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ORIGINAL

VALLERAND'S MODEL IN ASTURIAN ADOLESCENTS: IMPLEMENTATION AND DEVELOPMENT

EL MODELO DE VALLERAND EN ADOLESCENTES ASTURIANOS: IMPLEMENTACIÓN Y EXTENSIÓN

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ABSTRACT

The complete sequence of Vallerand's model (1997) was examined in the context of physical education: Social factors influence the psychological mediators, which in turn predicted motivation types, which lead to certain consequences. Based on the Vallerand's Model and Ntoumanis (2001) empirical study, this investigation was undertaken to test the full model in all sequences with a sample of Asturian adolescent students (N = 507) of a wider age range (12 -17 years), including as a social factor a distinct sub-dimension to

the original work (important role) and introducing two new motivational consequences (fun and degree of perceived pressure). The Spanish validated version of these questionnaires was used: PMCSQ-2, BPNES, PLOC, three subscales of IMI (enjoyment, effort, and competence) and other motivational outcomes such as boredom and future sport participation. Results from the Confirmatory Factor Analysis showed that the data fit the model proposed, and they showed that the three psychological needs mediated between the task climate and the intrinsic motivation. This positively predicted enjoyment, effort and future sport participation, and negatively boredom. Competence was the stronger predictor, positively influencing the most autonomous types of motivation, and negatively the more controlled ones. Amotivation positively predicted boredom and pressure, and negatively effort.

KEYWORDS: Self-determination, Physical education, Motivational regulations, Hierarchical Model

RESUMEN

Se examinó la secuencia del modelo de Vallerand (1997) en el contexto de la educación física: Los factores sociales influyen en los mediadores psicológicos, que a su vez predicen los tipos de motivación, que dan lugar a determinadas consecuencias. Tomando como base el Modelo de Vallerand y el estudio empírico de Ntoumanis (2001), este trabajo se propuso comprobar el modelo completo en todas sus secuencias con una muestra de estudiantes adolescentes asturianos ($N=507$) de una franja de edad más amplia (12-17 años), incluyendo como factor social una subdimensión distinta al trabajo original (papel importante) e introduciendo dos nuevas consecuencias motivacionales (diversión y grado de presión percibida). Se administraron versiones españolas de diversos cuestionarios: PMCSQ-2, BPNES, PLOC, IMI (diversión, esfuerzo percibido y presión percibida) y consecuencias motivacionales (aburrimiento e intención de práctica). El análisis factorial confirmatorio reveló que los datos se ajustaban bien al modelo, y que las tres necesidades psicológicas mediaban entre el clima de tarea y la motivación intrínseca. Ésta predijo positivamente la diversión, el esfuerzo e intención de práctica, y negativamente, el aburrimiento. La competencia percibida resultó el predictor más fuerte, influyendo positivamente en la motivación más autónoma y, negativamente, en la más controlada. La desmotivación predijo positivamente el aburrimiento y la presión y, negativamente, el esfuerzo.

PALABRAS CLAVE: Autodeterminación, Educación Física, Regulaciones motivacionales, Modelo Jerárquico

INTRODUCTION

The Self-Determination Theory (SDT; Deci & Ryan, 1985; 2002) has evolved as one of the main theoretical frameworks used to understand motivation towards

physical activity in sport and physical education (PE) contexts (Ntoumanis & Standage, 2009). The SDT points out that what drives human conduct is the satisfaction of the basic needs, but environmental factors can promote or inhibit this tendency (Deci & Ryan, 2002). Based on these ideas, different types of motivation have been established: intrinsic motivation, extrinsic regulation (integrated regulation, identified regulation, introjected regulation, external regulation), and amotivation.

Intrinsic motivation refers to the act of performing an activity a) for the excitement, the enjoyment, the aesthetic value or the pleasure it brings (stimulation), b) for the satisfaction of exploring and learning (knowledge) or c) for the joy of overcoming obstacles and reaching goals (achievement) (Vallerand, 2001). Integrated regulation deals with behaviours related to personal values, goals and needs. For example, a student participates in PE because he/she knows that it is important to achieve a healthy lifestyle. Identified regulation is linked to the action of performing an activity considered as not interesting, but that it is perceived as important to reach certain personal goals. For example, a student participates in PE because he/she wants to improve his/her sport skills. Integrated and identified regulations have been also defined as autonomous extrinsic motivation. Introjected regulation represents those behaviours carried to avoid blame or shame (constrain or inner pressure) or to obtain feelings of personal worth (Deci & Ryan, 2002; Ryan & Deci, 2000). For example, a student participates in PE because he/she will feel bad about him/herself if he/she does not participate. External regulation is instrumental (a mean to reach other ends). The individual performs an activity because his/her motivation is controlled through a reward-punishment system (constrains). For example, a student participates in PE because he/she feels that he/she must do it for a significant peer. Introjected and external regulations have been defined as controlled regulations. Finally, amotivation refers to behaviours not intrinsically, nor extrinsically motivated. It is the lowest level of self-determined motivation. Amotivated individuals do not link their behaviors with the consequences of their actions. This type of motivation is developed when individuals experience feelings of incompetence and lack of control (Deci & Ryan, 1985).

The SDT also includes social factors, teachers and/or coaches, as influential on individuals' motivation (Deci & Ryan, 1985). However, this social influence is mediated by the individual's self-perceptions of competence (the need to obtain the desired outcomes and experience mastery and efficacy), autonomy (the individual's need to feel the source and regulator of his/her own conduct) and relatedness (the need to feel that one can be connected to others safely). Research on PE has examined several relevant elements of social contexts that can predict the satisfaction of this need (for example, the motivational climate or the autonomy). Regarding the motivational climate, mastery climates are characterized by a context where students perceive that personal improvement and learning are rewarded, while students in ego climates perceive that outstanding performances are rewarded. Research has showed that mastery climates promote feelings of competence, autonomy and relatedness, and,

consequently, foster self-determined motivation (Ames, 1992). Different research works have been conducted in PE and sport contexts have been positively link mastery climates to competence (Cecchini, Fernández-Río, Méndez-Giménez, Cecchini, & Martins, 2014; Reinboth, Duda, & Ntoumanis, 2004), autonomy (Standage, Duda, & Ntoumanis, 2003) and, to a lesser extent, relatedness (Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002). Furthermore, research has showed that higher levels of these three needs are linked to a more degree of self-determined motivation in PE (Cox & Williams, 2008; Ntoumanis, 2005; Standage et al., 2003; Standage, Duda, & Ntoumanis, 2006) and sport (Cecchini, Fernández-Río, & Méndez-Giménez, 2014; Reinboth et al., 2004; Sarrazin et al., 2002).

Finally, motivation leads to different types of cognitive, emotional and behavioural consequences. Positive consequences, such as persistence in sport activities, are produced by the more self-determined types of motivation (intrinsic motivation and identified regulation), while negative consequences are produced by the least self-determined types of motivation (external regulation and amotivation). In PE contexts, research has showed that the most self-determined students have higher intentions to do physical activity, they tend to voluntarily participate en PE and they are more physically active during their free time (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Ntoumanis, 2001, 2005; Standage, et al., 2003).

Based on the SDT, Vallerand (1997) and Vallerand and Losier (1999) developed the Hierarchical Model of Intrinsic and Extrinsic Motivation, which includes four causal stages: Social factors → Psychological mediators → Types of motivation → Consequences. Over the last decade, this framework has been a great tool to understand how the motivational processes of athletes/students take place in training/education at the cognitive, behavioural and affective level. Ntoumanis (2001) was the first one to test Vallerand's hierarchical model in a sample of British students in PE. The revised structural equation model showed that perceived competence was the main psychological mediator. Intrinsic motivation was linked with positive consequences, while external regulation and amotivation were predictors of negative consequences. However, Standage, Duda and Ntoumanis (2003) uncovered one limitation of that study: autonomy and relatedness were measured through two items moderately associated, which could have reduced the relationships between both variables and the different motivational regulations, and produced a low Cronbach alpha (.43 and .65 respectively). In the present study, we have tried to avoid this limitation using measures of autonomy and relatedness with a larger number of items. Another limitation of the Ntoumanis' study was the age group (14-16). There is a need to test the model in other grade levels.

Recent works have replicated Vallerand's model in sport and PE contexts in Spain, including new variables or motivational consequences (e.g. Almagro, Sáenz-López, González-Cutre & Moreno-Murcia, 2011; González-Cutre, D., Sicilia, & Moreno Murcia, 2011; Méndez-Giménez, Fernández-Río, & Cecchini, 2013; Moreno-Murcia, Zomeño, Marín, Ruiz, & Cervelló, 2013). Mastery or task

climates (where the teacher/coach promotes personal improvements and self-referenced comparisons) have been linked to more adaptive behavioural, cognitive and affective results than ego climates (which promote normative comparison) (for a revision see Braithwaite, Spray, & Warburton, 2011). However, up to date, the complexity of the whole model has not been tested with 12-14 year old students, a critical phase in adolescence, where sport participation and the interest on PE begin to decline (Cecchini, Méndez-Giménez, & Muñiz, 2003). Despite the fact that the relationships between social goals and SDT have been studied to explain enjoyment in PE ((Moreno-Murcia, Hernández, & González-Cutre, 2009), this has not been studied as a consequence variable, which can enhance our knowledge on the relationships between the elements of the model and new behavioural consequences. Boredom was studied as a dependent variable in Ntoumanis' study (2001), and it could be considered the opposite to enjoyment, a global study of the model allows for its specific inclusion. Certainly, boredom is not the exact opposite to enjoyment; a specific scale to measure it is needed. On the other hand, Ntoumanis (2001) concluded that students that feel pressure to participate or that feel that they are wasting their time in PE should be carefully considered. The present study tries to give light to this question.

GOALS AND HYPOTHESIS

Using Vallerand's model as a base and Ntoumanis (2001) empirical study, the present work tries to test the complete model with all its consequences in a sample of Spanish adolescents (12-17 years old), including as a social factor a different sub-dimension (Important role) and introducing two new behavioural consequences: enjoyment and perceived pressure.

In sum, the goal was to test the mediation functions of relatedness, competence and autonomy among the different elements of the task climate (cooperative learning, effort and important role) and the different types of motivational regulations. Our first hypothesis was that cooperative learning will be positively linked to perceived relationship, effort/improvement will be linked to perceived competence and important role, and important role will be linked to autonomy (figure 1). Our second hypothesis was that competence, autonomy and relationship will be positively related to self-determined motivation, competence will be the strongest predictor of all types of motivation, positively with the most autonomous, and negatively with the least self-determined types. Finally, positive effects of the most self-determined types of motivation over the most adaptive consequences were also hypothesized.

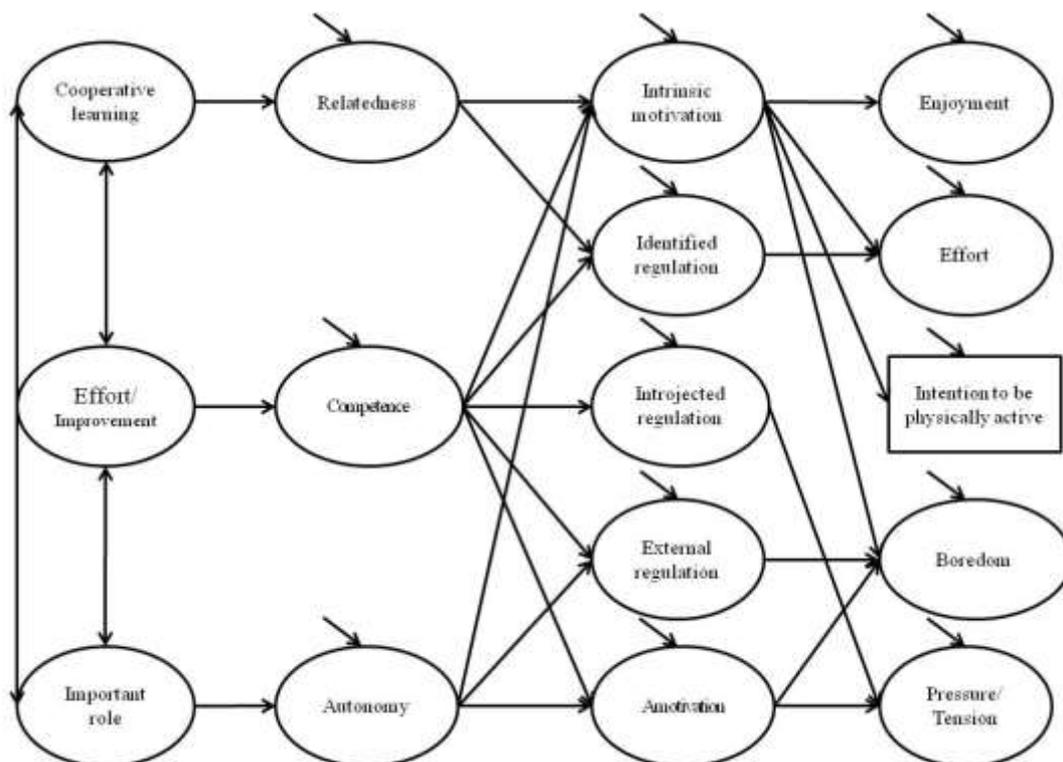


Figure 1. Revised model of the motivational process in PE. Based on Vallerand's model (1977), including important role in social factors and enjoyment and pressure as motivational results.

METHOD

Participants

A total of 507 secondary education students (267 males, 240 females) from one school in northern Spain, ages 12-17 years ($M= 14.35$, $SD= 1.69$) agreed to participate. Table 1 shows the sample distribution based on grade level and gender.

Table 1. Participants' distribution based on gender and grade level.

		Grade					Total
		1º ESO	2º ESO	3º ESO	4º ESO	1º Bachiller	
Gender	Males	59	56	62	58	32	267
	Females	50	52	50	49	39	240
	Total	109	108	112	107	71	507

Procedure

First, permission from the Ethic Committee of the researchers' university and the participating school was obtained. Second, a written informed consent from the students' parents was also obtained. Students completed an anonymous questionnaire which included all the instruments described below. The

procedure took 30 minutes of a PE lesson. Data were analyzed using SPSS 19.0.

Instruments

Perceived Motivational Mastery Climate. The mastery subscale of the Perceived Motivational Climate in Sport Questionnaire-2 was used (PMCSQ-2; Newton, Duda, & Ying, 2000). It was validated for Spanish physical education settings by González-Cutre, Sicilia, and Moreno (2008). It consists of three subscales: Cooperative Learning (4 items), Effort/Improvement (4 items), and Important Role (4 items). Cronbach alpha of the mastery climate subscale was .84 (.65 for cooperative learning, .70 for effort/improvement and .70 for important role). Although some of the scores were below .70, it is considered acceptable due to the reduced number of items. The original questionnaire (Newton et al., 2000) also showed scores below .70 in some dimensions.

Basic Psychological Needs. The Basic Psychological Needs in Exercise (BPNES; Vlachopoulos & Michailidou, 2006) was validated to Spanish physical education contexts by Moreno, González-Cutre, Chillón, and Parra (2008) and it was used in the present work. It contains three subscales: Autonomy (4 items), Competence (4 items), and Relatedness (4 items). The common stem was: "In my physical education class...". Cronbach alphas of each subscale were .71, .69 y .84, respectively.

Motivational regulations. The Perceived Locus of Causality questionnaire (PLOC; Ryan & Connell, 1989) was used to study students' motivation. It contains four subscales to measure motivation in the classroom: Intrinsic Motivation, Identified Regulation, Introjected Regulation, and External Regulation. It was adapted for physical education contexts by Goudas et al. (1994). The same authors also adapted the Amotivation subscale of the Academic Motivation Scale (Vallerand et al., 1993). The complete instrument was validated for Spanish physical education settings by Moreno, González-Cutre, and Chillón (2009). Cronbach alphas for each subscale were: .75, .74, .61, .70, .76, respectively.

Consequences. Three subscales of the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989) were used: Effort (4 items), Enjoyment (4 items), and Pressure/Tension (4 items). Cronbach alphas were .80, .84 and .68, respectively. They represent significant consequences of the different types of motivation (Ntoumanis, 2002). The IMI has showed adequate validity when used in PE context and adolescents (Mitchell, 1996). On the other hand, **boredom** was assessed through three items developed by Duda, Fox and Armstrong (1992) to measure affective responses on children performing physical activity. Cronbach alpha was .70. Finally, **intention to be physically active in the future** were assessed through one item developed by Ntoumanis (2001). Declaring an intention is the strongest predictor of behavior. All research

instruments used a 5-point likert scale ranging between 1 (totally disagree) to 5 (completely agree).

RESULTS

Descriptive analyses and correlations among variables

Table 2. Cronbach alphas, means, standard deviations and correlations among variables.

Variables	α	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1. Cooperative learning	.71	3.84	.73	1.00															
2. Improvement	.73	4.20	.64	.52**	1.00														
3. Important role	.74	3.89	.73	.52**	.57**	1.00													
4. Relatedness	.79	4.09	.71	.41**	.30**	.22**	1.00												
5. Competence	.73	3.86	.70	.23**	.31**	.25**	.43**	1.00											
6. Autonomy	.76	3.38	.81	.35**	.27**	.33**	.37**	.55**	1.00										
7. Intrinsic motivation	.81	3.94	.79	.42**	.43**	.36**	.39**	.62**	.55**	1.00									
8. Identified regulation	.78	4.06	.91	.26**	.39**	.35**	.33**	.52**	.42**	.64**	1.00								
9. Introjected regulation	.70	3.33	.83	.20**	.15**	.25**	.16**	.33**	.40**	.37**	.33**	1.00							
10. External regulation	.72	2.99	1.06	-.09*	-.12**	-.06	-.09*	-.16**	.01	-.20**	-.14**	.39**	1.00						
11. Amotivation	.79	1.97	.94	-.19**	-.40**	-.28**	-.24**	-.38**	-.15**	-.40**	-.39**	.08	.45**	1.00					
12. Enjoyment	.85	3.99	.81	.43**	.49**	.42**	.47**	.63**	.57**	.78**	.59**	.35**	-.20**	-.47**	1.00				
13. Effort	.73	4.10	.81	.27**	.38**	.28**	.30**	.46**	.22**	.42**	.39**	.19**	-.16**	-.38**	.48**	1.00			
14. Intención de práctica	-	4.11	1.16	.13**	.15**	.13**	.23**	.44**	.23**	.41**	.39**	.19**	-.11*	-.28**	.38**	.29**	1.00		
15. Boredom	.72	1.65	.72	-.29**	-.36**	-.24**	-.37**	-.46**	-.34**	-.46**	-.35**	-.07	.22**	.49**	-.55**	-.45**	-.27**	1.00	
16. Anxiety	.71	2.20	.83	-.21**	-.20**	-.11*	-.37**	-.32**	-.17**	-.26**	-.20**	.15**	.23**	.36**	-.34**	-.27**	-.19**	.33**	1.00

Note: * $p < .05$. ** $p < .01$

Table 2 shows Cronbach alpha coefficients, means, standard deviations and bivariate correlations of all variables. Regarding task motivational climate, important role and cooperative learning showed the highest scores. Regarding basic psychological needs, participants scored higher relatedness, followed by competence and autonomy. Regarding motivational regulations, identified regulation scored higher, followed by intrinsic motivation, and the least self-determined types of motivation. Finally, regarding motivational consequences, effort and intention to be physically active scored higher, followed by enjoyment. Overall, the highest scores can be found in the variables improvement and effort perceived in class, while the lowest were amotivation and boredom. Cronbach alphas were above .70 in all subscales, showing their validity.

Structural equation analysis of the model

Since the main goal of the present research work was to assess the causal relations among variables, a structural equations model (SEM) was used. This technique has been recommended in previous works to understand the multidimensional framework of the SDT (Ntoumanis, 2001; Vallerand, 1997). A SEM allows researchers to build hypothesis about the type and direction of relations that are expected among variables. This is the reason why they are called: confirmatory models (Ruiz, Pardo, & San Martín, 2011).

It is known that the goodness-of-fit deteriorates as the size of the sample used increases. The SEM tolerates few variables, since the bigger their number, the harder is to reproduce correctly the observed covariances, and a bigger sample size is needed, too (Ruiz et al., 2011). This problem can be solved by combining the items into pairs (Marsh, Richards, Johnson, Roche, & Tremayne, 1994). The first two items of each subscale are averaged to form the first item pair; then, the second two items are averaged to form the second pair, and so forth. Marsh et al. (1994) suggested the use of item pairs because their scores are more reliable, they tend to be normally distributed and the ratio of the number of measured variables to the number of participants is reduced, reaching acceptable scores. In this research work, the use of item pairs resulted in two observed variables as indicators of each latent factor.

AMOS 18.0 (Analysis of Movement Structures) program was used (Arbuckle, 1997). To examine our hypothesis, the initial model was tested through SEM based on the motivational sequence described by Vallerand (1997) and Vallerand and Losier (1999). Results showed that Mardia's normalized coefficient was relatively large (multivariate kurtosis = 62.72). Therefore, data were analyzed using the robust maximum likelihood method. This procedure is recommended by Bentler (1995) when data are not normally distributed. In testing the initial model, evaluation of the goodness-of-fit to the sample data was determined on the basis of multiple criteria: chi-square, chi-square/degrees of freedom ratio ($X^2/d.f.$), CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), RMSEA (Root Mean Square Error Approximation) and RMR (Root Mean Square Residual). A good fit to the model is achieved when $X^2/d.f.$ is below 3, CFI and TLI are equal or bigger than .90, and RMSEA and RMR are equal or smaller than .06 (Hu & Bentler, 1999).

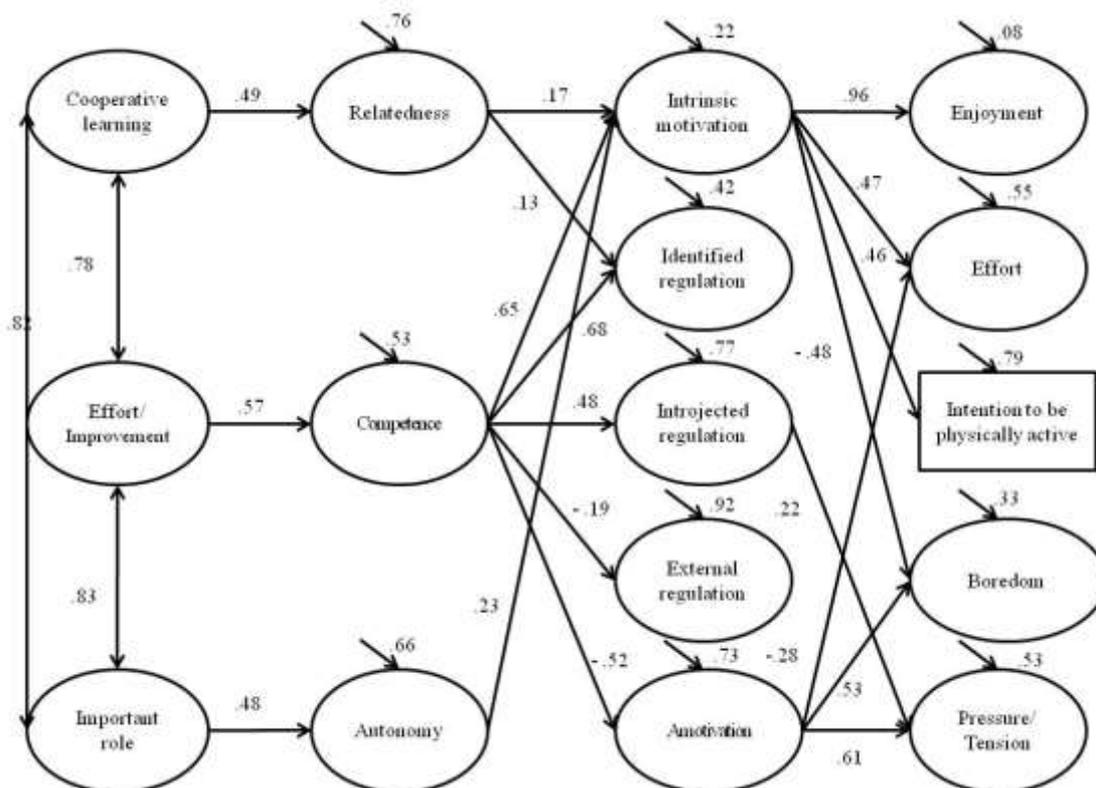


Figure 2. Revised model of the motivational process in PE.

Note. All parameters have been standardized and they are statistically significant.

Fit indices showed that the initial model did not fit well: $\chi^2(400) = 1191.41$, $p < .001$; $\chi^2/d.f. = 2.95$; CFI = .89; TLI = .87; RMSEA = .06; RMR = .07. Using the Wald tests and the Lagrange multiplier test, a second structural equation analysis was conducted to obtain the best possible fit in the revised model (Ntoumanis, 2001). The paths between autonomy and external regulation, autonomy and amotivation, identified regulation and effort, and external regulation and boredom were eliminated because they were not significant. A path between amotivation and boredom was added, and we allowed the connection between the residuals of the different types of motivation (Ntoumanis, 2001). Fit indices showed a better fit to the model $\chi^2(400) = 1056.01$, $p < .001$; $\chi^2/d.f. = 2.64$; CFI = .91; TLI = .90; RMSEA = .06; RMR = .05. Figure 2 only shows the structural model (latent factors connexion routes). The assessment model (latent factor connexion routes with indicators) has been eliminated from Figure 2 to ease the view, but all relevant information is presented in Table 3.

Table 3. Factor loading and residuals in the structural equation model

Factors	Variables	Factor loading	Residuals
Cooperative learning	Indicator1	.717	.486
	Indicator2	.747	.442
Improvement	Indicator1	.553	.695
	Indicator2	.727	.431
Important role	Indicator1	.747	.442
	Indicator2	.620	.626
Relatedness	Indicator1	.948	.101
	Indicator2	.648	.580
Competence	Indicator1	.841	.302
	Indicator2	.654	.562
Autonomy	Indicator1	.877	.231
	Indicator2	.930	.135
Intrinsic Motivation	Indicator1	.829	.223
	Indicator2	.821	.226
Identified regulation	Indicator1	.547	.601
	Indicator2	.885	.217
Introjected regulation	Indicator1	.563	.620
	Indicator2	.756	.438
External regulation	Indicator1	.594	.648
	Indicator2	.909	.174
Amotivation	Indicator1	.776	.397
	Indicator1	.844	.633
Enjoyment	Indicator2	.895	.199
	Indicator2	.823	.323
Effort	Indicator1	.614	.623
	Indicator2	.896	.196
Boredom	Indicator1	.731	.466
	Indicator2	.537	.722
Tension	Indicator1	.692	.520
	Indicator2	.757	.427

Note. All factor loadings are significant $p < .001$.

DISCUSSION AND CONCLUSIONS

The present work examined the sequence of Vallerand's (1997) theoretical model in the Spanish context of PE, incorporating several variables: social factors (task climate) → psychological mediators → types of motivation → consequences. Results support the hypothesized model. As they are congruent with the ones obtained by Ntoumanis (2001) in the British context.

The initial model did not show a good fit to the data. Therefore, the paths between autonomy and external regulation, autonomy and amotivation, identified regulation and effort, and external regulation and boredom were eliminated because they were not significant. This decision was considered appropriate because the motivational sequence described by Vallerand (1997) has been tested completely in PE contexts only by Ntoumanis (2001), and the

model is still exploratory. The main reasons for this inadequate fit could be based in several reasons, that should be studied in future works: large number of variables, different assessment instruments or characteristics of the sample.

Social Factors' influence. The first hypothesis was supported by the moderate significant links that connected the three social factors (cooperative learning, improvement/effort and important role) with the three psychological mediators (relatedness, competence and autonomy). Previous research works in the context of PE support the connection between mastery climate and needs satisfaction (Cox & Williams, 2008). Results are congruent with the theoretical framework used and Ntoumanis' study (2001), which support the idea that mastery climates builds up feelings of belonging and cooperation (Ames, 1992). However, Standage et al. (2003) found only one link between mastery climates and autonomy. The weakness of the instrument used to assess the mastery climate (*L'Echelle de perception du Climat Motivational*, EPCM) was the reason behind their results, because it did not included a subscale to measure cooperative learning. Second, mastery climate predicted perceived competence in PE contexts. Our study also showed the link between improvement/effort and competence. Our results are congruent with those obtained by Kavussanu and Roberts (1996) and Ames (1992), which showed that when individual criteria are used to assess y reward performance, students feel more competent and safe, because the assessed results are easier to control. Furthermore, when students feel that success is achieved through hard work and the desire to learn, they have more control or autonomy over their achievement in PE class (Treasure & Roberts, 2001). Finally, the present work supports the idea that students show higher autonomy levels when they perceive that their teachers give them an important role, regardless of their skill level (Cox & Williams, 2008).

Motivational mediators. Regarding our second hypothesis, results also support the predicted mediations of competence, autonomy and relatedness on the different socio-contextual factors and their connections with intrinsic motivation. These results are congruent with previous research works in PE contexts (Ntoumanis, 2001, Standage et al., 2003, 2005, 2006). The present study found that competence perception was the highest predictor of intrinsic motivation, followed by autonomy and relatedness. Ntoumanis (2001) and Standage et al. (2006) suggested that feelings of competence can be more significant in PE due to the public exposure of students and the relevance of physical skills in this context. Standage et al. (2003) believed that PE teachers are aware of the importance of fostering competence among children, and our data uphold this idea. Previous research works have showed the need to build goals and social relations among students to promote intrinsic motivation (Méndez-Giménez, Cecchini, Fernández-Río, & González, 2012). A mastery climate seems to foster social relations more than an ego climate. Contrary to the work of Ntoumanis (2001), our results showed that autonomy is a predictor (weak) of intrinsic motivation, which is consistent with previous works by Ntoumanis (2005) and Standage et al. (2003) and confirm the mediator role of this need supported by the SDT.

Congruent with Ntoumanis' work (2001), both competence and relatedness positively predicted the identified regulation. However, both in studies autonomy did not predicted that link, showed in other works which considered self-determined motivation the sum of intrinsic motivation and identified regulation (Standage et al., 2003) or an index (Ntoumanis, 2005). In the present work, competence also positively predicted introjected regulation, and negatively the least self-determined regulations (external regulation and amotivation). Ntoumanis (2001) believed that the role of perceived competence is crucial since some students do not have any previous experience on several sport activities. Students who perceive themselves very competent have less chances of being externally motivated or amotivated in the PE classes. On the contrary, those who believe that their physical competence is low tend to view the PE experience senseless (amotivation) and they participate in class because they follow the rules or fear the punishment (external regulation).

On the other hand, in the present study the paths between autonomy and external regulation and autonomy and amotivation were eliminated because they were not statistically significant. Previous research works on the connection between autonomy and motivational regulations have produced contradictory results. Ntoumanis (201) found a negative prediction between autonomy and external regulation, while Standage et al. (2003) suggested connections between autonomy and introjected regulation and autonomy and self-determined motivation, in line with the SDT (Deci & Ryan, 1985). These contradictions have been recently individually examined. Lim and Wang (2009) assessed the autonomy support through the modified version of the *Sport Climate Questionnaire* (6 items), and it predicted positively the intrinsic motivation and the identified regulation and negatively the external regulation and the amotivation. Intrinsic motivation positively predicted intention, too. There were no links between introjected regulation and intentions. Our study partially confirmed these results, probably for the large number of variables studied and the different instruments used to assess autonomy.

Self-regulations. Regarding our third hypothesis, intrinsic motivation positively predicted enjoyment and effort, in line with the SDT (Deci & Ryan, 1985), and intention to be physically active in PE students. These results are congruent with previous research works. Ntoumanis (2001) found that intrinsic motivation predicted effort and intention to be physically active. Similar results were obtained by Standage et al. (2003) regarding students' intentions. Positive links between intrinsic motivation and intentions to be physically active or active participation in PE class were found by Biddle et al. (1995) and Sas-Nowosielski (2008), respectively. This highlights the important role of PE in the promotion of active lifestyles to improve public health (McKenzie, 2001). Additionally, Standage et al. (205) found that intrinsic motivation predicted positive results in PE: students' concentration, their liking of challenging tasks, and positive affect in the PE classes. Ntoumanis (2005) also found that the most self-determined students tended to participate more in voluntary PE classes during the following school year. Different research works on PE have consistently linked

autonomous motivation (intrinsic motivation and identified regulation) with several adaptive consequences: high levels of interest (Goudas, Biddle, & Fox, 1994), students' concentration in class (Ntoumanis, 2005), informed vitality (Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008), general self-esteem (Standage, Gillison, & Treasure 2007), health-related quality of life (Standage et al., 2007), and goal achievement/performance (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008). Furthermore, students' autonomous motivation positively predicts teachers' positive ratings of their students' effort (Ntoumanis, 2005) and persistence in PE (Standage et al., 2006). In this same trend, in our study intrinsic motivation negatively predicted maladaptive responses, such as boredom, which is consistent with previous studies (Ntoumanis, 2001), and support results previously discussed on enjoyment. Higher intrinsic motivation in PE students produces more enjoyment and less boredom. Standage et al. (2005) also found negative links between intrinsic motivation and lack of enjoyment. In the present study, amotivation was negatively linked to effort and positively to boredom and perceived pressure. Previous studies also found that amotivation positively predicted boredom (Ntoumanis, 2001), lack of enjoyment (Standage et al., 2005), negative affect and depression (Mouratidis et al., 2008)

Finally, introjected regulation positively predicted adolescents' perceived pressure/tension. Deci, Eghrari, Patrick, and Leone (1994) believed that introjected regulated behaviours are made under external pressure and tension, and they are associated to high levels of anxiety. Nevertheless, previous studies could not find this link (Yli-Piipari, Watt, Jaakkola, Liukkonen, & Nurmi, 2009). Behaviours that try to avoid that other people (teachers, peers) think that I am incompetent can be problematic and cause nervousness. If students care about what others think of them in PE class, and view this rating as a menace to their perceived competence, the end result might be an increase in the anxiety levels. In the present study, a link between amotivation and perceived pressure was found, which is congruent with previous research works (Yli-Piipari et al., 2009), a connection between amotivation and external regulation was not found. This findings indicate that pressure derived from the own feelings of guilt could be higher than the pressure derived from extrinsic motivations. Yli-Piipari et al. (2009) found that students in the low-motivation cluster showed higher levels of physical inactivity and lower levels of enjoyment in PE than students in the "high motivation" cluster", but also experienced lower levels of anxiety.

A limitation of the present study is its trans-sectional design, which only allows to adjust the proposed model in a certain time. Future research works should be use longitudinal designs, where students are assessed several times during a long period on time of active participation in PE class to determine the stability of the links found in the present study along time. Further, the present study tried to extend the age range of previous studies (Ntoumanis, 2001), the model should be tested in primary education students (age range 10-12 years), to gain a deeper understanding of the complex behavioural regulations of the transition between infancy and adolescence.

Results of the present research work shed light on important implications for physical educators. They emphasize the importance of promoting class climates that foster cooperative learning to strengthen students' interpersonal relations, tasks focused on effort and personal improvement to enhance students' perceived competence, and derive responsibility to the students to let them know that they play an important role in their learning and improve their autonomy. This environment increases self-determined motivation, which, in turn, fosters effort, enjoyment, and intentions to be physically active, and prevent boredom and perceived pressure, negative consequences of amotivation.

The present study also holds some limitations. External validity of the results is questioned because students belonged to a single school, which produces lack of representativity. Future research works should replicate the model used in this study with participants from different regions and backgrounds. On the other hand, the trans-sectional and correlational nature of the present study allows only for a fit of the model to a certain time, and does not allow for causal connections.

Future lines of research should follow longitudinal or experimental designs where the study groups (including primary education students) will be assessed several times over a long period of active participation in PE to determine the stability of the connections found over time.

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