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ARTICLE

Cooperative Classrooms and Academic Performance in Physical Education: A Multilevel Analysis

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Purpose: The aim was to assess how two contextual variables, number of students per class and in-class global cooperation, affect students' academic performance in physical education. ***Method:*** Multilevel analysis was performed given the data's hierarchical nature (L1 = 1,185 participants and L2 = 64 classrooms), including regression analysis to assess how the contextual variables at the classroom level affected students' grades. ***Results:*** Results showed that the differences observed between classrooms in students' academic performance can be attributed largely to the perceived in-class global cooperation and not to the number of students per class. Group processing, promotive interaction, and individual accountability were the strongest predictors because these cooperative learning essential elements showed significant differences between classrooms. ***Discussion/Conclusion:*** Academic performance in physical education is not only determined by personal factors but also by contextual factors like perceived in-class cooperation. Group processing, promotive interaction, and individual accountability can be considered the most relevant critical features. Cooperative learning contexts are not easy to build, and depending on how successfully they are constructed, the outcomes can be very different.

Keywords: cooperation, grades, educational level, context, class size

Cooperative, collaborative, or other forms of group learning are frameworks that are increasingly used in education with the aim of promoting teamwork among children (learning to work as a team), improve performance, and learn or develop interpersonal skills (Johnson & Johnson, 2009). The ability of all students to learn to work cooperatively with others has been considered the cornerstone of building and maintaining our society. Cooperative learning has been studied from different perspectives (Slavin, 2014): (a) motivational—task motivation is the key element of the teaching–learning process, (b) social cohesion—group cohesiveness is the most important factor for the group to be effective, (c) cognitive—mental processing of information is promoted by the groups' interactions to increase students' achievement, and (d) developmental—collaboration between group members helps them operate within one another's proximal zones of development (Vygotsky, 1978) and advance more than they could individually. Slavin (2014) believed that the four perspectives can be connected because group cohesion can enhance group interactions, which can motivate individuals to engage in mental processes to help each other master the tasks and learn. On the other hand, cooperative learning has also been associated with the social constructivism theory, which explains that learners actively construct their own knowledge through experiences and interactions with others (Bruner, 1966). Therefore, these interactions are fundamental for any individual to learn and progress. From a social psychology viewpoint, Deutsch (1949) defined a cooperative social situation as one wherein the goals of individuals are so closely linked that there is a positive correlation between the achievements of their individual goals. An individual reaches his/her goal if, and only if, the other members also achieve theirs. From a behavioral perspective, Kelley and Thibaut (1969) defined a cooperative structure as one wherein an individual's rewards or reinforcements are directly proportional to the quality of the group work. According to Johnson and Johnson (1987), cooperative learning groups are based on the *positive interdependence* between group members as goals are structured so that students are interested in their efforts but also in those of others. There is *individual accountability* as the behavior and the performance of each individual student are assessed. The teachers provide information to the group about each individual's progress to help the group assess their functioning (*group processing*). Leadership is coshared; all group members share responsibility for learning because the ultimate goal is to help all group members learn as much as possible through *promotive interaction*. Finally, within each group, individuals learn *interpersonal skills*, such as active listening or empathy. These five constitute cooperative learning's basic elements (Johnson & Johnson, 2009).

Cooperative learning has been widely investigated since the 1970s when the first studies on specific implementations emerged (Slavin, 1991). Most research has focused on comparing three types of interactions/organizations—cooperative, competitive, and individual (Johnson et al., 1980; Skon et al., 1981)—and the consequences of the use of cooperative learning techniques on academic, social, and affective variables (Johnson & Johnson, 2018). Regarding academic variables, in their meta-analysis, Johnson et al. (1981) found that cooperative contexts were superior to competitive and individualistic in terms of performance and productivity of all participants. According to Gillies (2016), several meta-analyses have provided ample evidence of the effectiveness of cooperative learning on students' outcomes: learning and performance (Johnson et al., 1990, 2014; Roseth et al., 2008; Slavin, 2013; Slavin et al., 2014). León et al. (2014) found an explanatory model of the effectiveness of cooperative learning through group communication, group members' interdependence, and responsibility. Moreover, cooperative learning effectiveness on students' learning and performance has been shown regardless of the content (language and literature, social sciences, mathematics, physical education, . . .) and the educational level (Capar & Tarim, 2015).

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Regarding performance in physical education, the systematic review conducted by Casey and Goodyear (2015) showed the effectiveness of cooperative learning in the four learning domains. At the physical level, the authors described improvements in motor skills and techniques (Nopembri et al., 2019). At the cognitive level, results showed greater tactical understanding and better decision making (Casey, 2013; Casey & Dyson, 2009). At the social level, research found significant improvements in the development of interpersonal skills and interpersonal relations (Casey & Dyson, 2009; Goudas & Magotsiou, 2009). Finally, at the affective level, social and psychological aspects of learning were found to be positively affected by cooperative learning: students' ability to encourage each other (Dyson, 2002), self-confidence and self-esteem (Goodyear et al., 2014), or intrinsic motivation (Fernandez-Rio et al., 2017). In a recent systematic review of the last 5 years, Bores-García et al. (2020) highlighted that most of the research has evolved to focus on assessing the influence of cooperative learning on the students' social domain (motivation, group climate, and teacher–student interaction), leaving other domains, such as the physical or the cognitive, understudied.

Despite the positive outcomes observed, implementing cooperative learning in physical education is not an easy challenge for teachers (Dyson et al., 2010) because, among other things, cooperation does not come naturally between students (Dyson et al., 2004). Moreover, preservice and novice teachers recognized a lack of pedagogical skills to use this type of framework (Silva et al., 2021), and although they are inclined to use alternative pedagogical approaches, many quit after the initial implementation phase or honeymoon period (Goodyear & Casey, 2015). Scholars such as Dyson and Casey (2016) have provided practical examples and guidance on how to create cooperative learning contexts at elementary, middle, and high school to successfully achieve the desired outcomes. However, although many teachers claim that they use cooperative learning, they do not always incorporate the previously mentioned five basic elements (Casey & Goodyear, 2015), and when cooperative learning is not highly structured, it does not produce the desired results (Cecchini et al., 2020). Cooperative learning contexts are not easy to build; it takes time for teachers and students (Bjørke & Moen, 2020), and depending on how successfully they are constructed, the outcomes can be very different (Muldner et al., 2014).

Traditionally, academic performance has been conceptualized based on the knowledge and skills that a student demonstrates in a subject, operationalized in a final grade that represents performance and academic achievement (Johnson et al., 1980). Cognitive variables, such as intelligence, skills, and prior knowledge, conative variables, such as cognitive and learning styles, and affective variables, such as motivation and personality, have been considered the individual factors responsible for academic performance and, consequently, obtaining good grades (Johnson et al., 1981). Research on academic performance has not only assessed personal or individual factors. It has also focused on the effects of contextual variables (Van Mieghem et al., 2018), such as family participation in the school (Wilder, 2013), teacher–student relationship (Nath, 2012; Ramberg et al., 2018), types of grouping and student participation (Kunz, 2014), and the use of techiques, such as peer tutoring (Dunn et al., 2017). The class groups' contextual variables deserve special attention as they include socioeducational indicators like the interaction systems (teacher–student and student–student) and the degree of student participation (Dyson et al., 2010). There is evidence of students' better academic performance when the working environment is cooperative (Slavin, 2013). Nevertheless, class groups' characteristics, such as the number of students per class (smaller better than larger) (Tourón et al., 2018) or the teaching style (autonomy supportive better than controlling), have been found to be factors capable of influencing students' academic performance (Filippello et al., 2019).

Regarding the connections between the number of students per class and academic performance, previous research has showed that overcrowded classes have a negative impact on the educational process (Mustafa & Al-Hamadi, 2017). In physical education, Bevans et al. (2010) uncovered that students in schools with a low student–teacher ratio had more physical education time and engagement and higher levels of in-class physical activity. It is expected that these high levels could lead students to a better academic performance, but this is highly speculative because, to our knowledge, there are no published studies on the connections between class ratios and students' academic performance in physical education.

Based on the aforementioned, the present study did not focus on the personal variables that can influence students' academic performance because they have been over researched. The aim was to assess how two contextual variables, number of students per class and perceived in-class cooperation, affect students' academic performance in physical education. The first hypothesis was that the perceived in-class cooperation will positively affect students' grades. The second hypothesis was that the smaller the number of students per class, the better the grades.

Method

Participants

An ex post facto, cross-sectional research design was followed to assess connections between variables with no direct intervention (Cohen et al., 2011). Ex post facto research allows us to tease out possible antecedents of events that have happened and cannot, therefore, be controlled or manipulated by the investigator (Cooper & Schindler, 2001). The minimum number of participants was determined from the total number of students enrolled in primary education, secondary education, and baccalaureate in western Spain (122,133 students) during the 2019/2020 school year, considering a 3% sampling error and a 96% confidence level. Participants' selection was conducted using multistage, cluster sampling and random selection of the classrooms in 12 randomly selected schools that had more than one in Years 6, 7 (primary education; 10–12 years), 8, 9, 10, 11 (secondary education; 12–16 years), and 12 and 13 (baccalaureate; ≥16 years). Random selection included assigning numbers to all the classrooms using computer-generated random numbers. All schools were public and situated in urban, lower middle socioeconomic level neighborhoods. Physical education classes were based on the Spanish national curriculum, and all teachers declared that they had included cooperative learning in their physical education programs.

The original sample consisted of 1,269 students, but 84 were excluded because they returned blank questionnaires. The final sample included 1,185 students from primary education ($n = 549$; 255 in Year 6 and 294 in Year 7), secondary education ($n = 465$; 181 in Year 8, 117 in Year 9, 89 in Year 10, and 78 in Year 11), and baccalaureate ($n = 171$; 94 in Year 12 and 77 in Year 13). The mean age was 13.01 years ($SD = 2.48$; range 10–20; 47.9% girls [$n = 568$], 52.1% boys [$n = 617$]). A total of 64 classrooms participated (primary education = 27, secondary education = 27, and baccalaureate = 10). The mean number of students per class was 22.70 ($SD = 4.70$; range = 6–30).

Measures

Cooperative Learning Questionnaire

This questionnaire was developed by Fernandez-Rio et al. (2017a) to assess the five essential components of cooperative learning, and it showed adequate validity and reliability. Initially, it consisted of 30 items (developed by a group of experts) grouped into the five basic elements of cooperative learning. To assess the instrument's content validity and applicability, the first version underwent a process of double debugging. First, the content validity coefficient was calculated using an expert trial to obtain a second version with 25 items (content validity coefficient ≥ .90). Second, a pilot study was conducted to modify and/or eliminate items. The final version was reduced to 20 items. Confirmatory factor analyses, convergent validity, discriminant validity, multigroup confirmatory factor analyses, and concurrent validity showed strong reliability with a wide sample of 11,202 students from primary (1,203), secondary (2,144), and baccalaureate (512) enrolled in 68 different schools from 62 Spanish cities. It began with the sentence: "In my physical education classes . . ." referring specifically to this educational context. It included a total of 20 items grouped into five factors: interpersonal skills (i.e. "we work on dialogue, listening skills and/or debate"), group processing (i.e., "we take decisions by consensus among group members"), positive interdependence (i.e., "help from my groupmates is important to complete the task"), promotive interaction (i.e., "groupmates relate and interact with one another during tasks"), and individual accountability (i.e., "each member of the group must participate in group tasks"). The Cooperative Learning Questionnaire also provided an in-class cooperation factor, obtained from the mean scores of the five factors. Participants indicated their level of agreement with each item using a Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). To assess the reliability of the different factors, the following indices were calculated: Cronbach's alpha (α), composite reliability (CR), and McDonald's Omega (ω). Although α is dependent on the number of items and alternative answers, CR and ω are calculated using the factor loadings, and they are considered stronger reliable indices. Scores over 0.70 are considered acceptable. Convergent validty was estimated calculating the average variance extracted (AVE), which should be higher than 0.50. The reliability indices of the different factors in this study were calculated: interpersonal skills, α = .83, CR = 0.84, ω = 0.78, AVE = 0.57; group processing, α = .85, CR = 0.81, ω = 0.80, AVE = 0.52; positive interdependence, α = .81, CR = 0.89, ω = 0.84, AVE = 0.67; promotive interaction, α = .85, CR = 0.85, ω = 0.82, AVE = 0.54; individual accountability, α = .80, CR = 0.82, ω = 0.80, AVE = 0.55; and in-class global cooperation, α = .88, CR = 0.91, ω = 0.88, AVE = 0.57. To determine whether the factor model of the original validation study provided a good fit to the data, the next goodness-of-fit indices (GFIs) were calculated for the present study: chi-square test (χ^2), chi-square/degrees of freedom (χ^2/df), GFI, incremental fit index (IFI), Tucker–Lewis index (TLI), comparative fit index (CFI), root mean square of residuals (RMSR), and root mean square error of approximation (RMSEA). The following scores were obtained: $\chi^2 = 393.717$, $\chi^2/df = 4.18$, GFI = .995, IFI = .939, TLI = .922, CFI = .939, RMSR = .034, and RMSEA = .050. Similar results were obtained for the global cooperation factor: $\chi^2 = 1{,}279.245$, $\chi^2/df = 4.526$, GFI = .908, IFI = .904, TLI = .900, CFI = .933, RMSR = .060, and RMSEA = .057. Scores over .90 in GFI, IFI, TLI, and CFI and under .08 in RMSEA and RMSR indicate that the model shows a good fit. All showed reliability and validity evidence for the generalization of results (Costello & Osborne, 2005).

Academic Performance

Academic performance was assessed using the students' physical education grades at the end of the school year. This is an objective measure that represents the learning outcomes, and it was provided by the teachers. In the Spanish educational system, the same score scheme is used in all the educational stages observed (primary, secondary, and baccalaureate), consisting of a final grade in a 0–10 range.

Number of Students per Class Group

This information was provided by each class' tutor and confirmed by the school's administration.

Procedure

The study followed the ethical guidelines of the American Psychological Association (2010). Ethical approval was also obtained from the University of Extremadura Bioethics and Biosafety Committee (no: 0063/2019). Schools were contacted to fully explain the study and obtain authorization. Similarly, parental consent and students' agreement were collected before the beginning of the study. Those willing to participate also agreed to grant access to the students' grades. Anonymity and confidentiality of the data obtained was guaranteed, and participants were told that their responses would not affect their physical education grades. Questionnaire administration was conducted during school hours, in a confortable room, to provide a quiet space without distractions. It took around 15 min. Data collection was conducted 2 months prior to the end of the school year (to avoid conflict with the final grades), and (final) grades were accessed when school ended.

Data Analysis

Initially, reliability and confirmatory analyses of the instrument were performed. Next, a multilevel analysis was conducted given the data's hierarchical nature. The participanting students were grouped by each school administration in different classes based on several elements (number of students per class, type of teacher, and methodology used . . .), which could have influenced the dependent variables under study. The need to control the possible connections between students and the classrooms where they experienced learning and obtained a grade led us to the use of multivariate regression models that fit nested or hierarchical data. Hierarchical or multilevel linear models were developed to assess data when some of the variables were nested or grouped in others of higher level (Goldstein, 2003; Raudenbush & Bryk, 2002). In the present study, the participating students were nested in classrooms that experienced different teachers and teaching styles. These models assumed that students belonging to the same class would tend to manifest similar behaviors.

The statistical adjustment process began with a random effects analysis of varaince model called the unconditional or null model, represented in the equation: $Y_{ij} = \gamma_{00} + u_{0j} + e_{ij}$, where Y_{ij} is the performance of the *i*-umpteenth student nested in the *j*-umpteenth classroom, γ_{00} is the global average performance, u_{0j} indicates the existing variability between classrooms regarding average student performance, and e_{ij} denotes the existing variability between average student performance in the nested *j*-umpteenth classrooms.

This model was calculated without Level 2 explanatory or contextual variables (classrooms) and served as a reference to evaluate the goodness-of-fit of the other alternative models wherein classrooms' explanatory or contextual variables were incorporated step by step (Hofmann et al., 2000).

After this step, three models of means were adjusted as results, using regression analysis, to assess how the explanatory or contextual variables at the classroom level affected students' performance (grades). First, Model A, represented by the equation $Y_{ij} = \gamma_{00} + \gamma_{01}$ (number of students per class)$_j + u_{0j} + e_{ij}$, was adjusted to determine to what extent the context variable, number of students per classroom, explained students' performance. Next, Model B, $Y_{ij} = \gamma_{00} + \gamma_{01}$ (number of students per class)$_j + \gamma_{02}$ (interpersonal skills)$_j + \gamma_{03}$ (group processing)$_j + \gamma_{04}$ (positive interdependence)$_j + \gamma_{05}$ (promotive interaction)$_j + \gamma_{06}$ (individual accountability)$_j + u_{0j} + e_{ij}$, was adjusted, adding to the previous model the five essential elements of cooperative learning to assess which of them predicted students' academic performance to a greater or lesser extent. Finally, Model C, $Y_{ij} = \gamma_{00} + \gamma_{01}$ (number of students per class)$_j + \gamma_{07}$ (in-class global cooperation)$_j + u_{0j} + e_{ij}$, substituted the five essential elements of cooperative learning with the in-class cooperation factor. In these analyses, the dependent variable was the average grade. Global adjustment statistics were calculated (deviation −2LL, the Akaike information criterion, and the Bayesian information criterion) to determine to what extent the proposed model was capable of representing the observed data variability. The smaller the value of the global fit indices, the better the model fits the data. Statistical analyses were performed using SPSS software (version 22.0; IBM Corp., Armonk, NY) statistical package for PC and JAPS (freely available online).

Results

Table 1 shows descriptive statistics of the variables involved in the study: academic performance as a dependent variable at Level and as predictor or explanatory variable at Level 2: classrooms—students per class, in-class global cooperation, interpersonal skills, group processing, positive interdependence, promotive interaction, and individual accountability. The number of participants was 1,185 (students) at Level 1 and 64 (classrooms) at Level 2.

The goal was to find an explanatory model of academic performance only with Level 2 predictors at the classroom level.

Table 1 Descriptive Statistics

	M	*SD*	Minimum	Maximum
Level 1, students ($N = 1{,}185$)				
Academic performance in PE	7.65	1.50	1	10
Level 2, classrooms ($N = 64$)				
Students per class	22.17	4.70	6	30
In-class cooperation	3.87	0.56	1.65	5
Interpersonal skills	3.44	0.83	1	5
Group processing	3.58	0.80	1	5
Positive interdependence	3.99	0.68	1	5
Promotive interaction	4.02	0.67	1	5
Individual accountability	4.32	0.65	1	5

Note. *N* participants = 1,185; Level 2 class groups = 64. PE = physical education.

To achieve this goal, a random effects analysis of variance (null model) was conducted (Table 2). The estimate of the constant or intersection, the only parameter of fixed effects in the model, was found to be different from zero. The value of the estimate (γ_{00}; $\beta = 7.594$) of academic performance in the 64 participating classrooms differed from zero ($p < .001$). On the other hand, the estimates of the covariance parameters were observed (the estimates of the parameters associated with the random effects of the model) obtaining statistically significant differences ($p < .001$). The variance of the factor (classroom u_{0j}; $\beta = 0.768$) indicated how much academic performance varied between classrooms, whereas the variance of the residuals (residuals e_{ij}; $\beta = 1.536$) indicated how much performance varied within each classroom.

To understand these results and calculate the variability between the different classrooms compared with the variability between students in the same class, the intraclass correlation coefficient (ICC) was calculated. Scores close to 0 indicate that the subjects within the same group are as different from each other as those who belong to other groups; that is, the classroom factor does not help explain the variability of academic performance. Values close to 1 indicate that all the variability of the dependent variable, academic performance, is caused by differences between classrooms. In the present study, a score of .333 was obtained: 33.3% of the total variability of academic performance corresponded to the differences between classrooms. These significant differences represented the variability at Level 2.

Once the existence of differences between classrooms was verified, the next step was to try to reduce the existing 33.3% of the total variability of academic performance between classrooms, using explanatory or contextual variables at Level 2 (classroom level). The goal was to determine whether there was a variable that could explain these differences. To achieve this goal, three models of means were adjusted as results, using regression analysis.

Model A was adjusted to find to what degree the variable "number of students per class" explained student academic performance, and Table 2 shows that there were no significant differences: $\gamma_{01;}$ $\beta = 0.0347$; $p > .05$. Furthermore, the ICC was reduced by only five hundredths. On the other hand, comparing the estimates of random effects of the unconditional model ($\beta = 0.768$) and those of this Model A (u_{0j}; $\beta = 0.753$), the proportion of variance explained at Level 2 was (0.768–0.753)/0.768 = 0.019. That is, 1.9% of the differences observed between classrooms in students' academic performance were attributed to the Level 2 variable—number of students per class.

Model B was adjusted incorporating the five essential elements of cooperative learning into the previous model to assess which of them predicted academic performance to a greater or lesser extent, and results showed significant differences regarding group processing: $\gamma_{03;}$ $\beta = 0.145$; $p < .05$, promotive interaction: $\gamma_{05;}$ $\beta = 0.203$; $p < .001$, and individual accountability: $\gamma_{06;}$ $\beta = 0.235$; $p < .001$. Furthermore, the ICC was reduced by 5.6%. On the other hand, the proportion of variance explained at Level 2 was 0.281 (0.768–0.552/0.768). That is, 28.1% of the differences observed between classrooms in students' academic performance were attributed to the Level 2 variables—group processing, promotive interaction, and individual accountability.

Model C was adjusted substituting the five essential elements of cooperative learning for the in-class cooperation factor, and results showed significant differences: $\gamma_{07;}$ $\beta = .679$; $p < .001$. The ICC went from 33.3% to 26.7%, decreasing by 6.6%. The proportion of variance explained at Level 2 was 0.315 (0.768–0.526)/0.768. That is, 31.5% of the differences observed between

Table 2 Connections Between Academic Performance and Cooperative Learning Elements in the Class Groups

	Interclass group level ($n = 64$)			
	Null model	Model A	Model B	Model C
Fixed effects	**β (*SE*)**	**β (*SE*)**	**β (*SE*)**	**β (*SE*)**
Intersection classrooms, γ_{00}	**7.594** (0.12)**	**6.873** (0.51)**	**4.169** (0.53)**	**4.296** (0.51)**
Students per class, γ_{01}		0.0347 (0.02)	0.0321 (0.02)	0.0325 (0.02)
Interpersonal skills, γ_{02}			0.068 (0.06)	
Group processing, γ_{03}			**0.145* (0.07)**	
Positive interdependence, γ_{04}			0.043 (0.07)	
Promotive interaction, γ_{05}			**0.203** (0.08)**	
Individual accountability, γ_{06}			**0.235** (0.07)**	
In-class cooperation, γ_{07}				**0.679** (0.07)**
Random effect residuals, e_{ij}	1.536	1.536	1.439	1.444
Random effect classroom, u_{0j}	**0.768** (0.16)**	**0.753** (0.15)**	**0.552** (0.12)**	**0.526** (0.11)**
ICC	.333	.328	.277	.267
Overall model test				
Explained variance (R^2)		**1.9%**	**28.1%**	**31.5%**
Deviation (−2LL)	3,761.294	3,764.808	3,693.874	3,683.932
AIC criterion	3,765.294	3,768.808	3,697.874	3,687.932
BIC criterion	3,775.313	3,778.825	3,707.882	3,697.947

Note. ICC = intraclass correlation coefficient; Deviation (−2LL) = minus twice the logarithm of the maximum likelihood function; AIC = Akaike information criterion; BIC = Bayesian information criterion.
*$p < .05$. **$p < .01$. Bold values are associated with these p values.

classrooms in students' academic performance were attributed to the Level 2 variable: in-class cooperation. Finally, this Model C is the one that presents a better fit to the data with lower values in the different information criteria: deviation −2LL, Akaike information criterion, and Bayesian information criterion.

Discussion

The aim of this study was to assess how two contextual variables, number of students per class and perceived in-class cooperation, affect students' academic performance in physical education. Results showed that the differences observed between classrooms in students' academic performance can be attributed largely to the perceived in-class cooperation and not to the number of students per class. Furthermore, group processing, promotive interaction, and individual accountability could be considered the strongest predictors because these cooperative learning essential elements showed significant differences.

The first hypothesis was that perceived in-class cooperation will positively affect students' grades, and the results confirmed it. It could be said that one third of the students' academic performance in physical education was dependent on contextual variables, in this case, in-class cooperation. Results showed that the more the students perceived a cooperative context in their classes, the greater the impact on their academic performance (grades). Contrary to popular beliefs, competitive contexts in physical education have been connected to a decrease in the task-involving climate and the students' intrinsic motivation, perceived competence, and effort (Cecchini et al., 2019). If students do not feel competent in the tasks, their motivation decreases and they stop trying, which could negatively affect their academic performance (grades). On the contrary, when students feel intrinsically motivated, their basic psychological needs increase (autonomy, competence, and relatedness) and positive outcomes, like academic perdormance, can happen. Cooperative contexts have been found to improve students' performance (León et al., 2015, 2017; Slavin, 2013), which can lead to better grades. Moreover, effectiveness of cooperation on students' learning and performance has been shown regardless of the content and the educational level (Capar & Tarim, 2015). Results from the present study confirmed both ideas: highly-perceived in-class cooperation has been connected to better students' grades, regardless of the content experienced in their physical education classes. Previous reviews conducted in physical education (Bores-García et al., 2020; Casey & Goodyear, 2015) highlighted the effectiveness of cooperative learning contexts to promote students' learning in the four domains (physical, cognitive, social, and affective). However, to our knowledge, this is the first study to positively connect perceived in-class cooperation and students' grades in physical education. This could be considered significant as many teachers claim that they try to promote a cooperative class climate, but they do not always incorporate the five basic elements (Casey & Goodyear, 2015), and when cooperative learning is not highly structured, it does not produce the desired results (Cecchini et al., 2020). Cooperative learning contexts are not easy to build; some researchers claim that they require a minimum of 17 lessons (Bjørke & Moen, 2020), and many teachers stop trying once they face the first difficulties after the initial honeymoon period (Goodyear & Casey, 2015). Results from the pesent study indicate that depending on how successfully the in-class cooperation is constructed, the outcome, grades, can be very different, in line with previous research (Muldner et al., 2014).

Deepening this connection, results showed the existence of significant differences in students' academic performance when considering only three of the basic elements of cooperative

learning: group processing, promotive interaction, and individual accountability. In a previous study, León et al. (2014) found an explanatory model of the effectiveness of cooperative learning through group communication, group members' interdependence, and responsibility, which is similar to the basic elements researched in the present study. Therefore, both studies highlight the importance of these three essential elements of cooperative learning. Previous studies showed that students experiencing cooperative learning contexts highlighted the social relations developed, which promoted communication and interconnections among group members (Bjørke & Moen, 2020), not only to close friends (Fernandez-Rio et al., 2017), and helped them succeed. Regarding promotive interaction and group processing, cooperation allows group members to be in direct contact with each other to encourage each other and to help each other; interaction enables better attitudes toward school activities and greater commitment to learning (Johnson & Johnson, 2017). In a cooperative classroom, group members reflect, debate, listen, ask, explain . . . promoting information processing strategies that influence academic performance (Slavin, 2014). Discussing and confronting ideas promotes active learning—cognitive restructuring and the development of higher quality strategies (Callender & McDaniel, 2009; Schunk, 2012)—and students who provide more elaborate explanations to others improve their academic performance as well as that of others (Webb, 2008; Webb et al., 2009). In the same line, learning to ask and answer questions in cooperative learning contexts has been positively associated with performance (O'Donnell, 2000; Sporer et al., 2009). The whole idea lies within the social constructivism theory, which highlights that learners actively construct their own knowledge through experiences and interactions with others (Bruner, 1966).

Regarding individual accountability, cooperative contexts provide students with more responsibility and control over their learning, with greater autonomy and independence from the teacher (Curran & Standage, 2017; León et al., 2017, 2019; Mendo et al., 2017). Individual responsibility within a group's work is considered a necessary condition for the group to be successful (Johnson & Johnson, 1987). In cooperative learning contexts, students depend on each other; they all share responsibility for their learning. Each member is committed to do their part of the work, and the group is held responsible for achieving the group's goals. As a consequence of their participation in cooperative situations, the student learns to become responsible, and this responsibility has been found to be a key resource in academic performance (Carbonero et al., 2015). Previous research has linked responsibility with academic performance, favoring task-approach goals and motivation (Rivera-Pérez et al., 2021), study skills (Richardson, 1993), and learning (Benson et al., 2006; Lerner et al., 2009).

The second hypothesis was that the smaller the number of students per class, the better the grades, and the results did not confirm it. Previous research has pointed in the opposite direction: students in schools with low student–teacher ratio had more physical education time and engagement and higher levels of in-class physical activity (Bevans et al., 2010). Moreover, overcrowed classes have been found to produce a negative impact on the educational process (Mustafa & Al-Hamadi, 2017). Results from the present study indicated that there was no connection between class ratio and students' academic performance (grades) and that the most important factor influencing students' grades was in-class cooperation. Therefore, the present study uncovered that class ratio is not so determinant in classes where cooperation is high. Previous works have indicated that the most important factor influencing students' academic achievement was the teachers' instructional framework, despite overcrowded classes; being the cooperative one was better than being the competitive and the individualistic one (Johnson & Johnson, 2017). However, research has indicated that this is only possible when cooperative learning is highly structured and properly implemented (Cecchini et al., 2020), which is in line with the present study, as high perceived in-class cooperation was connected to academic performance. For cooperative learning to be truly effective, the working groups must be properly coregulated (Salonen et al., 2005), and the teacher must provide adequate guidance and feedback during the process and at the end of it (Gillies, 2008; Van Leeuwen & Janssen, 2019). This framework has been previously connected to students' self-regulated learning and academic self-efficacy (Fernandez-Rio et al., 2017) and, in the present study, with academic performance (grades). This could be considered important because an adequate methodological framework, which promotes perceived in-class cooperation, has been found to be a positive influence in the students' grades regardless of the class ratio. Therefore, the development of a cooperative context could be considered an adequate tool for overcrowded classes (those close to 30 students).

The present study is not without limitations, the most important one being the use of questionnaires as a data collection method. Future studies should use other instruments, like individual interviews or focus groups. The second limitation is that it only assessed students' views. There is a need to collect information from other participants, like teachers, to obtain a wider vision. Another limitation of the present study derives from its cross-sectional design, which prevents us from drawing cause–effect relationships. Finally, it should be noted that the sample is restricted to Spanish students.

On the other hand, the present study also has some strengths. It is the first one to connect perceived in-class cooperation and academic performance in physical education, which represents a significant contribution to the existing literature on this pedagogical framework. The study also uncovered the significance of each of the five essential elements of this pedagogical framework, highlighting that three of them were directly connected to students' academic performance: group processing, promotive interaction, and individual accountability. Finally, it exposed the relative and low importance of class size in students' academic achievement, highlighting that in-class cooperation can be a tool to counteract the negative consequences of crowded classrooms.

Conclusions

Academic performance in physical education is not only influenced by personal factors (cognitive, social, and affective) but also by contextual factors like in-class global cooperation. Within this framework, group processing, promotive interaction, and individual accountability could be considered the most relevant critical features, and teachers should pay close attention to them. Finally, class size was not found to be a significant contextual factor in students' academic performance, being a cooperative context more important to positively influence students' grades. These contexts are not easy to build, and depending on how successfully they are constructed, the outcomes can be very different.

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