












Novelty, emotions and intention to be physically active in Physical Education students

Sebastián Fierro-Suero^{1*}  , David González-Cutre²  , Luis Murta³ ,
Bartolomé J. Almagro¹   & Pedro Sáenz-López¹  

¹ Faculty of Education, Psychology and Sport Sciences, University of Huelva (Spain).

² Department of Sports Sciences, Sports Research Centre, Miguel Hernández University of Elche (Spain).

³ Departamento de Artes, Humanidades e Desporto, Instituto Politécnico de Beja (Portugal). Quality of Life Research Center (CIEQV), Santarém (Portugal).



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Abstract

In recent years, the importance of students' emotions in Physical Education classes has been highlighted. Novelty has also recently been proposed as a candidate for basic psychological need. To date, no study has specifically focused on analysing the relationships between these two constructs, which is the main objective of this paper. For this purpose, a structural equation model was tested with 799 Physical Education students with a mean age of 13.16 years ($SD = 1.17$). The results showed that students' perception of their teachers' novelty support strategies predicted the satisfaction of this need ($\beta = .81$; $p < .01$). In turn, novelty satisfaction positively predicted positive emotions and negatively predicted negative emotions, with the explained variances of enjoyment (52%), pride (41%), and boredom (37%) standing out. Finally, the emotions enjoyment ($\beta = .45$; $p < .01$) and hopelessness ($\beta = -.16$; $p < .01$) predicted intention to be physically active in the future. These results show the importance of novelty in making PE a positive emotional experience and its effect on the creation of healthy habits.

Keywords: basic psychological need, boredom, enjoyment, interpersonal style, novelty support.

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*Corresponding author:

Sebastián Fierro-Suero
fierro.suero@ddi.uhu.es

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Introduction

The promotion of active lifestyles is a priority goal of modern societies, as around three quarters of adolescents do not get enough physical activity (Guthold et al., 2020). In this sense, the role of schools in general and in particular Physical Education in promoting healthy lifestyles has been highlighted (Ferriz et al., 2016). Physical Education is the only period of structured, compulsory, and regular physical activity in the educational curriculum (Grao-Cruces et al., 2019). However, the number of hours devoted to this subject is limited and differs from country to country (De Meester et al., 2014). For this reason, although Physical Education provides an opportunity to directly increase hours of physical activity (Hollis et al., 2017), it is equally important to make this motor experience psychologically positive (Diloy-Peña et al., 2021) in order to encourage students to engage in extracurricular physical activity (Castillo et al., 2020; Fierro-Suero et al., 2022). At a psychological level, students' motivation towards Physical Education has been one of the main constructs studied (Vasconcellos et al., 2020). Recently, as a complement to the study of motivation, several research studies have been initiated focusing on students' emotions (e.g., Fierro-Suero et al., 2021; Niubò-Solé et al., 2022; Simonton & Garn, 2018, 2020), as this construct also conditions the experience of Physical Education classes and influences relevant variables such as academic performance, the intention to engage in extracurricular physical activity, or the level of physical activity practice in leisure time (Fierro-Suero et al., 2022, 2023; Simonton & Garn, 2020).

Emotions are understood as a series of multi-component (affective, cognitive, physiological, motivational, and expressive-behavioural) changes in an organism's psychophysical system that occur in response to important situations (Scherer & Moors, 2019). The Control-Value Theory of Achievement Emotions (CVTAE; Pekrun, 2006) has been the main theoretical framework used in general for research in education (e.g., Camacho-Morles et al., 2021; Pekrun et al., 2017) and in Physical Education in particular (Fierro-Suero et al., 2023; Simonton & Garn, 2018, 2020). This theory categorises emotions in the academic field from a cognitive-social perspective, establishing a sequential model in which there is feedback between different phases such as the learning environment generated, the appraisals of value and control made by students, the emotions of achievement experienced and, finally, the consequences related to these emotions.

Students make evaluations about their surroundings, either consciously or unconsciously, on an ongoing basis (Pekrun & Stephens, 2010). These regulatory processes are associated with people's basic psychological needs

(Deci & Ryan, 2000) and to some extent act as mediators between learning environments and experienced emotions (Pekrun et al., 2006). As a result, the CVTAE proposes a categorisation of emotions based on three main criteria: valence (positive or negative), level of activation (activating or deactivating), and object focus (process-task focused or outcome focused). The most researched emotions in Physical Education have been enjoyment, pride, boredom, hopelessness, anxiety, and anger. In this sense, enjoyment is a positive, activating, task-focused emotion that arises when attractive and creative challenges are solved; pride is a positive, activating, outcome-focused emotion that arises when the learner feels an important part of a success; boredom is a negative, deactivating, activity-focused emotion that arises when the proposed tasks lack value for the learner or are repetitive tasks; hopelessness is a negative, deactivating, outcome-focused emotion that arises when the learner feels it is impossible to avoid failure; anxiety is a negative, activating, outcome-focused emotion, which arises when the learner places a high value on the outcome, but the situation is not entirely dependent on them and their concentration is on losing or failing; finally, anger is a negative, activating emotion, which may be task-focused when the learner feels they have the task under control but its demands are excessively high, or outcome-focused, when the learner feels that the final outcome has been decided by someone else (Pekrun, 2006; Pekrun et al., 2007; Pekrun & Stephens, 2010). For examples of how each of the emotions arise in specific situations in Physical Education classes, it is recommended to read Fierro-Suero et al. (2023).

Aspects related to the learning environment that influence emotions include teachers' support for autonomy (Pekrun, 2006). This concept has often been used generically to refer to the interpersonal styles that teachers acquire when supporting students' basic psychological needs (Ryan & Deci, 2017). Self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2017) explains that people innately and universally have basic psychological needs such as autonomy, competence, and relatedness to others. Different emotions can arise from the satisfaction or frustration of these needs (Flunger et al., 2013; Ryan & Deci, 2001).

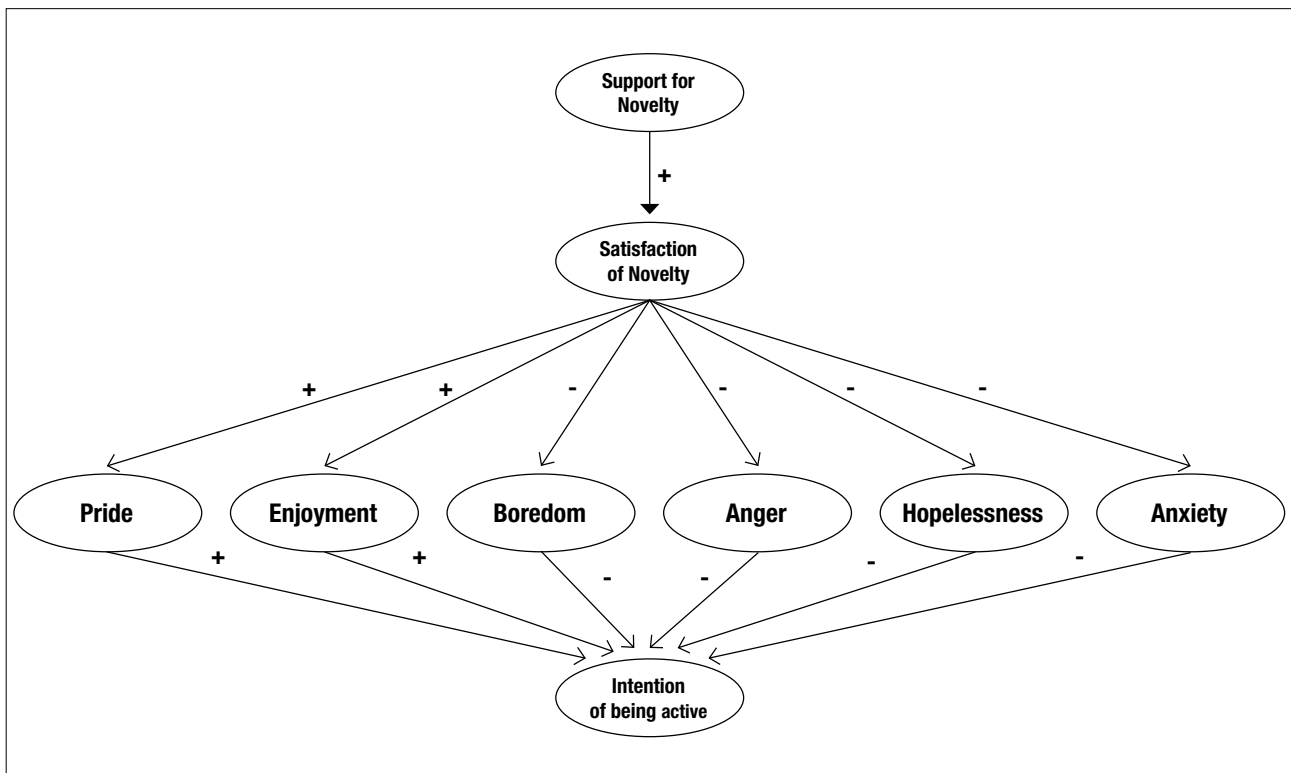
For some years now, novelty has been postulated as a candidate to be included as another basic psychological need (González-Cutre et al., 2016; Vansteenkiste et al., 2020). Novelty has been defined as the need to experience something not experienced before or different from what is experienced in the daily routine (González-Cutre et al., 2016). In other words, Physical Education teachers establish styles that support novelty when they propose activities that are not usual for students, address alternative contents

to the traditional ones, use different materials, or establish innovative methodologies (Fierro-Suero et al., 2020c). So far, studies have shown that novelty satisfaction is related to positive consequences in Physical Education classes such as well-being, enjoyment, intrinsic motivation, or the intention to practise extracurricular physical activity (Aibar et al., 2021; Fernández-Espínola et al., 2020; González-Cutre et al., 2020; González-Cutre & Sicilia, 2019), while novelty frustration is associated with negative consequences such as amotivation, boredom, or loss of concentration (González-Cutre et al., 2023). These studies have contributed evidence to the criteria established by Ryan and Deci (2017) for the analysis of new basic psychological needs, while showing that novelty in PE classes plays a role in the emotional experience of students. However, studies so far have only been able to include a few emotions in isolation (enjoyment and boredom), and only one study has been found that has covered a wide emotional range. In this study, developed by Fierro-Suero et al. (2020b) to validate the Achievement Emotions Questionnaire for Physical Education, it was found through criterion validity analysis using regression analysis that novelty satisfaction positively predicted positively valenced emotions (enjoyment and pride) and negatively predicted negatively valenced emotions (anger, hopelessness, and boredom). However, it was also found that novelty satisfaction positively predicted anxiety, an *a priori* outcome

which was unexpected and should be explored further. In this sense, it was considered necessary to carry out a study in which the emotional impact of novelty in Physical Education classes is investigated more specifically, including all emotions in the same model, since in the aforementioned study the emotions were included independently in each regression analysis.

The practice of extracurricular physical activity is influenced by the prior intention to engage in it (Ajzen, 2020), with one of the fundamental aims of Physical Education being to get students active throughout their future lives as explained above. Recently, Fierro-Suero et al. (2023) have shown that the emotions experienced by students in Physical Education classes influence their intention. Based on the above, the present study tested the hypothesised structural equation model (Figure 1) in which it was expected that perceived teacher support for novelty would positively predict students' satisfaction with novelty (Fierro-Suero et al. 2020c) (H1). In turn, novelty satisfaction was expected to positively predict positively valenced emotions and negatively predict negatively valenced emotions (Fierro-Suero et al., 2020b) (H2). Finally, it was expected that positive emotions experienced by students would positively explain the intention to engage in physical activity outside school, whereas negatively valenced emotions would explain it negatively (H3) (Fierro-Suero et al., 2023).

Figure 1
Hypothesised model.



Method

Participants

A total of 799 ESO (mandatory secondary education) students (46.4% boys and 53.6% girls) aged between 11 and 17 years old participated in the study ($M_{age} = 13.16$; $SD = 1.17$). The students came from five different secondary schools in south-west Spain and were distributed among the four ESO grades as follows: 1st year ESO ($n = 253$), 2nd year ESO ($n = 283$), 3rd year ESO ($n = 207$), 4th year ESO ($n = 56$). Most of the students were of Caucasian origin and of average socio-economic status. The sample was selected on the basis of the centres that agreed to participate in the study (non-probabilistic).

Measures

The students completed a questionnaire with some socio-demographic questions and a series of scales described below. All resources were completed using a Likert-type scale where 1 was “Strongly Disagree” and 5 was “Strongly Agree”.

Support for novelty

The four items referring to novelty support from the Basic Psychological Needs Support Questionnaire in Physical Education (SBPN4) (Fierro-Suero et al., 2020c) were used. The questionnaire used started with the sentence “In my P.E. classes, my teacher...” and an example item is “They often propose new activities”.

Satisfaction of novelty

The five items of the Novelty Satisfaction Scale (González-Cutre & Sicilia, 2019; González-Cutre et al., 2016) were used. The scale starts with the sentence “In my PE classes...” and an example of the items is “I feel that I do new things”.

Emotions in Physical Education

The Achievement Emotions Questionnaire for Physical Education (AEQ-PE) (Fierro-Suero et al., 2020b) was used. This questionnaire, consisting of a total of 24 items, measures six different emotions such as enjoyment (e.g., “I enjoy being in P.E. classes”), pride (e.g., “I take pride in

being able to keep up with the pace of PE class”), boredom (e.g., “I’m looking forward to the end of PE class because it’s so boring”), anxiety (e.g., “I worry about the difficulty of the things I might be asked to do in PE class”), anger (e.g., “I get irritated at the thought of all the useless things I have to learn in PE”), and hopelessness (e.g., “I have lost all hope of doing PE activities effectively”).

Intention to be physically active

The Spanish version (Moreno et al., 2007) of the Physically Active Intention Scale (Hein et al., 2004) was used. The scale is composed of five items (e.g., “I am interested in the development of my physical condition”). The scale begins with the pre-sentence “Regarding your intention to practice any physical-sports activity...”.

Procedure

The present study was conducted in accordance with the ethical principles established by the American Psychological Association (2020) and has been approved by the Andalusian Committee for Biomedical Research (TD-OCME-2018).

In order to carry out this research, we first contacted the management teams of the selected schools, informing them and requesting their collaboration in the participation of their pupils. As the students were minors, permission was requested from their legal guardians. Once all the consent forms had been collected, the data were collected by means of a written questionnaire during the second term and during school hours. During the completion of the questionnaire, a person responsible for the research was always present to remind participants that participation was anonymous and voluntary, to ensure the smooth running of the process, and to answer any questions they might have had. Students took around 10-15 minutes to complete the questionnaire.

Statistical Analysis

First, the validity and reliability of all resources were analysed through confirmatory factor analysis, Cronbach’s alpha (α) and the Omega coefficient (ω). Subsequently, descriptive statistics (means and standard deviations) and bivariate correlations between the study variables were analysed. Correlations below .80 indicate the absence of multicollinearity between variables (Hair et

al., 2018). Prior to structural equation analysis, multivariate normality was tested and a Mardia coefficient of 114.99 was obtained. Given the lack of multivariate normality, the maximum likelihood method was used in conjunction with the bootstrapping procedure in the following analyses. After estimating the fit of the measurement model, the model proposed in Figure 1 was tested through structural equation analysis. The models were evaluated on the basis of the following fit indices: χ^2/df , CFI (Comparative Fit Index), TLI (Tucker-Lewis Index), RMSEA (Root Mean Square Error of Approximation) and SRMR (Standardized Root Mean Square Residual). The following values are indicators of acceptable fit indices: χ^2/df less than 5, CFI and TLI greater than .90, RMSEA and SRMR equal to or less than .08 (Hu & Bentler, 1999; Schermelleh-Engel et al., 2003). Analyses were carried out using PROCESS MACRO version 3.0 (Hayes & Coutts, 2020) for IBM SPSS Statistics version 23 and AMOS 23.0 (IBM, Armonk, NY, USA).

Results

Preliminary analysis

Table 1 shows that the different resources used showed acceptable validity and reliability values.

The descriptive results (means and standard deviations) and the results of the bivariate correlations are shown in Table 2. Correlations indicated that both support and novelty satisfaction were positively and statistically significantly related to positive valence emotions (enjoyment and pride) and intention to be physically active. In contrast, the relationship was significant and negative with negative emotions, except between support for novelty and anxiety, where there was no statistically significant relationship. The relationship between emotions and intention to be physically active was significant in all cases, being positive for positively valenced emotions and negative for negatively valenced emotions.

Table 1
Goodness-of-fit indices and reliability values of the resources used.

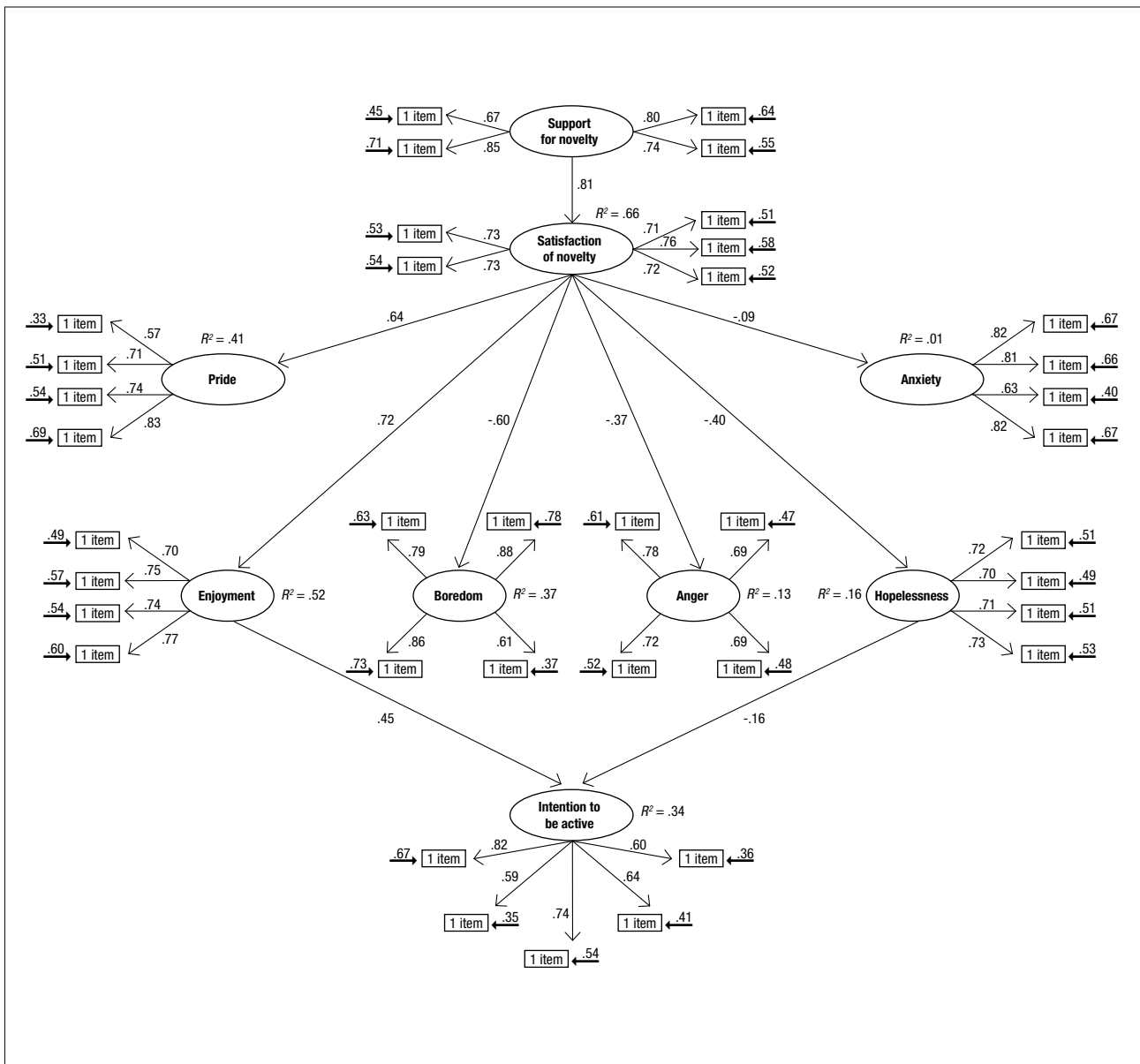
	χ^2/df	CFI	TLI	RMSEA	SRMR	α	ω
Support for novelty	3.08	.99	.99	.05	.01	.85	.85
Satisfaction of novelty	2.32	.99	.99	.04	.01	.85	.86
Emotions in Physical Education	3.15	.94	.93	.05	.05	-	-
Enjoyment	-	-	-	-	-	.83	.83
Pride	-	-	-	-	-	.81	.81
Boredom	-	-	-	-	-	.82	.83
Hopelessness	-	-	-	-	-	.81	.81
Anxiety	-	-	-	-	-	.79	.80
Anger	-	-	-	-	-	.79	.79
Intention to be physically active	5.91	.99	.96	.08	.03	.79	.79

Table 2
Descriptive statistics and bivariate correlations.

	M	SD	1	2	3	4	5	6	7	8	9
1. Sup. novelty	3.56	1.03	-	.68**	.53**	.37**	-.51**	-.24**	-.04	-.28**	.24**
2. Sat. novelty	3.52	0.90		-	.60**	.52**	-.53**	-.34**	-.11**	-.31**	.29**
3. Enjoyment	4.05	0.90			-	.70**	-.68**	-.57**	-.22**	-.47**	.46**
4. Pride	4.01	0.87				-	-.50**	-.49**	-.24**	-.40**	.43**
5. Boredom	1.83	0.89					-	.48**	.21**	.55**	-.28**
6. Hopelessness	1.43	0.68						-	.45**	.50**	-.38**
7. Anxiety	1.98	0.91							-	.33**	-.16**
8. Anger	1.43	0.68								-	-.22**
9. Int. Phys. Act.	4.20	0.82									-

NB. Sup. novelty = Support for novelty; Sat. novelty = Satisfaction of novelty; Int. Phys. Act. = Intention to be physically active; M = Mean; SD = Standard deviation; ** $p < .01$.

Figure 2
Final structural equation model.



NB: All the ratios shown have a value of $p < .01$.

Structural equation modelling

The measurement model developed with the nine correlated study variables and their corresponding items yielded adequate fit indices ($\chi^2(629) = 1,499.44$, $\chi^2/df = 2.38$, $p = .00$, CFI = .94, TLI = .94, SRMR = .04, RMSEA = .04). Once the adequacy of the measurement model was checked, the hypothesised structural equation model was tested (Figure 1). Non-significant relationships between latent variables were eliminated. The final model (Figure 2) showed acceptable fit indices ($\chi^2(641) = 1,558.13$, $\chi^2/df = 2.43$, $p = .00$, CFI = .94, TLI = .93, SRMR = .06,

RMSEA = .05). This model shows how novelty support significantly predicted novelty satisfaction with 66% of the variance explained. In turn, novelty satisfaction significantly and positively predicted the emotions of pride and enjoyment, and significantly and negatively predicted the emotions of boredom, anger, hopelessness, and anxiety. The highest explained variances were found for the emotions of enjoyment (52%), pride (41%), and boredom (37%). Finally, the emotions of enjoyment and hopelessness predicted intention to be physically active with 34% of variance explained.

Discussion

In the last decade, the number of studies focusing on students' emotions in Physical Education classes has increased considerably. Some of these studies have focused on the analysis of emotions as a cause of various behaviours such as academic performance, intention to engage in extracurricular physical activity, intensity and timing of extracurricular physical activity, disruptive behaviour during classes, etc. (Fierro-Suero et al., 2023; Simonton & Garn, 2020; Zimmermann et al., 2021). Other studies have analysed possible antecedents of emotions highlighting aspects related to basic psychological needs (Fierro-Suero et al., 2020b) and teachers' interpersonal styles (Yoo, 2015; Zimmermann et al., 2021). However, although novelty has been proposed as a candidate for being a basic psychological need (González-Cutre et al., 2016, 2020; Vansteenkiste et al., 2020), the role that novelty may play from the interpersonal style of teacher support to student satisfaction and its relationship with emotions is still unknown, as none of the developed models have included it in the sequence. For this reason, the aim of this research was to test a structural equation model in which the role of novelty on students' emotions in Physical Education classes and its possible influence on the intention to be physically active was analysed.

The present study found that students' perception of teacher support for novelty predicted satisfaction of this candidate basic psychological need with high explained variance (H1). These results are in line with those of the first and only study known to have measured support for novelty in PE classes (Fierro-Suero et al., 2020c). This research found that, in addition to predicting novelty satisfaction, novelty support was able to significantly and positively predict the satisfaction of all three basic psychological needs. This result suggests that if teachers introduce novelty in their classes, for example in the activities, content, or methodologies they use, they can satisfy their students' need for novelty. Indeed, previous studies have found a positive association between pedagogical models that may be novel for learners (such as the comprehensive model or the sports education model), the satisfaction of the need for novelty, and motivational improvements (e.g., Gil-Arias et al., 2021).

Regarding the second hypothesis (H2), novelty satisfaction positively predicted the emotions of enjoyment and pride and negatively predicted the emotions of boredom, anger, hopelessness and anxiety. In this respect, the results obtained were in line with those of the study by Fierro-Suero et al. (2020b) with the caveat that they found a positive relationship between novelty satisfaction and anxiety. In the present study, when anxiety worked in synergy with the other emotions in a full model, novelty satisfaction was found to negatively predict anxiety, albeit with very low explained variance. These results

are consistent with expectations, since the satisfaction of a basic psychological need should imply psychological growth, well-being and optimal functioning (Deci & Ryan, 2000). In this sense, we could interpret the satisfaction of the need for novelty as obtaining the optimal dose of novelty that each person needs (Ibáñez de Aldecoa et al., 2022), and not as an excess of novel stimuli that could generate anxiety if one does not perceive oneself as having the capacity to cope with them. However, it must be admitted that the satisfaction of the needs for autonomy, competence, and relatedness were not considered in this research, which prevents us from knowing the role played by the satisfaction of novelty beyond the satisfaction of the three basic psychological needs established by the self-determination theory.

Focusing on positive emotions, novelty satisfaction was positively associated with enjoyment and pride (H2) in line with previous work (Fierro-Suero et al., 2020b; González-Cutre et al., 2020). In this sense, novelty can make the tasks posed enhance creativity and the resolution of new problems, making them attractive and generating enjoyment in the students (Pekrun, 2006). At the same time, avoiding repetition of the same tasks by promoting new and changing situations will allow students to feel more likely to be an important part of overcoming some of the challenges posed, which will generate pride (Pekrun, 2006).

Regarding negative emotions, boredom was found to be the emotion with the highest variance explained by novelty satisfaction (H2) in line with previous studies (Fierro-Suero et al., 2020b). Monotony (Lye & Kawabata, 2021) and frustration of novelty (González-Cutre et al., 2023) have been shown to be direct predictors of boredom, which is in line with Pekrun (2006), who indicated that repetitive tasks or tasks that lack intrinsic value for learners would lead to boredom. Therefore, applying interpersonal styles that support novelty in Physical Education classes is seen as an effective strategy to reduce students' boredom.

Although to a lesser extent than boredom, novelty satisfaction also negatively predicted the emotions of anger and hopelessness (H2). These results suggest that creating novel situations in Physical Education could help to reduce students' anger when they have to repeat the same thing over and over again. Furthermore, for hopelessness to emerge in a learner, there needs to be a negative appraisal of the challenge, so that they become aware that success will be impossible (Pekrun, 2006). Thus, promoting new or different environments in Physical Education classes could make students, when faced with unfamiliar challenges, face them from a more positive point of view and without the negative prospective evaluations of facing something they already know they have failed to overcome on previous occasions, which decreases hopelessness.

Finally, regarding the relationships between positive emotions and the intention to practise extracurricular physical activity, only the effect of enjoyment was significant (H3), which shows the importance of students having fun in PE class in order for them to want to continue practising physical activity outside school. This result is in line with the work of Fierro-Suero et al. (2023), although they found that pride also played an important role in predicting this intention. Moreover, in the work cited above, it was found that these emotions had a different moderating effect on girls and boys, so it is necessary to attend to gender-specific strategies. Regarding negative emotions, hopelessness was the only emotion that negatively predicted intention to engage in physical activity outside school (H3) in line with previous studies (Fierro-Suero et al., 2023). Therefore, those students who experience hopelessness in PE classes show a refusal to engage in extracurricular physical activity. This is possibly due to the fact that their previous experience of physical activity has been so negative that their prospective evaluations of the new possibilities of extracurricular physical activity are still focused on failure and they do not feel like repeating it because it does not support their well-being.

The results of the study point to the benefits of novelty in PE classes from an emotional point of view and the creation of physically active habits. In this sense, teachers could develop unusual content such as alternative sports, new physical-expressive trends (Fierro-Suero et al., 2020c; González-Cutre et al., 2021; González-Cutre & Sicilia, 2019) or bring the different possibilities of extracurricular physical activity in the neighbourhood environment closer to Physical Education (Fierro-Suero et al., 2022). This could serve to make the first experience of such practices emotionally satisfying, as the students do not have previous negative appraisals, which will reduce their hopelessness and anxiety. Likewise, using new technologies, reconverting the traditional use of sports materials, using innovative materials and avoiding classical methodologies could be other possibilities to generate interpersonal styles that support novelty (Fierro-Suero et al., 2020c; González-Cutre et al., 2021; González-Cutre & Sicilia, 2019). These and other strategies could allow us to provide more opportunities for students to experience pride in being part of different successes, as well as to adapt tasks to be engaging challenges that generate enjoyment and avoid boredom and anger.

Despite the results obtained, the present research has a number of limitations that must be taken into account. Firstly, the study followed a correlational methodology that prevents the establishment of causal relationships. For this reason, it is necessary to carry out future intervention studies along the lines proposed. In addition, measuring students'

perceptions of their teachers' novelty support could be a bias that could be avoided in the future by using other sources of information, such as self-reports by teachers or external evaluations using observation resources for this purpose (Fierro-Suero et al., 2020a). Similarly, it would be interesting to analyse in the future the role that variety (Eather et al., 2023) may play in the emotional experience of students and to see if the effects are similar to those of novelty. Another limitation of the present study is the failure to consider the gender of the students, as previous studies (e.g. Fierro-Suero et al., 2023) have highlighted the importance of gender in the relationships studied. Finally, the development of models that include the support and satisfaction of the three basic psychological needs is considered necessary to see how novelty works in synergy with these needs and to clarify the effect of each of them on students' emotions.

Conclusion

In summary, the results of this study have shown that students' perception of the strategies that their teachers develop to support novelty in PE lessons has a positive effect on the satisfaction of their need for novelty (H1). In turn, novelty satisfaction predicted positive emotions positively and negative emotions negatively (H2). Finally, only the emotions of enjoyment and hopelessness played a significant role in predicting intention to be physically active in the future (H3).

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