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Improving motivation for physical activity and physical education through a school-based intervention.

Abstract

The aim was to examine the effects of a multicomponent school-based intervention on psychological correlates of physical activity (PA) in physical education (PE) and leisure-time PA settings. Two hundred and ten students ($M=13.06\pm0.61$) were assigned either to a control or an experimental school. Curricular and extracurricular PA actions were developed during one academic year to empower adolescents to be active by themselves. Experimental school students reported significant improvements in almost all psychological determinants and correlates of PA in PE and leisure-time PA settings, when compared to both control school students and their own baseline values. Results highlight the importance of developing multicomponent school-based interventions that involve the school community to improve students' motivational outcomes in PE and leisure-time PA contexts.

Key words: adolescence, self-determination, secondary education, physical education, motivation, physical activity, intervention.

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Introduction

Health benefits of regular physical activity (PA) in youth are well-documented (Tremblay et al., 2016). However, large international studies (Guthold, Stevens, Riley, & Bull, 2020) and results from “Spain's 2018 Report Card on PA for children and youth” (Roman-Viñas, Zazo, Martínez-Martínez, Aznar-Lain, & Serra-Majem, 2018) revealed that only a small percentage of adolescents met moderate-to-vigorous physical activity (MVPA) recommendations (i.e., 60 minutes of daily MVPA) (Tremblay et al., 2016). School is considered an ideal setting for adolescents' PA promotion, not only due to its compulsory nature, but also because it may involve other agents from the whole school community such as families, teachers or peers (Murillo et al., 2013). Areas such as physical education (PE) in particular, but also other school subjects, school recess, active school commuting, after-school intervention programs, and tutorial action plans (Murillo et al., 2013) can provide multiple opportunities to meet PA recommendations (i.e., directly) as well as health literacy skills that empower adolescents to be physically active outside school (i.e., indirectly; Slingerland & Borghouts, 2011).

Although school is potentially considered a key context to promote PA (Murillo et al., 2013), most school-based interventions seem to show small or non-significant effects on increasing adolescents' PA levels (Borde, Smith, Sutherland, Nathan, & Lubans, 2017; Love, Adams, & van Sluijs, 2019). Moreover, Nguyen et al. (2016) revealed that intervention effects diminish over time, thus suggesting the difficulty of maintaining long-term effectiveness of

PA intervention programs. The lack of theoretical behavior change frameworks in the design of school-based interventions, the variability of school community agents and areas involved as well as their short-term duration could explain these small effect sizes (Borde et al., 2017; Rhodes, Janssen, Bredin, Warburton, & Bauman, 2017). Multicomponent interventions that involve different curricular and non-curricular areas (e.g., PE lessons, extra-curricular PA programs, school recess, etc.) have been identified as one of the most promising approaches to increase adolescents' PA levels (van de Kop, van Kernebeek, Otten, Toussaint, & Verhoeff, 2019). Given that students' motivational experiences in PE lessons may transfer to motivational experiences in leisure-time PA (Hagger & Chatzisarantis, 2016) and, consequently, may influence PA levels, it is of paramount importance to integrate school PE programs into school PA interventions (Errisuriz, Golaszewski, Born, & Bartholomew, 2018). Using multicomponent school-based interventions, specifically grounded in theoretical models of behavior change, may help to enhance motivational outcomes in PE and leisure-time PA settings, as well as to maintain the beneficial effects of an intervention over time (Kwasnicka, Dombrowski, White, & Sniehotta, 2016; Rhodes et al., 2017).

Multiple theoretical frameworks

Social ecological model (Sallis, Owen, & Fisher, 2008), self-determination theory (Deci & Ryan, 1985), and theory of planned behavior (Ajzen, 1991) are theoretical frameworks that have been widely used to analyze the main social and individual factors associated with PA, but also to improve the long-term effects of PA intervention programs (Kwasnicka et al., 2016). Given that PA is influenced by multiple factors, social ecological model and self-determination theory suggest that involving the whole school community (e.g., teachers, families, peers) in school PA programs is required to introduce health behavior

changes (Zhang & Solmon, 2013). According to self-determination theory, social cognitive theories provide a comprehensive picture of immediate antecedents of behavior but neglect the origins of the antecedents. Therefore, the integration of an organismic theory of human behavior such as self-determination theory and a social cognitive theory such as theory of planned behavior may provide a better understanding of motivational processes to be active (Hagger, & Chatzisarantis, 2009). Integrating these theories should be considered to enhance the quality of school-based interventions because of their capacity to explain greater amounts of PA variance (Hagger, & Chatzisarantis, 2009; Hagger, & Chatzisarantis, 2016; Zhang & Solmon, 2013).

Self-determination theory proposes three innate and universal human needs (i.e., autonomy, competence, and relatedness), that may either be satisfied (i.e., students' sense of choice, efficacy, and belonging) or frustrated (i.e., students' sense of pressure, inefficacy, and rejection) by the social environment. Further, novelty and variety have been identified as potential variables of influence (Sylvester, Jackson, & Beauchamp, 2018). Whereas novelty (i.e., students' sense of experiencing something new or unusual) has recently been proposed as an additional fourth need (González-Cutre, Romero-Elías, Jiménez-Loaisa, BeltránCarrillo, & Hagger, 2019), variety (i.e., students' sense of experiencing a combination of novel and familiar tasks) has been suggested as a psychological experience that may account for unique variance in participant well-being in PA contexts (Sylvester et al., 2018b).

Studies grounded in self-determination theory suggest that satisfaction and frustration of basic psychological needs are distinctly related to different antecedents (Sun & Shen, 2017; Vasconcellos et al., 2019). In line with social ecological model, self-determination theory points out that social environmental factors such as autonomy support for leisure-time PA

(i.e., encouraging adolescents' choices, options, and opportunities to participate in leisure-time PA) from multiple sources (e.g., families, teachers, peers) may influence students' motivational outcomes in leisure-time PA (González-Cutre, Sicilia, Beas-Jiménez, & Hagger, 2014b; Sevil, García-González, Abós, Generelo, & Aibar, 2018) and, consequently, initiation and long-term maintenance of PA (Gillison, Rouse, Standage, Sebire, & Ryan, 2018; Perry, Garside, Morones, & Hayman, 2012).

Regarding PE, self-determination theory distinguishes other dimensions of teachers' motivating styles called need-supportive and need-thwarting interpersonal styles. Need-supportive teaching style is composed of autonomy (i.e., encouraging students' interest, choice, and responsibility in learning process), competence (i.e., providing structure, process-relevant feedback, and realistic goals to develop students' desired skills), and relatedness support (i.e., developing a warm and friendly environment by fostering students' positive relationships), which has been positively related to basic psychological need satisfaction in PE lessons (Sun & Shen, 2017; Vasconcellos et al., 2019). Externally controlling style (i.e., use of controlling language, yelling, pressure, and threats) and internally controlling style (i.e., pressure on students to meet the teacher's expectations by appealing to their feelings of self-worth, guilt, shame, and anxiety) represent one of the dimensions of need-thwarting teaching style, which has been positively associated with basic psychological need frustration in PE lessons (Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015).

Recently, 21 motivation and behaviour change techniques (MBCTs) has been identified to guide self-determination theory-based interventions in multiple domains (e.g., leisure-time PA and PE; Teixeira et al., 2020). Autonomy-support techniques (e.g., provide choice, use noncontrolling informational language, etc.), competence-support techniques

(e.g., offer constructive, clear, and relevant feedback, clarify expectations, etc.), and relatedness-support techniques (e.g., encourage asking of questions and provide opportunities for ongoing support, etc.) has been identified as promising strategies to satisfy basic psychological needs (Gillison et al., 2018; Teixeira et al., 2020).

Satisfaction or frustration of basic psychological needs has been related to different types of motivation. According to self-determination theory, there is a wide range of reasons to be active, which vary along a continuum of self-determination, from more to less self-determined forms of motivation. Identified, integrated, and intrinsic regulations represent the more autonomous forms of motivation (i.e., engaging in an activity due to internal reasons such as personal values, benefits, life goals, or pleasure). Extrinsic and introjected regulations represent the more controlled forms of motivation (i.e., engaging in an activity due to external and internal pressures such as punishment, reward, or feelings of guilt). Finally, amotivation is the absence of either extrinsic or intrinsic reasons to engage in an activity. Evidence from PE and PA domains supports that satisfying basic psychological needs, as well as other variables such as novelty and variety satisfaction, has been positively associated with students' autonomous forms of motivation and, consequently, other positive outcomes (e.g., intention to be active, enjoyment; González-Cutre et al., 2019; González-Cutre, Sicilia, Sierra, Ferriz, & Hagger, 2016; Sylvester et al., 2014; Vasconcellos et al., 2019). In turn, frustration of basic psychological needs has been positively related to controlled forms of motivation or amotivation and, in turn, with a wide range of maladaptive outcomes (e.g., disengagement, boredom; Haerens et al., 2015; Koka, Tilga, Kalajas-Tilga, Hein, & Raudsepp, 2019; Pulido, Sánchez-Oliva, Sánchez-Miguel, Amado, & García-Calvo, 2018).

Exclusively using self-determination theory framework does not allow us to perfectly understand the influence of motivational processes on PA. Integrating theory of planned behavior and self-determination theory improves the explanation of PA intention, which has been considered one of the best predictors of PA behavior (Rhodes et al., 2017) (for further understanding regarding how autonomous motivation forms the basis of social-cognitive judgments, see the trans-contextual model of motivation proposed by Hagger & Chatzisarantis (2009) and Hagger & Chatzisarantis (2016). Attitude (i.e., adolescents' perception of positive or negative evaluation of performing a target behavior), subjective norm (i.e., adolescents' perception of normative expectations to perform or not to perform a target behavior), and perceived behavioral control (i.e., adolescents' beliefs of ease or difficulty to perform a target behavior) seem to be positively influenced by students' autonomous motivation for leisure-time PA and, in turn, they positively influence PA intention (González-Cutre, Sicilia et al., 2014).

Intervention programs in leisure-time PA and PE settings

Over recent years, there has been an increase in the number of correlational studies that support the integration of multiple theoretical frameworks such as social ecological model, self-determination theory, and theory of planned behavior to achieve a broader understanding of PA behavior (Hagger & Chatzisarantis, 2009; Hagger & Chatzisarantis, 2016). However, there is a paucity of intervention studies based on the integration of these theoretical frameworks and most of them only include a few determinants and correlates of PA (Hagger & Chatzisarantis, 2016).

Grounded mainly in self-determination theory, multicomponent school-based PA interventions, as well as the development of need-supportive teaching programs by PE

teachers, have evidenced a positive effect on students' motivational outcomes in leisure-time PA and PE settings, respectively (Perry et al., 2012; Sun & Shen, 2017; Vasconcellos et al., 2019). However, to our knowledge, few multicomponent school-based PA interventions, based on different theoretical frameworks, have simultaneously examined their effects on motivational outcomes in two domains (i.e., PE and PA context; González-Cutre, Ferriz et al., 2014; González-Cutre et al., 2018). Likewise, only some studies have also adopted a whole-of-school approach that involved not only PE teachers but also other significant agents such as teachers from different disciplines, tutors, peers, mothers, or fathers, and none of them have included all these school community agents (Perry et al., 2012). For example, an intervention program conducted previously by González-Cutre et al. (2014) among elementary school students, showed an increase in students' perceptions of autonomy support for leisure-time PA from PE teachers, parents, and peers, autonomous forms of motivation in PE and leisure-time PA settings, as well as variables from theory of planned behavior and at self-reported PA levels. Although this finding contributes to extending the considerable empirical support for the integration of multiple theoretical frameworks, long-term multicomponent intervention studies and whole-of-school approaches are required.

There is also a limited number of intervention studies that have analyzed their effects on reducing controlling teaching style and, consequently, students' basic psychological need frustration in PE lessons. A significant decrease in both variables has been observed in previous PE programs (Cheon, Reeve, & Song, 2016; Cheon, Reeve, & Ntoumanis, 2018). Further studies that examine the effects of need-supportive and controlling teaching style on students' motivational outcomes seem necessary in PE lessons. Moreover, the measurement of some variables inherently related to self-determination theory, such as novelty and variety,

could provide additional information on the motivational processes involved in PA behavior change (Sylvester et al., 2018b).

The present study

A multicomponent intervention called “Paths of the Pyrenees” has previously shown to be effective in increasing the percentage of adolescents who met PA recommendations (from 23% before the intervention to 64.6% after the intervention) and other health-related behavior recommendations (i.e., 24-hour movement guidelines; details of the reference are omitted to guarantee anonymity). Given that most of the intervention strategies focused on PA promotion, evidence regarding their exclusive effects on psychological determinants and correlates of PA may provide a good indicator for PA maintenance (Kwasnicka, et al., 2016). The main strengths of this study are the following: 1) Integration of multiple theories, 2) whole-of-school approach that involve PE teachers, teachers, mother, father, tutor, and peers, 3) multiple determinants and correlates of PA in two settings (i.e., PE and leisure-time PA contexts), 4) the inclusion of several outcomes that had not been tested before (i.e., novelty), 5) the innovative character of a multicomponent PA program, and 6) a long-term intervention. Although a limited number of studies have examined the effects of multicomponent PA programs on the basis of some of these mentioned strengths, to our knowledge there are no studies that include all of them together.

The aim of this study was to investigate the effects of the “Paths of the Pyrenees” school-based intervention on socio-cultural determinants of PA (i.e., autonomy support for leisure-time PA from PE teacher, teachers, tutor, mother, father, and peers) and PE (i.e., teachers' motivating style), motivational outcomes in leisure-time PA (i.e., basic psychological need satisfaction, novelty satisfaction, and motivation) and PE settings (i.e.,

basic psychological need satisfaction and frustration, novelty and variety satisfaction, and motivation), and different psychological variables outlined in theory of planned behavior (i.e., attitude, subjective norm, control, and intention to be physically active). We hypothesized that experimental school students would show improvements in socio-cultural determinants and motivational outcomes in leisure-time PA and PE settings as well as in theory of planned behavior variables.

Method

Design and study context

A quasi-experimental design was applied to a convenience sample of adolescents from two public secondary schools in Huesca (Spain) during one academic school year. Huesca is a mid-sized city located in the north-east of the country. It has a population of 52,339 inhabitants who live in an urban area of 6.75 km². The average gross domestic product of the city is around 23,000 Euros. Both schools were located in two neighborhoods with similar socio-demographic characteristics. They were also similar regarding school size (i.e., ~1000 students), school schedules, walkability, and sport facilities. Both schools had two hours of PE sessions per week and one hour of tutorial action per week. In Spain, each class has a tutor who is in charge of all academic, social, and emotional aspects of their students, which are dealt with in weekly tutorial action sessions. Students have one teacher for each subject (e.g., Math, Science, PE...). The average class size is around 25 students. These groups are established by the school board at the beginning of the academic year and remain intact during the academic year.

Participants

From an initial sample of 225 second grade Secondary Education students¹ (52.9% girls; $M= 13.06\pm 0.61$ years), a final sample of 210 students participated in this study (93.33% response rate): 105 from the experimental school ($M=13.05\pm 0.59$ years) and 105 from the control school ($M=13.07\pm 0.63$ years). These students voluntarily agreed to participate, and written permission was obtained from their parents. This study was also approved by the Ethics Committee for Clinical Research of Aragon (CEICA).

Materials

Perceived autonomy support for leisure-time PA. Students' perceptions of autonomy support for leisure-time PA from PE teachers, teachers, mother, father, tutor, and peers were measured separately by the Spanish version (Moreno, Parra, & Gonzalez-Cutre, 2008) of the Perceived Autonomy Support Scale for Exercise Settings (PASSES) for each source of support. Twelve items were answered separately for each of the different social agents (e.g., “My PE teacher/teachers/mother/father/tutor/peers encourage(s) me to do active sports and/or vigorous exercise in my free time”). Students responses to the PASSES were rated on 7-point scales ranging from 1 (strongly disagree) to 7 (strongly agree).

Teachers' motivating style in PE. Students' perceptions of autonomy, competence, and relatedness support from the PE teacher were assessed by the Spanish version of the Questionnaire of Basic Psychological Needs Support in Physical Education (Sánchez-Oliva, Leo, Amado, Cuevas, & García-Calvo, 2013). The stem “In PE classes, my teacher...” was followed by 12 items (four items per factor) that assessed: autonomy support (e.g., “Often asks us about our preferences with respect to the activities we carry out”), competence support

¹ It must be noted that the second grade of Secondary Education in Spain is equivalent to 8th grade students from middle school in the U.S.

(e.g., “Offers us activities based on our skill level”), and relatedness support (e.g., “Encourages positive interactions among all pupils”). Meanwhile, internally and externally controlling teaching behavior of the PE teacher was assessed using a Spanish translated version of a previously questionnaire developed by De Meyer, Soenens, Aelterman, De Bourdeaudhuij, & Haerens (2016). The stem “In PE classes, my teacher...” was followed by nine items that assessed: internally controlling teaching (four items; e.g., “Pays less attention to me when I disappoint him/her”) and externally controlling teaching (five items; e.g., “Yells when I am not doing what (s)he wants me to do”). Both questionnaires scored on a 5-point Likert scale.

Basic psychological need satisfaction in PE and leisure-time PA. Students' perceptions of autonomy, competence, and relatedness satisfaction were assessed using the Spanish version in PE (Moreno, González-Cutre, Chillón, & Parra, 2008) and leisure-time PA (Sánchez & Núñez, 2007) of the Basic Psychological Needs in Exercise Scale (BPNES). Both scales consisted of 12 item (four items per factor) that assessed: autonomy (e.g., “I have the opportunity to make choices with respect to the way I do the exercises”/“I feel very strongly that I have the opportunity to make choices with respect to the way I exercise”), competence (e.g., “I feel that exercise is an activity that I do very well”/“I feel that I execute very effectively the exercises of my training program”) and relatedness (e.g., “I feel very comfortable with my classmates”/“I feel that I associate with the other exercise participants in a very friendly way”) introduced by the stem “In my PE lessons...” or “When I do PA...” respectively. Both three-factor scales comprise 12 items (four items per factor) with a 5-point Likert scale.

Basic psychological need frustration in PE. Students' perceptions of autonomy, competence, and relatedness frustration in PE were assessed using the Spanish version of the Basic Psychological Need Satisfaction and Frustration Scale validated in an educational context (BPNSNF; Chen et al., 2014). The scale consisted of 12 items (four items per factor) that assessed: autonomy (e.g., “I feel pressured to do too many things”), competence (e.g., “I feel disappointed with many of my performance”) and relatedness frustration (e.g., “I feel that people who are important to me are cold and distant towards me”) with a 5-point Likert scale. Similar to previous studies (Haerens et al., 2015), this scale was adjusted slightly to adapt to the specific context of PE lessons.

Novelty satisfaction in PE and leisure-time PA. Students' perceptions of novelty satisfaction in PE and leisure-time PA were assessed using the Spanish version of the Novelty Need Satisfaction Scale (NNSS; González-Cutre et al., 2016). This one-factor scale comprised six items (e.g., “I think I discover new things frequently”) with a 5-point Likert scale.

Variety satisfaction in PE. Students' perceptions of variety satisfaction in PE were assessed with an adapted version of the Perceived Variety in Exercise (PVE) one-factor questionnaire (Sylvester et al., 2014) that comprises five items with a 6-point Likert scale. One of the items was slightly reworded changing “my exercise program” to “my PE lessons” (i.e., “I feel like my PE lessons are varied”) to better reflect the specific context.

Motivation in PE and leisure-time PA. Students' perceptions of different types of motivation were assessed in PE (Ferriz, González-Cutre, & Sicilia, 2015) and leisure-time PA (González-Cutre, Sicilia, & Fernández, 2010) using the Spanish version of the Perceived Locus of Causality Scale and the Behavioral Regulation in Exercise Questionnaire,

respectively. The scale in PE context contained six factors and 24 items (four item per factor) that assessed: intrinsic motivation (e.g., “Because PE is fun”), integrated regulation (e.g., “I consider exercise a fundamental part of who I am”), identified regulation (e.g. “Because I want to learn sport skills”), introjected regulation (e.g., “Because I want the others to think that I’m good”), external regulation (e.g. “So that the teacher won’t yell at me”), and amotivation (e.g. “But I really feel I’m wasting my time in PE”) with a 7-point Likert scale. The scale in leisure-time PA context contained 23 items that assessed: intrinsic motivation (e.g., “I get pleasure and satisfaction from participating in PA”), integrated regulation (e.g., “I consider PA a fundamental part of who I am”), identified regulation (e.g. “I value the benefits of PA”), introjected regulation (e.g., “I feel ashamed when I miss PA”), external regulation (e.g. “I take part in PA because my friends/family/partner say I should”), and amotivation (e.g. “I don’t see why I should have to do PA”) with a 4-point Likert scale.

Theory of planned behavior variables. Students' perceptions of attitude, subjective norm, perceived behavioral control, and intention to be physical active were assessed using the Spanish version (Tirado, Neipp, Quiles, & Rodríguez-Marín, 2012) of the Theory of Planned Behavior Questionnaire. This four-factor scale comprised 16 items (i.e., five items for attitude [e.g., “boring-interesting”], four items for subjective norm [e.g., “Most people close to me expect me to do active sports and/or vigorous physical activities during my leisure time for the next 5 weeks”], and three items for both perceived behavioral control [e.g. “I feel in complete control over whether I do active sports and/or vigorous physical activities in my leisure-time in the next 5 weeks”], and intention [e.g., “I intend to do active sports and/or vigorous physical activities during my leisure-time in the next 5 weeks...”] with a 7-point Likert scale.

Covariates. Age, gender, and socio-economic status (SES; Currie et al., 2008) were self-reported. A composite socio-economic indicator was calculated (Currie et al., 2008).

Procedure

The “Paths of the Pyrenees” intervention program was applied during one academic year (2015-2016) to the experimental school whereas the control school followed their usual education curriculum without additional intervention. Data collection was administered in paper-and-pencil format before and immediately after the intervention program during two different sessions of approximately forty minutes each. Questionnaires about leisure-time PA context and PE lessons were independently completed during both sessions, which took place with a gap of at least one day between them. Controlling teaching and variety scales were translated from English to Spanish using the guidelines developed by the International Test Commission (Muñiz, Elosua, & Hambleton, 2013).

Intervention program

The multicomponent school-based intervention called “Paths of the Pyrenees” was designed based on different theoretical frameworks (i.e., social ecological model, self-determination theory, and theory of planned behavior) as well as effective strategies to increase PA (Murillo et al., 2013). Guided by social ecological model and adopting a whole-of-school approach, “Paths of the Pyrenees” aimed to empower and support adolescents for them to become physically active in and out of school. Before and during the intervention, teachers and tutors attended a 20-hour workshop whose aim was to develop a health intervention program, adopting an interdisciplinary curricular approach to promote PA. Grounded in self-determination theory, PE teachers also received a training program to be more need-supportive and less controlling, using the three interactive parts described by Aelterman, Vansteenkiste, Van den Berghe, De Meyer, & Haerens (2014). The need-

supportive teaching training received by PE teachers focused on seventeen out of twenty-one motivation and behavior change techniques provided by Teixeira et al. (2020) as follow: five of the seven autonomy-supportive techniques (i.e., use noncontrolling, informational language, explore life aspirations and values, provide a meaningful rationale, provide choice, and encourage the person to experiment and self-initiate the behavior), five of the seven competence-supportive techniques (i.e., clarify expectations, assist in setting optimal challenge, offer constructive, clear, and relevant feedback, help develop a clear and concrete plan of action, and promote self-monitoring) and, finally, all relatedness-supportive techniques (i.e., acknowledge and respect perspectives and feeling, encourage asking of questions, show unconditional regard, demonstrate/show interest in the person, use empathic listening, providing opportunities for ongoing support, prompt identification, and seek available social support). Finally, consistent with self-determination theory, autonomy-supportive techniques and strategies were also provided to families to encourage their children to be active. The autonomy support training program received by teachers, PE teachers, families, and tutor focused on five of the seven autonomy-supportive techniques provided by Teixeira et al. (2020): use noncontrolling, informational language, explore life aspirations and values, provide a meaningful rationale, provide choice, and encourage the person to experiment and self-initiate the behavior. It must be noted that PE teacher and the school community agents of the control school did not deliberately use any need-supportive techniques provided by Teixeira et al. (2020). Although the intervention was developed by school teachers, one facilitator (i.e., member of the research group with educational training) coordinated the intervention.

In general terms, “Paths of the Pyrenees” comprised six main components that were developed via curricular (i.e., project-based learning, tutorial action, and school recess) and

extracurricular areas (i.e., family participation, special activities or events, and dissemination of information and local events). Regarding curricular areas, an interdisciplinary project-based learning about health was carried out by the different general education teachers over the school year. The tutorial action plan comprised 10 sessions geared towards increasing knowledge and awareness of PA, managing the distribution of time, and empowering adolescents to develop health literacy skills and manage their own PA. Some of these sessions also focused on the organization of physical activities by the students themselves during school recess. Regarding extracurricular areas, families were invited to provide information about their children's PA and to participate in several meetings about health-related behaviors. Special activities and local events were offered throughout the school year to the entire school community. Finally, information about the program was regularly disseminated via normal school communication methods (i.e., school blog, bulletin boards, newsletters) (further details of the intervention are available in Table 1 of supplementary material).

Data analysis

Levene and Kolmogorov-Smirnov tests were used to ensure homogeneity of variances and normality of distribution, respectively ($p > .05$). Cronbach's coefficient was calculated for each scale of the study. Descriptive statistics, internal reliability (see Tables 3 and 4), and correlations (see Table 2 of supplementary material) were calculated for all study variables. The intensity of autonomy-supportive strategies of the different sources of support was calculated through a descriptive analysis. Correlations between all different study variables were calculated (see Table 1 and 2). A 2 x 2 (time x group) multivariate analysis of covariance (MANCOVA) with repeated measures over time was used to examine the effect of the intervention program on each set of study variables (i.e., including individual factors and

composite variables). Gender and SES were included as covariates in all analyses. Between-group differences were tested comparing experimental and control school differences in each measuring time. Within-group differences were tested comparing pre-post differences in each group. A paired t-test with Bonferroni correction was used for statistical comparisons. Cohen's criteria were used as indicators of small (.01), medium (.06), and large (.14) effect sizes (Cohen, 1988). All statistical analyses were conducted using IBM SPSS Statistics v.23.0.

Table 1. Correlations between study variables in PE context.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
AS 1	-	.35	.24	-.25	-.35	.21	.21	.20	.34	.28	-.25	-.18	-.16	.23	.14	.25	-.12	-.01	-.26
CS 2		-	.28	-.20	-.37	.22	.22	.09	.24	.11	-.28	-.20	-.13	.14	.21	.19	-.23	-.10	-.17
RS 3			-	-.37	-.31	.34	.28	.18	.29	.32	-.20	-.25	-.15	.39	.27	.22	-.18	-.10	-.30
ICT 4				-	.31	-.28	-.19	-.15	-.25	-.30	.29	.15	.10	-.18	-.25	-.24	.17	.04	.28
ECT 5					-	-.19	-.24	-.18	-.25	-.15	.23	.10	.15	-.20	-.18	-.29	.17	.19	.24
AUT S 6						-	.39	.14	.19	.27	-.21	-.20	-.23	.25	.26	.30	-.16	-.19	-.21
COM S 7							-	.04	.17	.31	-.18	-.23	-.16	.28	.24	.23	-.26	-.18	-.21
REL S 8								-	.11	.32	-.04	-.03	-.21	.12	.08	.32	-.20	-.05	-.13
NOV 9									-	.27	-.26	-.19	-.15	.25	.16	.18	-.06	-.01	-.18
VAR 10										-	-.24	-.22	-.15	.28	.32	.36	-.12	-.21	-.30
AUT F 11											-	.30	.18	-.12	-.16	-.25	.05	.07	.28
COM F 12												-	.21	-.04	-.19	-.22	.17	.05	.42
REL F 13													-	-.12	-.20	-.14	.21	.22	.16
INTR 14														-	.15	.24	-.22	-.26	-.17
INTE 15															-	.20	.01	-.20	-.23
IDEN 16																-	-.16	-.06	-.29
INTRO 17																	-	.18	.15
EXT 18																		-	.06
AMOT 19																			-

Note: 1. AS=Autonomy support; 2. CS=Competence support; 3. RS=Relatedness support; 4. ICT=Internal controlling teaching; 5. ECT=External controlling teaching; 6. AUT S=Autonomy satisfaction; 7. COM S=Competence satisfaction; 8. REL S=Relatedness satisfaction; 9. NOV=Novelty; 10. VAR=Variety; 11. AUT F=Autonomy frustration; 12. COM F=Competence frustration; 13. REL F=Relatedness frustration; 14. INTR=Intrinsic motivation; 15. INTE=Integrated motivation; 16. IDEN=Identificated motivation; 17. INTRO=Introjected motivation; 18. EXT=External motivation; 19. AMO=Amotivation; Variables correlations between .13 and .17 are significant at $p < 0.05$ level; Factors correlations $\geq .17$ are significant at $p < 0.01$ level; Non significant correlations are marked in italics.

Table 2. Correlations between study variables in leisure-time PA context.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
PAS PET 1	-	.27	.19	.21	.24	.26	.17	.41	.14	.18	.28	.17	.22	-.16	-.02	-.37	.24	.18	.21	.28
PAS TE 2		-	.16	.12	.05	.14	.12	.24	.09	.09	.16	.20	.11	-.18	-.05	-.19	.16	.19	.10	.20
PAS FA 3			-	.19	.11	.16	.28	.26	.13	.22	.20	.32	.21	-.16	-.11	-.22	.32	.23	.24	.30
PAS MO 4				-	.18	.19	.20	.32	.28	.19	.11	.20	.09	.02	-.00	-.18	.09	.11	.13	.31
PAS PE 5					-	.18	.22	.32	.05	.16	.09	.15	.04	-.05	-.12	-.35	.21	.11	.12	.20
PAS TU 6						-	.18	.20	.11	.19	.22	.13	.13	-.12	-.01	-.15	.19	.14	.06	.17
AUT S 7							-	.27	.19	.26	.27	.33	.13	-.17	-.00	-.22	.21	.17	.19	.41
COM S 8								-	.15	.21	.22	.24	.16	-.05	-.15	-.35	.27	.21	.23	.40
REL S 9									-	.17	.13	.06	.22	-.09	-.07	-.17	.14	.01	.14	.25
NOV 10										-	.18	.22	.26	-.09	-.05	-.16	.19	.18	.20	.27
INTR 11											-	.17	.01	-.18	-.16	-.29	.24	.32	.31	.39
INTE 12												-	.16	-.04	.00	-.15	.25	.19	.21	.33
IDEN 13													-	-.14	-.06	-.08	.19	.12	.08	.15
INTRO 14														-	.11	.27	-.13	-.15	-.03	-.13
EXT 15															-	.20	-.05	.00	-.06	-.08
AMOT 16																-	-.25	-.22	-.23	-.32
ATTI 17																	-	.33	.35	.33
NORM 18																		-	.34	.30
PBC 19																			-	.36
INT 20																				-

Note: 1. PAS PET=Perceived autonomy support from PE teacher; 2. PAS TE=Perceived autonomy support from teacher; 3. PAS FA=Perceived autonomy support from father; 4. PAS MO=Perceived autonomy support from mother; 5. PAS PE=Perceived autonomy support from peers; 6. PAS TU=Perceived autonomy support from tutor; 7. AUT S=Autonomy satisfaction; 8. COM S=Competence satisfaction; 9. REL S=Relatedness satisfaction; 10. NOV=Novelty; 11. INTR=Intrinsic motivation; 12. INTE=Integrated motivation; 13. IDEN=Identificated motivation; 14. INTRO=Introjected motivation; 15. EXT=External motivation; 16. AMO=Amotivation; 17. ATTI=Attitudes; 18. NORM=Subjective norms; 19. PBC=Perceived behavioural control; 20. INT=Intentions. Variables correlations between .13 and .17 are significant at $p < 0.05$ level; Factors correlations $\geq .17$ are significant at $p < 0.01$ level; Non significant correlations are marked in italics.

Results

Autonomy-supportive strategies from the school community agents

Three experts identified the intensity of autonomy-supportive strategies for leisure-time PA of the different sources of support across the three terms of this school-based intervention (see Table 1 of supplementary material and Figure 1). As observed in Figure 1, most strategies were developed by PE teachers, tutors, and peers across the intervention and, particularly in the third term.

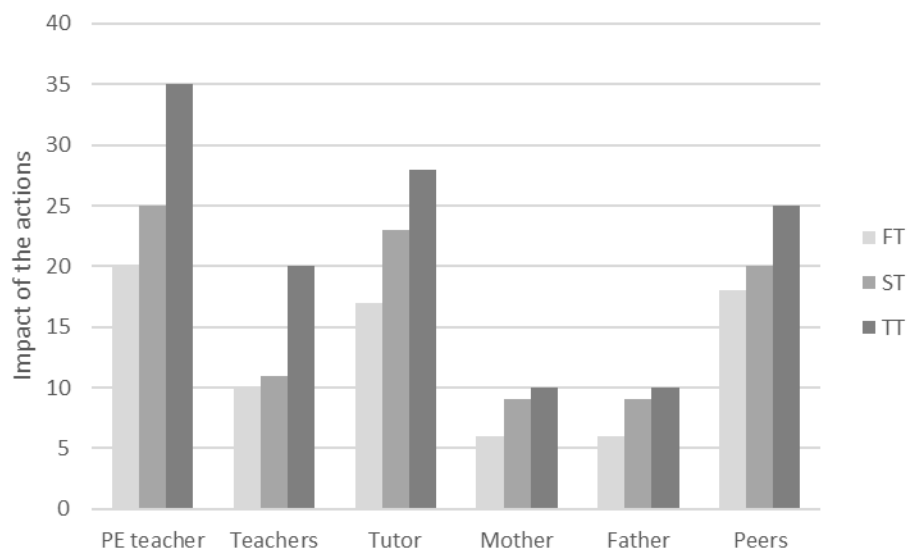


Figure 1. Intensity of autonomy-supportive strategies for leisure-time PA on different school community agents across the intervention. Note: FT = First term; ST = Second term; TT = Third term.

Correlational results

The low correlations between study variables (lower than .50 in PE and leisure-time PA settings) suggest that there is no overlapping between study variables (see Table 2 of supplementary material). As observed in Tables 1 and 2, positive and significant correlations between the variables integrated in the “bright side” of motivation in PE (i.e., need-supportive teaching, basic psychological needs, novelty and variety satisfaction, and autonomous motivation) were found. Positive and significant correlations between the variables integrated in the “dark side” of motivation in PE (i.e., controlling teaching in PE, basic psychological need frustration in PE, and controlled and amotivation in PE) were also found. Finally, positive and significant correlations between the variables in leisure-time PA context (i.e., autonomy support from different sources of the school community, basic psychological needs and novelty satisfaction, autonomous motivation, and theory of planned behavior variables) were also found.

Intervention effects

Levene and Kolmogorov-Smirnov tests revealed homogeneity of variance between the control and experimental groups, and normality of data. Results reported a significant effect on the interaction of time and group in each set of analyzed variables, showing medium to large effect sizes (see Tables 3 and 4).

Table 3. Descriptive statistics of socio-cultural determinants and motivational outcomes in SDT, and variables of TPB for leisure-time PA in experimental and control school. Inter- and intragroup effects.

Study variables	Test time	α	Experimental school	Control school	Contrast between groups (control-experimental school)						
			$M(SD)$	$M(SD)$	Mean Diff.	Standard error	$F(1,202)$	p	η_p^2	95% CID	
Autonomy support for PA from PE teacher (n=206)											
Wilks' Lambda=.594; $F(6,197)=22.408$; $p<.001$; $\eta_p^2=.406$											
Autonomy support from PE teacher	Pre	.95	4.27(1.33) ^a	4.30(1.49) ^a	-.02	.19	.02	.886	.000	-.41	.36
	Post	.96	5.52(1.10) ^b	4.52(1.35) ^a	1.00	.17	33.56	<.001	.142	.66	1.34
Autonomy support from teachers	Pre	.91	3.55(1.23) ^a	3.37(1.46) ^a	.18	.19	.88	.348	.004	-.19	.55
	Post	.96	4.40(1.16) ^b	3.40(1.42) ^a	1.00	.18	29.44	<.001	.127	.63	1.36
Autonomy support from father	Pre	.96	5.23(1.38) ^a	5.13(1.64) ^a	.10	.21	.22	.633	.001	-.31	.52
	Post	.97	5.95(1.22) ^b	5.11(1.61) ^a	.84	.20	17.59	<.001	.080	.44	1.24
Autonomy support from mother	Pre	.95	5.33(1.22) ^a	5.35(1.39) ^a	-.01	.18	.01	.922	.000	-.38	.34
	Post	.96	5.98(1.24) ^b	5.43(1.20) ^a	.54	.17	9.82	.002	.046	.20	.88
Autonomy support from peers	Pre	.97	3.88(1.68) ^a	3.67(1.70) ^a	.20	.24	.75	.385	.004	-.26	.68
	Post	.97	4.83(1.52) ^b	3.79(1.70) ^a	1.04	.22	20.88	<.001	.094	.59	1.49
Autonomy support from tutor	Pre	.95	2.64(1.27) ^a	2.63(1.17) ^a	.00	.17	.00	.962	.000	-.33	.35
	Post	.97	3.98(1.58) ^b	2.87(1.48) ^a	1.11	.21	26.12	<.001	.115	.68	1.54
Autonomy, competence, relatedness need satisfaction and novelty in LTPA (n=210)											
Wilks' Lambda= .815; $F(4,203) = 11.532$; $p<.001$; $\eta_p^2=.185$											
Autonomy satisfaction in leisure-time PA	Pre	.88	3.68(0.84) ^a	3.66(0.98) ^a	-.02	.12	.04	.832	.000	-.21	.27
	Post	.70	4.22(0.77) ^b	3.73(0.76) ^a	.48	.10	20.68	<.001	.091	.27	.69
Competence satisfaction in leisure-time PA	Pre	.94	3.57(1.15) ^a	3.41(1.30) ^a	.16	.16	.91	.341	.004	-.17	.49
	Post	.87	4.12(0.99) ^b	3.43(1.22) ^a	.69	.15	19.98	<.001	.088	.38	.99
Relatedness satisfaction in leisure-time PA	Pre	.81	4.09(0.66) ^a	3.99(0.87) ^a	.09	.10	.80	.370	.004	-.11	.31
	Post	.72	4.11(0.82) ^a	3.86(0.85) ^a	.25	.11	4.90	.028	.023	.02	.47
Novelty in leisure-time PA	Pre	.90	3.38(0.97) ^a	3.42(0.92) ^a	-.05	.13	.14	.701	.001	-.30	.20
	Post	.89	4.10(0.93) ^b	3.50(0.92) ^b	.59	.12	21.04	<.001	.093	.33	.84
Motivational regulations for LTPA (n=210)											
Wilks' Lambda=.707; $F(6,201)=13.859$; $p<.001$; $\eta_p^2=.293$											
Intrinsic motivation for leisure-time PA	Pre	.94	2.73(1.04) ^a	2.72(1.20) ^a	-.01	.15	.00	.945	.000	-.29	.31
	Post	.85	3.40(0.80) ^b	2.89(1.11) ^a	.51	.13	15.15	<.001	.069	.25	.77
Integrated regulation for leisure-time PA	Pre	.91	2.26(1.04) ^a	2.35(1.15) ^a	-.09	.15	.38	.537	.002	-.39	.20
	Post	.83	3.06(0.94) ^b	2.35(1.11) ^a	.71	.14	23.71	<.001	.103	.42	.99
Identified regulation for leisure-time PA	Pre	.90	2.53(1.10) ^a	2.38(1.15) ^a	.14	.15	.86	.353	.004	-.16	.46
	Post	.76	3.06(0.87) ^b	2.28(1.13) ^a	.77	.14	29.37	<.001	.125	.49	1.05
Introjected regulation for leisure-time PA	Pre	.92	1.46(1.03) ^a	1.46(1.26) ^a	-.00	.16	.00	.970	.000	-.31	.32
	Post	.86	0.87(0.84) ^b	1.43(1.23) ^a	-.56	.14	14.42	<.001	.065	-.85	-.26
External regulation for leisure-time PA	Pre	.92	1.34(1.05) ^a	1.39(1.17) ^a	-.04	.15	.10	.753	.000	-.35	.25
	Post	.80	1.29(0.85) ^a	1.47(1.07) ^a	-.17	.13	1.85	.175	.009	-.43	.08

Amotivation for leisure-time PA	Pre	.93	0.91(0.93) ^a	1.20(1.22) ^a	-.28	.15	3.60	.059	.017	-.58	.01
	Post	.89	0.69(0.90) ^b	1.26(1.26) ^a	-.57	.15	13.65	<.001	.062	-.87	-.26
Variables of theory of planned behaviour (n=210)											
Wilks' Lambda=.667; F(4,203)=24.181; p<.001; η ² =.323											
Attitudes	Pre	.96	5.07(1.57) ^a	5.25(1.69) ^a	-.17	.23	.59	.443	.003	-.62	.27
	Post	.91	5.78(1.39) ^b	5.11(1.64) ^a	.66	.21	9.60	.002	.045	.24	1.09
Subjective norms	Pre	.91	5.33(1.54) ^a	5.30(1.49) ^a	.03	.21	.03	.862	.000	-.37	.45
	Post	.86	6.00(1.42) ^b	5.17(1.46) ^a	.83	.20	17.33	<.001	.078	.44	1.23
Perceived behavioural control	Pre	.93	5.13(1.79) ^a	5.48(1.60) ^a	-.35	.23	2.22	.137	.011	-.82	.11
	Post	.85	5.74(1.56) ^b	5.33(1.53) ^a	.40	.21	3.53	.061	.017	-.02	.83
Intentions	Pre	.94	5.09(1.71) ^a	5.11(1.80) ^a	-.06	.23	.08	.733	.000	-.53	.39
	Post	.90	5.95(1.43) ^b	4.93(1.83) ^a	1.01	.22	20.55	<.001	.091	.57	1.46

Note: α=Alpha de Cronbach; Diff.=Difference; CID=Confidence interval differences; LL=Lower limit; UL=Upper limit. Intra-group comparison for each variable is indicated with different superscripts (a, b). Different superscripts indicate that values are significantly different.

Table 4. Descriptive statistics of socio-cultural determinants and motivational outcomes in SDT for PE in experimental and control school. Inter- and intragroup effects.

Study variables	Test time	α	Experimental school	Control school	Contrast between groups (control-experimental school)						
			M(SD)	M(SD)	Mean Diff.	Standard error	F (1,202)	p	η ²	95% CID	
Autonomy, competence and relatedness support from PE teacher (n=210)											
Wilks' Lambda=.601; F(3,204)=45.113; p<.001; η ² =.399											
Autonomy support from PE teacher	Pre	.89	3.26(0.97) ^a	3.16(1.04) ^a	.09	.14	.45	.500	.002	-.18	.37
	Post	.84	4.07(0.95) ^b	3.11(1.01) ^a	.96	.13	49.40	<.001	.193	.69	1.23
Competence support from PE teacher	Pre	.93	3.62(1.03) ^a	3.40(1.16) ^a	.21	.15	1.93	.166	.009	-.08	.51
	Post	.89	4.36(0.93) ^b	3.31(1.09) ^a	1.05	.14	53.73	<.001	.207	.76	1.33
Relatedness support from PE teacher	Pre	.92	3.67(1.09) ^a	3.43(1.14) ^a	.24	.15	2.53	.113	.012	-.05	.55
	Post	.86	4.39(0.95) ^b	3.32(1.05) ^a	1.07	.14	57.78	<.001	.219	.79	1.34
Internal and external controlling teaching style of PE teacher (n=210)											
Wilks' Lambda=.731; F(2,205)=37.717; p<.001; η ² =.269											
Internal controlling teaching of PE teacher	Pre	.82	2.10(0.99) ^a	2.27(0.95) ^a	-.17	.13	1.64	.201	.008	-.44	.09
	Post	.85	1.50(0.87) ^b	2.37(0.90) ^a	-.87	.12	49.54	<.001	.194	-1.11	-.62
External controlling teaching of PE teacher	Pre	.88	2.31(1.08) ^a	2.43(0.91) ^a	-.12	.14	.76	.383	.004	-.40	.15
	Post	.86	1.65(0.94) ^b	2.59(0.87) ^a	-.94	.12	53.63	<.001	.207	-1.19	-.68
Autonomy, competence, and relatedness need satisfaction, novelty and variety in PE (n=210)											
Wilks' Lambda=.743; F(5,202)=13.952; p<.001; η ² =.257											
Autonomy satisfaction in PE	Pre	.91	3.34(1.01) ^a	3.38(1.13) ^a	-.04	.14	.08	.775	.001	-.33	.25
	Post	.90	3.91(1.17) ^b	3.25(1.07) ^a	.65	.15	16.75	<.001	.075	.33	.96
Competence satisfaction in PE	Pre	.94	3.41(1.19) ^a	3.39(1.23) ^a	.01	.16	.01	.912	.001	-.30	.34
	Post	.92	3.95(1.18) ^b	3.23(1.19) ^a	.72	.16	18.53	<.001	.083	.39	1.05
Relatedness satisfaction in PE	Pre	.90	3.84(0.95) ^a	3.76(1.02) ^a	.08	.13	.42	.517	.002	-.18	.36
	Post	.84	3.90(1.07) ^a	3.57(1.00) ^b	.33	.14	6.29	<.001	.030	.07	.60
Novelty satisfaction in PE	Pre	.90	3.38(0.89) ^a	3.41(0.92) ^a	-.02	.12	.05	.820	.000	-.27	.21
	Post	.83	4.05(0.96) ^b	3.28(0.91) ^a	.76	.13	33.05	<.001	.138	.50	1.02
Perceived variety in PE	Pre	.89	4.06(0.95) ^a	3.87(1.10) ^a	.18	.14	1.77	.183	.009	-.08	.46
	Post	.92	4.66(1.31) ^b	3.69(1.14) ^a	-.96	.17	31.37	<.001	.132	.62	1.30
Autonomy, competence, and relatedness need frustration PE (n=210)											
Wilks' Lambda=.809; F(3,204)=16.030; p<.001; η ² =.191											
Autonomy frustration in PE	Pre	.88	2.45(0.98) ^a	2.63(1.03) ^a	-.18	.14	1.68	.196	.008	-.46	.09
	Post	.89	1.80(1.06) ^b	2.75(1.06) ^a	-.95	.14	40.10	<.001	.163	-1.25	-.65
Competence frustration in PE	Pre	.92	2.20(1.15) ^a	2.46(1.26) ^a	-.25	.16	2.31	.130	.011	-.58	.07
	Post	.92	1.74(1.07) ^b	2.51(1.26) ^a	-.77	.16	21.95	<.001	.096	-1.10	-.44

Relatedness	Pre	.91	1.80(0.98) ^a	2.04(1.12) ^a	-.24	.14	2.58	.109	.012	-.53	.05
frustration in PE	Post	.93	1.45(0.98) ^b	2.07(1.14) ^a	-.62	.14	17.15	<.001	.077	-.92	-.32
Motivational regulations in PE (n=210)											
Wilks' Lambda=.709; F(6,201)=13.729; $p < .001$; $\eta_p^2 = .291$											
Intrinsic	Pre	.95	4.95(1.59) ^a	4.60(1.82) ^a	.34	.23	2.13	.146	.010	-.12	.81
motivation in PE	Post	.94	5.55(1.72) ^b	4.48(1.67) ^a	1.06	.23	19.68	<.001	.088	.59	1.53
Integrated	Pre	.89	4.28(1.15) ^a	4.25(1.50) ^a	.03	.18	.04	.836	.000	-.33	.40
regulation in PE	Post	.89	5.16(1.25) ^b	4.14(1.39) ^a	1.01	.19	28.81	<.001	.123	.64	1.39
Identified	Pre	.89	4.42(1.15) ^a	4.29(1.40) ^a	.13	.17	.56	.453	.003	-.21	.48
regulation in PE	Post	.87	5.32(1.24) ^b	4.21(1.32) ^a	1.11	.18	37.91	<.001	.155	.75	1.46
Introjected	Pre	.84	3.89(1.13) ^a	4.03(1.45) ^a	-.13	.18	.52	.471	.003	-.49	.22
regulation in PE	Post	.88	3.13(1.45) ^b	4.13(1.43) ^a	-.99	.20	24.66	<.001	.107	-1.39	-.60
External	Pre	.86	3.42(1.41) ^a	3.22(1.36) ^a	.19	.19	.99	.320	.005	-.19	.58
regulation in PE	Post	.90	2.89(1.75) ^b	3.32(1.28) ^a	-.42	.21	3.89	.050	.019	-.85	-.00
Amotivation in PE	Pre	.93	2.32(1.39) ^a	2.71(1.50) ^a	-.39	.20	3.74	.054	.018	-.79	.00
	Post	.91	1.74(1.20) ^b	2.84(1.34) ^a	-1.09	.17	37.88	<.001	.155	-1.45	-.74

Note: PET = Physical Education Teacher; α =Alpha de Cronbach; Diff.=Difference; CID=Confidence interval differences; LL=Lower limit; UL=Upper limit. Intra-group comparison for each variable is indicated with different superscripts (a, b). Different superscripts indicate that values are significantly different.

Between-group effects

No statistically significant differences were found between control and experimental school students at baseline values in any variable of the study. However, after the intervention program, the experimental school students reported significantly higher values in all psychological variables than the control school students, except for external regulation in leisure-time PA. All variables in the post-test showed medium-to-large effect sizes (Table 3 and 4).

Within-group effects

Experimental school students reported a statistically significant improvement in all psychological variables of the study in comparison to their baseline values, except for relatedness satisfaction in leisure-time PA and PE, and external regulation in leisure-time PA (Tables 3 and 4). Additionally, as fidelity indicators of the intervention, experimental school students showed statistically significant higher values in autonomy support for leisure-time PA from different sources (i.e., PE teachers: Wilks' Lambda=.624; F(1,206)=124.213; $p < .001$; $\eta_p^2 = .376$; teachers: Wilks' Lambda=.777; F(1,206)=59.022; $p < .001$; $\eta_p^2 = .223$; father: Wilks' Lambda=.857; F(1,203)=33.966; $p < .001$; $\eta_p^2 = .143$; mother: Wilks' Lambda=.880;

$F(1,205)=27.912$; $p<.001$; $\eta_p^2=.120$; peers: Wilks' Lambda=.831; $F(1,206)=41.8989$; $p<.001$; $\eta_p^2=.169$; and tutor: Wilks' Lambda=.695; $F(1,206)=90.226$; $p<.001$; $\eta_p^2=.305$), as well as in autonomy, competence and relatedness support from PE teacher (Wilks' Lambda=.601; $F(3,204)=45.113$; $p<.001$; $\eta_p^2=.399$), and internal and external controlling teaching style values (Wilks' Lambda=.731; $F(2,205)=37.717$; $p<.001$; $\eta_p^2=.269$) from PE teachers, all showing medium-to-large effect sizes.

Discussion

Experimental school students reported significant improvements in almost all socio-cultural determinants and motivational outcomes in PE and PA settings, as well as in theory of planned behavior variables, supporting the proposed hypothesis. Apart from increasing PA levels (Sevil, García-González, Abós, Generelo, & Aibar, 2019), the “Paths of the Pyrenees” program improves psychological determinants and correlates associated with PA in both PA and PE contexts, which have been identified as “active ingredients” of PA changes and long-term PA maintenance (Gillison et al., 2018; Rhodes et al., 2017). These findings are in line with a previous school-based PA intervention where autonomy support for leisure-time PA from PE teachers, parents, and peers was an effective strategy to improve students' autonomous motivation in leisure-time PA and PE contexts, control, subjective norm, intention to be physically active, and PA levels (González-Cutre, Ferriz, et al., 2014). Our results seem to support the effectiveness of integrating multiple theoretical frameworks, the development of a multicomponent PA program, and the adoption of a whole-of-school approach to positively influence students' psychological outcomes and PA levels (Rhodes et al., 2017; van de Kop et al., 2019).

The development of the multicomponent “Paths of the Pyrenees” program, which particularly comprised autonomy-supportive training for teachers, tutors and parents, was

effective in increasing students' perception of autonomy support for leisure-time PA from all agents involved. This fact would be an indicator to ensure high fidelity of the intervention. To our knowledge, this is the first study that analyzes the effects of a school-based PA intervention on students' perception of autonomy support for leisure-time PA, not only from PE teachers, parents and peers, but also from teachers, tutor, and mother and father, separately. In line with our results, a previous school-based intervention, conducted over five weeks and focused on autonomy-supportive strategies to promote PA showed an increase in students' perceptions of autonomy support for leisure-time PA from PE teachers, parents and peers (González-Cutre, Ferriz, et al., 2014). However, in a recent six-month multicomponent PA intervention (González-Cutre et al. 2018), significant differences were found, after the intervention, in students' perceptions of autonomy support for leisure-time PA from parents and peers, while no differences were found in autonomy support from PE teachers. Our results suggest that training parents, teachers, and tutors in multiple co-acting autonomy-supportive techniques and strategies, as well as encouraging their involvement in curricular and extracurricular activities (e.g., bike week, local sport events), may considerably improve students' perceptions of autonomy support for leisure-time PA. Considering peer support, several reasons could explain improvements in students' perceptions. First, the intervention was designed to empower adolescents to develop their own activities (e.g., design of activities during school recess). Second, the creation of a healthier and more active school environment could provide the opportunity to develop new relationships across different school grades. Third, most of the activities offered in this program inherently involved the collective participation of peers. To illustrate this, some recreational activities such as a Datchball tournament required the participation of at least 10 students. All these facts may consequently

provide different types of PA support from peers such as encouragement or role modeling (Maturó & Cunningham, 2013).

Despite the importance of all agents, the largest effect size was observed in students' perceptions of autonomy support for leisure-time PA from PE teachers. This result, attributable to the important role of PE teachers in all components of the program (see Figure 1), is in line with previous studies (Kalajas-Tilga, Koka, Hein, Tilga, & Raudsepp, 2019; Sevil et al., 2018) where it was shown that PE teachers can also support students' leisure-time PA. The intra-group analysis revealed a large effect size in terms of support from tutors. The high number and the specific health-related content of tutorial sessions in the program (see Figure 1), in addition to low values in autonomy support for leisure-time PA from tutors before the intervention, could explain this effect size. Another possible explanation was that tutorial action could be particularly effective to empower adolescents to be physically active in and out of school. To illustrate this, information about local sport events was provided weekly by tutors. The smallest effect sizes were found in students' perceptions of autonomy support for leisure-time PA from mother and father. A possible reason might be that PA support from parents decreases in the transition from childhood to adolescence (Lau, Faulkner, Qian, & Leatherdale, 2016) and that intervention strategies focused more on autonomy support from teachers (see Figure 1).

Consistent with our hypothesis, a positive intervention effect was found in students' motivational outcomes to leisure-time PA (i.e., basic psychological need satisfaction, novelty satisfaction, and motivation), and variables of theory of planned behavior. Results of this study are in line with previous intervention studies that have suggested the effectiveness of adopting a whole-of-school approach involving multiple sources (i.e., PE teacher, teachers,

tutor, mother, father, and peers) to increase students' motivational outcomes, theory of planned behavior variables and, subsequently, PA behavior (Rhodes et al., 2017). Our results seem better than previous short-term school-based PA interventions (González-Cutre, Ferriz, et al., 2014), where significant changes were only reported in integrated and identified regulation in leisure-time PA, control, subjective norm, intention, and PA levels. Considering the additive model (Sevil et al., 2018), long-term social support simultaneously provided by multiple agents such as teachers, tutors, families, students, and PE teachers, in particular, could have additional effects on students' motivational outcomes in the PA setting. Autonomy, competence, and relatedness satisfaction in leisure-time PA could be especially influenced by the existence of multiple sources of support (González-Cutre, Sicilia, et al., 2014). On the basis of the theoretical tenets of self-determination theory (Ryan & Deci, 2017), students' perceptions of choice (i.e., autonomy), efficacy (i.e., competence), and integration (i.e., relatedness) in leisure-time PA could significantly contribute to autonomous motivation in leisure-time PA. Consistent with the trans-contextual model of motivation (Hagger, & Chatzisarantis, 2009; Hagger, & Chatzisarantis, 2016), another theoretical explanation of our results could be the transfer of motivation from PE to leisure-time PA. If students have positive motivational experiences during PE lessons, they are likely to be more involved in PA outside school (Hagger, & Chatzisarantis, 2016; Sun et al., 2017). Surprisingly, no significant differences in external regulation in PA were found, which may be attributable to the additional social support provided by different agents that could influence students' perceptions. The greater values of novelty satisfaction could be due to the wide range of novel activities and situations of the multicomponent PA program (e.g., Datchball, kin-ball, trekking, bike week). To our knowledge, this is the first study that examines the effect of a school-based PA intervention on novelty satisfaction in leisure-time

PA (González-Cutre et al., 2016), so its theoretical mechanism of influence should be further examined.

Going deeper into one of the more important components of the “Paths of the Pyrenees” program (i.e., PE lessons), a significant improvement in teachers' motivating styles was found. Consistent with previous studies, teacher training to adopt a need-supportive teaching style and to avoid a controlling teaching style was effective to increase students' perceptions of need-supportive behaviors (e.g., Sánchez-Oliva, Pulido-González, Leo, González-Ponce, & García-Calvo, 2017), and to reduce controlling teaching behaviors (e.g., Cheon et al., 2016; Cheon, Reeve, & Ntoumanis, 2018) in PE classes, which could, in addition, be an indicator of the high fidelity of the intervention. Although further studies using systematic observation instruments are required to code the frequency and the intensity of need-supportive behaviors (Quested, Ntoumanis, Stenling, Thogersen-Ntoumani, & Hancox, 2018), students' perceptions of their teachers' motivating styles have shown an influence on motivational outcomes. Therefore, special attention should be paid to teachers' motivating styles in PE intervention programs.

The current work broadens knowledge of previous research by examining the effects of teaching programs, aimed at improving teachers' motivating styles, on students' motivational outcomes in PE classes, both on the “bright” and “dark” side of motivation. Students who participated in the “Path of the Pyrenees” program reported a significant improvement in motivational outcomes in PE classes on both sides of motivation (i.e., “bright” and “dark” sides). Our results are consistent with past literature, in which significantly higher values in basic psychological need satisfaction and autonomous motivation (Sánchez-Oliva et al., 2017), as well as significantly lower values in basic

psychological need frustration and amotivation (Cheon et al., 2016), were found after implementing teaching programs to become more need-supportive or less controlling. In keeping with self-determination theory (Ryan & Deci, 2017), the adoption of a motivating teaching style could help to fulfil the satisfaction of basic psychological needs and to avoid the frustration of basic psychological needs, which, in turn, could enhance the more autonomous forms of motivation in PE lessons. Students from the experimental school also showed higher values in novelty and variety satisfaction in the PE context. Although qualitative studies should be conducted for a broader explanation of these changes, our results suggest that teachers' motivating styles in PE lessons could play a key role in students' perception of novelty and variety satisfaction.

Our findings have several limitations. First, a convenience sample from two public secondary schools was used. Second, data was exclusively collected from students' self-reported measures, which could introduce social desirability. Therefore, no observational instruments were used to assess the motivating style from different school community agents in both experimental and control school. Third, considering the nature of the multicomponent intervention, we could not determine which dimensions, strategies, and social agents were more effective in each variable. In this vein, given the small sample size it was not possible to conduct a structural equation modeling to know how the “Paths of the Pyrenees” program could induce changes in adolescents' PA levels. Four, the lack of a follow-up assessment does not allow us to examine the long-term effectiveness of PA intervention programs as suggested by several authors (Nguyen et al., 2016). Nevertheless, the positive impact on students' motivational outcomes in PE and PA settings may suggest the maintenance of PA over time. The use of observational instruments to assess teachers' motivating styles and the application of the RE-AIM framework would be helpful to understand the intervention effects.

Conclusion

Applying behavior change theories such as social ecological model, self-determination theory, and theory of planned behavior for designing and implementing multicomponent school-based interventions seems to be effective in improving adolescents' socio-cultural and psychological determinants of PA. Consequently, multicomponent PA programs such as “Paths of the Pyrenees” may help to enhance the maintenance of PA levels in adolescents. The adoption of a whole-of-school approach, involving school teachers, families, students and, particularly, PE teachers, seems decisive to empower adolescents to be active in and out of school. Our results highlight the key role of PE teachers in students' motivational experiences, which in turn can be transferred to autonomous motivation in a leisure-time PA context.

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