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Clusters of psychological needs and motivational profiles in school physical education and their impacts on adolescents' mental health



Clusters de necessidades psicológicas e perfis motivacionais na educação física escolar e seus impactos na saúde mental de adolescentes

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ABSTRACT

Introduction: Self-determination theory highlights the importance of basic psychological needs (BPN) satisfaction (autonomy, competence and relatedness) for motivation and psychological well-being. In physical education (PE), environments supporting these needs are linked to positive outcomes, while environments that frustrate them may lead to maladaptive results. Objective: To verify whether mood profile can be predicted based on BPN clusters in PE, motivational regulations and physical activity (PA) choices. Method: A cross-sectional population based study of 2,757 adolescent students (15 ± 4 years) selected proportionately to population size from Great Florianopolis/ Santa Catarina. Questionnaires measured BNP, motivational regulations, PA choices, and mood profile. The students were divided intro three clusters based on their BPN profiles in PE: Cluster 1 (positive) reported high satisfaction of BPN; Cluster 2 (intermediate) had moderate satisfaction; Cluster 3 (negative) experienced low satisfaction and frustration of BPN. Data were analyzed using descriptive and inferential statistics. Results: Clusters 3 (negative) and 2 (moderate), compared to Clusters 1 (positive), were three and two times more likely to have a negative mood profile, respectively. PA choices increased the prevalence ratio for Cluster 3 (OR = 3.81; 95% CI = 2.52 - 5.75). Identified regulation (OR = 0.80; 95% CI = 0.67 - 0.95) and intrinsic regulation (OR = 0.83; 95% CI = 0.72 - 0.96) slightly decreased the negative association between Cluster 2 and 3 and were associated with a positive mood profile. Conclusion: PE environments that fail to satisfy BPN expose students to a negative mood profile. Choices of PA related to an external locus of control may worsen this condition. However, internal motivational regulation, particularly intrinsic and identified regulation, appears to promote a positive mood.

Keywords: Motor activity; Mood disorders; Affective symptoms.

RESUMO

Introdução: A teoria da autodeterminação destaca a importância da satisfação para as necessidades psicológicas básicas (NPB) (autonomia, competência e vínculo) para a motivação e o bem-estar psicológico. Na Educação Física (EF), ambientes que apoiam essas necessidades estão associados a resultados positivos, enquanto ambientes que as frustrações podem levar a resultados desadaptativos. Objetivo: Verificar se o perfil de humor pode ser predito com base em Cluster de NPB em EF, regulações motivacionais e escolhas de atividade física (AF). Método: Estudo transversal de base populacional com 2.757 adolescentes estudantes (15 ± 4 anos) selecionados proporcionalmente ao tamanho populacional da Grande Florianópolis/Santa Catarina. Questionários avaliaram as NPB, as regulações motivacionais, as escolhas de AF e o perfil de humor. Os estudantes foram divididos em três Clusters com base em seus perfis de NPB na EF: Cluster 1 (positivo) relatou alta satisfação das NPB; Cluster 2 (intermediário) apresentou satisfação moderada; Cluster 3 (negativo) experimentou baixa satisfação e frustração das NPB. Os dados foram analisados por estatísticas descritivas e inferenciais. Resultados: Os Clusters 3 (negativo) e 2 (intermediário), em comparação com os Cluster 1 (positivo), tiveram três e duas vezes mais chances de ter um perfil de humor negativo, respectivamente. A escolha de AF aumentou as razões de prevalência de risco para o Cluster 3 (OR = 3,81; 95% CI = 2,52 - 5,75). A regulação identificada (OR = 0,80; 95% CI = 0,67 - 0,95) e a regulação intrínseca (OR = 0,83; 95% CI = 0,72 – 0,96) reduziram ligeiramente a associação negativa entre Cluster 2 e 3 e foram associadas a um perfil de humor positivo. Conclusão: Ambientes de EF que não satisfazem as NPB expõem os estudantes a um perfil de humor negativo. Escolhas de AF relacionadas a um locus de controle externo podem agravar essa condição. No entanto, a regulação motivacional interna, especialmente as regulações intrínseca e identificada, parece promover um humor positivo.

Palavras-chave: Atividade motora; Transtorno de humor; Sintomas afetivo.

Introduction

Substantial research has attested advantages of an autonomy-supportive environment in physical education $(PE)^{1,2}$. It is proposed that those environments might take an important role on psychological behavior by supporting essential needs for ongoing psychological growth³.

In the educational sphere, PE may enhance the provision of Basic Psychological Need (BPN), resulting in the development of autonomous motivation. More specifically, these support and motivation in a PE context will be assumed to satisfy needs of autonomy, competence and relatedness, which in turns result in positive adaptive outcomes³. For instance, a PE environment that encourages students to make choices, develop their skills, and build meaningful connections with peers is likely to foster positive affective states and a better psychological disposition. Conversely, a controlled environment that undermines the satisfaction of these needs may decrease autonomous motivation and lead to maladaptive outcomes^{1,3}.

This evidence highlights an environment where the mastery context is associated with students' satisfaction and enjoyment⁴. This affective response relies on motivation as a predictor of intentions to positive behaviors such as engagement in PE, higher educational performance and creativity, and better psychological health. There is an increasing body of literature that addresses motivation and health behavior in educational setting^{5,6}. Essentially, PE classes may take an important role on promoting health-related behavior outside schools as well as on supporting the likelihood of being active on leisure-time⁷.

However, it is important to notice that even though a possible positive affective response in PE can be expected, in adolescence certain behaviors can be moderated for external reasons such as a high degree of boredom and dissatisfaction⁸. This can be associated to the fact that even though sports and exercise bring joy and intrinsically motivated engagement, the social context (e.g. provided by parents, teachers or significant others) often interfere with extrinsic incentives, influencing individual's experiences and motivation^{9,10}. A controlled environment that undermines the need of satisfaction is thought to decrease the provision of BPN satisfaction resulting in decrements of autonomous motivation and, subsequently in maladaptive outcomes¹¹.

Studies indicate that choice for sports during lei-

sure-time, for example, is often guided by a greater sense of fun and enjoyment, making it more intrinsically motivated¹². On the other hand, exercise tends to be associated with extrinsic motivation, where the choice is often influenced by external goals, such as health benefits, appearance, or performance improvement. Unlike sports, which are typically pursued for their inherent pleasure, exercise may involve internal pressures or a sense of obligation, reflecting a controlled behavior driven by perceived rewards or punishments¹³.

Findings regarding health-related behavior also point a singular condition concerning the locus of motivation. Usually, PE can impact on the well-being thus supporting the BPN, or foster ill-being through feelings of dissatisfaction or unpleasure¹⁴. In terms of psychological well-being the patterns of evidence signalize a positive relationship in which social environments support them and a negative relationship when controlled forms of behaviors take place¹⁵. A recent study with adolescent students revealed that amotivation (lack of intention) was positively associated to social physique anxiety. On the other hand, intrinsic motivation predicted a negative social physique anxiety, supporting the tenets of BPN in PE as important for a better well-being¹⁶.

Mood state, although a key psychological outcome, has been rarely investigated in the context of PE and physical activity (PA). Evidence suggests that PA can evoke positive emotional responses, as proposed by theories like the catharsis theory and the transactional theory of stress and coping¹⁷. These frameworks highlight how engaging in PA fosters emotional regulation by providing a pleasant and meaningful experience, reducing negative emotions such as anger, anxiety, and depression. In this sense, integrating PA into educational settings not only promotes positive mood states but also equips individuals with essential coping mechanisms to navigate daily stressors and maintain mental health¹⁷.

Beholding these important evidence, the body of literature concerning mood profile in students is still scarce. If the provision of BPN is associated to different locus of motivation and those motivations determine different choices of PA, it might be possible that the patterns of adaptive outcomes on mood can assume different forms.

The objective of the study was to verify whether mood profile can be predicted based on BPN clusters in PE, motivational regulations, and adolescents' PA choices in leisure-time.

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Methods

Study design and ethical considerations

This study is part of the research "Physical Education and Sports in Santa Catarina: research and development at public schools from Brazil. It is a field research characterized by a descriptive design. Ethical approval was obtained from Santa Catarina State University (protocol number 502.531).

Population and Sample Selection

This is a cross-sectional population-based study of 2,757 teenagers students selected with proportionate-to-size from Great Florianopolis, Santa Catarina. Eligible participants were students enrolled from the 9th grand of elementary school to the 3rd grand of high school, aged between 10 and 19 years, attending public institutions administered by the state of Santa Catarina.

Initially, authorization was obtained from the Santa Catarina Department of Education to conduct the research. Participants were recruited through invitations at participating schools, where students needed the consent of their legal guardians. Data collection took place in 2014. Students were assessed at school during PE classes by two trained researchers. Before administering the questionnaire, students received an explanation with instructions. All outcomes were collected using standardized questionnaires. Participants were informed that their responses were anonymous and confidential.

Sample size was conducted according to the procedures described by Luiz e Magnani¹⁸. It was calculated considering a 95% confidence Interval, and an error of 3%. The prevalence was estimated by 50%. By utilizing conglomerate school approach it was considered a design effect of 1.5, which represents an increase of 50% of the sample. A correction was also made due to possible sample slippages by incomplete questionnaires. It was added another 40% and estimate was made based on infinite population. At least 2.243 teenagers were required. The sample was derivate from 26 different public schools in eight cities. Although the influence of the environment, both within and outside the school, is relevant to teenagers experiences, this factor was not considered in the analysis of clusters.

Data collection procedures

Data collection preferentially occurred at the time of PE classes at information and/or communication technology laboratories. Participants filled an electronic questionnaire specific created for this research. They spent between 25 to 45 minutes filling the questionnaires.

Instruments and measurements

Leisure-time PA was analyzed by the Physical Activity Evaluation Questionnaire for adolescents¹⁹. It comprises 17 questions divided into two blocks: 1) sport or exercise (15 questions) and 2) transportation PA (2 questions). Blocks 1 and 2 evaluate the PA on a weekly basis, whereas block 1 evaluates it annually too. The questionnaire was standardized to yield a final score of PA in minutes (weekly and yearly). For example, in block 1, based on the type of activity cited, we multiply daily duration in minutes by weekly frequency (minutes per day x weekly frequency) and by months per year of activity (minutes per day x weekly frequency x 4 x months per year). Up to three types of activity were accepted, and, at the end, the sum of the three activities gives the final score for block 1. In block 2, transportation activity (cycling or walking) has a fixed factor of five times per week, which is multiplied by the number of minutes per day spent on the activity (minutes per day x 5). To identify the choices for PA, we used qualitative information based on the primary type of activity chosen in block 1. The different types of PA were classified into three groups: sports, exercise and dance. Sport were defined as structured and competitive activities, while exercise included planned, non-competitive activities aimed at improving health. The PA classification between the two raters was calculated, yielding the following results: sports 92%; exercise 99% and dance 100%.

Psychological need satisfaction in PE was evaluated by Portuguese version and adaptation of the BPN in Exercise Scale²⁰. It is a 12-item self-reported measure in order to assess psychological needs based on the self-determination theory (SDT) tenets. Items measuring the satisfaction for autonomy (e.g., I feel that my activities are based on my true interests), for competence (e.g., I feel that I can successfully complete difficult tasks), and for relatedness (e.g., I feel good with my classmates) were observed by 4 items each on five-point Likert scales with end-points of not true at all (1) and very true (5).

The motivational framework based on SDT was analyzed by the Behavioral Regulation in Exercise Questionnaire-2; BREQ-2²¹. It is a 19-item self-reported measure developed to assess exercise regulations based on the SDT. Questionnaire contains five subscales that measure amotivation; external, introjected, identified, and intrinsic regulation of exercise behavior. Participants responded to each item on a five-point scale anchored by (0) 'Not true for me' and (4) 'Very true for me'.

Mood was assessed using the 24-item Brazilian version of the Brunel Mood Scale²². The Brunel Mood Scale assesses anger, confusion, depression, fatigue, tension and vigor. Items are rated on a 5-point scale anchored from zero ("not at all") to four ("extremely"). Participants were divided in two groups based on each sub-scale: (0) positive mood profile and (1) negative mood profile. Categorization was made based on the 50 percent cut point presented in the validation study²².

Statistical Analysis

Data was previous organized and categorized in Microsoft Excel 2010 and later was exported to SPSS for Windows. Preliminarily exploratory analysis was performed following descriptive. The minimum and maximum values of the variables; kurtosis and skewness, as well as normality test (Kolmogorov–Smirnov test) was used to determine if the data set was well-modeled by a normal distribution. Data set were also analyzed as frequency, measures of central tendency and variability. Central tendency included the mean, while measures of variability included the standard deviation.

The cluster analysis was applied to identify groups of students with different perception of BPN' satisfaction in PE context. The three factors that shape this construct were used as a predicted variable (relatedness, competence and autonomy). All variable were standardized using Z-scores (mean = 0, standard deviation = 1). A K-mean cluster analysis was performed on the sample and 3 lusters were identified. Cluster 1 (positive) indicated the best profile for relatedness, competence and autonomy whereas datum was above the mean. Cluster 2 was identified by having a slight datum below the mean (intermediate group) and Cluster 3 (negative) had the worse BPN profile with the lowest values for BPN.

The One-way ANOVA test (Scheffe Post hoc) was performed to analyze motivational regulations and mood profile differences between BPN clusters. Association between categorical variables as BPN clusters and PA choices was analyzed by qui-square test, effect size was followed by Cramer's V. Binary logistic regression model was performed in order to investigate the predictable ratios of BPN cluster, PA choices and motivational regulation on mood profile. Mood was the dependent variable (0 – positive mood; 1 – negative mood). Cluster 1 (best profile for BPN) was the reference; for PA choices, the sports category was the reference. Three different models were created. Model 1 analyzed BPN clusters in crude condition; model 2 was adjusted by PA choices; and model 4 was adjusted by PA choices, introjected regulation, identified regulation and intrinsic regulation. Motivational regulations were analyzed in different models considering the main motivational differences between clusters. All measures assumed a 95% of confidence level. Statistical analysis was performed in SPSS v.20 and figures were created using GraphPad Prism 5 software.

Results

The final Sample consisted of 2,757 teenagers (1,061 male and 1,224 female), with a mean age of 15 ± 4 years. No missing data were observed, as all question-naires were fully completed by the participants and included in the analysis.

Based on BPN, three different Cluster groups were observed. Cluster 1 (positive) showed the best profile for relatedness, competence and autonomy, with values above the mean. Cluster 2 had slightly lower values (intermediate group, with values around the mean) and Cluster 3 (negative) had the lowest values for all needs (Figure 1). Need for competence (F = 1299.8; p < 0.001) and relatedness (1282.4; p < 0.001) were the main factors differentiating the Clusters. Cluster 1 showed significantly higher BPN satisfaction than both Cluster 2 and Cluster 3 (p < 0.001), while Cluster 3 had the lowest values.



Figure 1 – Clusters based on satisfaction of basic psychological needs in physical education context of adolescent students. Santa Catarina, Brazil.

Predicted variables: relatedness (dark blue); competence (blue); and autonomy (gray).

Choices for sports and exercise were different within Clusters and there was a weak association between Clusters and PA choices ($X^2 = 26.655$, p < 0.001; Cramer's V = 0.12, p < 0.001). Regarding sports choice, more than 50% of the teenagers were in Cluster 1 and only 8.5% in Cluster 3. For exercise choice the biggest proportion was allocated in Cluster 2 (44.9%), followed by 41.9% in Cluster 1 and 13.2% in Cluster 3.

All motivational regulations differed between Clusters, except for external regulation. Post-Hoc pointed differences between Clusters 1, 2 and 3 (Table 1).

Mood profile also differed between Clusters , except for tension (F = 1.78; p = 0.169). Cluster 1 represented low values of depression (F = 35.79; p < 0.001), anger (F = 20.21; p < 0.001), fatigue (F = 25.44; p < 0.001), confusion (F = 13.58; p < 0.001) and high values of vigor (F = 129.68; p < 0.001) compared to Cluster 2 and 3. The same pattern was identified in Cluster 2 over 3, Figure 2.

Exploratory logistic regression analysis (crude) revealed that Cluster 3 and 2, compared to Cluster 1, were 3 and 2 times more likely to have a negative mood profile, respectively. Adjusted by PA choices no interaction was found, however, PA choices on leisure-time increased the prevalence risk ratios for Cluster 3 (OR = 3.81; 95% CI = 2.52 - 5.75; p < 0.001), Table 2.

Motivational regulations were carried out in binary logistic regression considering the magnitude of differences between clusters; a significant association between motivational regulations and mood profiles was observed (Table 3).

Discussion

The purpose of the present study was to verify whether mood profile can be predicted based on basic BPN clusters in PE, motivational regulations and PA choices. It is proposed that the enhancement of students' satisfactions of the three psychological needs in PE is a very crucial pedagogical act and could be achieved by promoting skills, knowledge, and dispositions for successful and enjoyable participation in PA both in and outside of the school²³.

The three basic needs are essential nutriments in SDT that must be satisfied within the social context in order to promote motivation and healthy psychological functioning²⁴. It is suggested that satisfaction of autonomy, competence and relatedness contribute to the enhancement of self-determined motivation²⁴, impacting on motivational outcomes in education and PA settings^{23,25}.

These are in line with some aspect of the present work, considering that teenagers with greater support of BPN in PE (Cluster 1) seem to be more intrinsically motivated comparing to other group. It is supposed that those students also experience a greater sense of satisfaction and pleasure. On the other hand, Clusters 2 and 3 possibly do not have those adaptive outcomes, impacting negatively on psychological well-being.

The main motivational differences between clusters in our results point out the assumption that adolescents' perception of need satisfaction is an important link to autonomous motivation²⁶. Especially for identified and intrinsic regulation, the provision of BPN addresses behavior as a consequence of students' feeling of choice and volition²⁴. Both motivational locus of causality is associated with higher commitment and better maintained performance²⁷.

Others studies that focused on affective consequences have shown a relationship between BPN, self-determined motivation and enjoyment, confirming that these variables are important to achieve greater feelings of enjoyment and satisfaction²⁸. They may contribute to maintenance of PA²³ and to sustaining positive psychological health-related behaviors²⁹.

However, a more negative environment with low BPN support can lead to a higher risk of maladaptive outcomes, as it fosters controlled forms of motivation such as amotivation and external regulation, which are

Table 1 - Motivational differences between basic psychological needs clusters 1, 2 and 3 of adolescents students. Santa Catarina, Brazil

	Cluster 1 Mean ± SD	Cluster 2 Mean ± SD	Cluster 3 Mean ± SD	F	р
Amotivation	0.45 ± 0.72*	0.60 ± 0.84**	0.98 ± 1.07	41.50	<0.001
External regulation	0.67 ± 0.85	0.72 ± 0.85	0.79 ± 0.87	2.13	0.119
Introjected regulation	1.02 ± 1.04	0.91 ± 1.02***	0.76 ± 0.94	6.99	0.001
Identified regulation	2.41 ± 1.01*	$1.96 \pm 1.05^{**}$	1.45 ± 1.07	100.86	< 0.001
Intrinsic regulation	$2.81 \pm 1.05^*$	2.26 ± 1.12**	1.54 ± 1.20	154.17	<0.001

* Difference between Cluster 1 and Cluster 2, p < 0.001. ** Difference between Cluster 2 and Cluster 3, p < 0.001. *** Difference between Cluster 1 and Cluster 3, p = 0.002. SD = standard deviation.

T-Escore	FATOR					T-Escore	
	Ten	Dep	Ang	Vig	Fad	Conf	
80+			- 9			-	80+
79	13				16		79
78						10	78
77		10					77
76	12		Q		15		76
75	12		0		15		75
73	11	٩			14	٩	73
72	11	5			14	5	74
73			7	16			73
72	10		,	10	12		72
71	10			15	15	0	71
70		õ		15			70
69			~		10		69
68	9	7	D	14	12	7	68
6/		/				/	0/
66					11		66
65	8		•	13			65
64		6	15			6	64
63			/ \	12	10		63
62	7						62
61			1	-013(2)	1000	1000	61
60	~	5 /	4	11	9	5	60
59	6	•	A 1	10.000	10.00		59
58			(m)	10	8	/ •	58
57		4 /	1.	0		/ 4	57
56	5	_	/ 3 \		/	10	56
55	-			/ 9 /	7/	1 9	55
54	C.	3 /		1 1	/ ۴		54
53	4	\sim /		1 8		/ 3	53
52	19	6	2	//	\/6/.	/	52
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50 -	3	2		\7 /	\5 /	2	50
49		19962			7		49
48	2		1	6/			48
47	1.24			ĕ	4		47
46				0.610	1.1.20	1	46
45	1	1		5	3		45
44		0	0	2	1007044		44
43			-	4	2	0	43
42	0						42
41	-						41
40				3			40
39				5	1		39
38				2	-		38
37				2	0		37
26							26
25				1			25
3/				+			3/
22				0			22
22				Ч			22
21							21
20				L			20
30	6. E					1	30

Figure 2 – Clusters based on satisfaction of basic psychological needs in physical education context of adolescents students. Santa Catarina, Brazil.

Cluster 1 (white), Cluster 2 (gray) and 3 (black). Values are set as mean and the table of reference was based on Brunel Mood Scale (Rohlfs, et al.²²). Ten = Tension; Dep = Depression; Ang = Anger; Vig = Vigor; Fad = Fatigue; Conf = Confusion.

Table 2 – Association between mood profile, basic psychological
needs clusters and leisure-time physical activity choices of adoles-
cent students. Santa Catarina, Brazil.

Variables	Crude OR (95% CI)	Adjusted OR (95% CI)			
Basic psychological needs clusters					
Cluster 1	1	1			
Cluster 2	2.01 (1.63 – 2.47)*	2.06 (1.63 – 2.61)*			
Cluster 3	3.17 (2.27 – 4.44)*	3.81 (2.52 – 5.75)*			
Leisure-time physical activity choices					
Sports	1	1			
Exercise	1.31 (1.07 – 1.61)**	0.95 (0.73 – 1.24)			

OR = odds ratio; 95%CI = 95% confidence interval. Note: The model was adjusted by gender, age and the amount of PA (annually). *Statistically significant for p < 0.001. **Statistically significant for p < 0.05.

Table 3 – Association between mood profile, basic psychological needs clusters, leisure-time physical activity choices and motivational regulations of adolescent students. Santa Catarina Brazil.

Variables	Adjusted OR (95% CI)
Basic psychological needs clusters	
Cluster 1	1
Cluster 2	1.82 (1.43 – 2.33)*
Cluster 3	3.02 (1.96 – 4.64)*
Leisure-time physical activity choices	
Sports	1
Exercise	0.90 (0.69 – 1.78)
Motivational regulations	
Amotivation	1.49 (1.28 – 1.74)*
Introjected regulation	1.47 (1.28 – 1.68)*
Identified regulation	0.80 (0.67 - 0.95)**
Intrinsic regulation	0.83 (0.72 - 0.96)**

OR = odds ratio; 95% CI = 95% confidence interval. Note: The model was adjusted by gender, age and the amount of PA (annually). *Statistically significant for p < .001. **Statistically significant for p < 0.05. External regulation does not appear in the model due to no association with mood profile.

associated with negative mood profiles²⁴. Evidence suggests that when students' BPN are not met in PE, they are more likely to experience dissatisfaction and unpleasure, further decreasing their psychological well-being²⁵.

The contrary seems to also be true and less supportive environment in PE leads to a negative mood profile. Evidence from a recent meta-analysis showed that external regulation and amotivation are negatively associated with adaptive outcomes and positively with maladaptive outcomes²⁵. Environment, which is poor to provide BPN, is also positively related to controlled forms of motivation such as amotivation and external regulation; those conditions are due to foster ill-being through feelings of dissatisfaction or unpleasure^{25,30}. Suggesting the whereas emotional disorders are related to controlled forms of motivation.

This controlled environment seems to impact significantly on the support of the BPN. In which a socially controlled behavior is associated with affective and behavioral outcomes such as depreciation of psychological well-being²⁴. In this case, behavior will be mediated by the dissatisfaction of the BPN for autonomy, competence, and relatedness.

It seems that the likelihood of negative affect is also supported based on adolescents' choice on leisure-time. Firstly, it is important to consider that a poor mediating effect of BPN in PE do not necessarily disable individual's capability of being active, however, can be linked with different intentions²⁷. Evidence pointed that environment which is prior to extrinsic locus of causality, may imposes difficult to sustain PA overtime^{27,31}. In this case, positive adaptive outcomes are not expected³². This is in accordance with our current findings where it was identified that, for Cluster 3 (negative support of BPN), exercise compared to sports on leisure-time increased the likelihood of a negative mood (crude analysis).

Studies indicate that PA motivations vary across contexts³² and choice for exercise might be supported by some related to gain or reward. It is possibly conducted based on internal rewards and punishments where the choice is fueled by a controlled behavior^{33,34}. Contrarily, choice for sports in leisure-time seems to naturally represent an autonomous conduct, allowing a greater sense of fun and enjoyment³⁴. These motivational differences were explored by Oktem³⁵ investigating the participation in recreational and competitive sport on psychological well-being. It was observed that a recreational environment, such as recreational sports participation, assigns greater emphasis on intrinsic locus of causality, considering that individuals are happier and more content. In that regard, even in leisure-time, different motivational conditions may enhance maladaptive outcomes and seem that the relationship between PA and psychological well-being cannot be attributed only to the extent of regular participation in physical activities.

When adjusting the clusters and the PA choices by motivational regulations, our results demonstrated a contributive protection effect for identified and intrinsic motivation on mood. As a result, Clusters 2 (intermediated) and 3 (negative) decreased the likelihood of being harmful. An intrinsic behavior is related to individual's sense of control²⁴ and it is an import criteria to improve effect on mental health³⁶. When autonomous forms of regulation guides behavior, positive affective response are more expected²⁴.

A strength of this study is the use of standardized and validated questionnaires, which ensures reliability and consistency in data collection. Additionally, the large sample size enhances the generalizability of the findings. One possible limitation in the present study is that students' perception of need satisfaction in PE can be influenced by different environments and significant others such as PE teacher, parents and friends. It is possible that the perception of satisfaction, as well as, the perception of psychological needs thwarting might be influenced partly by those variables. These results can be practically applied to guide PE teachers in designing strategies and interventions that foster the satisfaction of psychological needs, thereby promoting positive outcomes in students' engagement and motivation in PE classes.

In conclusion, this study highlights the importance of intrinsic motivation in promoting adolescents' psychological well-being through PA. The findings emphasize the need for PE programs to support psychological needs, fostering autonomy and enjoyment, to improve both mental health and long-term engagement in PA.

Conflict of interest

The authors declare no conflict of interest.

Author's contributions

Matias TS: Conceptualization; Methodology; Software; Formal analysis; Investigation; Project administration; Visualization; Writing – original draft; Writing – review & editing; Approval of the final version. Jesus EED: Investigation; Writing – original draft; Writing – review & editing; Approval of the final version. Andrade A: Supervision; Project administration; Writing – original draft; Approval of the final version.

Declaration regarding the use of artificial intelligence tools in the article writing process

The authors did not use artificial intelligence tools for preparation of the manuscript.

Availability of research data and other materials

The contents underlying the research text are contained in the manuscript.

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Reviewers' assessment

The reviews of this article were originally conducted in Portuguese. This version has been translated using ChatGPT and subsequently reviewed by the Chief Editors.

Reviewer A

Anonymous

To the author and editor

- Thank you for this submission. Exploring how motivational profiles in school physical education impact adolescents' mental health is a relevant topic for improving education quality and promoting psychological well-being in this setting.
- Below are some points and suggestions for revision.

General

• I suggest a more detailed review of the text's writing, as the manuscript contains some grammar, word choice, and structural issues that may hinder clarity and flow.

Introduction

- Page 2, line 16: The word research is uncountable, so it cannot be used in the plural. I suggest reword-ing the sentence.
- Page 2, line 20: The sentence is unclear; rephrase it for better clarity, e.g., "In the educational sphere, PE may enhance the provision of Basic Psychological Needs (BPN), which can result in the development of autonomous motivation."
- Page 2, line 25: Rephrase "Those evidences pointed an environment where the mastery context has been related to students' satisfaction and enjoyment" since evidence is an uncountable noun. Also, ensure the verb tense is correct.
- Page 3, line 19: Replace "reveled" with "revealed."
- Page 3, paragraph 4: Consider integrating this paragraph more cohesively into the study's argument.
- Methods:
- Page 4, paragraph 2: Clearly present participant eligibility criteria. Sample characteristics should be reported in the Results section.
- Include information on how participants were recruited.
- Please add the data collection period to the Methods section.
- Page 5, line 23: The acronym SDT should be written out in full upon its first appearance.

- The assessment instruments for each variable of interest are well described.
- Page 7, line 7: What value was considered "a slight datum below the mean"? I suggest including this information in the Methods section.

Results

- Report the characteristics of the study participants.
- It is important to state whether any data were lost due to incomplete questionnaires or missing responses that had to be excluded from the analysis. If applicable, indicate the number of participants with missing data for each variable of interest.

Discussion

- The text explores the results related to each cluster well, but it could further discuss the negative and specific effects of environments with low BPN support.
- Please include a paragraph highlighting the strengths of the present study and add directions for the practical applicability of the findings.
- Consider making the last paragraph clearer as a general conclusion of the study.

Final Decision

• Major revisions

Reviewer B

Anonymous

To the author and editor:

• On page 1, "word counts" are presented, but the manuscript submission guidelines do not require this information.

Abstract

- The introduction section is missing in the abstract, even though the manuscript submission guidelines require it.
- Remove "Discussion", as the guidelines specify using only "Conclusion."
- The keyword "Self-determination theory" is not found as a descriptor or MeSH term. I suggest re-

viewing or replacing it.

• I recommend improving the abstract, especially the methodology section. It would be helpful to better explain the three clusters and their meanings. For example, when mentioning "Cluster 3 (negative)" in the results, providing more details would aid comprehension. The abstract currently contains 128 words, within the 250-word limit, allowing space to expand this section.

Introduction

- Page 2, line 23: I suggest adding an example similar to the one on page 3, line 5, for better understanding.
- Page 3, lines 1–9: The line spacing is 1.5, whereas the rest of the introduction is double-spaced. The manuscript submission guidelines require double spacing.
- Page 3, lines 10–13: Does the author mean that sports have both benefits and drawbacks? Or is this a comparison between exercise and physical activity, with decisions made based on perceived benefits? Or does "exercise" on line 11 relate to "sport" on line 10? The text is somewhat unclear. I suggest clarifying this passage since it is addressed in the results—what is the distinction between sport and exercise in this context?
- Page 3, line 19: Is the correct term "amotivation" or "motivation"?
- Page 4, line 2: Check whether "are" should be replaced with "is."
- Page 4: The term "adolescent's" appears in different forms ("adolecents," "adolescents"). I suggest ensuring consistency or replacing "adolescent's" with "teenager."

Methods

• Page 4, line 12: What does "obtained XXX (protocol number XXX)" refer to?

- Page 5, lines 1–2: The study involved schools from eight cities. Since the introduction discusses how the environment inside and outside school can influence adolescents, was this factor considered in the cluster analysis?
- Page 5, line 16: What criteria differentiate a sport from an exercise in this study?
- Page 6, line 4: There is a red dot in the text—please change the text color.
- I suggest adding subheadings within the Methods section for each component description. This would make it easier to understand which part of the methodology is being explained.

Results

• Page 8, lines 1–7: The differences between clusters in specific profiles are mentioned, but differences compared to which clusters? For example, "Cluster 1 showed the best profile (p<0.001)"—was this in relation to clusters 2 and 3, or only one of them?

Discussion

- Page 9, line 6: Review the repeated preposition in the sentence.
- Page 9, line 17: Check the demonstrative pronoun, as the sentence refers to plural results rather than a single result.
- Page 10, line 5: Verify the correct demonstrative pronoun for plural variables.
- Page 11, line 12: Check the verb conjugation, as the sentence is in the third-person singular.
- Page 11, line 12: There is a green dot at the end of the sentence—please change the text color.
- Page 11, line 20: There is a red dot at the end of the sentence—please change the text color.

Final Decision

• Major revisions