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The impact of cooperative learning on peer relationships, intrinsic motivation and future intentions to do sport

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Abstract

Background: Understanding intra-individual change is a key question when studying causality between variables. The first objective was to examine, using the technique of true intra-individual change (TIC, Δ) for the first time, the motivational sequence proposed by Vallerand (1997), ΔCo-operative learning → ΔRelatedness → ΔIntrinsic motivation → ΔIntention to do sport. **Method:** The sample comprised 372 students divided into two groups, experimental and control. During a 6 month period the experimental group was taught co-operative learning strategies by a suitably trained teacher. **Results:** Positive changes were seen in the experimental group in all of the variables examined, while the control group remained unchanged. The results of the TIC suggest accepting the motivational sequence describe. **Conclusions:** Co-operative learning may by an appropriate method to improve self-determined motivation according to the model described.

Keywords: Intraindividual change, cooperative learning, physical education, motivation, instructional strategies.

Resumen

Repercusión del aprendizaje cooperativo sobre las relaciones con los compañeros, la motivación intrínseca y las intenciones futuras de práctica deportiva. **Antecedentes:** conocer el cambio intraindividual es una cuestión clave para bordar el estudio de la causalidad entre variables. El primer objetivo fue comprobar, por primera vez, utilizando la técnica del verdadero cambio intraindividual (TIC, Δ), la secuencia motivacional propuesta por Vallerand (1997), ΔAprendizaje cooperativo → ΔRelación → ΔMotivación intrínseca → ΔIntenciones de práctica deportiva. **Método:** la muestra estuvo formada por 372 estudiantes que se dividieron en dos grupos: experimental y control. Durante 6 meses al grupo experimental se le aplicaron estrategias de aprendizaje cooperativo por un profesor formado a tal efecto. **Resultados:** se observaron cambios positivos en el grupo experimental en todas las variables analizadas, mientras que el grupo control permaneció estable. El TIC permite aceptar la secuencia motivacional descrita. **Conclusiones:** el aprendizaje cooperativo puede ser un método adecuado para incrementar la motivación autodeterminada en base al modelo descrito.

Palabras clave: cambio intraindividual, aprendizaje cooperativo, educación física, motivación, estrategias instruccionales.

This study uses, for the first time, a predictive model constructed on intra-individual differences in the perceptions physical education (PE) students have about co-operative learning, relatedness, intrinsic motivation and future intentions of doing sport. More specifically, it aims to test a hierarchical model based on self-determination theory (SDT), and particularly the findings from Vallerand (1997): Contextual factors → Satisfaction of psychological needs → Self-determined motivation → Personal and social consequences (Vallerand, 1997). In the proposed model we decided to include analysis based on "true intra-individual change (TIC, Δ)", as these models are key for the study of causality between variables (Steyer, Partchev, & Shanahan, 2000). Consequently, the model to be tested would be: ΔCo-operative learning → ΔRelatedness → ΔIntrinsic motivation → ΔIntentions to do sport. In addition to testing the model, in this study we also aim to do so in two different groups; one group which has no interventions, and another in which co-operative learning is used systematically. Our objective is to establish: a) whether the model fits the data well in both cases; b) the impact of systematic co-operative learning on the experimental group in these variables.

Co-operative learning is a teaching method based on a combination of didactic strategies in which the students work in pairs or small groups to help each other reach common goals, and must depend on each other to achieve those goals (Fernández-Río & Méndez-Giménez, 2016; Johnson, Johnson, & Holubec, 2013; Sharan, 2014). Despite beginning in the 1980s, it is a teaching practice that experts consider to be one of the most innovative pedagogical approaches in today's educational landscape (Ghaith, 2018; Surian & Damini, 2014; Velázquez, 2015).

According to the literature there are four main approaches for co-operative learning: conceptual, structural, curricular and complex instruction. The conceptual approach (Johnson, Johnson, & Holubec, 2013) emphasises four learning elements for the structure

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of activities: Face-to-face interaction, in which the members of the group have to be in direct contact to encourage and support each other during the task; Individual accountability, each member of the group must be responsible for part of the overall goal; *Group processing*, the group as a whole must reflect, talk, debate and process available information; and *Interpersonal and small group skills*, as a consequence of the other elements the group members will develop interpersonal communication skills (e.g. encouraging, congratulating, active listening), management skills (e.g. respect, sharing, managing, mediating) and leadership skills (e.g. guiding, explaining, suggesting, directing). The structural approach (Kagan, 1990) stresses *Positive interdependence*, the members of the group depend on each other to achieve the goal. The curricular approach is subject specific (Slavin, 1995) and stresses group rewards and individual responsibility. Finally, the complex instruction approach (Cohen, 1994) focuses on group work for problem-solving tasks (Altıntas & Ilgun, 2016; Nopembri, Sugiyama, Saryono, & Rithaudin, 2019) which are usually open-ended.

SDT considers all human behaviour to be motivated by three universal psychological needs: competence, autonomy and relatedness (Deci & Ryan, 2000). Relatedness is identified with the feeling of being accepted by others, with concern for the wellbeing, safety and unity of the members of a group. To satisfy this need it seems right to generate a climate which encourages social relationships between participants, such as in the strategies developed for co-operative learning described above. Various studies have noted the impact of co-operative learning on the satisfaction of the need for relatedness in a PE context (Casey & Goodyear, 2015; Cecchini, Fernández, & Cecchini, 2013; Méndez-Giménez, Fernández-Río, & Cecchini, 2016). Satisfying this need should have an impact on intrinsic motivation, or on the inherent tendency to seek novelty and challenge, to expand and exercise one's own skills as the SDT postulates (Deci & Ryan, 2000). In PE, various studies have noted the positive effect of relationships with others on intrinsic motivation (Moreno, González-Cutre, Chillon, & Parra, 2008). STD also suggests that intrinsic motivation, engagement with an activity, should have significant personal and social consequences. In the PE context they may include consequences on future intentions to do sport (Cuevas, Contreras, Fernández, & Martí, 2014). The complete model would be: Co-operative learning → Relatedness → Intrinsic motivation → Intentions to do sport.

Evaluating students and presenting those measures as averages gives an apparently simple view which hides the huge variety there is in the student population. This is why explaining inter-individual differences in terms of intra-individual change is one of the key interests in differential psychology. According to this approach, TIC scores (the difference between two variables with true scores) between two measurement time points are the values of the latent variables (Steyer, Partchev, & Shanahan, 2000). For example, looking at the correlations of the variable *Intention to do sport* in pre-test and post-test we may see that generally this correlation is not perfect. Often the correlation is less than expected due to measurement errors. Nevertheless, a correlation of less than one between variables that the TIC measures means that some individuals change more than others in the attribute being considered. Why do some individuals change and others do not? Continuing with the example, we may consider that these fluctuations in the TIC of intentions to do sport may be related to the fluctuations in TIC in intrinsic motivation. Continuing with this predictive model based on the *Hierarchical Model* (Vallerand, 1997; Vallerand & Losier, 1999), the final novel model would be: ΔCo-operative learning → ΔRelatedness → ΔIntrinsic motivation → ΔIntention to do sport.

Finally, what would happen if in addition, the setting were manipulated in order to increase co-operative learning in the classes? In principle, the theory suggests that that should produce positive changes in the three dependent variables; Relatedness, Intrinsic Motivation and Intention to do sport. But what would the TIC produce in this case? Certainly, some individuals would change more than others, but could those changes also be explained by the same model?

We have two objectives in this study. The first is to analyse the changes in each of the two groups in the aforementioned variables. Based on the research cited previously, in the experimental group we would expect to see increases in: a) the perception of co-operative learning in the class, b) levels of relatedness, c) intrinsic motivation and d) future intentions to do sport. Our second objective is to examine the proposed model from TIC (Steyer, Partchev, & Shanahan, 2000), in both control and experimental groups. As this is the first study to look at the relationship between these variables using TIC it seems a little bold to state a starting hypothesis, however we would expect the model to have a good fit to the data (Vallerand, 1997).

Method

Participants

The sample was made up of 372 students (202 boys, 170 girls) aged between 12 and 17 (M = 14.20 years; SD = 2.34) from four state-funded secondary schools chosen by convenience. The sample unit is the class-group which was organised into two groups: experimental (n = 182; 96 boys and 86 girls) and control (n = 190; 101 boys and 89 girls). The design is a quasi-experimental pre post test, as it is not possible to suppose that the two groups are initially equivalent within the limits of sampling error.

Instruments

Co-operative learning. The *Co-operative learning* subscale was used from the Perceived Motivational Climate in Sport Questionnaire (PMCSQ-2) by Newton, Duda, & Yin (2000) in a version that had been adapted and validated for the Spanish PE context by González-Cutre, Sicilia, & Moreno (2008). This factor is made up of four items (e.g. "Classmates work together as a team"). The root statement is "In my PE classes…". The responses range from 1 (Totally disagree) to 5 (Totally agree). In this study Chronbach's alpha for the experimental and control group and pre-test and post-test were respectively .84, .76, .85 and .80.

Basic Psychological Needs. We used the *Relatedness* subscale of the Basic Psychological Needs in Exercise Scale (BPNES) designed by Vlachopoulos & Michailidou (2006) in the version validated in Spanish and adapted to PE by Moreno, González-Cutre, Chillón, & Parra (2008). The subscale has 4 items (e.g. "I feel that I associate with the other exercise participants in a very friendly way."). The root phrase was "In my PE classes…". The responses ranged from 1 (Totally disagree) to 5 (Totally agree). In this study the Chronbach's alpha for the experimental and control group and pre-test and post-test were respectively .84, .77, .88 and .81.

Intrinsic Motivation. To look at PE students' intrinsic motivation we used the Perceived Locus of Causality scale (PLOC; Goudas, Biddle, & Fox, 1994). The scale was translated to Spanish and validated for a PE context in Spain by Moreno, González-Cutre, & Chillon (2009). The intrinsic motivation subscale has four items (e.g. "Because Physical Education is enjoyable") preceded by "I participate in Physical Education classes…". In this study Chronbach's alpha for the experimental and control groups and the pre-test and post-test were respectively .86, .85, .90 and .86

Intention to do sport. We used Moreno, Moreno, & Cervelló's (2007) version of the Intention to be Physically Active Scale (IPAS; Hein, Müür, & Koka, 2004). It has five items to evaluate a student's intention to be physically active (e.g. "After finishing school I want to join a sports or training club" preceded by "Regarding your intention to do sport…". Responses ranged from 1 (*Totally disagree*) to 5 (*Totally agree*). In this study Cronbach's alpha for the experimental and control groups and the pre-test and post-test were respectively .81, .86, .86 and .90.

Co-operative program and teacher training. The program included sessions of basketball, football, volleyball and physical expression based on the contributions of Goudas and Magotsiou (2009). Each session was based on one of the four co-operative learning approaches; conceptual (Johnson, Johnson, & Holubec, 2013), complex instruction (Cohen, 1994), structural (Kagan, 1990) and curricular (Slavin, 1995). Table 1 gives a brief overview of the program as an example.

Procedure

The study was carried out in conformance with the World Medical Association Declaration of Helsinki (Williams, 2008) and the Ethics Committee of the University. Informed consent was obtained from the parents and school authorities. All of the questionnaires were completed under the supervision of an experienced researcher.

The measuring instruments were applied before (Pre-test) the beginning of the school year, and 6 months later (Post-test). During the intervening time co-operative learning strategies (detailed below) were applied in the PE sessions for the experimental group by a suitably trained teacher. Meanwhile the control group had their planned PE sessions, without applying co-operative learning strategies.

Data analysis

We performed a multivariate analysis in the pre- phase in order to ensure that there were no significant differences between the groups in the variables being examined, along with a repeated measure MANOVA to see the differences in interactions time × group × gender, in order to determine whether the experimental group exhibited differences compared to the control group between the pre- and post- phases in the variables being studied, and that any changed did not depend on participants' gender. Following that, the TIC was performed using the framework of structural equation modelling (SEM). The four or five indicators in each dimension were packaged together to make two indicators per construct, following the procedure from Little, Cunningham, Shahar, and Widaman (2002). As prior data analysis revealed substantial multivariate kurtosis, we performed an analysis based on the use of the Satorra-Bentler chi-squared (S-Bχ^2) statistic and robust standard estimators implemented in the EQS statistics program: for incremental indices of fit, we used the *Comparative Fit Index* (*CFI), as a measure of absolute indices of fit determining how well the model predicts the covariance matrix we used the *Root Mean Square Error Approximation* (RMSEA) and the *Root Mean Square Residual* (SRMR). To complete the analysis we included 90% confidence intervals provided by the *RMSEA.

There seems to be no consensus between researchers on the number of participants needed for the estimations of confirmatory analysis to be reliable. We used the method from MacCallum, Browne, & Sugawara (1996) to calculate the power. In all of the models the power was above .90 (MacCallum et al., 1996).

In order to test the hypothesis that the measuring model in invariant over time, we performed a CFA analysis on the model state (Steyer, Partchev, & Shanahan, 2000). To analyse the pattern of intra-individual change in each participant, we calculated the Reliable Change Index (RCI; Christensen & Mendoza, 1986). In the second stage, we tested a reference model, *baseline model*, and

Table 1
Program description

Elements of learning for structuring the activities	Theoretical focus of co-operative learning	Lesson content
Understand the importance of co-operation in class and in everyday life, the characteristics of co-operation, introduction to the teaching method	Activities aimed at understanding the 4 focuses of co-operative learning	A) co-operative activities in class B) demonstration of reciprocal teaching cards
Face-to-face interaction, members of the group must be in direct contact with each other to give encouragement and support during the tasks	Conceptual focus	Two-hand passes in volleyball Mixed groups of 4. Reciprocal teaching. Alternating roles
Individual accountability, each member of the group must be responsible for a part of the overall task	Conceptual focus	Choreographing a dance. Mixed groups of 4. Each member must choreograph a part of the dance on a general pattern. Reciprocal learning. Combine all elements. Rehearsal. Demonstration
Group processing, the group as a whole must reflect, talk, discuss and process the available information	Conceptual focus	Invent a game with two basketballs and two hoops in which players must co-operate to reach a common goal. Groups of 4. Presentation to the whole group
Interpersonal and small group skills), leadership (i.e., guide, explain, suggest, direct).	Conceptual focus	Direct the co-operation process of a group to meet the goal of dancing a synchronized dance created by the group leader. Groups of 4. Reciprocal teaching. Alternating roles

theoretical models on both the control and experimental groups. To do that we followed the two-step procedure recommended by Anderson & Gerbing (1988).

Results

Differences between groups

The results of the multivariate analysis did not show and statistically significant differences in any of the variables examined, Wilks' Lambda (1, 355) = .973, $F = 2.45$, $p > .05$, $\eta^2 = .03$, which means that both groups started from the same level.

The repeated measure MANOVA did give rise to differences in the interaction time × group Wilks' Lambda (4, 352) = -.887, $F = 11.25$, $p < .001$, $\eta^2 = 11$, but not in the interaction time × group × gender, Wilks' Lambda (4, 352) = .992, $F = .750$, $p > .05$, $\eta^2 = 01$. The following univariate analyses show that the experimental group scored more highly than the control group in all variables, Co-operative learning, $F (1, 355) = 24.09$, $p<.001$, $\eta^2 = .06$; Relatedness, $F (1, 355) = 19.86$, $p<.001$, $\eta^2 = .05$; Intrinsic motivation, $F (1, 355) = 29.18$, $p<.001$, $\eta^2 = .08$, and Intentions to do sport, $F (1, 355) = 20.47$, $p<.001$, $\eta^2 = .07$.

Confirmatory factorial analysis on the model state

The CFA on the model state (Steyer et al., 2000) showed that the measuring model is invariant over time. Comparing the restricted model in the experimental group with the model in which there are no invariance restrictions, the model fit does not improve significantly (Δ S-Bχ^2 (4) = 5.84, n.s.). The same is seen with the control group (Δ S-Bχ^2 (4) = 13.77, n.s.).

Intra-individual changes

The Reliable Change Index (RCI; Christensen & Mendoza, 1986) showed that in all the variables examined in the experimental group, the percentage of students who significantly raised their scores is substantially higher than the percentage of students whose scores fell, while in the control group just the opposite was seen. If the percentages of students with significant intra-individual changes are added together, in two variables it is slightly higher in the experimental group, and in the other two variables substantially higher in the control group (Table 3).

Checking the theoretical model

Firstly, we evaluated the theoretical model in which the factors of co-operative learning, relatedness, intrinsic motivation and intentions to do sport covary (M1 and M2). In both groups the correlational models fit the data well (Table 4). Following that, we performed a structural equation analysis of the theoretical model (ΔCo-operative learning – ΔRelatedness – ΔIntrinsic motivation – ΔIntention to do sport). In both groups the models had an acceptable fit to the data, although in the experimental group the SRMR is a little high (Figure 1).

Discussion

The first of the objectives was to analyse the changes to the variables in each of the groups. In that respect, and as we hypothesised, in the experimental group we saw an increase in students' perceptions of co-operative learning given in class, verifying an improvement in student's perceptions of the changes in teaching methodology and the actions of the teacher attempting to encourage co-operative learning. This information confirms the validity of the program, based on the four aforementioned co-operative learning approaches. We also saw an increase in the satisfaction of the psychological need for relatedness. In other words, co-operative learning seems to activate the feeling of being accepted by others, the support of others concerned for one's wellbeing and security, increasing affective links

Table 2
Descriptive analysis of the variables co-operative learning, relatedness, intrisic motivation and intentions to do sport in pre- and post-test phases, in both groups and the effect size

	Experimental				Control				Effect Size(r)
	Pre		Post		Pre		Post		
	M	SD	M	SD	M	SD	M	SD	
Co-operative learning	3.74	.86	4.14***	.91	3.60	.80	3.41	.92	.39
Relatedness	3.94	.94	4.24***	.87	3.97	.87	3.78	.86	.26
Intrinsic motivation	3.42	1.07	4.04***	1.03	3.64	1.04	3.54	.93	.25
Intention to do sport	3.69	1.00	4.14***	.93	3.84	1.04	3.65	1.10	.23

Table 3
Percentage of participants who changed scores in the variables analysed

	% Experimental Group			% Control Group		
	Reduction	Increase	Change	Reduction	Increase	Change
Co-operative learning	8.62	27.07	35.69	22.04	12.36	34.40
Relatedness	5.75	18.39	24.14	20.43	16.67	37.10
Intrinsic motivation	5.75	32.18	37.93	18.27	15.05	33.32
Intention to do sport	5.75	21.84	27.59	23.66	17.74	41.40

Table 4
Confirmatory Factorial Analysis and covariance of hypothetical models

Model	S-Bx2	*df*	*CFI	SRMR	*RMSEA (90% CI)		AIC
Experimental group correlation							
M_1	85.99	72	.989	.040	.034	(.000 – .058)	-58.01
Control group correlation							
M_2	104.60**	72	.970	.049	.049	(.026 – .069)	-39.40
Experimental group theoretical model							
M_3	137.14***	90	.964	.090	.055	(.035 – .073)	-42.87
Control group theoretical model							
M_4	119.71*	90	.973	.034	.064	(.016 – .060)	-61.33

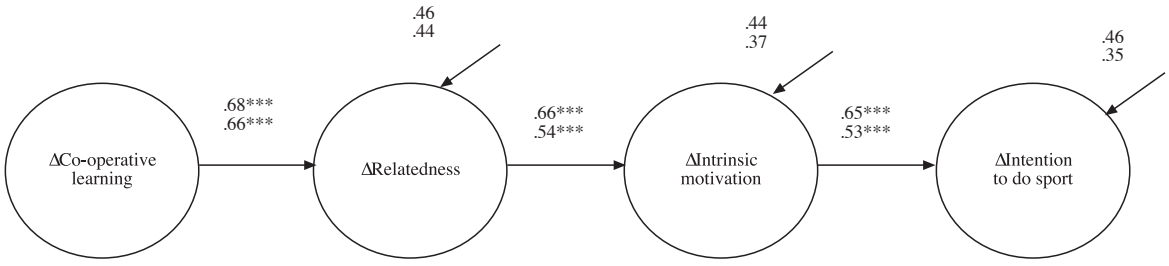

Figure 1. Structural equation analysis of the theoretical model in the control group (top) and experimental group (bottom)

between members of the group (Cecchini et al., 2013; Méndez-Giménez et al., 2016). In addition we saw an increase in intrinsic motivation. Previous research has found that techniques of co-operative working come into play in intrinsic motivation in PE classes (Cecchini, Méndez-Giménez, Sánchez Martínez, & Fernández-Río, 2019; González-Cutre et al., 2011; Sevil et al., 2016); influencing intrinsic motivation by increasing satisfaction and pleasure in understanding and one's own competence, and by trying to benefit others, in such a way that affective factors combine with cognitive factors when it comes to boosting learning and motivation. Finally, we also saw an increase in intentions to do sport, establishing a relationship between co-operative learning and the intention to do sport (e.g., Cecchini et al., 2013).

In both experimental and control groups we saw that individuals differed in the patterns of their change. In the experimental group 27% saw a significant increase in the amount of co-operative work in the PE classes, but that was not a universally shared view. Approximately 64% did not note any significant change, and 8.62% even reported that the amount of co-operative work had fallen. In the control group there was a similar proportion of students who had changed their perception of co-operative work in class, but the pattern of change was different. Some participants had changed more than others in this respect, but overall these changes cancelled each other out.

Based on these results, it is essential to understand the TIC pattern in both experimental and control groups based on the theoretical model. In both groups the model had an acceptable fit to the data, although in the experimental group the SRMR is a little high. Comparing the models stepwise between the two groups we see the following:

Step 1, ΔCo-operative learning → ΔRelatedness. This is similar in both groups, with very similar predictive value for the exogenous variable ($\Delta\gamma = .02$), that explains a similar percentage of the variance ($\Delta R^2 = .02$). This is consistent with the *Hierarchical Model* (Vallerand, 1997; Vallerand & Losier, 1999), and with the results of various transversal studies (e.g., Cecchini et al., 2013; Méndez-Giménez et al., 2016). Situations in a PE class in which students have tasks of working together and learning to help each other (e.g. demonstrating or teaching a skill) help them to feel closer and more connected to each other.

Step 2, ΔRelatedness → ΔIntrinsic motivation. In both cases this is significant ($p < .001$), although slightly higher in the control group ($\Delta\gamma = .11$), explaining a higher percentage of the variance ($\Delta R^2 = .07$). Step 3, ΔIntrinsic motivation → ΔIntentions to do sport. We see something similar to the previous step. It exhibits a predictive nature ($p < .001$), but with different weights for the variable ΔIntrinsic motivation ($\Delta\gamma = .12$). The control group again explains slightly more of the variance of ΔIntentions to do sport ($\Delta R^2 = .11$). In summary, the results largely support the proposed pattern of sequences with the caveats already noted in the experimental group. These results allow us to address the hypothesis of what happens in the experimental group when they use co-operative learning. The results seem to indicate that this use produces intra-individual changes in relatedness, which then impacts on intrinsic motivation, which in turn changes intentions to do sport. These results are consistent with the predictions of SDT (Vallerand, 1997) and may have significant implications for school PE (Fernández-Río, Cecchini, & Méndez-Giménez, 2014; Fernández-Río, Sanz Fernández-Cando, & Santos, 2016; González-Cutre, Sicilia, & Moreno Murcia, 2011; Moreno-Murcia, Zomeño, Marín, Ruiz, & Cervelló, 2013). The reason is that co-operative learning may help to tackle one of PE's main aims: encouraging and training for regular physical activity in free time, continuing into adulthood, which is linked to the adoption of

habits of physical exercise that have positive influences on health and quality of life (LOMCE, 2013). More than 80% of the world adolescent population do not do enough physical activity, and inactivity is the fourth biggest risk factor for early death worldwide (World Health Organization [WHO], 2017).

This study does have some limitations. For example, it does not allow us to establish causality between objectives 1 and 2. We cannot determine the causality of the theoretical model presented over the events of the intervention. New studies should tackle that question as well as the impact of ΔCo-operative learning on other variables such as Δcompetence, Δautonomy, Δeffort, Δpersistence etc. Additionally, the TIC allows for comparison of change over more time points, and analysis of, for example, the difference between T2-T1, T3-T1 and T3.T2 and the relationship with other variables at the same time. Longitudinal studies should be done in the future which include these possibilities.

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