

A School-Based Motivational Intervention to Promote Physical Activity from a Self-determination Theory Perspective

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Abstract

This study analyzed the effects of a multidimensional intervention to promote physical activity (PA) in school, based on self-determination theory. The study involved 88 students, aged between 14 and 17 years, who were divided into a control group ($n = 59$) and an experimental group ($n = 29$). In the experimental group, a 6-month intervention was conducted, applying a teaching unit of fitness and health in physical education (PE) classes, an extracurricular program of healthy PA, and meetings with families. Questionnaires were administered to measure different motivational variables and PA levels at four time points. Significant differences were found in favor of the experimental group in parental and peer autonomy support; integrated regulation in PE; autonomy, intrinsic and identified regulation in leisure-time PA; moderate, hard, and very hard PA; and physical self-worth. Motivational effects were maintained over time but the effects on PA levels disappeared at 6 months.

Keywords: autonomous motivation, school, physical exercise, adolescence, self-concept

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Introduction

Sedentary behavior is one of the main worldwide risk factors for illness and death (World Health Organization, 2009), it has a high economic cost (Kruk, 2014) and therefore, represents a serious public health problem. According to recent data from the Eurobarometer (TNS Opinion & Social, 2014), carried out in 27 countries of the European Union, 44% of the population never does any moderate physical activity (PA), and 54% never does any vigorous PA. These percentages were higher in Spain, reaching 57 and 67%, respectively. In the case of Spanish children and adolescents between 6-18 years, only 48% did at least 60 minutes of daily PA (Roman, Serra-Majem, Ribas-Barba, Pérez-Rodrigo, & Aranceta, 2008). These data are cause for concern and make it necessary to conduct interventions for the promotion of the PA in the population.

In this sense, the school represents an ideal context in which to develop active, healthy lifestyles, given that children and adolescents remain a great deal of time at school (Lonsdale et al., 2013). In addition, behaviors learned at this stage may be maintained in adulthood (Telama et al., 2014). Recent studies show, on the one hand, the need for these interventions to promote PA at school to be carried out in a multidimensional format, encompassing physical education (PE) classes (Martinez-Lopez, Grao-Cruces, Moral-Garcia, & Pantoja-Vallejo, 2012) and leisure-time after school (Atkin, Gorely, Biddle, Cavill, & Foster, 2011), and also involving the families in the process (Alberga et al., 2013; Murillo-Pardo, Camacho-Miñano et al., 2015). On the other hand, these interventions should be based on theoretical frameworks for the designing of specific guidelines (Biddle, Mutrie, Gorely, & Blamey, 2012). Therefore, this study was developed to assess the effects of a multidimensional intervention to promote PA at school on different motivational variables and PA levels in

adolescents, drawing from the postulates of self-determination theory (SDT; Ryan & Deci, 2000).

SDT is the motivational theory that is currently developing the most research in this field and has been widely used in recent years to develop intervention strategies aimed at improving student motivation in PE classes (Amado et al., 2014; Cheon & Reeve, 2015), as well as increasing their participation in PA (González-Cutre, Ferriz et al., 2014; Murillo-Pardo, García-Bengoechea, Generelo-Lanaspa, Zaragoza-Casterad, & Julián-Clemente, 2015; Smith et al., 2014). SDT states that everyone has three basic psychological needs (competence, autonomy, and relatedness), whose satisfaction is related to the development of more autonomous forms of motivation and more positive consequences. The need for autonomy refers to performing actions without outside pressure, and being able to choose freely and make one's own decisions. Competence concerns feeling effective in one's continued interactions with the environment, and being able to exercise one's capabilities and to seek optimal challenges. Relatedness is identified with the feeling of connection with others, developed through the process of socialization. In this line, it is necessary to help adolescents to feel competent, autonomous, and related in their PE classes and during their participation in PA.

According to SDT, the satisfaction of these needs leads adolescents to acquire more autonomous forms of motivation towards PE and leisure-time PA: intrinsic motivation, integrated and identified regulation. Intrinsic motivation represents a person's commitment to carry out an activity for its enjoyment and pleasure, so that the activity is an end in itself. Integrated regulation occurs when people recognize as their own the values and the needs of the activity and integrate it into their lifestyle. Identified regulation is a result of one's knowledge of the importance and benefits of carrying out certain behaviors (e.g., the benefits of PA for health). However, frustration of the basic psychological needs is associated with

more controlled motivational forms (introjected and external regulation) and with amotivation. Introjected regulation implies carrying out the activity due to feelings of guilt or anxiety, whereas external regulation is characterized by seeking external reinforcements and avoiding punishment. Finally, amotivation represents a state of indifference toward the activity, not finding enough benefits compared to the costs involved, and therefore, not having any intention to carry out the activity.

Satisfaction of the basic psychological needs and acquisition of more autonomous forms of motivation in PA contexts have been associated with different positive consequences, such as increased levels of PA (Owen, Smith, Lubans, Ng, & Lonsdale, 2014; Teixeira, Carraça, Markland, Silva, & Ryan, 2012) and a better physical self-concept (Standage, Gillison, Ntoumanis, & Treasure, 2012). Young people who are sufficiently active, compared with inactive ones, as well as enjoying better physical health, report more positive physical self-concept and self-esteem (Dishman et al., 2006).

SDT also states that the social agents (parents, peers, and teachers) play a very important role in the development of a more positive motivation towards PA and, therefore, their influence must be taken into account in the interventions of promotion of PA. For example, parents' levels of PA are related to their children's; children are more likely to take part in PA if their parents perceive it as fun, and parental support is essential throughout the process (Alberga et al., 2013). A recent qualitative study conducted to design and improve an intervention for the promotion of PA at school (Murillo-Pardo, Camacho-Miñano et al., 2015) shows that involvement in PA is not the adolescents' sole responsibility, but rather that their close environment also influences their choice. In SDT, the concept of autonomy support was coined to refer to the support of the different social agents who allow choice, show respect and encourage the relevance, value, and utility of the activities (Stroet, Opdenakker, & Minnaert, 2013). Studies in the field of education have shown the effectiveness of

intervention programs designed to support autonomy (Su & Reeve, 2012). Teacher autonomy support in PE classes, and parental and peer autonomy support in leisure-time PA have been correlated with satisfaction of the basic psychological needs, more autonomous forms of motivation, and participation in PA (González-Cutre, Sicilia, Beas-Jiménez, & Hagger, 2014).

Previous studies have already addressed initiatives of PA promotion at school under the SDT paradigm, yielding interesting results: 1) reduction of sedentary behavior and increase of PA in PE classes (Lonsdale et al., 2013); (2) reduction of sedentary time in everyday life (Murillo-Pardo, García-Bengoechea et al., 2015); (3) increase in the satisfaction of basic psychological needs, autonomous motivation and enjoyment of PE through a sport education program focused on autonomy support (Wallhead, Gran, & Vidoni, 2014); (4) motivational improvements in PE and leisure-time PA, as well as greater participation in after-school PA, through meetings with parents and activities with the students associated with videos centered on the promotion of PA (González-Cutre, Ferriz et al., 2014).

However, new multidimensional interventions are necessary, which guarantee continuity and allow a transfer of motivation in PE to a leisure-time context, providing specific opportunities for PA at school outside school hours (Murillo-Pardo, Camacho-Miñano et al., 2015; Wallhead et al., 2014). The present study had the purpose of analyzing the effects of a multidimensional intervention for the promotion of PA at school, based on SDT principles. The intervention lasted 6 months and covered the following points: 1) development of a teaching unit of fitness and health, consisting of 15 sessions in PE class, applying motivational strategies to satisfy students' basic psychological needs; (2) providing a motivational program of healthy PA carried out at school outside regular school hours, guaranteeing continuity between PE and leisure-time PA. To our knowledge, this study is the first that implements this action in interventions of promotion of PA based on SDT; (3) meetings with parents to instill in them the importance of their children's participation in PA.

We compared the effects of the intervention in an experimental group and a control group that did not receive any treatment. We measured students' perceived PE teacher, parental, and peer autonomy support, basic psychological needs satisfaction, and motivation in PE and in leisure-time PA, physical self-concept, and PA levels. We expected an improvement in the experimental group in all these variables across the different areas of intervention.

Method

Participants

Participants in this study were 88 students enrolled in the last two years of Compulsory Secondary Education (36 boys and 52 girls), aged between 14 and 17 years ($M = 14.67$, $SD = .66$), from two schools of a Spanish city. The participants were divided into a control group ($n = 59$) and an experimental group ($n = 29$). The control group was made up of 21 boys and 38 girls ($M_{age} = 14.51$, $SD = .62$) and the experimental group of 15 boys and 14 girls ($M_{age} = 15.0$, $SD = .59$).

Measures

Autonomy support. To measure autonomy support for PA participation perceived by the adolescents in the PE teacher, parents, and peers, we used the Perceived Autonomy Support Scale for Exercise Settings (PASSES) of Hagger et al. (2007). This instrument has shown suitable psychometric properties in Spain for the PE teacher's measurement (Moreno, Parra, & Gonzalez-Cutre, 2008) and for parents' and peers' measurement (González-Cutre, Sicilia et al., 2014). Concretely, confirmatory factor analysis showed acceptable fit indices (CFI = .92, IFI = .92, RMSEA = .08, SRMR = .04 for teachers; CFI = .95, IFI = .95, RMSEA = .078, SRMR = .036 for parents; CFI = .92, IFI = .92, RMSEA = .10, SRMR = .043 for peers) and good internal consistency was obtained in these studies (Cronbach's alpha of .91 for teachers, .93 for parents, and .94 for peers). The scale was administered three times, using

the same 12 items, but each time, referring to one of the three social agents (e.g., "I think that my PE teacher/parents/peers understand why I choose to do active sports and/or vigorous exercise in my free time"). The items were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Basic psychological needs. We used the Spanish version (Moreno, González-Cutre, Chillón, & Parra, 2008; Sánchez & Núñez, 2007) of the Basic Psychological Needs in Exercise Scale (BPNES) of Vlachopoulos and Michailidou (2006). We measured satisfaction of the basic psychological needs for competence (e.g., I execute effectively the exercises), autonomy (e.g., I have the opportunity to make choices with respect to the way I do the exercises), and relatedness (e.g., I feel very comfortable with my classmates/the other exercise or sport participants), both in the context of PE and in the context of leisure-time PA, through 12 items (four per factor) that were rated on a 5-point Likert scale ranging from 1 (*totally disagree*) 5 (*very strongly agree*). This scale has shown acceptable fit indices in confirmatory factor analysis: CFI = .94, IFI = .94, RMSEA = .07, SRMR = .07 for the PE context (Moreno, González-Cutre et al., 2008); and CFI = .95, IFI = .95, RMSEA = .08, SRMR = .05 for the leisure-time PA context (Sánchez & Núñez, 2007). The analysis of internal consistency was also satisfactory in these previous studies: Cronbach's alpha of .81 for autonomy, .78 for competence, and .84 for relatedness in PE; and .74 for autonomy, .87 for competence, and .81 for relatedness in leisure-time PA.

Types of motivation. To measure different types of motivation established by SDT in PE, we used the Perceived Locus of Causality Scale (PLOC, Goudas, Biddle, & Fox, 1994), in its Spanish version, which includes items to measure integrated regulation (Ferriz, González-Cutre, & Sicilia, 2015). The scale contains the stem "I take part in this PE class..." and comprises a total of 24 items (four per factor): intrinsic motivation (e.g., "because PE is fun"), integrated regulation (e.g., "because it matches my lifestyle"), identified regulation

(e.g., “because I want to learn sport skills”), introjected regulation (e.g., “because I would feel bad about myself if I didn’t”), external regulation (e.g., “because that’s what I am supposed to do”) and amotivation (e.g., “but I really feel I’m wasting my time in PE”). Responses were rated on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Ferriz et al. (2015) obtained acceptable fit indices in confirmatory factor analysis (CFI = .92, IFI = .92, RMSEA = .065, SRMR = .065), the factor structure of the scale was invariant across gender and the city of origin of students, and Cronbach’s alpha values ranged from .69 to .93.

To measure motivation in leisure-time PA, we used the Behavioural Regulation in Exercise Questionnaire (BREQ-3) of Wilson, Rodgers, Loitz, and Scime (2006), validated in the Spanish context by González-Cutre, Sicilia, and Fernández (2010). This questionnaire contains the stem, “Why do you engage in exercise?”, followed by 23 items to measure different types of motivation: intrinsic motivation (e.g., “I exercise because it’s fun”), integrated regulation (e.g., “I consider exercise a fundamental part of who I am”), identified regulation (e.g., “I value the benefits of exercise”), introjected regulation (e.g., “I feel guilty when I don’t exercise”), external regulation (e.g., “I exercise because other people say I should”) and amotivation (e.g., “I don’t see the point in exercising”). Responses were rated on a 4-point Likert scale ranging from 1 (*not true for me*) to 4 (*very true for me*). González-Cutre et al. (2010) showed adequate psychometric properties of the instrument using confirmatory factor analysis (CFI = .91, IFI = .91, RMSEA = .06, SRMR = .06), the model was invariant across gender and age, and the analysis of internal consistency by Cronbach’s alpha ranged from .66 to .87.

Physical self-concept. We used the Physical Self-Perception Profile (PSPP, Fox & Corbin, 1989) in its Spanish version (Moreno & Cervelló, 2005). The questionnaire is made up of 30 direct and inverse items grouped into five factors: physical condition (e.g., “I always maintain excellent physical condition and fitness”), body attractiveness (e.g., “I am always

satisfied with my physical appearance”), perceived competence (e.g., “I think that I am always among the best when it comes to participating in physical activities”), physical strength (e.g., “My muscles are as strong as those of most people of my sex”), and physical self-worth (e.g., “I do not feel sure of myself when participating in physical activities”). Responses were rated on a 4-point Likert scale ranging from 1 (*completely disagree*) to 4 (*completely agree*). Moreno and Cervelló (2005) revealed acceptable fit indices in confirmatory factor analysis (CFI = .95, RMSEA = .073) and Cronbach’s alpha values of .75 for physical condition, .76 for body attractiveness, .80 for perceived competence, .60 for physical strength, and .73 for physical self-worth.

Physical activity levels. The 7 Day-PAR questionnaire was used to measure the levels of self-reported daily PA (Sallis et al., 1985; Sallis, 1997), in its Spanish version (Grandes et al., 2009), which presents adequate reliability and validity. This questionnaire is used to recall the PA carried out during the past week. Participants must indicate the minutes dedicated every day of the week to PA, distinguishing the different intensities: moderate (“activities that feel like walking at a normal rhythm”), hard (“activities that are not as intense or hard as running, but require more effort than moderate activity”), very hard (“activities that feel like running”). The questionnaire also collects information about the participants’ daily hours of sleep. The questionnaire protocol allowed us to calculate the total daily minutes of light PA by subtracting the time dedicated to sleeping and to doing moderate, hard, or very hard PA from the total minutes of the day. A recent study (Beltrán-Carrillo et al., 2016) compared the measure of this questionnaire with the objective data obtained from accelerometers (concurrent validity), showing a positive correlation between the two measures. The correlation coefficient was higher as the intensity of PA increased (ranging from .25 to .38, $p < .01$).

Design and Procedure

We selected two schools from the same Spanish city in which the authors' university was located due to the accessibility of the sample, and the staff of both schools agreed to participate in the study. The schools were located in two neighborhoods with similar characteristics separated by a distance of only 4 kms. The majority of students were Caucasian and of a middle-income socio-economic status. The two schools had similar facilities and the same educational curriculum, and they represented the standard Spanish school. Each of the schools was assigned to an experimental condition, such that the control group was made up of three classes from School A and the experimental group of five classes from School B. Although initially, there was a similar number of participants in both groups, the experimental group sample was finally smaller because not all the students of this group decided to participate in the extracurricular PA program offered, and only those who participated ($n = 29$) were taken into account in the analysis.

Each of the two groups was led by a different PE teacher, both with more than 15 years of teaching experience. We selected these two teachers because they were the PE teachers of the most of the classes in the last two years of Compulsory Secondary Education in these schools. This education stage is characterized by a decline in adolescents' PA participation and we were particularly interested in developing the intervention with these students. In the control group, the teacher was simply told to teach a teaching unit of 15 one-hour sessions of the content block of fitness and health (at the rate of two sessions per week) the same way he usually taught. In the experimental group, three simultaneous actions were carried out (Figure 1). The first one consisted of a teaching unit of 15 one-hour sessions (two sessions per week) of the content block of fitness and health in PE classes. The contents and activities of the teaching unit were developed by our research group, and carried out by the PE teacher, who was trained in motivational strategies to promote satisfaction of students' basic psychological needs. The contents were oriented practically toward knowledge about the problem of

sedentary behavior, the promotion of healthy habits and recommendations about PA, including different methods and games to improve physical condition.

[Insert Figure 1 here]

The second action consisted of offering a program of free extracurricular PA in the afternoons, whose contents were consistent with PE classes. The program was launched at the same time as the teaching unit of physical fitness and health in PE classes. This program was taught by a different teacher, who was also trained in motivational strategies. This program had a duration of 6 months, with three 90-minute weekly sessions. The PA program design complied with the recommendations of PA for adolescents described by Sallis and Patrick (1994). All the sessions contained a warm-up (10% of the practice time), a set of aerobic resistance (60% of practice time), a strength-resistance set (20% of practice time), and flexibility and cool-off (10% of practice time). The aerobic resistance activities were of moderate to vigorous intensity (60-90% of maximum heart rate). The strength activities were based on games and exercises involving the large muscle groups. In addition, the development of coordination and balance was also addressed.

The motivational strategies employed by the PE teacher and the PA program teacher were established to encourage the participation in healthy PA through the satisfaction of basic psychological needs and the increase of autonomous motivation. The following are some examples of the strategies used to promote satisfaction of the basic psychological needs. To promote satisfaction of the need for competence, task goals were appropriately proposed, adapting them to the students' capabilities and providing positive feedback. To foster autonomy, the students were allowed to choose the activities they liked the most and about which they wanted to learn or deepen their knowledge, from among different activities with the same goals. In addition, they were given the opportunity to express their opinion at the end of each session so we could find out what they thought. Finally, to satisfy the need for

relatedness among the students, we used strategies in group formation and we developed cooperative activities with a common goal to be achieved together. To encourage the teacher-student relationship, the teachers sometimes participated with the students in the proposed activities, and they also tried to ask about daily aspects of their lives, empathizing with them and showing concern about their problems outside of the class.

To ensure that both the PE and PA program teachers correctly applied the motivational strategies in which they had been trained, we recorded three sessions taught by each teacher. We also recorded three sessions of the teaching unit taught by the teacher of the control group. Analysis of the videos was carried out through an instrument drawn up for this purpose, consisting of five items to verify the application of motivational strategies to promote competence (e.g., “The teacher implements a progressive learning process, from lowest to highest difficulty”), four items for autonomy (e.g., “The teacher allows the student to choose: tasks, music, material, etc.”) and four items for relatedness: between students (e.g., “The teacher favors the relationship among the students: group tasks are proposed in which all members are necessary for success, the same groups are not always formed, etc.”); teacher-student (e.g., “The teacher shows an affective attitude toward the students”). To confer validity to the instrument, prior to its use, the items were assessed by three experts in SDT, foreign to our research group, who rated the representativeness of each of the items with regard to the motivational strategy for which it had been designed on a 5-point Likert scale, ranging from 1 (*not very representative*) to 5 (*very representative*). After addressing the comments of reviewers and making the pertinent changes, we repeated the process of item assessment. Finally, only those items that obtained at least a mean rating of 4 points by the three experts were retained.

The videos were analyzed by one of the members of the research group, a specialist in SDT, by simply stating whether or not the strategies were applied during the session. The PE

teacher of the experimental group fulfilled 100% of the competence strategies, 100% of the autonomy strategies, and 100% of the relatedness strategies; that is, a 100% implementation of the strategies to promote satisfaction of the basic psychological needs. The PA program teacher obtained a percentage of 80% for competence, 56.25% for autonomy, 87.5% for relatedness, that is, a total of 75%. The PE teacher of the control group obtained smaller percentages: 33.3% for competence, 33.3% for autonomy, 8.3% for relatedness; a total of 23.07%.

In the third action, three meetings were held with the parents, and a trekking excursion was organized in the natural environment, thereby engaging the parents in doing PA together with their children. The first meeting was held after the first data collection (Time 1), just before starting the intervention in PE classes and in the extracurricular PA program. In this meeting, we explained the project and the negative consequences of a sedentary lifestyle on health and well-being, trying to clarify any false beliefs and possible doubts of the parents. The second meeting, which took place at the same time as the intervention in PE, dealt with recommendations of healthy PA, according to experts. The last meeting took place at the end of the teaching unit of physical fitness and health in PE, and addressed strategies to promote the participation in PA by developing positive motivation in their children: allowing them to choose the physical activity they want to participate in, asking them how the training has fared, going to see them when they participate in physical activity, providing positive reinforcements, emphasizing aspects of self-improvement, effort, and fun, etc. In addition, we made a final request for them to become involved and to encourage their children to maintain healthy and active lifestyles. The trekking excursion took place just before the end of the extracurricular PA program.

The study was approved by the Research Ethics Committee of a public university. We then requested permission from the education administration of the government of the

autonomous community in which the study was conducted and from the school boards. Finally, the parents of the students involved in the study signed their informed consent. The participation of the students was completely voluntary, and both parents and students were informed of the goals and procedures of the study.

Data collection was carried out at four separate times. At Time 1, we measured the variables before any kind of intervention took place to obtain the initial data. The data were measured again at the end of the intervention of the teaching unit of fitness and health in PE (Time 2). The third measurement (Time 3) took place at the end of the extracurricular PA program, and the follow-up (Time 4) was performed 6 months after completing all the interventions.

At each of the four times, the questionnaires were administered in two different sessions, lasting approximately 40 minutes. In the first session, the students completed the questionnaires related to the PE context (teacher autonomy support, need satisfaction, and motivation) and the self-concept questionnaire. In the second session, seven days later, we administered the motivational questionnaires related to leisure-time PA (parental and peer autonomy support, need satisfaction and motivation) and the recall questionnaire of the amount of PA done that week (7 day-PAR).

Data Analysis

The data were analyzed with the statistical package SPSS 19. The Kolmogorov-Smirnov test was performed to determine the normality of the data, revealing that many variables were non-normal ($p < .05$). Also taking into account that the experimental group was small, we decided to use nonparametric tests. To analyze group differences, a Mann-Whitney *U*-test for two independent samples at each measurement time was conducted. To analyze the intra-group differences across the four times, Friedman test for related samples was performed. Finally, multiple comparisons were conducted using Wilcoxon's test for two

related samples to determine between which specific data there were significant differences. The Bonferroni adjustment was used to control the rate of error. Given that, in our study, data were collected at four moments and that six pair-wise comparisons were carried out, the level of significance for this test was of $.05/6$ ($p < .008$).

For all nonparametric comparisons of means between two samples, we calculated the effect size with Cliff's delta calculator (Macbeth, Razumiejczyk, & Ledesma, 2011). A Cliff delta (δ) value of .147 is considered small, a value of .33 is considered medium, and a value of .474 is considered large (Romano, Kromrey, Coraggio, & Skowronek, 2006). Internal consistency of the variables was assessed for all data collections through Cronbach's alpha.

Results

Preliminary Analysis (Time 1)

The Mann-Whitney U -test (Table 1) on the data obtained at Time 1 revealed significant pretest group differences. This represents a common problem in natural setting interventions, in which modifications to balance the groups are not possible because they are pre-established by the school. Specifically, significant differences were found in teacher autonomy support, satisfaction of basic psychological needs in PE (competence, autonomy and relatedness), and intrinsic, identified, and introjected regulation in PE. In addition, in leisure-time PA, significant differences in two basic psychological needs, competence and relatedness, were found. The experimental group obtained the highest mean score in all these variables.

Effects of the Intervention

Inter-Group Effects

After completing the teaching unit (Time 2). After the intervention carried out in the teaching unit of physical fitness and health in PE and the meetings with the parents, the Mann-Whitney's U -test (Table 1) at Time 2 showed that the significant pretest differences in teacher autonomy support, autonomy in PE, intrinsic motivation in PE, and relatedness in

leisure-time PA were maintained. In addition, there were differences in peer and parental autonomy support, external regulation and amotivation in PE, autonomy and intrinsic motivation in leisure-time PA, and in the daily minutes of moderate PA. The experimental group obtained higher means in all the variables, except for amotivation in PE, where the control group's means were higher.

Upon completing the extracurricular PA program (Time 3). The Mann-Whitney *U*-test (Table 1) for Time 3 showed that the initial significant differences in teacher autonomy support, autonomy and relatedness in PE, intrinsic motivation, identified and introjected regulation in PE, and competence and relatedness in leisure-time PA were maintained. In addition, the significant differences found at Time 2 in peer and parental autonomy support, amotivation in PE, and autonomy and intrinsic motivation in leisure-time PA were also maintained, while new differences emerged in integrated regulation in PE, identified regulation and amotivation in leisure-time PA, and daily minutes of hard and very hard PA. The experimental group obtained higher mean scores in all variables, except for amotivation in PE and in leisure-time PA, where the score was higher in the control group.

6 months follow-up (Time 4). The significant Time 2 differences in parental and peer autonomy support, amotivation in PE, autonomy and intrinsic motivation in leisure-time PA, as well as the Time 3 difference in amotivation in leisure-time PA were all maintained. In addition, significant differences emerged in physical self-worth, favoring the experimental group (Table 1).

[Insert Table 1 here]

Intra-Group Effects

We analyzed the intra-group changes that occurred across the four measurement times with the Friedman test for related samples. In the experimental group, we found significant differences between the mean scores at the different times for the following variables: teacher

autonomy support ($p = .003$); peer ($p = .004$) and parental ($p = .042$) autonomy support; autonomy in PE ($p = .006$); intrinsic regulation ($p = .007$), integrated regulation ($p = .002$), identified regulation ($p = .013$), and external regulation ($p = .013$) in leisure-time PA; perceived physical strength ($p = .022$); and moderate PA ($p < .001$). In the control group, we found differences in peer autonomy support ($p = .008$); autonomy ($p = .049$) and amotivation ($p = .001$) in PE; relatedness ($p = .012$), identified regulation ($p = .035$), introjected regulation ($p = .009$), and amotivation ($p = .023$) in leisure-time PA; as well as in light PA ($p = .001$) and very hard PA ($p < .001$).

Below are the specific differences found between each of the measurement times, applying the Wilcoxon test for two related samples and taking into account the Bonferroni adjustment:

- Time 1-Time 2: in the experimental group, we observed an increase in peer autonomy support ($p = .002$, Cliff's $\delta = .30$), intrinsic regulation ($p = .004$, Cliff's $\delta = .20$) and integrated regulation ($p = .003$, Cliff's $\delta = .16$) in leisure-time PA, and in daily minutes of moderate PA ($p = .001$, Cliff's $\delta = .44$). In the control group, we found an increase in amotivation in PE ($p = .003$, Cliff's $\delta = .17$) and a decrease in perceived physical strength ($p = .005$, Cliff's $\delta = -.20$).
- Time 1-Time 3: increases were found in the experimental group in teacher autonomy support ($p = .006$, Cliff's $\delta = .36$), peer autonomy support ($p = .007$, Cliff's $\delta = .37$), autonomy in PE ($p = .001$, Cliff's $\delta = .28$), integrated regulation ($p = .006$, Cliff's $\delta = .21$) and identified regulation ($p = .003$, Cliff's $\delta = .35$) in leisure-time PA, and daily minutes of light PA ($p = .007$, Cliff's $\delta = .28$). In the control group, we found an increase in amotivation in PE ($p = .001$, Cliff's $\delta = .29$) and in amotivation in leisure-time PA ($p = .004$, Cliff's $\delta = .22$), and a decrease in physical self-worth ($p = .001$, Cliff's $\delta = -.32$) and in daily minutes of very hard PA ($p < .001$, Cliff's $\delta = -.40$).

- Time 1-Time 4: in the experimental group, we found an increase in peer autonomy support ($p < .001$, Cliff's $\delta = .41$) and integrated regulation in leisure-time PA ($p = .006$, Cliff's $\delta = .23$). In the control group, we found an increase in autonomy in PE ($p = .002$, Cliff's $\delta = .08$), introjected regulation in leisure-time PA ($p = .005$, Cliff's $\delta = .30$), and in the daily minutes of light PA ($p < .001$, Cliff's $\delta = .30$), as well as a decrease in the daily minutes of moderate PA ($p = .001$, Cliff's $\delta = -.32$).
- Time 2- Time 3: an increase in the experimental group was found in autonomy in PE ($p = .002$, Cliff's $\delta = .32$) and in the daily minutes of light PA ($p = .005$, Cliff's $\delta = .36$), and a decrease in moderate PA ($p < .001$, Cliff's $\delta = -.48$). In the control group, we found a decrease in satisfaction of the need for relatedness in leisure-time PA ($p = .003$, Cliff's $\delta = -.17$) and in the daily minutes of very hard PA ($p < .001$, Cliff's $\delta = -.36$).
- Time 2-Time 4: a decrease in external regulation in PE was found in the experimental group ($p = .006$, Cliff's $\delta = -.26$) and in the daily minutes of moderate PA ($p < .001$, Cliff's $\delta = -.71$). In the control group, we found an increase in light PA ($p = .006$, Cliff's $\delta = .25$).
- Time 3-Time 4: In the control group, we found an increase in light PA ($p = .003$, Cliff's $\delta = .33$) and in very hard PA ($p < .001$, Cliff's $\delta = .45$).

Discussion

The purpose of this study was to analyze the effects of a multidimensional intervention for the promotion of PA at school carried out from the perspective of SDT. To our knowledge, this is the first study based on this theory that has tested the effect of an extracurricular PA program that complemented the PE classes, ensuring continuity between the educational and leisure-time contexts. Previous studies (Chatzisarantis & Hagger, 2009; González-Cutre, Ferriz et al., 2014; Wallhead et al., 2014) showed that interventions in PE

based on autonomy support facilitated more autonomous forms of motivation in the students. However, the potential for transfer from PE to leisure-time PA could be compromised if appropriate extracurricular activities are not provided for the students (Wallhead et al., 2014). The results of the present study revealed a positive effect of the intervention on motivational variables and student levels of PA. The combination of an intervention in PE classes and the development of an extracurricular PA program and meetings with parents was effective. However, six months after the end of the intervention, although the motivational effects remained, the effects on PA levels had disappeared.

Initially, there were already some differences between the experimental group and the control group in some motivational variables. However, after completing the teaching unit of PE, new differences appeared in other variables, such as parental and peer autonomy support, external regulation and amotivation in PE, autonomy and intrinsic regulation in leisure-time PA, and daily time of moderate PA. The experimental group showed higher scores in all these variables, except for amotivation in PE, where the control group scored higher. The changes observed in peer autonomy support, intrinsic regulation in leisure-time PA, and daily time of moderate PA were the most pronounced in the experimental group.

On the one hand, the creation of a climate of autonomy support both in PE classes and in the extracurricular PA program could have promoted an increase in students' perception of the interest in and importance of PA for their classmates. On the other hand, the meetings with the parents also seemed to have some effect on their attitude towards the promotion of PA in their children. As highlighted in a recent qualitative study based on formative research to improve interventions for the promotion of PA (Murillo-Pardo, Camacho-Miñano et al., 2015), the near environment plays a key role in this work. In this study (Murillo-Pardo, Camacho-Miñano et al., 2015), the adolescents stressed the influence of peers and older

students, and the families acknowledged that their involvement was absolutely necessary to achieve an environment in which PA would take place on a regular basis.

Intervention in PE through the motivational teaching unit on fitness and health also helped to keep amotivation low during classes, whereas it increased in the control group. Previous studies have already underlined the importance of the teacher's intervention through autonomy support to keep the levels of amotivation low in PE (Cheon & Reeve, 2015; Cheon, Reeve, & Moon, 2012). Students' lack of motivation may be due to the belief that they do not have enough skill, or that they do not need to strive because of little value that they attribute to the activities and to the learning. It is important to prevent the development of these beliefs through PE classes that show the benefits of PA for health and that support the participation in autonomous PA.

The changes observed in this study in the perceived autonomy support in the different social agents could be associated with adolescents' higher participation in moderate PA in their leisure-time, motivated by higher enjoyment during participation (intrinsic regulation). The offer of a PA program after school hours but within the school and directly linked to the content taught in PE classes and adapted to the students' interests probably made it more fun for them. In this way, the students could see an association between what they learned at school and what they could do in their leisure-time, enjoying this transfer of knowledge (Hagger & Chatzisarantis, 2016).

After completing the extracurricular PA intervention program, these motivational group differences were maintained, and other relevant ones emerged. Especially noteworthy are the group differences found in integrated regulation in PE, identified regulation in leisure-time PA, and hard and very hard PA levels, which were higher in the experimental group. The experimental group also showed an increase in the perception of PE teacher autonomy support, satisfaction of the need for autonomy in PE, and integrated regulation in leisure-time

PA. These results reveal an increase in autonomous forms of motivation such as integrated and identified regulation, which play a fundamental role in the promotion of PA. It seems that, through the combined effect of the various intervention agents, the adolescents became aware of the importance of PA for health, so that they integrated it into their lifestyle. This positive motivation may be associated with the maintenance of the hard and very hard levels of PA in the experimental group compared to the control group. Taking into account the usual decrease of PA levels during adolescence, linked, among other variables, to amotivation, the results of this study show the need to carry out multidimensional interventions of this type in school, given their motivational and behavioral effectiveness (Owen et al., 2014).

To verify whether the effects are maintained over time, we performed a follow-up measurement 6 months after the end of the intervention. The results revealed that the main motivational changes were maintained. However, the group differences in daily minutes of PA disappeared. These data indicate that it is necessary to increase the duration of interventions to achieve greater effectiveness. In this line, a recent study that compared different cohorts of adolescents who underwent an intervention for the promotion of PA at school between 1 year and 3 years (Murillo-Pardo, García-Bengoechea et al., 2015) reaches some interesting conclusions. On the one hand, strategies of PA promotion require time to become operational and modify the school environment. On the other hand, the intervention should be prolonged enough to have a maintained effect on the adolescents' behavior. It is important that the intervention strategies are established in the entire educational community to be able to intervene in a coordinated and global manner. For this purpose, it would be necessary to invest time to train the educational staff and the students' families, so that they become aware of the importance of promoting PA from school at these ages. SDT represents an interesting theoretical framework that can be used to train the different agents that influence the participation of adolescents in PA.

A striking result found 6 months after the intervention was the emergence of significant group differences in physical self-worth. In the control group, physical self-worth diminished significantly throughout the intervention, whereas in the experimental group, it increased but not in a statistically significant way. The development of autonomous motivation for exercise prevents physical self-worth from being negatively affected, as in this type of motivation, there is a no self-assessment or continuous comparison of physical skills (Standage et al., 2012). It seems that the implementation of an intervention for the promotion of PA based on the satisfaction of the basic psychological needs could help to improve adolescents' physical self-worth over time. It must be borne in mind that an environment adapted to the participants' characteristics was created during the intervention, both in PE classes and through the meetings with the families and the extracurricular PA program. This type of programs based on physical fitness and health, not linked to the participation in a particular sport, can be an interesting choice for motivational enhancement and promotion of PA, and for adolescents' self-esteem and well-being.

However, this study presents some limitations. First, it is necessary to highlight the absence of an objective measure of PA. Although initially, our intention was to incorporate a measure of accelerometry in the study, a number of problems emerged. Given that there were many measurement times, we found that, in several of them, the adolescents forgot to carry the accelerometer for sufficient time (4 or more measurement days and a minimum of 10 hours of recording per day), which led to a loss of important information that precluded drawing conclusions about this measure. This led us to choose to analyze the data of the 7 Day-PAR questionnaire. However, we highlight that the 7 Day-PAR is one of most recognized and widely used self-report instruments for the measurement of PA at the international level, as its reliability and validity have been demonstrated (Sallis, 1997).

Second, there was an important difference in the size of the control group and the experimental group. This was due to the fact that participation in the extracurricular PA program was voluntary, and fewer adolescents volunteered than we had expected. We admit that this could also influence the results of the study, because all the students who participated in the PA program had a positive predisposition towards it, and they also obtained a higher initial score in some of the study variables, and this could affect the evolution of their motivation over time positively. However, in an opposite view, it could be considered that it was more difficult to increase the high initial scores of the experimental group students in adaptive motivational variables. Therefore, although we admit that the presence of non-equivalent groups is a limitation of this study, we highlight that there was an important effect in many variables and in different time points. Future studies should increase the number of participants and initially classify groups in low, medium and high autonomous motivation and compare the effect of similar school-based interventions for the promotion of PA across groups.

We also propose to carry out this type of studies including a qualitative evaluation of the intervention process. Traditionally, researchers tend to interpret the results of these interventions by assessing the changes on concrete variables measured in pre- and post-tests. However, this perspective is not enough to understand the specific situations that participants experience during the different interventions in depth. The employment of interviews and qualitative observation could help us understand why motivational effects are maintained after the intervention but not PA effects, why physical self-worth improves after a long period of time, or what the particular effect of the meetings with families is. This qualitative methodology could also be very useful to identify problems, limitations and mistakes during interventions with the objective of optimizing them along the study or improving future attempts.

It would be also interesting to include novelty support as a motivational strategy to promote PA in line with a recent proposition that considers novelty as a basic psychological need from the perspective of SDT (González-Cutre, Sicilia, Sierra, Ferriz, & Hagger, 2016). If teachers include novel activities during PE classes and extracurricular PA programs, they can surprise students and stimulate autonomous motivation for PA. On the one hand, novelty could increase enjoyment during the classes because adolescents want to live new experiences and sensations. On the other hand, the variety of activities could help adolescents know a big range of PA possibilities to carry out in their leisure-time. However, novelty should be progressively included to avoid making people feel incompetent when facing the new physical activities proposed. The importance of novelty for the promotion of PA should also be highlighted in meetings with families.

In summary, this study has shown the effectiveness of an SDT-based multidimensional intervention for the promotion of PA at school. The incorporation of motivational strategies in PE class, along with meetings with the families, and the offer of an extracurricular PA program that guaranteed the continuity with the class-work had important behavioral and motivational effects. However, 6 months after the intervention, the effects on PA levels were lost, revealing the need to establish multidimensional motivational interventions that persist over time and involve the entire educational community. After obtaining the adolescents' participation in a PA program of several sessions per week, terminating the program at the end of the study was clearly a problem for the maintenance of PA. Public administration, schools, and parents' associations should explore avenues to finance such programs and ensure that these offers are stable in the school.

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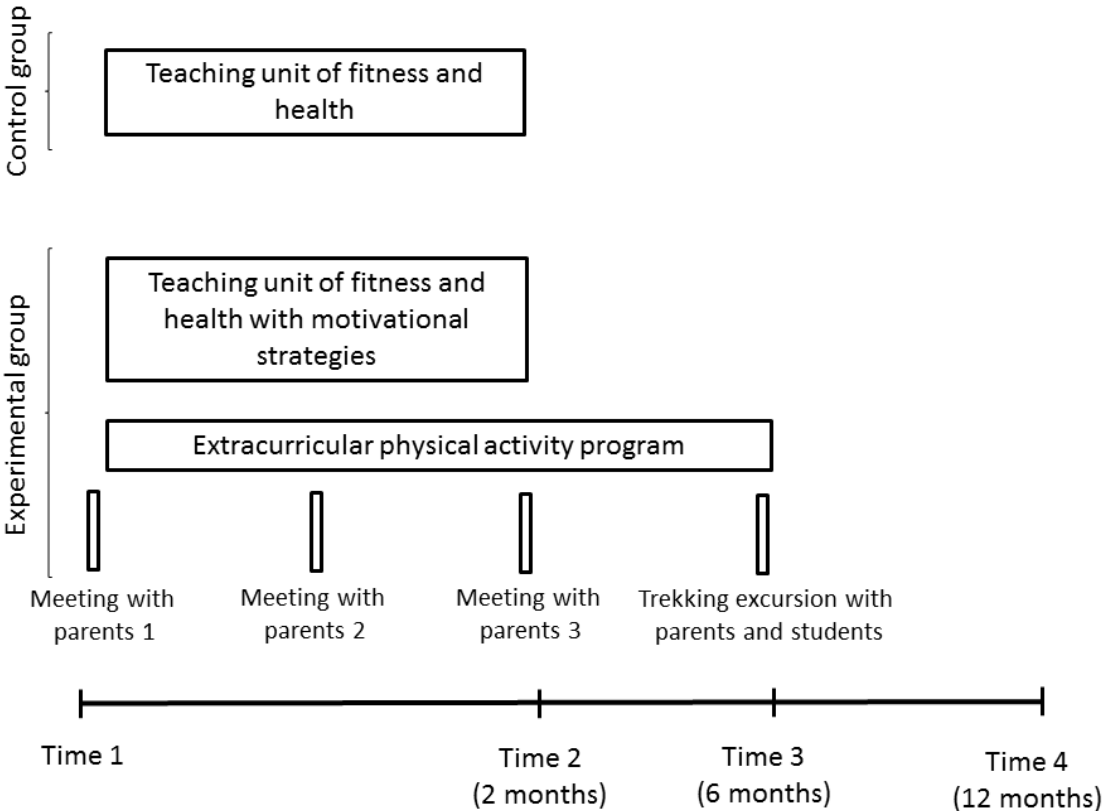


Figure 1. Research design.

Table 1. Mann-Whitney U-Test for Two Independent Samples

	Time 1					Time 2					Time 3					Time 4				
	α	CG	EG	U	Cliff's δ	α	CG	EG	U	Cliff's δ	α	CG	EG	U	Cliff's δ	α	CG	EG	U	Cliff's δ
Teacher autonomy support	.92	5.22	5.94	523.00**	.39	.95	5.19	6.09	377.00**	.54	.97	4.95	6.34	282.50**	.65	.97	5.13	6.35	302.50**	.60
Peer autonomy support	.92	4.47	5.02	619.00	.25	.93	4.76	5.66	460.00**	.42	.94	4.74	5.73	356.00**	.48	.95	4.88	5.82	421.00**	.46
Parent autonomy support	.94	5.15	5.61	675.00	.18	.96	5.23	5.94	542.50*	.32	.98	4.99	6.02	384.50**	.44	.96	5.13	5.94	499.00**	.36
Competence PE	.77	3.57	3.86	634.50*	.26	.77	3.59	3.70	742.00	.10	.79	3.59	3.88	644.00	.19	.76	3.64	3.89	616.50	.19
Autonomy PE	.68	3.00	3.41	592.50*	.31	.72	3.24	3.53	599.50*	.28	.76	3.28	3.96	433.00**	.46	.78	3.39	3.70	563.50	.26
Relatedness PE	.87	4.03	4.47	612.50*	.28	.82	4.05	4.19	694.50	.16	.85	3.82	4.40	504.50**	.37	.89	3.95	4.39	547.00*	.28
Intrinsic PE	.73	5.29	5.78	591.00*	.31	.83	5.07	5.70	525.50**	.36	.91	5.02	6.12	389.00**	.51	.93	5.09	5.84	479.00**	.37
Integrated PE	.87	4.90	5.34	669.50	.22	.94	5.00	5.25	750.00	.09	.96	4.78	5.69	511.00**	.36	.97	4.95	5.48	573.50	.24
Identified PE	.73	5.23	5.79	583.50*	.32	.87	5.27	5.69	623.50	.25	.91	4.91	6.12	374.50**	.53	.91	5.17	5.75	553.00*	.27
Introjected PE	.66	3.93	4.72	510.50**	.40	.68	4.09	4.65	614.00	.26	.74	4.04	4.67	560.00*	.30	.60	3.97	4.24	677.00	.10
External PE	.62	3.42	3.69	755.00	.12	.56	3.30	3.99	524.50**	.37	.63	3.42	3.60	710.50	.11	.69	3.21	3.28	730.00	.03
Amotivation PE	.68	1.93	1.51	652.00	-.24	.83	2.29	1.81	598.50*	-.28	.90	2.68	1.68	464.00**	-.42	.88	2.33	1.78	508.50*	-.33
Competence PA	.79	3.56	3.91	601.00*	.27	.81	3.55	3.92	622.00	.22	.82	3.48	3.91	496.00*	.28	.82	3.55	3.98	550.00*	.30
Autonomy PA	.75	3.70	3.97	690.00	.17	.80	3.72	4.15	586.50*	.27	.79	3.67	4.32	377.00**	.45	.87	3.74	4.26	534.50*	.32
Relatedness PA	.86	3.91	4.47	535.00**	.35	.86	3.99	4.53	507.50**	.36	.77	3.78	4.56	322.00**	.53	.89	4.06	4.55	500.00**	.36
Intrinsic PA	.87	3.16	3.34	709.50	.14	.85	3.10	3.55	496.50**	.38	.91	3.03	3.60	389.00**	.44	.90	3.04	3.60	417.00**	.47
Integrated PA	.94	2.75	2.81	786.50	.08	.92	2.82	3.10	641.50	.20	.93	2.80	3.14	541.50	.21	.92	2.90	3.20	615.50	.21
Identified PA	.79	2.98	3.05	812.50	.02	.80	3.08	3.33	631.50	.21	.80	3.05	3.47	477.50*	.31	.84	3.10	3.40	617.00	.21
Introjected PA	.57	1.72	1.78	771.00	.07	.59	1.92	1.96	762.00	.05	.62	1.95	2.00	684.00	-.01	.72	2.05	2.06	771.50	-.02
External PA	.83	1.37	1.22	665.50	-.20	.73	1.34	1.31	786.00	.02	.74	1.49	1.39	674.00	.02	.73	1.52	1.45	709.00	-.10
Amotivation PA	.76	1.36	1.34	813.00	.02	.80	1.45	1.24	710.00	-.11	.73	1.62	1.23	482.50*	-.30	.87	1.56	1.28	566.50*	-.28
Physical condition	.84	2.81	2.83	831.50	.03	.89	2.74	2.78	806.50	.02	.86	2.70	2.88	713.00	.11	.86	2.68	2.87	657.50	.13
Body attractiveness	.90	2.75	2.70	837.50	-.02	.89	2.61	2.47	745.50	-.10	.86	2.63	2.50	737.00	-.08	.92	2.60	2.65	732.00	.03
General perceived competence	.85	2.59	2.68	798.50	.07	.86	2.58	2.59	806.00	.03	.88	2.60	2.75	703.50	.12	.85	2.63	2.72	674.00	.11
Physical strength	.59	2.67	2.70	737.00	.14	.67	2.47	2.46	776.50	.06	.63	2.61	2.48	749.50	-.06	.65	2.60	2.64	715.50	.05
Physical self-worth	.65	3.06	3.03	810.50	.05	.75	2.91	2.88	810.00	.02	.74	2.71	2.96	605.50	.24	.65	2.85	3.18	509.00*	.33
Daily light PA	-	907.63	891.03	692.00	-.16	-	911.71	885.59	534.00	-.25	-	910.57	929.78	602.00	.13	-	948.59	923.41	561.50	-.17
Daily moderate PA	-	24.01	14.56	689.00	-.17	-	19.66	25.74	469.00**	.39	-	20.80	11.90	651.50	-.05	-	10.60	6.83	604.00	-.14
Daily hard PA	-	11.68	17.86	617.00	.25	-	14.79	17.14	685.50	.11	-	13.24	18.68	502.50*	.27	-	11.99	26.14	649.50	.04
Daily very hard PA	-	15.11	15.81	789.50	-.05	-	11.49	14.75	731.50	.05	-	2.41	10.37	535.00*	.23	-	12.51	11.54	612.50	-.13

Note. PE = Physical Education; PA = Physical Activity; α = Cronbach's alpha; CG = Control Group; EG = Experimental Group; * $p < .05$; ** $p < .01$