. The scale was scored as recommended by Vallerand⁹ and Taylor and Ntoumanis²⁶ with the following weights: 2 (two) for intrinsic motivation; 1 (one) for extrinsic motivation identified regulation; -1 (negative one) for the average between extrinsic motivation introjected and external regulation; and -2 (negative two) for amotivation.

Data Analysis

Data analyses was performed by the Statistical Package for the Social Sciences (SPSS) version 17.0. Paired t-test compared the teachers' and students' motivation scale means before and after the intervention. Differences between students' self-determined motivation stratified by school were assessed by general linear model repeated measures ANOVA and effect sizes (Cohen's *d*) were calculated. Effect sizes were interpreted as small (0.20 a 0.49), medium (0.50 a 0.79), and large (≥ 0.80)²⁷. Linear mixed effects regression analysis stratified by sex was employed to assess the differences in students' motivation (self-determination continuum) before and after the intervention. Each model was adjusted for time, socioeconomic status, and age. The Skewness and Kurtosis values of student's motivation constructs was available (appendix 2). The significance level was set at 5% ($p < 0.05$).

Results

All teachers (3 males and 1 female) had a specialization degree. The overall students' mean age was 16.39 (1.15) years, and 56.4% were females. Table 1 shows the socioeconomic and demographic characteristics of the teachers and students by school.

Table 1. Socioeconomic and demographic characteristics of teachers' and students'

	School 1	School 2	School 3	School 4
Teachers (n=4)	n=1	n=1	n=1	n=1
Age (years)	46	34	32	51
Gender	M	M	M	F
Degree completed (year)	1993	2005	2006	1985
Highest degree received	Specialist	Specialist	Specialist	Specialist
Continuing education course	Yes	Yes	Yes	Yes
Marital status	Married	Married	Married	Married
Economic level	B2	B2	B2	B2
Students (n=611)	n=171	n=100	n=143	n=197
Age (years)*	16.4 (1.3)	17.0 (1.7)	16.4 (1.1)	16.4 (1.1)
Gender	n (%)	n (%)	n (%)	n (%)
Male	82 (48.0)	53 (53.0)	44 (30.8)	87 (44.2)
Female	89 (52.0)	47(47.0)	99 (69.2)	110 (55.8)
Parents' cohabitation				
With mother	58 (33.9)	43 (43)	59 (41.2)	87 (44.2)
With father	13 (7.6)	9 (9)	4 (2.8)	9 (4.5)
With mother and father	100 (58.5)	48 (48)	80 (60)	101 (51.3)
Mother's education (years)				
≤ 3	49 (28.6)	44 (44)	53 (37.1)	74 (37.6)
4 – 8	48 (28.1)	32 (32)	46 (32.2)	67 (34.0)
≥ 9	74 (43.3)	24 (24)	44 (30.7)	56 (28.4)
Family income (USD)**				
3,041 to 2,051 (A1+A2)	4 (2.3)	0 (0)	2 (1.4)	5 (2.5)
1,087 to 629 (B1+B2)	28 (16.4)	14 (14)	19 (13.3)	19 (9.6)
373 to 223 (C1+C2)	93 (54.4)	39 (39)	63 (44.1)	100 (50.8)
151 to 86 (D+E)	46 (26.9)	47 (47)	59 (41.2)	73 (37.1)

Source: Authors

Knowledge about teaching physical education to high school students

The baseline data indicate that all teachers were planning all classes only once a year. The PE class's content consisted essentially of sports and they did not provide much choice and opportunities for students' initiatives. After the intervention, the teachers changed the class contents, all teachers' began including general exercises and games. Teachers from schools 3 and 4 also included dance classes. The teachers also tried to improve their relationship with the students by instructing them more carefully during the class and offering them feedback with regard to their performance.

Motivation

Table 2 shows the overall mean of self-determined motivation score and by teacher before and after the intervention. The teachers' combined score increased by 2.09 points after the intervention. Individually, teachers 2 and 4 presented the highest increases in motivation score.

Table 2. Means of the overall self-determined motivation scores of the four teachers and by teacher before and after the intervention

Teacher self-determined motivation scores	Baseline	Post-test	Difference
	Mean (SD)	Mean (SD)	
School 1	8.98 (1.6)	10.35 (1.4)	+1.37
School 2	7.23 (1.2)	9.78 (1.3)	+2.55
School 3	7.95 (1.4)	10.14 (1.2)	+2.19
School 4	8.50 (1.7)	10.73 (1.4)	+2.23
All teachers	8.16 (0.8)	10.25 (0.4)	+2.09

Source: Authors

Table 3 shows the students' motivation by school before and after the intervention. The analysis of variance (ANOVA) repeated measurement test showed a statistically significant main effect by time in Extrinsic Motivation Integrated Regulation ($F=10.1$; $p<0.01$) and Self-determined Motivation ($F=12.3$; $p<0.01$). There were interaction time by group in Emir Extrinsic Motivation Identified Regulation ($F=5.6$; $p<0.01$), Extrinsic Motivation External Regulation ($F=7.41$; $p<0.01$), Amotivation ($F=5.32$ $p<0.01$) and Self-determined Motivation ($F=4.87$; $p=0.03$). Assessment of the simple effects indicated that the School 3 had the higher intervention effect ($d=1.01$).

Table 3. General linear model repeated measures of students self-determined motivation scores by school

Student self-determined motivation scores	School 1	School 2	School 3	School 4	Time		Time X Group	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	F	p	F	P
Intrinsic Motivation								
Baseline	5.4 (1.5)	4.8 (1.6)	3.8 (1.5)	4.0 (1.7)	3.25	0.07	1.16	0.32
Post-test	5.6 (1.2)	5.0 (1.4)	4.8 (1.4)*	5.1 (1.5)*				
EM Identified Regulation								
Baseline	5.3 (1.4)	4.9 (1.7)	4.0 (1.5)	4.1 (1.5)	10.1	<0.01	5.6	<0.01
Post-test	5.5 (1.3)	5.1 (1.3)	5.0 (1.4)*	5.3 (1.4)*				
EM Introjected Regulation								
Baseline	3.5 (1.5)	3.6 (1.7)	3.3 (1.3)	3.3 (1.3)	2.15	0.14	0.73	0.53
Post-test	3.7 (1.4)	3.6 (1.6)	3.4 (1.4)	3.7 (1.4)*				
EM External Regulation								
Baseline	2.1 (1.2)	2.5 (1.4)	3.3 (1.4)	3.4 (1.4)	0.82	0.36	7.41	<0.01
Post-test	2.3 (1.2)	2.8 (1.3)	2.6 (1.2)*	3.2 (1.4)*				
Amotivation								
Baseline	1.9 (1.2)	2.5 (1.6)	3.0 (1.4)	3.0 (1.4)	0.09	0.76	5.32	<0.01
Post-test	2.1 (1.2)	2.7 (1.6)	2.5 (1.4)*	2.6 (1.5)*				
Self Determinant Motivation								
Baseline	8.3 (5.1)	6.8 (3.9)	1.1 (4.9)	2.0 (5.7)	12.3	<0.01	4.87	0.03
Post-test	8.7 (4.6)	6.6 (4.6)	5.9 (4.6)*	5.5 (5.4)*				
<i>d</i> (Cohen)	0.08	0.04	1.01	0.63				

Note: * $p<0.05$ baseline x post-test in each school. EM.: Extrinsic Motivation

Source: Authors

The linear mixed effects regression analysis was performed stratified by sex (Tables 4 and 5). Significant group and group by time interactions were found. For boys, Intrinsic Motivation, Extrinsic Motivation Identified Regulation, and Extrinsic Motivation External

Regulation scores were significantly higher over time. For girls results indicate all scores were higher over time except for Extrinsic Motivation External Regulation and Amotivation. Also, intrinsic motivation significantly declined with age for boys and girls (i.e., time-based differences) as well as Extrinsic Motivation Introjected Regulation for girls.

Table 4. Linear mixed effects regression analysis for boys' motivation to participate in physical education classes (n =266)

	Coef β .	SE	z	P>z	95% CI	
Self Determinant Motivation						
Time	0.302	0.287	1.05	0.293	-0.261	0.865
Socioeconomic status	0.116	0.080	1.45	0.146	-0.040	0.273
Age	-0.397	0.211	-1.890	0.059	-0.810	0.016
Constant	7.179	0.608	11.800	0.000	5.987	8.372
Intrinsic Motivation						
Time	0.240	0.090	2.67	0.008	0.064	0.416
Socioeconomic status	0.003	0.022	0.12	0.902	-0.040	0.045
Age	-0.151	0.058	-2.63	0.008	-0.264	-0.039
Constant	5.304	0.149	35.51	0.000	5.012	5.597
Extrinsic Motivation Identified Regulation						
Time	0.240	0.079	3.02	0.002	0.084	0.395
Socioeconomic status	0.015	0.022	0.68	0.499	-0.029	0.059
Age	-0.082	0.060	-1.38	0.168	-0.199	0.035
Constant	5.266	0.089	58.85	0.000	5.091	5.442
Extrinsic Motivation Introjected Regulation						
Time	0.080	0.086	0.93	0.351	-0.088	0.248
Socioeconomic status	-0.029	0.025	-1.18	0.237	-0.078	0.019
Age	-0.072	0.066	-1.1	0.273	-0.202	0.057
Constant	3.774	0.092	41.01	0.000	3.594	3.954
Extrinsic Motivation External Regulation						
Time	0.217	0.088	2.47	0.014	0.045	0.390
Socioeconomic status	-0.030	0.021	-1.42	0.157	-0.070	0.011
Age	0.054	0.055	0.99	0.322	-0.053	0.162
Constant	2.439	0.154	15.82	0.000	2.137	2.741
Amotivation						
Time	0.120	0.096	1.25	0.211	-0.068	0.308
Socioeconomic status	-0.042	0.021	-2.01	0.045	-0.084	-0.001
Age	0.089	0.056	1.6	0.110	-0.020	0.198
Constant	2.211	0.123	17.91	0.000	1.969	2.453

Source: Authors

Table 5. Linear mixed effects regression analysis for girls' motivation to participate in physical education classes (n=345)

	Coef. β	SE	z	P>z	95% CI	
Self-Determinant Motivation						
Time	3.765	0.356	10.56	0.000	3.066	4.463
Socioeconomic status	0.006	0.040	0.14	0.885	-0.073	0.085
Age	-0.166	0.168	-0.99	0.321	-0.495	0.162
Constant	2.360	1.228	1.92	0.055	-0.047	4.767
Intrinsic Motivation						
Time	1.035	0.108	9.62	0.000	0.824	1.246
Socioeconomic status	-0.005	0.013	-0.36	0.715	-0.029	0.020
Age	-0.121	0.052	-2.32	0.020	-0.223	-0.019
Constant	3.925	0.280	14	0.000	3.375	4.474
Extrinsic Motivation Identified Regulation						
Time	1.040	0.104	10.02	0.000	0.836	1.243
Socioeconomic status	0.007	0.012	0.61	0.542	-0.016	0.030
Age	-0.093	0.048	-1.92	0.055	-0.187	0.002
Constant	4.030	0.228	17.65	0.000	3.582	4.478
Extrinsic Motivation Introjected Regulation						
Time	0.259	0.098	2.65	0.008	0.067	0.450
Socioeconomic status	-0.011	0.011	-1.03	0.305	-0.033	0.010
Age	-0.141	0.044	-3.18	0.001	-0.227	-0.054
Constant	3.178	0.071	44.67	0.000	3.038	3.317
Extrinsic Motivation External Regulation						
Time	-0.486	0.094	-5.17	0.000	-0.670	-0.302
Socioeconomic status	0.006	0.011	0.5	0.614	-0.016	0.028
Age	-0.019	0.046	-0.4	0.689	-0.109	0.072
Constant	3.191	0.263	12.13	0.000	2.676	3.707
Amotivation						
Time	-0.399	0.103	-3.86	0.000	-0.602	-0.197
Socioeconomic status	0.008	0.012	0.64	0.52	-0.016	0.032
Age	-0.097	0.051	-1.91	0.056	-0.196	0.003
Constant	2.941	0.188	15.68	0.000	2.573	3.308

Source: Authors

Discussion

This study assessed the teachers' and students' motivation in PE classes pre and post intervention. A significant increase in teachers' and students' motivation score was observed after the intervention. Also we found a statistically significant main effect by time in Extrinsic Motivation Identified Regulation and Self-determined Motivation. There were significant interaction time by group in Extrinsic Motivation Identified Regulation), Extrinsic Motivation External Regulation, Amotivation and Self-determined Motivation.

Few studies have assessed the motivation of PE teachers at work²⁸. A study conducted with 204 United Kingdom physical education teachers that also used the Work Motivation Inventory found a mean work motivation score of 8.62²², very similar to the present score before the intervention. Among the 4 teachers we observed higher mean self-determined

motivation score for the two older teachers (ages 46 and 51), who graduated longer ago and had more work experience than for the two younger teachers (ages 32 and 34), a trend that continued after the intervention. A possible explanation for this finding is experience acquired during class and perceived challenges in conducting activities may encourage teachers to adopt and adapt teaching strategies, possibly increasing their motivation.

All teachers increased self-determined motivation score after the intervention. This change could be associated with knowledge acquired during training and awareness of his competence and autonomy to plan his classes, factors that affect motivation. The importance of encouraging teacher motivation is recognized because motivation is related to teaching methods²⁹.

The results of studies conducted in schools using the Self-Determination Theory indicate that motivated teachers are more open to changing methods and teaching contents and that this can influence student motivation and participation in class^{14,30}. This premise was realized during an intervention in France, with three PE teachers and 185 students to test the effects of a training program based on motivation and teaching style. The teachers managed to improve their teaching style, and the students were receptive to these changes, becoming more satisfied, motivated, and self-determined, and participating more in class¹⁵.

The teacher's training was conducted individually in our intervention program. As a result, it was possible to deepen the discussion of the contents in their course materials, and of the difficulties that are faced everyday while teaching PE. Strategies such as collective discussion, study groups, in both presential and online learning forms, are suggested when it comes to applying the same training to large groups of teachers.

During the training the teachers stated the meetings had helped in bringing them up to date with specific knowledge regarding the teaching of physical education and exchanging experiences. They have also said that practices like this were either unusual or infrequent at the school. Such information has enabled us to realize the importance of recognizing and valuing teachers input as a way to make them feel an integral part of the school, and as a result to be more motivated to work.

Regarding student's motivation, we found different effect size by school. The students from School 3 and 4 had the highest changes in all motivation scores. We saw the improvement for the autonomous motivation (self-determined motivation, extrinsic motivation identified regulation) and decrease the controlled motivation (extrinsic motivation external regulation and amotivation). One explanation for this increase is that changes in teacher motivation may have had a positive impact on student's motivation, mainly in schools with the lowest motivation scores. The motivation of students from School 2 did not change significantly after the intervention and we saw the lowest intervention's effect.

We also analyzed the students' motivation stratified by sex. We found some differences between girls and boys. For boys, Intrinsic Motivation, Extrinsic Motivation Identified Regulation, and Extrinsic Motivation External Regulation score were statistically significant higher over time. Girls results indicate all scores were higher over time except for Extrinsic Motivation External Regulation and amotivation. Egli et al.³¹ have shown gender differences in motivational regulations by sex. Males tended to be more motivated by intrinsic factors, whereas females were more motivated by extrinsic factors. However, a study with British secondary school students had not found significant difference for any of the motivational regulations by sex³².

We observed that the traditional sports-based curriculum may have changed as the teachers had included other content such as dance, games, and exercise. The girls may have more self-competence, engagement and motivation in physical education class. However, for boys the reverse was true, the lack of competition and different content could have demotivated them. The challenge is how to structure class activities in order to engage and

motivate all students'. One strategy would be providing some level of autonomy where students should make choices related to the physical education class content. Providing a wider selection of content increases the likelihood that students' will find something they like that will keep them physically engaged and motivated.

Some studies also used the Perceived Locus of Causality Questionnaire to assess self-determined motivation in students but found different motivation and motivation dimension scores. An assessment of 787 British students found a mean general self-motivation score of 7.51, higher than the present score²⁶. A study that compared self-determined motivation dimension scores of United Kingdom and Hong Kong students found higher scores in the latter³³, but still lower than those of the present study. On the other hand, a study conducted in northwest England with 428 students found mean scores similar to the present scores⁵. The disparities may be explained by the cultural and environmental differences between Brazil and the developed countries. Additionally, the organization and structure of PE classes vary by country.

Identification and assessment of students' motivation dimensions are important because understanding the direction of motivational behavior will help to implement strategies that increase motivation. More motivated students learn more and use the teachings throughout life. Hence, motivated students in physical education classes tend to participate more in physical activities away from the school environment, contributing to a healthier life style³⁴. One should aim to develop intrinsic motivation since this is one of the most important predictors of the intention to practice physical activities and sports; it is also associated with better learning and socialization³.

Few studies assessed the relationship between physical education teacher and student motivation. Taylor and Ntoumanis²⁶ did not find a significant relationship between these two variables in a study of 51 physical education teachers and their 787 British students. The authors blamed the absence of association between teacher and student motivation on the small number of teachers in their sample and warned that the results should be interpreted with caution.

The present results indicate the importance of providing teacher training courses regularly, focusing on teaching styles and allowing teachers to use this knowledge to feel more competent, autonomous, motivated, and ready to create conditions that motivate their students. Others studies indicate the importance from the PE teachers' professional development training to change the teachers' teaching behavior^{35,36}. Van den Berghe *et al.*³⁷ show that teacher's behavior related with support for students' basic physiological needs can influence the student behavior in physical education classes.

Our intervention showed the training was effective, since it brought up changes in the motivation levels of teachers and students, especially for girls and from School 3 and 4. We believed the training has piqued the teacher's interest in the search for new knowledge and created an opportunity to share their practice. However, this strategy is not enough to improve motivation during the observed period. An intrinsically motivated individual can endorse an activity because it is interesting, challenging and enjoyable, and is more likely to be an autonomous motivated. Previous research in the context of PE has shown that autonomous motivation is associated with a number of positive outcomes, including increased engagement³⁸, concentration and best grades³⁹.

Our results suggest that training intervention increases teacher motivation and apparently, student motivation as well. However, the results should be interpreted with caution because of some study limitations, such as a short time intervention, a small number of teachers and schools, and the absence of a control group, which can jeopardize its external validity. Also, we suggest using the Multidimensional Work Motivation Scale⁴⁰ to measure

the teacher's motivation, because it tested the psychometric properties and was adapted to Brazilian population.

Conclusion

These results suggest that teacher training can lead to some improvements in teacher and students motivation. It is important to promote continued teachers training to improve or update the knowledge related to class lesson plan, class organization, how activities develop in class, the clarity and quality of teacher feedback among others. Therefore, if a teaching environment is well structured students and teachers can benefit from these investments. Consequently, more motivated students could participate more in physical education classes and physical activity. It would be interesting for future intervention study to evaluate for a long time and assess others variables related to motivation (e.g.: Psychological need satisfaction) as well as physical activity.

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