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Original

Effect of a Sport Education-based teaching unit in Physical Education on high school students' social networks and quantitative sociometry scores: A cluster randomized control trial☆

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ABSTRACT

The present study aimed: (a) to examine the effect of the Sport Education-based teaching unit on students' sociometric status and quantitative relationship indices from a macro-analysis perspective (classroom-group level); and (b) to study the effect of the program on students' relationships using a quantitative and visual analysis from a micro-analysis perspective (within the Sport Education subgroup teams level) in the Physical Education setting. One hundred and sixty-five high school students (46.7% females; $M_{age} = 14.0 \pm 1.1$ years old) from six pre-established classes were cluster-randomly assigned into the experimental ($n = 108$) or control groups ($n = 57$). Both groups carried out a six-week intervention program (two Physical Education lessons a week). The experimental group followed the Sport Education model, while the control group methodology was based on direct instruction. Results of the Multilevel Linear Model showed that there were no significant differences in students' sociometric indices nor sociometric status from a macro-analysis perspective. However, the results of the McNemar's test and the visual analysis of social networks within-teams in the experimental group showed that the students' relationships changed favorably within-team after the Sport Education program increased positive nominations and reduced negative nominations. In conclusion, these results suggest that the Sport Education model facilitates initiating new positive social relationships and removing negative relationships in within-team students.

Efecto de una unidad didáctica de educación deportiva en Educación Física sobre las relaciones sociales y los índices sociométricos cuantitativos: Un ensayo controlado y aleatorizado por grupos

Palabras clave:
Modelos pedagógicos
Interrelación
Educación física
Habilidades sociales
Sociograma
Adolescentes
Nominaciones entre iguales

RESUMEN

Los objetivos son: (a) comprobar el efecto de una unidad didáctica de Educación Deportiva sobre el estatus social de los estudiantes y los índices cuantitativos de relación entre compañeros desde una perspectiva de macroanálisis (grupo aula); y (b) estudiar el efecto del programa en las relaciones de los estudiantes mediante un análisis cuantitativo y visual desde una perspectiva de microanálisis (subgrupos de cada equipo) en Educación Física. Ciento sesenta y cinco estudiantes de Educación Secundaria Obligatoria (46,7% mujeres; $M_{edad} = 14{,}0 \pm 1{,}1$ años) de seis clases han sido asignados aleatoriamente a los grupos experimental ($n = 108$) o control ($n = 57$). Ambos realizan un programa de seis semanas (dos sesiones de Educación Física semanales). El grupo experimental sigue el modelo de Educación Deportiva, mientras que la metodología del grupo control se basa en la instrucción directa. Los resultados muestran que no

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hay diferencias estadísticamente significativas en los índices sociométricos ni en el estatus social desde una perspectiva de macroanálisis. Sin embargo, las relaciones cambian favorablemente dentro del equipo después del programa de Educación Deportiva, aumentando las nominaciones positivas y reduciendo las negativas en el grupo experimental. En conclusión, estos resultados sugieren que el Modelo de Educación Deportiva facilita el inicio de nuevas relaciones sociales positivas y la eliminación de relaciones negativas en los estudiantes dentro de los equipos.

Introduction

Sport practice is inherently linked with social concerns and it is considered an ideal environment for teaching adolescents how to effectively socialize with peers (Stuntz & Weiss, 2009). The desire of achieving social goals, especially those related to peer acceptance, group inclusion, or being with a friend, is extremely important during adolescence (Montgomery et al., 2020). Furthermore, it is considered essential to understand adolescents' behavior in the practice of physical activity (Allen, 2003). For example, these social issues are related to intrinsic motivation or enjoyment from physical activity (Alali et al., 2020), and have been considered in some motivation theories as being related to the promotion of physical activity. For instance, the theory of *Social Motivation in Youth Sport* proposed by Allen (2003) emphasizes the development of close social relationships (i.e., building friendship relations), the gain of popularity and recognition among peers, and the perception of belonging to a group as main factors for explaining adolescents' sport motivation. This importance of social relationships on sport motivation is also highlighted by the *Self-Determination Theory* (Ryan & Deci, 2020). Specifically, *relatedness*, understood as the need to feel connected with others and belonging to a group, is included as one of the three innate psychological needs in the *Self-Determination Theory* (Ryan & Deci, 2020). Therefore, emphasizing the enhancement of peer relationships and affiliation opportunities in the physical activity context seems to be very important because it may translate to an increase in adolescents' motivation towards sport and, consequently, the achievement of higher physical activity levels (Sheridan et al., 2014).

Physical Education (PE) is a crucial subject within the school setting that provides students with numerous interactions and social opportunities, promoting positive social skills among them (Molina et al., 2020), and helping at the same time, to prevent serious problems facing the school community, such as bullying (Jiménez-Barbero et al., 2020). Moreover, the PE subject has a recognized potential to contribute to the achievement of key mandatory educative competencies related to social skills and social responsibilities (Lleixá et al., 2016). However, there is vast heterogeneity regarding teacher role and discourse, contents, methodology, organizations, or task designs that teachers can apply during PE lessons and whose decisions will directly influence the achievement of these social aims (Jiménez-Barbero et al., 2020; Metzler, 2017). For effective development of social competencies and capacities, such as peer cooperation or building friendly relationships, the application of active and group-work methodologies seems necessary (Lleixá et al., 2016; Pozo et al., 2018).

Among others, the Sport Education Model (SE) could be an appropriate curriculum and instruction model to develop social skills and competencies (Siedentop, 1994). It is probably one of the most widely implemented and researched instructional approaches in the world, demonstrated by the numerous systematic reviews carried out internationally (e.g., Bessa et al., 2019; or Evangelio et al., 2018), and specifically in Spain (Guijarro et al., 2020). The main characteristics of this model are that: (a) the teaching unit is organized as a sport "season"; (b) students develop a "sense of affiliation" becoming members of a team (i.e., small group works); (c) the season has a "formal competition" phase, where small-sided games adapted to the students' level take place; (d) students assume different roles other than players (e.g., coach, captain or referee); (e) a "record keeping" of behaviors and results takes place throughout the formal competition; (f) and, the season is developed in a "festive" atmosphere, creating distinctive team elements, publishing photographs or celebrating achievements (Siedentop et al., 2019). Numerous SE-based studies have shown the potential for achieving multiple socially related benefits during the teaching-learning process in PE (Bessa et al., 2019; Evangelio et al., 2018). For example, the SE has shown to improve: (a) the number and quality of peer interactions, allowing students to get to know peers better (Fernández-Río & Menéndez-Santurio, 2017), and in consequence, fostering their relationship and building friendships (MacPhail et al., 2008; Puente-Maxera et al., 2020); (b) team membership and the sense of affiliation (Wallhead et al., 2013); (c) the levels of cooperation with peers (Pill, 2010); and (d) the satisfaction of the basic psychological need for relatedness (Wallhead et al., 2013).

Even though previous research has reported the outstanding influence of the SE on the social benefits mentioned above, the study design, target variables and instruments used to analyze results are highly heterogeneous (Bessa et al., 2019; Evangelio et al., 2018). Following the systematic review conducted by Bessa et al. (2019), the building and consolidation of positive peer-interactions (i.e., friendship relations) has been highlighted as one of the most studied variables. Despite this, in previous studies the instruments used to measure this variable have been mainly based on Likert-type questionnaires (e.g., Puente-Maxera et al., 2020) or qualitative analyses of the registered testimonies from teachers and students (e.g., Fernández-Río & Menéndez-Santurio, 2017; MacPhail et al., 2008). However, for measuring friendship and disliking relationships among peers within the school context, the peer sociometric nominations is considered the 'gold standard' method (Cillessen & Bukowski, 2018). The sociometric nominations method allows for the analysis of positive and negative peer interactions using quantitative indices, and for categorizing students into different sociometric statuses, as well as displaying a diagrammatic map of all of the nodes (individuals) and arcs in the class (arrows that represent the set of social relationships within the class-group) (González & García-Bacete, 2010). However, despite the great scientific evidence supporting the SE, only two previous studies have used sociometric nominations to examine the effect of a SE-based program on friendship relations in elementary school students (García-López et al., 2012; Molina et al., 2020). Regarding its effectiveness, although Molina et al.'s study (2020) was successful for decreasing the negative relationships among students, none of the two previous studies were effective for improving positive relationships among students. Nonetheless, these two previous studies did not include a comparison against another group (i.e., a control group), which could potentially bias their conclusions. Besides, they also carried out a very superficial analysis of the sociometric nominations, counting the number of positive and negative relationships (i.e., friends/enemies, respectively) existing in the class-group before and after the intervention.

Unfortunately, to our knowledge, there are no previous SE-based intervention studies which used a controlled design and conducted an extensive evaluation of the sociometric nominations

to measure relations among peers. Moreover, a complementary analysis that contributes further scientific knowledge on this important research topic could be to study how students' relationships in each of the SE teams could vary after the intervention. Finally, to study a sample of high school students using sociometric nominations is also pending and interesting due to the complex relationships among peers at this age in comparison with previous studies carried out in elementary school students. In order to face very common situations in adolescence, such as the marginalization caused by bullying, or marginalized situations caused by foreign students from other cultures, or students with special educational needs, one of the most effective strategies is to have a friend, someone to trust in the class to discuss their problems and to feel more integrated and included in the group (e.g., Hong & Espelage, 2012). Therefore, applying the SE may help to improve friendship relations by reinforcing these social ties and ultimately contributing to counteract these special circumstances, although this needs to be verified with future research.

Consequently, the present study pursued two main aims: (a) to examine the effect of the SE-based teaching unit on students' sociometric status and quantitative relationship indices from a macro-analysis perspective (classroom-group level); and (b) to study the effect of the program on students' relationships using a quantitative and visual analysis from a micro-analysis perspective (within the SE subgroup teams level) in the PE setting.

Method

Participants

A sample of 165 high-school students (77 females) aged 13-16 years old (M_{age} = 14.0 ± 1.1 years old) from six different eighth and tenth-grade (i.e., second and fourth-grade in the secondary education level in Spain) PE classes of one state high-school center were invited to participate in the present study. The school was situated in the city center of Granada (Spain). The teachers responsible for the Experimental group (EG) had previous experience in the SE model. They had taught at least two seasons of the model before this study and possessed the desire to implement the SE within their classes. The inclusion criteria for students were: (a) being enrolled in the eighth or tenth grades (classes where the school approvals were obtained); (b) being free from any health disorder which would make them unable to participate in PE; (c) being enrolled in the PE subject within their study program; (d) presenting written signed consent of their parents or legal guardians, and (e) presenting written signed assent of the students. The exclusion criterion was not having correctly filled out the sociogram at the beginning and/or at the end of the intervention program. However, to maximize the use of available data, all valid cases for each variable were used (i.e., even if for other variables they were excluded).

Measures

Anthropometric measures

Students' anthropometric measurements were measured following the *International Standards for Anthropometric Assessment* (Stewart et al., 2011).

Habitual physical activity

Students' habitual physical activity was estimated by the adapted and validated Spanish version of the *Physician-based Assessment and Counseling for Exercise questionnaire* (PACE) for adolescents (Martínez-Gómez et al., 2009). It consists of two questions that assess how many days in the last week and in a normal week at least 60 minutes of physical activity are performed. A 7-point Likert-type scale, ranging from 0 to 7 days was used. The PACE questionnaire has shown adequate convergent validity (accelerometer) among adolescents (r = .43; Martínez-Gómez et al., 2009).

Sociometric nominations

The *peer sociometric nominations* methods described by González and García-Bacete (2010) was used to examine students' sociometric status and quantitative indices. This method has been extensively used and its convergent validity and test-retest reliability have been demonstrated (Cillessen & Bukowski, 2018). The present study opted for a single criterion questionnaire (likeability) and a two dimension questionnaire (*positive and negative nominations*). Specifically, the two dimension questionnaire consists of two items: (1) "Who are the three classmates you like the most?" (i.e., *positive nominations*); (2) "Who are the three classmates you like the least?" (i.e., *negative nominations*). The number of nominations allowed was limited to three for each item and they also were limited to their classmates.

After obtaining the data from the peer sociometric nominations questionnaire, the information was analyzed following the *Sociomet* instructions (González & García-Bacete, 2010). Firstly, from the macro-analysis perspective (i.e., classroom-group level), students were classified into five categories of preferred, average, controversial, neglected, and rejected status (García-Bacete & Cillessen, 2017). To calculate the cut-off points for each sociometric status, the continuous binomial probabilities' method that adjusts the raw *positive nominations* and *negative nominations* received in each classroom was used. See García-Bacete and Cillessen (2017) for further details. Secondly, the sociometric indices were calculated by an *ad hoc* Microsoft Office Excel 2016 template (Microsoft® Corporation). All the raw scores were transformed into percentages to calculate the indices, so the scores range from 0 to 100. The indices were grouped into two main categories: (1) *Peer sociometric nominations received*: the scores of positive nominations and negative nominations received for each child were used to calculate the popularity, antipathy, social impact, and social preference indices; and (2) *Friendship and Enmity*: these variables measure dyadic relationships characterized by the reciprocity of affection between the two members of the dyad (i.e., mutual attractiveness or mutual antipathy), reflected in the friends and enemies' indices. See Supplementary File 1 for further description of the sociometric quantitative indices used in the present study. Afterward, the effect of the SE-based teaching unit on students' sociometric indices change scores (i.e., post-intervention – pre-intervention) was analyzed. In the sample of the present study (control group) the reliability of all the sociometry indices was good to excellent (.61-.94).

On the other hand, regarding the micro-analysis perspective in the EG, a dual approach analysis was performed to measure students' relationships within each team. Firstly, a quantitative analysis was done calculating the number of *positive nominations* and *negative nominations* received between students in the same SE team. Moreover, a visual analysis of each team structure was carried out building the sociometric networks, considering both one-way and mutual nominations, within each SE team.

Procedure

The present study is reported according to the CONSORT for cluster randomized trials guidelines (Campbell et al., 2012). The study protocol conforms to the Declaration of Helsinki statements (64th WMA, Brazil, October 2013) and it was approved by the Ethical Committee for human studies of the University of Granada. Due to the nature of the study (i.e., natural groups from an educational setting) and for practical reasons, a cluster-randomized controlled trial design was used. Randomization was conducted at the class-

level before the pre-intervention evaluation. Due to the posterior quantitative and visual analysis developed only in the EG according to their SE teams, a 2:1 ratio was followed. An independent researcher, blinded to the study objectives, randomly assigned the six natural classes of the selected school center, balanced by grade to form the Control group (CG; $n = 57$; one eighth-grade and one tenth-grade class) or the EG ($n = 108$; two eighth-grade and two tenth-grade classes).

Before the intervention, the PE teachers responsible for teaching the experimental and control lessons received three 90-min teacher-training sessions. The first session was focused on carrying out a deep explanation of the main characteristics of the SE model to guarantee its correct implementation following Siedentop et al. (2019) guidelines for the EG teachers, and an explanation about direct instruction's benchmarks following Metzler's (2017) guidelines and small-sided games approach for the CG teacher. The second and third meetings were focused on comprehensively designing the week-by-week plan (i.e., daily lessons and materials) for the entire season. Moreover, prior to carrying out the intervention, general characteristics of the participants were registered during the second part (i.e., 30 minutes) of one PE lesson. Afterward, the first part (i.e., 20 minutes) of another PE lesson during the first day (pre-intervention) and then again on the last day of the teaching unit (post-intervention) was used to administer the physical activity questionnaire and sociogram. Each evaluation was carried out by the same tester, instrument, protocol, and conditions. After the main researcher explained the corresponding instructions, students filled out the paper-based questionnaire and sociogram in an ordinary classroom under silent conditions.

Intervention

The two groups carried out a six-week intervention program for the teaching of team sports (i.e., basketball for eighth-grade and soccer for tenth-grade classes) with 12 PE sessions (60 minutes each lesson) and a frequency of two weekly sessions. The main differences between both teaching units are detailed in Supplementary File 2.

Experimental group

The teaching unit received by the EG group was divided into the five original phases proposed by Siedentop et al. (2019): (a) an introductory phase (one lesson), where the program was explained and students played some introductory games to assess their initial level; (b) a teacher-directed phase (two lessons), where the teams were made by the PE teacher according to students' level and balanced by gender, the roles were assigned according to student preferences and students played some technical and tactical skills games directed by the teacher; (c) a pre-season phase (four lessons), where students began to practice autonomously and assumed their roles within their team (i.e., coach, physical trainer, captain and material assistant), also the teams and roles remain permanent throughout the teaching unit; (d) a formal competition phase (four lessons), where the regular season based on small-sided games (i.e., 3 vs. 3) were developed, while one duty-team (referee, scorekeeper and reporter) supported the matches; and (e) the final event phase (one lesson), where a friendly championship and the awards ceremony took place in a festive atmosphere.

Control group

The teaching unit applied to the CG was based on direct instruction (Metzler, 2017) and the small-sided games approach. All sessions of this group were organized as follows: (a) massive organization of the whole group, combining simultaneous with alternative executions; (b) small-sided game tasks (at the end of the sessions to apply all the game elements worked during the session), in which all subgroups were changing from one session to another (i.e., all subgroups were not stable as in the EG). All sessions were oriented to the technical (e.g., passing or dribbling skills) and tactical (e.g., progression with the ball or counter-attacking) learning of sports. The general structure for all the lessons was: a 10-minute warm-up (games and aerobic exercises); a 40-minute main part (three-to-five technique-centered tasks and small-sided games 3 vs. 3); and a 5-minute cool-down (flexibility tasks).

Data analysis

Descriptive statistics for general characteristics of the participants and dependent variables were calculated. Statistical tests assumptions were checked and met. Then, as exploratory analyses, the one-way analyses of variance (ANOVA) (continuous variables) and the chi-squared test (categorical variables) were conducted to examine potential differences between the two groups.

Regarding the first aim, a Multilevel Linear Model with participants nested within classes was conducted for continuous variables (i.e., sociometric indices variables) because the unit of randomization and intervention was the class (Li et al., 2017). All the participants were included in the statistical analyses regardless of adherence to the protocol (i.e., intention-to-treat approach). However, since implementation of the missing data requires strong assumptions that are hard to justify, 'complete case' analyses including only those whose outcomes were known were used (i.e., excluding the participants that did not satisfactorily meet the exclusion criterion). Missing data was low (1.84%-4.29%). The maximum likelihood estimation method was used. The –2 log-likelihood was used to compare the models fit (i.e., comparing the change in the chi-square test). From all the potential confounding variables explored (i.e., grade, gender, body mass, body height, body mass index, habitual physical activity and intervention attendance), only habitual physical activity for the Popularity index, and habitual physical activity and body mass for the Enemies index were used. Effect sizes were estimated using the Cohen's d for pairwise comparisons. Effect sizes were considered small ($d = 0.20$-0.49), moderate ($d = 0.50$-0.79), or large ($d < 0.80$). Furthermore, the test-retest of the sociometry indices in the sample of the present study (control group) was estimated with Cronbach's alpha. Reliability values less than .40 were considered poor, values between .40 and .59 fair, values between .60 and .74 good, and values between .75 and 1.00 excellent (Hernaez, 2015). Regarding the categorical variable (i.e., sociometric status), the chi-squared test for each moment independently was carried out. Moreover, although in the present study an intention-to-treat approach was followed, as sensitivity analyses, all the above-mentioned analyses were also carried out with a per-protocol approach (i.e., including only the participants with an adherence to the protocol of 10 lessons, that is, $\geq$83.33%).

Finally, regarding the second aim, the McNemar's test on the positive and negative nominations within team variables was carried out to for a quantitative analysis of the relationship within the SE teams. Effect sizes were estimated using Cramer's V. Moreover, a visual analysis was conducted with regard to changes in *positive* and *negative nominations* within each team in the EG. The social networks graphs of the sociograms for the 26 teams of the EG were created and evaluated with the web tool Cliq (https://cliq.at/index.html) in order to provide a visual analysis of the positive and negative created and dissolved relationships. All statistical analyses were performed using the SPSS version 25.0 for

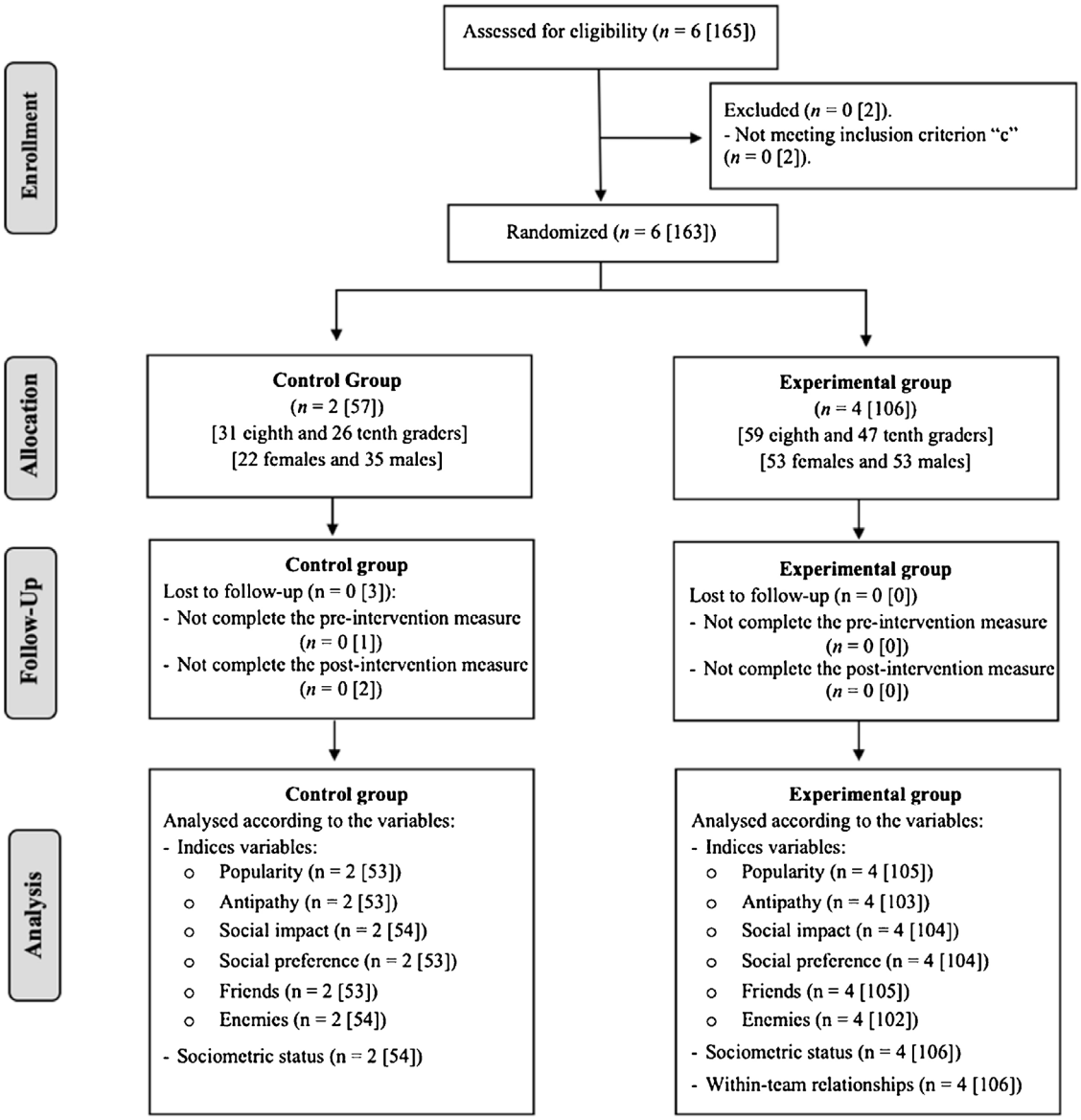

Figure 1. Flow chart of the school classes and students of the present study. All numbers are school classes [students].

Windows (IBM® SPSS® Statistics). The statistical significance level was set at $p < .05$.

Results

Final sample and general characteristics

Although all of the invited 165 students (46.67% females) agreed to participate, only 163 passed the inclusion criteria. Following that, the number of students that satisfactorily passed the exclusion criterion to become the final sample group was different depending on each dependent variable ($N = 156$-160; Figure 1). Supplementary File 3 shows the flow chart for the sensitivity analysis (i.e., per-protocol approach). Table 1 shows the general characteristics of the included participants. The results of the chi-squared test showed that the two groups were balanced in terms of age, grade and gender ($p > .05$). Additionally, the results of the one-way ANOVA showed that there were no differences in terms of body mass, body height, and body mass index ($p > .05$). However, the CG students had higher habitual physical activity levels than those from the EG ($p < .05$). The EG participants obtained an attendance rate of 91.2%.

Effect of the Sport Education-based teaching units on students' sociometry scores

The results of the Multilevel Lineal Model did not show statistically significant differences on students' sociometric indices from a macro-analysis perspective ($p > .05$; Table 2).

The chi-squared test results did not show statistically significant differences on students' sociometric status from a macro-analysis perspective ($p > .05$; Figure 2 and Table 3). The sensitivity analysis (i.e., per-protocol approach) found the same outcomes as the main analysis (i.e., intention-to-treat approach) (Supplementary File 3).

Effect of the Sport Education-based teaching units on within teams' relationships

The results of the McNemar's test showed that the SE program favorably improved EG students' *positive nominations* (from 28 to 42, $p < .001$, Cramer's $V = .80$) and reduced students' *negative nomi-*

Table 1
General characteristics of the included participants and differences between the two groups

	Total (N = 160)	Control (n = 54)	Experimental (n = 106)	χ^2/F	p[a]
Age (years)	14.0 (1.1)	14.1 (1.1)	14.0 (1.1)	–	–
Grade ($8^{th}/10^{th}$)	55.0/45.0	53.7/46.3	55.7/44.3	.055	.814
Gender (males/females)	53.1/46.9	59.3/40.7	50.0/50.0	1.232	.267
Body mass (kg)	57.7 (11.3)	57.0 (10.0)	58.0 (11.9)	.285	.594
Body height (cm)	163.2 (8.5)	162.7 (9.8)	163.5 (7.8)	.267	.606
Body mass index (kg/m^2)	21.6 (3.4)	21.5 (2.9)	21.6 (3.6)	.059	.808
Habitual physical activity (days/week)	2.8 (1.5)	3.2 (1.6)	2.6 (1.5)	4.689	.032

Note. Continous variables (i.e., age, body mass, body height, body mass index and habitual physical activity) are reported as mean (standard deviation) and categorical variables (i.e., grade and gender) as percentage.

[a] Significance level from the one-way analysis of variance for continous variables and the chi-squared test for categorical variables.

Table 2
Effect of the Sport Education-based teaching units on students' sociometry scores

		Pre-intervention	Post-intervention	Difference	Multilevel Lineal Model			Effect sizes
Indices	Group	*M (SD)*	*M (SD)*	*M (SD)*	*- 2LL*	*F*	*p*	*d*
Peer sociometric nominations received indices								
Popularity	CG (n = 53)	10.55 (5.44)	11.21 (6.20)	.65 (5.07)	927.861	1.702	.194	-0.13
	EG (n = 105)	11.49 (6.24)	11.39 (6.62)	-.10 (4.43)				
Antipathy	CG (n = 53)	9.36 (12.26)	9.92 (12.47)	.57 (5.10)	980.149	1.244	.266	-0.08
	EG (n = 103)	11.50 (14.69)	11.01 (14.78)	-.49 (5.89)				
Social impact	CG (n = 54)	20.28 (12.81)	20.81 (12.88)	.53 (7.81)	1096.595	.171	.679	-0.04
	EG (n = 104)	22.82 (13.95)	22.81 (16.01)	-.01 (7.83)				
Social preference	CG (n = 53)	.82 (13.91)	1.58 (14.86)	.77 (6.88)	1060.535	.386	.535	-0.05
	EG (n = 104)	.53 (17.02)	.55 (16.49)	.02 (7.26)				
Friendship and enmity indices								
Friends	CG (n = 53)	7.35 (3.51)	7.07 (3.28)	-.28 (3.35)	835.017	.433	.533	-0.13
	EG (n = 105)	7.68 (3.97)	6.89 (4.17)	-.79 (3.48)				
Enemies	CG (n = 54)	2.60 (3.09)	2.12 (2.67)	-.48 (2.93)	762.923	.014	.906	0.06
	EG (n = 102)	2.44 (3.25)	2.16 (3.54)	-.28 (2.93)				

Note. SD = Standard deviation; -2LL = -2 log-likelihood; d = Cohen's d effect size; CG = Control Group; EG = Experimental Group.

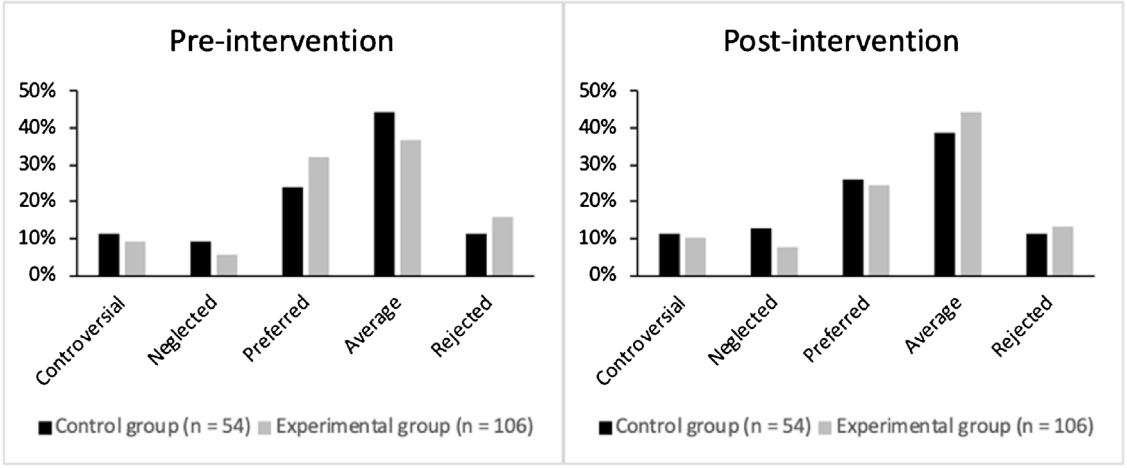

Figure 2. Students' sociometric status.

Table 3
Effect of the Sport Education-based teaching units on students' sociometric status

	Status					Chi-squared test	
	Controversial	Neglected	Preferred	Average	Rejected	χ^2	p
Pre-intervention							
CG (n = 54)	6 (11.1%)	5 (9.3%)	13 (24.1%)	24 (44.4%)	6 (11.1%)	2.690	.611
EG (n = 106)	10 (9.4%)	6 (5.7%)	34 (32.1%)	39 (36.8%)	17 (16.0%)		
Post-intervention							
CG (n = 54)	6 (11.1%)	7 (13.0%)	14 (25.9%)	21 (38.9%)	6 (11.1%)	1.541	.819
EG (n = 106)	11 (10.4%)	8 (7.5%)	26 (24.5%)	47 (44.3%)	14 (13.2%)		

Note. Sociometric status are reported as absolute frequency (percentage). CG = Control group; EG = Experimental group.

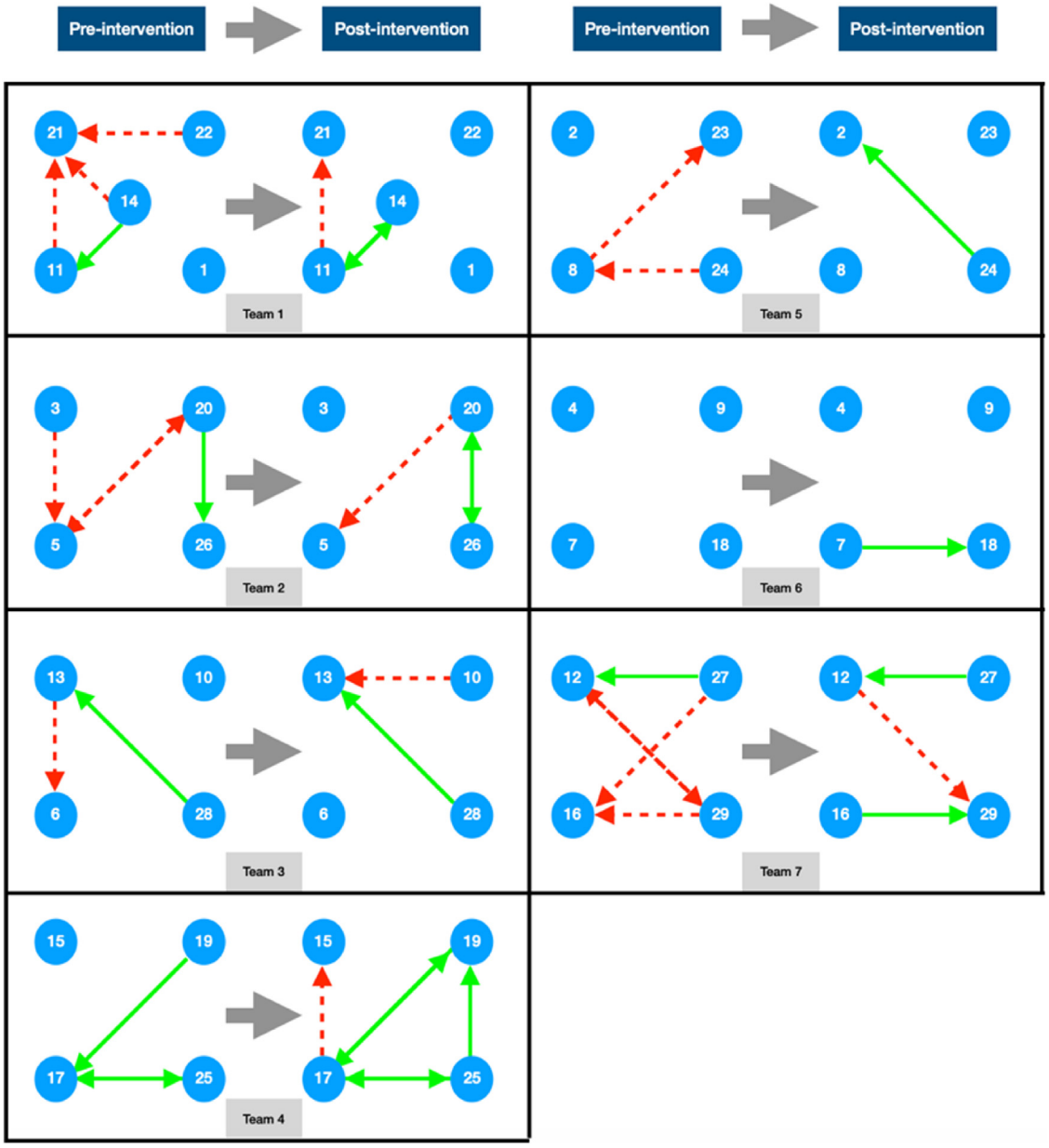

Figure 3. Examples of the within-teams sociometric nominations in one eighth-grade class. Green and continuous line arrows are positive nominations and red and dashed line arrows are negative nominations. Single-pointed arrows indicate one-way relationships, while double-headed arrows indicate reciprocal relationships. Nominations emitted to students who were on another team have been removed for a better understanding of the figure.

nations within teams (i.e., from 40 to 18, $p < .001$, Cramer's V = .52). Moreover, Supplementary File 4 shows the within-team social networks of the EG classes. As an example, in Figure 3 the within-team sociometric nominations in one eighth-grade class is presented. Regarding dyadic relationships, an increase in the number of mutually *positive nominations* were observed in teams one, two and four, as well as a decrease in the number of mutual *negative nominations* in teams two and seven. Moreover, the one-way positive relations increased in teams four, five, six and seven. Finally, as regards the one-way negative relations, there was a decrease in team one, two, four, five and seven. Furthermore, the same trend is observed for the within-team social networks of the other EG classes.

Discussion

Regarding the first aim, the findings of the present study have shown that there were no significant differences in students' sociometric indices nor sociometric status from a macro-analysis perspective. Focusing on studies based on the SE that also measured peer-relationships using sociometric methods, the present findings are in line with those of García-López et al. (2012), which also found no significant changes after the intervention in positive and negative relationships among students from a classroom-group level. Similarly, Molina et al. (2020) did not find significant differences in the positive relationships either, although they found a significant decrease in the negative relationships among students from a classroom-group level. However, both studies have several methodological differences with the present study that must be considered. Firstly, the analyses of the sociometric nominations used by García-López et al. (2012) and Molina et al. (2020) were only based on counting the mean raw number of positive and negative nominations before and after the intervention. Nevertheless, they did not calculate any sociometric indices nor students' sociometric status, and the indices calculated in the present study

provide more useful information (González & García-Bacete, 2010). Secondly, another difference lies in the age of the participants as previous studies were carried out with elementary students. Children in elementary school are in the pre-adolescence stage, which could be marked by friendship instability where students are regularly losing old friendships and forming new ones. However, as students grow older, they usually strive to consolidate friendships during the high school stage (Poulin & Chan, 2010). Therefore, it could be more difficult to change or build new friendship relations in high school students after a short-term school-based intervention. Thirdly, these previous studies applied a single group design, which does not allow to check whether the results obtained are actually due to the SE or due to other external factors (e.g., maturation change).

Moreover, there are many previous SE-based studies with apparently better results than the present study about improving friendship relations from a macro-analysis perspective in high school students (Bessa et al., 2019; Evangelio et al., 2018). However, most of them are based on students' interviews (e.g., Fernández-Río & Menéndez-Santurio, 2017) or Likert-type questionnaires (e.g., Puente-Maxera et al., 2020). Although these have been very popular methods for measuring class cohesion, these procedures do not show how students relate to each other specifically, if subgroups are formed, or if any of the team members are socially isolated. Therefore, the present study represents an advance using the peer sociometric nominations, which allow for analyzing positive and negative peer interactions in high school students (Cillessen & Bukowski, 2018). Nevertheless, despite the differences in the assessment instruments used, these previous studies coincide in the use of longer SE seasons (i.e., from 15 to 20 PE lessons). Therefore, although the present program was designed according to the creator of the model's recommendations (i.e., a minimum length of 12 sessions; Siedentop et al., 2019), it is likely that in order to achieve changes from a classroom-group level in high school students (i.e., students' sociometric status or improvements in sociometric indices) more extensive SE-based programs would be necessary. Nevertheless, the large number of curricular objectives that have to be developed during the scholar year, together with the low frequency of the PE subject (only two hours per week in Spain) (Hardman et al., 2014), make the application of longer interventions difficult for a specific educational objective.

Furthermore, according to the vision of the PE subject proposed by Haerens et al. (2011), a multi-model approach of the SE with other pedagogical models could be necessary for strengthening friendly relations and reducing disliking relations within the classroom-group. For instance, an excellent complementary model could be the *Teaching Personal and Social Responsibility model* (TPSR) proposed by Hellison (2011), which is considered to be one of the best models for promoting social skills in PE (Pozo et al., 2018). In fact, previous studies have proposed a hybridization of the SE and the TPSR models during PE lessons, proving to be effective fostering students' relatedness, empathy, social responsibility, cooperation, and respect at the classroom-group (Fernández-Río & Menéndez-Santurio, 2017; González-Víllora et al., 2019). These improvements could be due to the strategies that can be included in the TPSR model, such as: initial talks to open the lesson, where the personal and social responsibility goals to be practiced that day were explained; classroom-group meetings at the end of each lesson, where students share opinions, feelings, and ideas; or common analysis of the plays and behaviors observed in each game during the season phase. On the other hand, the inclusion of other specific strategies for the development of students' emotional intelligence such as self-control, self-awareness, or active listening may be another feasible idea which could contribute to strengthening social relations among peers in combination with the SE (Cañabate et al., 2018). However, teaching through a hybrid model is also considered a complex task that requires teachers to have a high level of knowledge about each pedagogical model and experience in teaching both models to be successful (González-Víllora et al., 2019). Unfortunately, the researchers nor the PE teachers participating in the present study had previous experience with the TPSR model or any other specific strategies proposed. Therefore, the implementation of a hybridization of the SE in the present study could have caused negative outcomes.

Regarding the second aim, the outcomes of this study showed that the students' relationships changed favorably after the SE program. Specifically, an increase in the number of positive nominations and a decrease in negative nominations has been observed in several teams of the SE program. The present results agree with those of García-López et al. (2012) that also found a significant increase in positive sociometric nominations within-team, this implies that the SE may be an adequate tool to improve friendship relations among students on the same team. Additionally, other qualitative studies observed the improvements of friendship relations within teams, getting very positive statements from students such as: "Our relationship improved because before, they were team members who I didn't speak to much and now I get on well with them" (Fernández-Río & Menéndez-Santurio, 2017); or "being part of a team brings people closer together" (Pill, 2010). These within-team peer relationship improvements may also be due to certain characteristic features of the SE which can force students to interact and make social connections and friendships (Evangelio et al., 2018). Firstly, these improvements may be due to students working in persistent teams during an extended period of time, interacting with peers they have never paid attention to before, and this methodology allows them the opportunity to get to know each other better and build friendships (MacPhail et al., 2008). Secondly, during the pre-season phase, students have to work autonomously, which requires talking among themselves and agreeing on what aspects to work on for preparing competitions. Moreover, students work attending their roles in the teams, which increases their level of responsibility. This forces them to interact with other teammates to explain tasks, or to encourage them during games, and consequently, increasing the social relationship between them (Bessa et al., 2019). Furthermore, it may also be due to the sense of affiliation by students to their team. Fernández-Río and Menéndez-Santurio (2017) study highlighted the importance of this affiliation sense with students' statements like "My relationship with my team members has improved a lot because we met to make the t-shirts, the flags and often we spoke via WhatsApp to organize the choreography and so on".

Finally, friendship and peer acceptance among peers has been proven as a crucial element to prevent or attenuate serious violence concerns among schoolchildren (Hong & Espelage, 2012). Therefore, the origination of new friendly relationships or the strengthening of those previously existing and the decrease in negative relations among peers found within teams could help to prevent some problems like bullying by including neglected students in friendship networks. The present article provides valuable knowledge in the area and helps PE teachers to design effective programs that allow students to get to know peers better and foster their friendly relationships.

Regarding the strengths of the present study, to our knowledge, this is the first study that applies a SE-based intervention conducting an extensive evaluation (i.e., quantitative indices, sociometric status, and diagrammatic map), providing empirical support for the effectiveness of the SE in improving students' within-team relationships. Moreover, the use of a cluster-randomized controlled trial design was more appropriate for the present research objective (Campbell et al., 2012). Besides, the CG also adds quality to the study allowing authors to control that results are due to the pedagogical model and not to possible external

factors. Additionally, since the randomization and intervention was conducted at the class-level, the assessment of the effect of the SE on sociometric quantitative indices with a Mixed Multilevel Linear Model with participants nested within classes (Li et al., 2017), as well as the visual analysis conducted within-team, represents an advancement with respect to the commonly applied analyses. This study also has some limitations that should be acknowledged. Firstly, the non-probabilistic and relatively small sample size limits the generalizability of the obtained outcomes to the particular studied context. Additionally, the teaching unit length could have been a limitation to achieving greater effects on students' sociometric status and quantitative relationship indices from a macro-analysis perspective (classroom-group level).

In conclusion, the present study aimed to examine the effect of the SE-based teaching unit on students' sociometric status and indices from a macro-analysis perspective, as well as students' relationships from a micro-analysis perspective in the PE setting. The findings showed no improvements in students' relationships from a macro-analysis perspective (classroom-group level). This might be due to it being a short-term SE-based program, and without the support of other specific strategies to strengthen friendships and decrease the disliking relationships. However, findings from the micro-analysis perspective showed that the program allows for better interaction and knowledge of teammates, creating new friendships and removing negative relationships with peers within-team. Therefore, these findings suggest that the SE was more community-oriented to the small teams, which facilitated initiating and maintaining positive social relationships, as well as contributed to peer acceptance and friendship development.

Declaration of conflicting interest

No potential competing interest was reported by the authors.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.psicod.2021.09.002.

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