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# ORIGINAL

# IMPACT OF COOPERATIVE LEARNING ON PHYSICAL EDUCATION IN BASIC PSYCHOLOGICAL NEEDS

# INCIDENCIA DEL APRENDIZAJE COOPERATIVO EN EDUCACIÓN FÍSICA SOBRE LAS NECESIDADES PSICOLÓGICAS BÁSICAS

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## ABSTRACT

Cooperative Learning (AC) is emerging as a tool that places students at the centre of the teaching and learning process in the area of Physical Education (PE). The objective of the present investigation was to analyse the impact of AC on the satisfaction of Basic Psychological Needs (BPNES) against a traditional teaching model in students of Compulsory Secondary Education (ESO). For the analysis, a total sample consisting of 185 participants was taken, and a quantitative method with a quasi-experimental design was used. Participants experienced six sessions through cooperative challenges. The BPNES Measurement Scale adapted to PE was used as an instrument. The results showed a statistically significant improvement in autonomy, competence and social relations in the experimental group. An active methodology based on cooperative learning in PE classes improves the satisfaction of BPNES.

**KEY WORDS**: self-determination; autonomy; competition; social relationships.

## RESUMEN

El Aprendizaje Cooperativo (AC) se perfila como una herramienta que centra a los estudiantes en el foco principal del proceso de enseñanza y aprendizaje en el área de Educación Física (EF). El objetivo de la presente investigación fue analizar el impacto del AC en la satisfacción de las Necesidades Psicológicas Básicas (BPNES) frente a un modelo de enseñanza tradicional en estudiantes de Educación Secundaria Obligatoria (ESO). Para el análisis, se tomó una muestra total formada por 185 participantes, en el que se empleó un método cuantitativo con un diseño cuasi-experimental. Se desarrollaron seis sesiones a través retos cooperativos. Se utilizó como instrumento la Escala de Medición de las BPNES adaptada a la EF. Los resultados mostraron una mejora estadísticamente significativa en la autonomía, competencia y relaciones sociales en el grupo experimental. Una metodología activa basada en el aprendizaje cooperativo en las clases de EF mejora la satisfacción de las BPNES.

**PALABRAS CLAVE:** autodeterminación; autonomía; competencia; relaciones sociales.

## INTRODUCTION

Physical Education (PE) is one of the subjects that favor the integral development of students, as highlighted by the study by Perlaza et al. (in Neira et al., 2017) when highlighting that in the search for human improvement in training processes, in the work "Brief analysis of the history of Physical Education of Ecuador and the world" the importance of the activity as a essential process in the integral formation of the personality in a way that serves the family, state and society to achieve motor autonomy. Therefore, physical activity and sports goes beyond a mere physical practice or a simple way of spending free time since it is considered a way of learning (Noguera, 1995), so according to Lavega et al. and Nelis et al. (in Muñoz, 2020) PE classes become an environment and fundamental tool of great importance for the comprehensive development of students and for the training and creation of different areas of knowledge related to affectivity (emotions, feelings and states of mood), as well as social, relational and cognitive benefits.

In the framework in which this subject is developed, the degree of motivation that students can develop and consolidate plays an essential and decisive role for the proper teaching and learning process, since motivation constitutes a fundamental aspect that offers the student the desire or encouragement to participate in PE classes. Thus, this participation or collaboration will be more significant at the moment in which the students obtain in the classes of this subject the corresponding answers to satisfy their motor needs, to investigate and explore, in addition to relating and staying physically active (Ntoumanis, 2002).

Thus, to achieve an adequate degree of motivation, the methodology used in the PE lessons is important. Traditionally, classes in this area have been limited to the development and application of various monotonous and ambiguous teaching processes in which competitiveness was given more relevance and in which students did nothing more than simple reproductions of what the teachers explained in class. Therefore, it was a simpler and faster teaching in which boys and girls play a passive role (SueSee and Edwards, 2011). However, as the years have arisen, different teaching methodologies and techniques have been implemented and applied that have gradually distanced themselves from the traditional methodological character in order to provide teaching and learning procedures that further highlight the cooperative and meaningful approach (Morales and González, 2014). Consequently, this type of methodology is focused on contextualization, communication and the transmission of values for the development of key competences in such a way as to respond to the integrative nature of this curricular area (Contreras et al., 2010). One of the active and innovative teachings that has taken on special importance in the teaching-learning process is Cooperative Learning (CL).

According to that, CL is one of the most relevant and prosperous manifestations of theory, research and practice in education. It is defined, according to Johnson et al. (1999), as "*the use of a methodology in small groups in which students work and cooperate jointly to optimize and get the most out of the learning of each one, as well as that of their equal*". In cooperative situations,

the objective of the group members is closely related since, they perceive that they can achieve and fulfill the proposed objective, so the group will begin to be a small learning society at the moment in which its components are care for each other, be aware that there is a final objective that unites them and that achieving that purpose is easier if they carry out mutual help and support (Ortuondo, 2018). Thus, CL is one of the pedagogical approaches most linked to the methodological development in PE as it focuses on the learning process and the needs of the student, since what is sought is a result that is positive and beneficial for this and for the rest of his classmates with whom s/he is connected in a cooperative way (Fernández-Río et al., 2016).

Furthermore, studies carried out with secondary school students have found improvements in interpersonal relationships, adopting positive changes in problem solving, prosocial behaviors, etc.; without differences in sex, after performing AL-based interventions (Ferriz-Valero et al., 2019). In this regard, García et al. (2021) playful activities that promote cooperation increase intrinsic motivation in PE classes without distinguishing between girls and boys, generating dynamics that the aforementioned study highlights.
It should be noted that Johnson et al. (1999) establish that cooperation is more efficient when a series of elements that are considered essential are integrated into the group. These elements have been analyzed in greater depth in the field of PE classes by authors such as Velázquez (2010) or Dyson et al. (2016) and consist of:

- Positive interdependence, the perception that you are linked with your colleagues in such a way that you cannot achieve certain success unless they do not and that, in addition, the work of others benefits you and your work carried out within of the group.

- Correct use of social skills, which implies teaching the students that make up the group leadership and decision-making skills, the creation of trust, communication and conflict resolution that they require to work and learn together and in an effective way.

- Encourage the interaction that occurs when the peers in the group promote the achievement of the rest: supporting, reinforcing, contributing, encouraging and praising the efforts of others to learn.

- Group functioning as a process so that students are aware of their self-learning and that of each of their peers so that they can recognize the various ways to improve their process.

- The evaluation and compliance of each team member with the return of this so that the members can verify their corresponding part of work.

In this regard, the motivation that students acquire when working cooperatively is essential. One of the theories that best makes explicit and facilitates the understanding of motivation and the various mechanisms that surround it is the Theory of Self-determination or TAD (Deci and Ryan, 1985, 2000, 2004 and

2020; Vasconcellos et al., 2020; White et al, 2021.), which in turn is made up of six sub-theories aimed at analyzing the specific aspects of the motivational phenomenon. In addition, four of these mini theories deal with the processes that direct behavior as they are; the theory of causal orientations that deals with intrinsic and extrinsic motivation and amotivation of people; the theory of cognitive evaluation that focuses on the study of intrinsic motivation at the contextual and situational level; the theory of organic integration that studies extrinsic motivation and amotivation in the same contexts as the previous conjecture and; goal content theory is of great importance because not only does self-determined behavior occur but also deals with what it is directed towards (Sheldon et al., 2004). The remaining theory refers to the theory of basic psychological needs, which contemplates that all human behavior is supported and motivated by three basic and universal psychological needs such as autonomy, competence and relationship with others at a global, contextual and situational level. It is these same authors, Ryan and Deci (2000 and 2004), who explain and detail what these three basic psychological needs consist of and on what they are based, highlighting the autonomy that represents the need that individuals have to intervene with a feeling and own behavior and with freedom in their actions. Likewise, competence refers to the requirement to have a superior feeling about the context in which it is found and to develop new skills and abilities. And, when it comes to the need for social relationships, it is linked to the need to feel and maintain a connection with other people. In addition, each of these needs that form the theory of basic psychological needs is closely related to CL because they are constructed through cognitive, social, affective and physical characteristics (Casey & Goodyear, 2015). On the one hand, in terms of the cognitive dimension, autonomy can be developed through different techniques, situations or strategies related to the game, which allows students to increase and acquire their knowledge (Casey, 2013). In the same way, the implementation of different practices in a group way contributes to the increase of interactions between boys and girls (Darnis and Lafont, 2013), resulting in greater social relationships and the development of some values necessary to work in groups, such as the empathy, respect, help and teamwork that are framed in social and affective aspects (Bayraktar, 2011). And, on a physical level, AL allows the development and increase of motor skills and sports techniques that lead to increases in physical activity (Casey et al., 2009). For this reason, as mentioned in the previous paragraphs, PE is ideal for carrying out the development of these innate variables that people possess through the practice of cooperative techniques (Delgado-Noguera, 1991). In addition, Moreno et al., (2012) highlight that these needs are presented as fundamental for growth, integration and development and social well-being because they constitute the main foundations on which motivation is based in the context of PE (Ferrer-Caja and Weiss, 2000) and are related to different environments such as education (Vansteenkiste et al., 2006) and sports (Edmunds et al., 2006). Consequently, adolescents will be physically more active and will have greater confidence as long as teachers create a motivational context that allows the satisfaction of basic psychological needs, which is translated as participation in PE classes (Rosenkranz, 2012). Therefore, the social context will be directly related to the satisfaction of each of these psychological needs. Thus, an adolescent who is immersed in an environment and social environment favored by autonomy and that involves

other people will be the most correct to develop and increase self-determined commitment (Moreno and González, 2006).

For all the above, the main objective proposed is to verify the incidence of CL in PE classes on the basic psychological needs of students compared to a traditional methodology. Thus, the initial hypothesis is raised that the students who receive the class through educational practice with a CL improve the results in the questionnaires that measure basic psychological needs with respect to the group that receives the sessions with a passive methodology through the style of teaching “modified direct control”.

## 1. METHOD

### 1.1. RESEARCH DESIGN

The present investigation is an empirical study that uses a quantitative methodology with a quasi-experimental design by non-probabilistic, intra- and inter-group clusters with test measures before and after the intervention. The independent variables applied were the set of cooperative challenges and the sex of the participants. While the dependent variables refer to autonomy, competence and social relationships, which are the focus of the scale of measurement of basic psychological needs. The intervention program lasted three weeks (6 sessions of 55 minutes in duration).

### 1.2. PARTICIPANTS

Initially, 194 students were recruited from the third and fourth year of compulsory secondary education at two public educational centers in the province of Alicante.

The inclusion criteria were the need to fill in the informed consent and the initial and final questionnaire to measure the satisfaction of basic psychological needs; attend and participate in each of the intervention sessions; study third and fourth of compulsory secondary education and the PE area; and function correctly in the main language (Spanish) with which the sessions are carried out. Finally, a total of 185 subjects participated in the research since nine participants were excluded from the research for not meeting the referred criteria. Maintaining the nature of the groups, a non-probabilistic cluster sampling was applied, giving rise to four groups made up of eight class-groups from both academic years. From the first two natural groups, the experimental group appeared, to which the active methodology was applied through CL in the form of cooperative challenges in groups, composed of 99 subjects (54 girls and 45 boys), and from the remaining two groups the control group to which a didactic unit based on the general and basic aspects of badminton was applied with a passive methodology through the modified direct command teaching style, formed by a total of 86 students (42 boys and 44 girls).

## 1.3. INSTRUMENTS

*Adaptation of the Scale of Basic Psychological Needs in Exercise and Sport (BPNES) adapted to Physical Education (validated by Moreno-Murcia et al., 2008).* This test is made up of 12 items preceded by the phrase "In my Physical Education classes ..." of which 1, 4, 7 and 10 correspond to *autonomy* (e.g.: "The exercises I do are adjusted to my interests") , the 2, 5, 8 and 11 to the competition (e.g.: "I feel that I have had a great progression with respect to the final goal that I have set myself") and, the 3, 6, 9 and 12 to social relationships (e.g.: " I feel very comfortable when I do the exercises with the other colleagues "). Answers are made using a Likert-type scale that ranges from number 1 (totally disagree) to number 5 (totally agree).

## 1.4. PROCEDURE

Both educational centers were accessed, and contact was maintained with the head of studies to explain the reason why they were interested in carrying out this research. Once the permission and authorization of the school board and management were granted to carry out the research and to carry it out, he contacted the PE teachers to begin both the application of surveys and the didactic intervention. Prior to the study, each one of the participants had one week to provide the researcher with their own informed consent regarding the approval of the students' relatives to participate in the research process. The Ethics Committee of the University of Alicante approved the conduct of this research (UA-2020-09-02).

## 1.5. INTERVENTION

Regarding the research process, it was carried out through an intervention program in which a total of six sessions were carried out with the experimental group in PE classes, carried out by PE teachers, graduates in Sport Sciences and physical activity. This intervention consisted of carrying out twelve challenges based on the AL distributed among the six sessions (two per session) in which the students had to act cooperatively. In addition, to increase the level of difficulty of the activities, each of the challenges presented different variants and rules that the students had to meet, as a group, to overcome them by using the necessary and corresponding material.

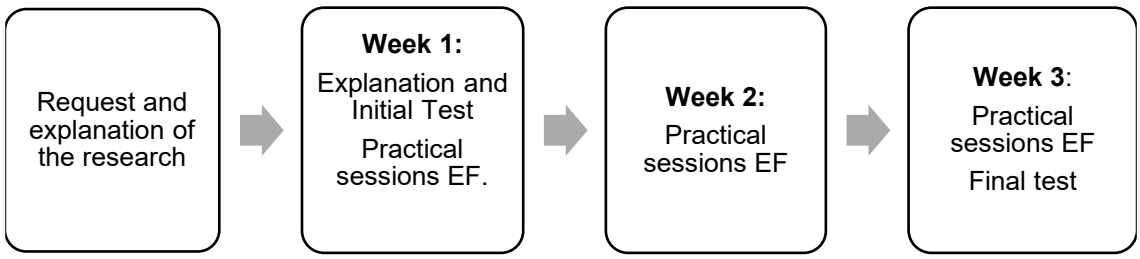


**Figure 1.** Phases of the cooperative experimental group intervention.

Regarding the badminton didactic unit that the students belonging to the control group completed, it was made up of a total of six sessions spread over a two-

week period and carried out by teachers with degrees in Physical Activity and Sports Sciences. In each of these sessions, the teaching and learning process was focused on carrying out different activities aimed at learning the technical, tactical and regulatory foundations, under a teaching focused on the 'modified direct command' as advocated in previous paragraphs.

This set of sessions and activities that make up both the intervention process and the didactic unit of the control group, are framed within the legislative framework corresponding to the academic stage, specifically, referring to royal ordinance 1105/2014, of December 26, by which establishes the basic curriculum for Compulsory Secondary Education and Baccalaureate in Spain. As a consequence, it is necessary to comment on the relationship that is presented with the objectives of stage a), b), c), d), g) and k) for presenting essential aspects that have to be carried out and are carried out in the development of each of the sessions.

### 1.6. STATISTICAL ANALYSIS

For the analysis of the results obtained, the statistical program Statistics Product and Service Solutions (IBM® SPSS® Statistics Version 26.0.0.0) and Microsoft Excel® in its 2016 version were used. First, the initial value analysis was performed (pre-test) in both groups to know the starting level that both the experimental group and the control group presented in terms of psychological variables at the beginning of the investigation and check if they presented significant differences both in the total sample and in the segmented by sex. To do this, after verifying by means of the Kolmogorov-Smirnov test ($n > 50$) or the Shapiro Wilk test ($n < 50$) that the samples did not follow a normal distribution, the non-parametric Mann Whitney U test was used.

To analyze the effect of the didactic units applied on basic psychological needs, the nonparametric Wilcoxon signed rank test was used and, if the normality criteria were observed, the parametric Student's t-test for related samples. Statistically significant differences were considered from $p < 0.05$. In addition, to calculate the effect size, it was performed using Rosenthal's r when the Wilcoxon test was applied, interpreting these values as small ($r < 0.10$), small and medium ($0.10 < r < 0,30$), medium and large ($0.30 < r < 0.50$) and large ($r > 0.50$) (Coolican, 2017). In the same way, to calculate the magnitude of the effect in T-test, Cohen's d was used, estimating minimum ($d < 0.41$), minimum and moderate values ($0.41 < d < 1.15$) , moderate and strong ($1.15 < d < 2.7$) and strong ($d > 2.7$) (Ferguson, 2016). Finally, it was also analyzed whether the post-test values presented significant differences between the experimental and control group at the global level of the sample and fractioned by sex, following the same procedure as in the pre-test values, that is, using the no parametric U of Mann Whitney test.

## 2. RESULTS

Initially, a comparison was made between the cooperative experimental group and the control group to find out if the basic level that the students had in

satisfying the set of basic psychological needs presented significant differences through the non-parametric Mann Whitney U test. The results show that there were no statistically significant differences ($p > 0.05$) between the experimental group and the control for the items that measured each of the basic psychological needs in the pre-test, obtaining values for autonomy such as $p = 0,13$, competence $p = 0.59$ and for social relationships of $p = 0.74$.

Subsequently, the sample was segmented according to the independent variable of sex, making a comparison between the experimental group and the control group to know the starting level in terms of the participants in the satisfaction of basic psychological needs and if they presented significant differences using the nonparametric Mann Whitney U test. The results show that there were no statistically significant differences ($p > 0.05$) between groups in the males regarding the items that measured the satisfaction of the variables studied, obtaining values for autonomy such as $p = 0.16$, competence $p = 0.50$ and for social relationships $p = 0.84$.

Regarding the results, when the experimental group and the control group were compared in terms of the females in the study of basic psychological needs statistically, statistically significant differences ($p < 0.05$) were found for the psychological autonomy variable ($p = 0,03$). There were no statistically significant differences in competence ($p = 0.85$) and social relationships ($p = 0.45$).

The analysis relative to the basic psychological needs of each dependent variable in the total sample is shown below. Table 1 shows that there were statistically significant differences ($p < 0.05$) in autonomy, competence and social relationships in terms of the experimental group. Likewise, the effect size was calculated using Rosenthal's r in the three variables that show scores between medium and large values ($0.30 < r < 0.50$).

Regarding the control group, it can be seen that there were statistically significant differences in the variables of autonomy and competence ($p <0.05$) but not in that of social relationships. Similarly, the effect size was calculated using Rosenthal's r in these variables, which showed values between medium and large ($0.30 < r <0.50$).

**Table 1.** Results of the total sample for the Wilcoxon signed rank test (pretest vs postest).

| | | Autonomy PRE-POST | Competence PRE-POST | Relationship PRE-POST |
|---|---|---|---|---|
| Ex coop | Negatives ranks | 22 | 23 | 30 |
| | Positives ranks | 61 | 57 | 60 |
| | Neutral ranks | 16 | 19 | 9 |
| | Z | -4,638 | -3,529 | -3,802 |
| | *p* | <0,001 | <0,001 | <0,001 |
| | *r* | 0,46 | 0,35 | 0,38 |
| Con | Negatives ranks | 21 | 21 | 34 |
| | Positives ranks | 43 | 47 | 34 |
| | Neutral ranks | 22 | 18 | 18 |
| | Z | -2,941 | -3,269 | -0,719 |
| | *p* | 0,003 | 0,001 | 0,47 |
| | *r* | 0,31 | 0,35 | - |

*Note*. Ex coop = cooperative experimental group; Con = non-equivalent control group; *r* = Effect size; *p* = bilateral significance.

Next, the analysis of the effect of the didactic units is carried out, segmenting by sex. The variables regarding males are shown in both groups that required a non-parametric and parametric analysis after checking the normality criteria. Table 2 shows the non-parametric Wilcoxon signed rank test within groups for the comparison of the pre-test and post-test samples regarding the satisfaction of basic psychological needs regarding to the males in the experimental group, with statistically significant differences ($p < 0.05$) in two of the dependent variables: competence and social relationships. As can be seen, the number of positive ranks are greater than the negative ones, which is why it is considered a favorable difference. To measure the magnitude of the effect of these results, the effect size has been calculated through Rosenthal's r in the two variables since they present statistically significant values, obtaining results with scores that are between medium and large values ($0.30 < r < 0.50$). As for the control group, the data show statistically significant differences in autonomy. In addition, an effect size between medium and large values ($0.30 < r < 0.50$) is estimated for this variable.

**Table 2**. Results in both groups for the Wilcoxon signed rank test in males (pretest vs postest).

| | | Autonomy | Competence | Relationship |
|---|---|---|---|---|
| Ex coop | Negatives ranks | - | 8 | 12 |
| | Positives ranks | - | 30 | 28 |
| | Neutral ranks | - | 7 | 5 |
| | Z | - | -3,137 | -3,064 |
| | *p* | - | 0,002 | 0,002 |
| | *r* | - | 0,46 | 0,46 |
| Con | Negatives ranks | 10 | - | - |
| | Positives ranks | 19 | - | - |
| | Neutral ranks | 13 | - | - |
| | Z | -2,026 | - | - |
| | *p* | 0,043 | - | - |
| | *r* | 0,31 | - | - |

*Note*. Ex coop = cooperative experimental group; Con = non-equivalent control group; *r* = Effect sizes; *p* = bilateral significance.

Table 3 summarizes the results of the parametric t-test in the males in the experimental group and the control group. Regarding the first group, autonomy stands out since it presents a positive increase in means before and after treatment and statistically significant differences ($p < 0.05$). Therefore, the effect size is calculated using Cohen's d, estimating a size between minimal and moderate values ($0.41 < d < 1.15$). Regarding the control group, improvements are found with respect to the means of the dependent variable of competence since they increase in the later phase of the test and present statistically significant differences. Likewise, after calculating Cohen's d, it estimates an effect size value close to the minimum necessary ($d < 0.41$) in this psychological variable. On the other hand, this does not happen in the social relations variable because the means do not improve and there are no statistically significant differences ($p > 0.05$).

**Table 3.** Results of the t-test in males (pretest vs postest).

| | | Average | n | SD | Deviation Average error | *t* | *p* | *d* |
|---|---|---|---|---|---|---|---|---|
| Par 1 Ex coop | AUT PRE | 12,47 | 45 | 3,98 | 0,59 | -2,787 | 0,008 | 0,44 |
| | AUT POST | 14,13 | 45 | 3,48 | 0,51 | | | |
| Par 2 Con | COM PRE | 13,60 | 42 | 3,29 | 0,509 | -3,026 | 0,004 | 0,34 |
| | COM POST | 14,60 | 42 | 2,64 | 0,408 | | | |
| Par 3 Con | RS PRE | 14,29 | 42 | 2,64 | 0,408 | 0,193 | 0,848 | - |
| | RS POST | 14,21 | 42 | 2,70 | 0,417 | | | |

*Note*. AUT = autonomy; COM = competence; RS = relationship; SD= Standard devistion; Ex coop = cooperative experimental group; Con = non-equivalent control group; *r* = Effect size; *p* = bilateral significance.

For the analysis of the effect of the didactic units segmenting by female sex, Table 4 shows the results of the non-parametric test of Wilcoxon signed ranges within groups for the comparison of the pre-test and post-test samples in terms of to the satisfaction of basic psychological needs in reference to the female sex in the experimental group and in the control group. Regarding the first, the values obtained after performing said test show a greater number of positive values of the ranges than values of negative ranges, in each of the variables. In this line, there are no statistically significant differences in competence ($p > 0.05$). However, they are found in autonomy and social relationships since both p values are less than 0.05. In addition, with this increase in scores and statistical results, the effect size has been calculated again with Rosenthal's r in both variables, estimating that the magnitude of effect is large ($r > 0.50$). Regarding the control group, only statistically significant differences were obtained in autonomy with an effect size with values between medium and large ($0.30 < r < 0.50$). However, no statistically significant differences are obtained in social relationships, despite presenting differences in their respective positive and negative range scores.

**Tabla 4.** Results for the Wilcoxon signed rank test in females (pretest vs postest).

| | | Autonomy | Competence | Relationship |
|---|---|---|---|---|
| Ex coop | Negatives ranks | 10 | 15 | 18 |
| | Positives ranks | 34 | 27 | 32 |
| | Neutral ranks | 10 | 12 | 4 |
| | Z | -4,022 | -1,766 | -2,410 |
| | *p* | <0,001 | 0,077 | 0,016 |
| | *r* | 0,54 | - | 0,32 |
| Con | Negatives ranks | 11 | - | 16 |
| | Positives ranks | 24 | - | 17 |
| | Neutral ranks | 9 | - | 11 |
| | Z | -2,105 | - | -1,018 |
| | *p* | 0,035 | - | 0,308 |
| | *r* | 0,31 | - | - |

*Note*. Ex coop = cooperative experimental group; Con = non-equivalent control group; *r* = Effect size; *p* = bilateral significance.

Table 5 shows the parametric t-test for the non-equivalent control group in females in the competence variable. An increase in the value of the mean from the pre-test to the post-test is appreciated and, at the same time, it presents statistically significant differences, since $p < 0.05$. Likewise, after this test, the magnitude of the effect of these scores was calculated with Cohen's d which, in this case, is found in small value intervals far away from the minimum required ($d < 0.41$).

**Table 5.** Results of the t- test in females (pretest vs postest).

| | | Average | n | SD | Deviation Average error | *t* | *p* | *d* |
|---|---|---|---|---|---|---|---|---|
| Con | COM PRE | 13,73 | 44 | 3,15 | 0,476 | -2,028 | 0,049 | 0,18 |
| | COM POST | 14,27 | 44 | 2,79 | 0,421 | | | |

*Note*. SD= Standard deviation; COM= Competence; RS = Relationship; Con = non-equivalent control group; *d* = Effect size; *p* = bilateral significance

Finally, for the analysis of the differences in basic psychological needs, a comparison was made between the experimental group and the control group to know if there were significant differences in terms of the satisfaction of the set of basic psychological needs of the students through nonparametric Mann Whitney U test.

Table 6 shows the changes produced in both groups after completing the didactic units, showing a final analysis that shows statistically significant differences ($p < 0.05$) between groups in social relationships.

**Table 6.** Difference of means in the post-test in the satisfaction of basic psychological needs with the Mann Whitney U test.

| | Group | n | Average | SD | Mann-Whitney U test | Z | *p* |
|---|---|---|---|---|---|---|---|
| AUT POST | Ex coop | 99 | 94,68 | 3,33 | 4090,5 | -0,460 | 0,64 |
| | Con | 86 | 91,06 | 2,72 | | | |
| COM POST | Ex coop | 99 | 98,65 | 3,08 | 7439 | -1,547 | 0,122 |
| | Con | 86 | 86,5 | 2,69 | | | |
| RS POST | Ex coop | 99 | 106,09 | 3,25 | 2961,5 | -3,585 | <0,001 |
| | Con | 86 | 77,64 | 2,76 | | | |

*Note*. SD= Standard deviation; Ex coop = cooperative experimental group; Con = non-equivalent control group; *p* = bilateral significance.

In addition, a comparison was made between the experimental group and the control group to find out the final value related to the sex of the participants in the satisfaction of basic psychological needs and if they presented significant differences using the non-parametric Mann Whitney U test.

Table 7 presented statistically significant differences in the social relationships variable, since $p < 0.05$ when the experimental and control groups were compared with respect to the males.

**Table 7**. Results in the final value for the satisfaction of basic psychological needs in males.

| | Group | n | Average | SD | Mann-Whitney U test | Z | *p* |
|---|---|---|---|---|---|---|---|
| AUT PRE | Ex coop | 45 | 44,74 | 3,44 | 911,5 | -0,286 | 0,77 |
| | Con | 42 | 43,2 | 2,54 | | | |
| COM PRE | Ex coop | 45 | 48,92 | 3,24 | 723,5 | -1,892 | 0,58 |
| | Con | 42 | 38,73 | 2,61 | | | |
| RS PRE | Ex coop | 45 | 51,24 | 3,37 | 619 | -2,783 | <0,001 |
| | Con | 42 | 36,24 | 2,66 | | | |

*Note*. SD= Standard deviation; Ex coop = cooperative experimental group; Con = non-equivalent control group; *p* = bilateral significance.

Table 8 shows, as in the previous one, statistically significant differences ($p < 0.05$) in social relationships when a comparison of both groups was made in the females of the items that measure basic psychological needs.

**Table 8.** Results in the final value for the satisfaction of basic psychological needs in females.

| | Group | n | Average | SD | Mann-Whitney U test | Z | *p* |
|---|---|---|---|---|---|---|---|
| AUT PRE | Ex coop | 54 | 50,44 | 3,25 | 1137 | -0,366 | 0,71 |
| | Con | 44 | 48,34 | 2,81 | | | |
| COM PRE | Ex coop | 54 | 50,71 | 2,84 | 1122 | -0,471 | 0,63 |
| | Con | 44 | 48,01 | 2,73 | | | |
| RS PRE | Ex coop | 54 | 55,49 | 3,14 | 864,5 | -2,325 | 0,02 |
| | Con | 44 | 42,15 | 2,89 | | | |

*Note*. SD= Standard deviation; Ex coop = cooperative experimental group; Con = non-equivalent control group; *p* = bilateral significance; AUT = Autonomy; COM = Competence; RS = Relationship

## 3. DISCUSSION

Firstly, the objective of the research was to analyze, from the perspective of the Theory of Self-determination (Deci and Ryan, 1985; Ryan and Deci, 2002), the impact of a program based on a learning model focused on a methodology active as CL is, compared to a traditional teaching model, on the satisfaction of basic psychological needs in secondary school students in PE.

In general, after carrying out and obtaining the results, the effect of the intervention on the students was positive since the results have shown improvements in the scores of each item that measured basic psychological needs.

The results of the intervention in the total sample show a significant increase in the experimental group in each variable that make up the basic psychological needs. However, in the control group there are also significant positive results in autonomy and competence, but not in social relationships. In addition, the effect sizes in each statistically significant variable and in both groups are between medium and large values, although autonomy presents higher values in the experimental group than in the control group and, in the experimental group, social relationships border on large values when calculating the magnitude of the effect.

These results hardly vary when the sample is segmented by sex since both in the sample of only men and in the sample of only women the experimental group and the control improve in the variables of autonomy and competence, but in social relationships only one group improves who performed CL.

On the one hand, the results of this investigation are similar to those of other investigations such as that of Cuevas et al. (2015) in which they carried out a quasi-experimental design with test measures before and after to see the influence that was had on basic psychological needs through the application of a sports model with cooperative methodologies compared to a traditional teaching model, resulting in improvements in the set of basic psychological needs in the experimental group, but not in the control group. However, as

mentioned, in the control group there were also improvements in autonomy and competence, which makes sense if it refers to the support that the teacher can provide to the students in the development of the sessions since, based on the Self-determination Theory (Deci and Ryan, 1985) and Ryan's postulates (1991), autonomy support behaviors are linked to positive student outcomes (Behzadnia and Deci, 2017). The same occurs in competition because this variable has proven to be a strong predictor of results in different aspects such as physical activity, effort or commitment in PE in academic stages such as secondary (Curran and Standage, 2017).

In the present study the only variable that has improved in the experimental group and not in the control group is social relationships, both for the total sample and for the sample segmented by sex. There are several investigations that focus on the importance of this variable in carrying out PE activities, among which it is highlighted that one of the main causes of participation in PE classes is the need to be and interact with peers or make new friends (Ntoumanis, 2001). An example is the study carried out by Carlson and Hastie (1997), in which they carried out a sports education model, obtaining as results a reinforcement and improvement of the social ties established between students, thus favoring socialization.

Similarly, the results obtained in terms of social relationships are similar to those obtained by Lebrero-Casanova et al. (2019) in their research, which consisted in the analysis of different psychological aspects (among them, basic psychological needs) through the implementation of participatory and cooperative methodological styles in students of similar ages to those of the present study. It is for this reason that in the intervention of the experimental group and, also referring to both sexes, it has probably been possible to establish more empathic links for communication and mutual support that has allowed doing a group cohesion sufficient to carry out the cooperative challenges (Balaguer et al., 2008). Along the same lines and based on the postulates of the motivation model proposed by Deci and Ryan (2000), the dimension of the relationship with others is invariable in terms of sex, so that girls and boys may have behaved in a similar way as has already been demonstrated and verified in other investigations (Guzmán and Kingston, 2012); León et al., 2013).

Finally, Méndez-Giménez et al. (2013) concluded in their research that the design of cooperative activities is essential to satisfy basic psychological needs, including social relationships. For this reason, the results achieved coincide with those of Gómez (2013) since they maintain a positive relationship after carrying out cooperative challenges regarding the study of the variables analyzed and, specifically, with social relationships since, apart from developing and improve different capacities such as decision-making or basic physical capacities through group motor activities, especially it allows to link and force social bonds between group members.

## 4. CONCLUSIONS

The intervention program proposed based on the CL methodology through cooperative challenges with the cooperative experimental group produced an improvement in the satisfaction of basic psychological needs with respect to the development of the badminton didactic unit taught by the control group with the traditional methodology through the “modified direct command” teaching style in which some of the basic psychological needs were also improved.

In this way, it has been observed that CL is an effective method that allows students to satisfy each of the basic psychological needs, in both sexes. However, it can only be concluded that CL was more effective than traditional learning in improving social relationships. For this reason, it seems that those teachings that do not meet methodological requirements related to group, cooperative and joint techniques do not satisfy the needs that require a social context and do those that are considered more intrinsic.

The limitations of the present study are fundamentally determined by the size of the sample, which does not allow the results to be generalized to the general population. Therefore, it is considered interesting to carry out this type of study with a larger sample in order to continue corroborating the positive effects of these methodologies on the psychological needs of students. At the same time, it would be interesting to consider other variables involved in PE such as the different dimensions of motivation, the climate of the task and ego, the role of the teacher with the students or the decrease in disruptive behaviors.

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