

Extending the trans-contextual model of motivation: Roles of controlling climate and basic need satisfaction and frustration

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Abstract

Autonomy, competence, and relatedness, basic psychological needs, are recognized as key factors influencing motivation in physical education (PE). Based on Self-Determination Theory (SDT), this study examines how the fulfillment and frustration of these needs mediate the relationship between students' perceptions of the motivational climate in PE and their intentions to engage in physical activity during free time. The study involved 250 fifth- and sixth-grade students (mean age = 11.66 years, SD = 0.68), who completed questionnaires assessing their perceptions of autonomy-supportive versus controlling teaching styles in physical education experiences of psychological need satisfaction and frustration, self-determined motivation in both school and leisure contexts, and constructs from the Theory of Planned Behavior (TPB) related to intentions and behaviors in leisure-time physical activity (LTPA). Path analysis confirmed the expected associations: an autonomy-supportive environment in PE was linked to reduced frustration of psychological needs, whereas a controlling climate was related to greater frustration. In particular, autonomy frustration was a significant negative predictor of self-determined motivation within the PE setting. This motivation, when transferred to leisure-time contexts, was positively associated with TPB-related outcomes, such as attitudes, perceived norms, perceived behavioral control, and intentions toward LTPA. The study lends empirical support to the trans-contextual model of motivation, illustrating how motivational dynamics in PE can extend to influence physical activity behavior beyond the school environment. It also emphasizes the importance of differentiating between the satisfaction and frustration of psychological needs, as each has a distinct effect on motivation. Ultimately, the findings highlight the value of cultivating autonomy-supportive PE climates to enhance students' motivation and encourage regular engagement in physical activity during their leisure time.

Key words: motivational climate, psychological need frustration, psychological need satisfaction, leisure-time physical activity, physical education

Introduction

The literature has comprehensively demonstrated the health advantages associated with consistent engagement in physical activity (PA) in both children (Gu et al., 2016) and adults (Rhodes et al., 2017). In addition to the contribution of PA to physical health, it also has a positive impact on children's psychological well-being (Kim et al., 2017; Parfitt & Eston, 2005). However, PA levels tend to decline with age (Amaraya et al., 2015; Nader et al., 2008), especially in children aged between 10 and 16 years old (Rostami-Moez et al., 2017; Sember et al., 2020). The decline of PA in this period coincides with declines in motivation toward and participation in physical education (PE) lessons (Barkoukis et al., 2010; Ntoumanis et al., 2009). As such, the onset of the decline in PA both in and outside the school context occurs at around 10–12 years of age, and motivation may have a significant influence on this process. The trans-contextual model of motivation (TCM) suggests that motivation in school physical education can influence decision-making in relation to participation in leisure-time physical activity (LTPA) (Barkoukis et al., 2021; Hagger & Chatzisarantis, 2016; Kalajas-Tilga et al., 2022a, 2022b). However, this model does not take into account important motivational variables such as basic psychological needs. The present study aims to integrate basic psychological needs into the TCM in order to better understand the motivational sequence connecting the motivation climate in PE with LTPA.

The trans-contextual model of motivation

The TCM is a multi-theory approach aiming to describe the processes through which motivation in educational settings affects behaviors outside of school (Hagger & Chatzisarantis, 2012, 2016). Specifically, the TCM synthesizes elements from three theories: self-determination theory (Deci & Ryan, 2000, 2002), the hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997), and the theory of planned behavior (Ajzen, 1985). According to self-determination theory (SDT), human behavior can be classified into three main types: intrinsically motivated, extrinsically motivated, and amotivated behavior. Intrinsic motivation arises from internal drives, such as personal interests, curiosity, values, or enjoyment of the activity itself. As such, intrinsically motivated behavior is self-sustained, does not rely on external rewards, and often involves tasks that

are optimally challenging and inherently satisfying. In contrast, extrinsic motivation depends on external incentives such as rewards, praise, grades, or recognition. Therefore, extrinsically motivated actions are performed not for their own sake but as a means to achieve a separate outcome. Finally, amotivation refers to a complete lack of motivation, meaning that neither intrinsic nor extrinsic factors drive the behavior. In such cases, individuals show no intention or willingness to act, often due to feelings of disinterest or helplessness (Deci & Ryan, 2000, 2002; Ryan & Deci, 2019, 2020).

SDT suggests that significant social agents in an individual's life, such as teachers, parents, and coaches, play a pivotal role in shaping motivation within specific contexts (Deci & Ryan, 2002; Ryan & Deci, 2020; Vallerand, 2007). This motivational influence is mediated through the satisfaction of basic psychological needs, which is essential for the achievement of psychological growth, well-being, and personal integrity (Deci & Ryan, 2000). These needs serve as the foundation for both energizing behavior (i.e., process) and directing it (i.e., content) (Deci & Ryan, 2000; Ryan & Deci, 2019). According to SDT, there are three innate psychological needs that are central to human motivation: the need for autonomy, which reflects the individual's desire to experience volition and self-endorsement in their actions (Reeve, 2012); the need for competence, which involves the individual feeling effective and capable in their pursuits; and the need for relatedness, which involves the individual establishing meaningful relations with others. These needs form the core psychological requirements for fostering intrinsic motivation, well-being, and optimal functioning. When the social environment supports these needs, individuals are more likely to experience sustained, self-determined motivation (Deci & Ryan, 2000; Ryan & Deci, 2019, 2020). For example, environments that support autonomy are expected to satisfy the three basic psychological needs and promote self-determined motivation and well-being (Theodosiou et al., 2021), whereas controlling climates are expected to undermine or thwart these needs and result in extrinsic motivation (Chen et al., 2020; Koka et al., 2021; Tilga et al., 2020).

The TCM postulates that school motivation influences LTPA motivation. The mechanism supporting this transfer of motivation is based on the work of Vallerand (1997, 2007), who proposed the existence of a reciprocal association between motivation across similar but diverse contexts. According to Vallerand, individuals have motivational schemata, which include motivational and behavioral patterns in a specific setting. In this sense, it is expected that self-determined motivation in one context would influence self-determined motivation in another distinct, but similar, context (Hagger & Chatzisarantis, 2016). Importantly, Hagger and Chatzisarantis (2016) suggested that the satisfaction of the basic psychological needs facilitates this transfer of motivation across contexts. Finally, according to the TCM, motivation influences intentions and actual behavior, potentially through the effects of certain key variables highlighted by the theory of planned behavior (TPB), namely perceived behavioral control, norms and attitudes (Ajzen, 2002). In particular, the theory of planned behavior (Ajzen, 1985) provides an explanation of the decision-making processes that result in the manifestation of a certain behavior. The TPB has been utilized to understand students' intentions and behaviors in educational settings. For instance, Tsorbatzoudis and Emmanouilidou (2005) reported that moral attitudes and perceived behavioral control significantly predicted intentions toward moral behavior, which, in turn, predicted students' moral behavior in PE. In addition, interventions utilizing the TPB have been effective in shaping students' beliefs and behaviors about both the inclusion of students with disabilities (Bebetsos et al., 2017) and LTPA participation (Barkoukis et al., 2021).

Previous evidence indicates that positive physical education experiences have been linked to higher levels of LTPA in young adolescents (Hernández et al., 2020). Additionally, past studies have consistently demonstrated that autonomy-supportive environments in PE lessons have a positive influence on engagement in PA during leisure time (e.g. Hagger & Chatzisarantis, 2012, 2016; Polet et al., 2020). Behzadnia et al. (2018) further confirmed the potential transfer of motivation from PE settings to leisure time. Similarly, Barkoukis and Hagger (2013) found that perceptions of the learning climate strongly predicted self-determined motivation in both PE and leisure-time contexts. Importantly, Cid et al. (2019) and Franco and Coterón (2017) indicated that autonomy-supportive climates resulted in the satisfaction of basic psychological needs and increased intentions to engage in physical activity. Hernández et al. (2020) and Erdvic et al. (2014) suggested that autonomy-supportive PE may positively affect high school students' intentions to be physically active out of school, even after graduation. Behzadnia et al. (2018) also demonstrated that the satisfaction of psychological needs mediated the effect of the school motivational climate on school motivation. Overall, recent evidence suggests that the satisfaction of basic psychological needs can positively influence the motivational connection between school PE and LTPA (Cid et al., 2019; Franco & Coterón, 2017).

The present study

Existing evidence has consistently shown that the motivational sequence proposed by the TCM sufficiently describes the effect of motivational climates that support autonomy on intentions toward and actual LTPA participation (Hagger & Chatzisarantis, 2016). Furthermore, past evidence indicates that the satisfaction of basic psychological needs mediates the effect of the motivational climate on motivation regulation (Behzadnia et al., 2018). In addition, within the field of TCM, need satisfaction has been found to mediate the effect of the motivational climate on motivational regulations in the context of both PE and LTPA (Barkoukis et al., 2010; Cid et al., 2019; Franco & Coterón, 2017). Conversely, psychological need frustration influences motivation in a

different way to need satisfaction (Bartholomew et al., 2011). In particular, psychological need frustration is negatively associated with self-determined motivation and positively associated with extrinsic motivation (Costa et al., 2015; Jaakkola et al., 2019). However, the trans-contextual effect of psychological need frustration in PE on motivational regulation in relation to LTPA has not yet been addressed. Furthermore, since psychological need frustration acts independently from need satisfaction (Chen et al., 2014), the investigation of this association is expected to provide valuable information about whether need frustration may undermine the anticipated positive effect of need satisfaction. In addition, previous studies have investigated the effect of climates supportive of autonomy on motivational regulations in PE and LTPA, but there is a lack of evidence regarding the role of controlling climates in this process (Haerens et al., 2015). Indeed, the TCM does not make any predictions about the impact of controlling climates on motivational processes (Hagger & Chatzisarantis, 2016). Controlling climates act independently from climates supportive of autonomy and, thus, may influence motivation differently (Amoura et al., 2015; Cronin et al., 2019). Therefore, it is expected that a controlling climate may result in controlled motivation, which may counter the positive effects of self-determined motivation. To address these gaps in the previous research, the present study aimed to investigate how the frustration and satisfaction of basic needs may influence the association of primary students' perceptions of the motivational climate (i.e., autonomy-supportive and controlling climates) in school PE on their intentions to engage in LTPA. Based on previous TCM research, we set the following hypotheses: a) autonomy-supportive climates will be positively associated with need satisfaction and motivation in PE and LTPA, whereas controlling climates will be positively associated with need frustration and negatively associated with motivation in PE and LTPA; b) the satisfaction of the basic needs will be negatively associated with the frustration of the respective needs; c) self-determined motivation in PE will be positively associated with self-determined motivation in LTPA; d) need satisfaction will be positively associated with PE and LTPA motivation, whereas need frustration will be negatively associated with these motivational outcomes; e) motivation in LTPA will be positively associated with LTPA social cognition and intentions; and f) LTPA social cognition will be positively associated with physical activity intentions.

Method

Participants

Overall, 250 primary school students (116 males and 134 females; mean age = 11.66 years, SD = .68) took part in the study. The participants were recruited from private elementary schools in an urban city in Northern Greece. In particular, 130 students (61 males and 69 females) were in the fifth grade, and 120 students (55 males and 65 females) were in the sixth grade.

Procedure

The study was designed and conducted in accordance with the Code of Ethics in Research of the Aristotle University of Thessaloniki. A convenience sample of schools that the researchers had access to and that were willing to take part in the study was used. The principals and physical education teachers of the selected schools were approached and informed about the purposes of the study. Upon approval from the school, an informed consent form was provided to the parents with a note to sign and return if they did not wish to allow their child to participate in the study. No forms were returned by the parents. A two-wave prospective design was used for the data collection. During the first wave of data collection, measures of LTPA motivational regulation and the components of the theory of planned behavior were administered to the participants. Students received both written and verbal instructions to base their responses on their personal experiences in physical education classes. After a period of 5 weeks, the second wave of data collection was conducted, during which the students completed the measures of PE motivational regulation, motivational climate, and need satisfaction and frustration. The students completed the questionnaires in the class before the beginning of a PE lesson under the supervision of their PE teachers. The students were provided with detailed guidance on how to complete the questionnaires, including explanations of the content, were notified that the questionnaire was anonymous and that their identities would remain confidential from their teachers and parents, were provided with explicit guarantees concerning data protection, and were made aware of their right to withdraw from the study before completing the questionnaire. The questionnaires were completed in a quiet classroom environment, and the students were seated separately to prevent any discussion or sharing of responses.

Measures

Autonomy support: Perceived autonomy support was measured using the Learning Climate Questionnaire (LCQ; Williams & Deci, 1996), which includes six items (e.g., "My PE teacher listens to how I would like to do things"). Responses were recorded on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The scale has been used in previous studies in PE settings to assess perceived autonomy support (Taylor et al., 2010; Cheon et al., 2016).

Controlling climate: Perceptions of the climate being controlling were assessed using the Controlling Coach Behaviors Scale (Bartholomew et al., 2010), which includes 15 items capturing five core aspects of controlling coaching behavior: controlling use of rewards (e.g., "My coach tries to motivate me by promising to reward me if I do well"), negative conditional regard (e.g., "My coach is less friendly with me if I don't make the effort to see things his/her way"), intimidation (e.g., "My coach shouts at me in front of others to make me do

certain things”), excessive personal control (e.g., “My coach expects my whole life to center on my sport participation”), and judging and devaluing (e.g., “My coach evaluates me negatively if I perform badly”). Participants rated each item on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree), with higher scores reflecting stronger perceptions of a controlling motivational environment.

Basic Psychological Need satisfaction: Three separate scales were used to measure the satisfaction of psychological needs. Specifically, satisfaction of the need for autonomy was measured using a five-item scale (Standage et al., 2003; e.g., “I have some choice in what I want to do in the PE lesson”). The satisfaction of the need for competence was measured using the Perceived Competence subscale of the Intrinsic Motivation Inventory (IMI; McAuley et al., 1989), which includes five items (e.g., “I think I am pretty good at PE”). For the assessment of the satisfaction of the need for relatedness, the five-item Acceptance subscale of the Need for Relatedness Scale (Richer & Vallerand, 1998) was used (e.g., “When participating in the PE lesson I feel supported”). Participants responded to these items on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Basic Psychological Need frustration: The Psychological Need Frustration Scale (Bartholomew et al., 2011) was used to assess the participants’ experiences of need frustration in PE contexts. This scale comprises 12 items measuring three dimensions of psychological need frustration, with each item preceded by the introductory phrase “In the physical education lesson...” Autonomy frustration was measured through items such as “I feel forced to follow decisions made for me,” while competence frustration was assessed with statements such as “There are times when I am told things that make me feel incompetent.” Relatedness frustration was evaluated using items including “I feel I am rejected by those around me.” Participants rated their agreement with each statement on a 7-point Likert scale ranging from 1 (totally disagree) to 7 (totally agree), with higher scores reflecting greater levels of need frustration.

Motivational regulations in PE: To assess motivational regulations in PE, we employed a modified version of the Perceived Locus of Causality scale (Ryan and Connell, 1989). Specifically, participants indicated their reasons for participating in PE through their responses to eight statements (with two items per motivational regulation type) on a 4-point Likert scale (1 = very true, 4 = not true at all). The four motivational regulation styles measured included the following: external regulation (e.g., “because important others want me to do it”), introjected regulation (e.g., “because I will feel ashamed if I do not”), identified regulation (e.g., “because I value PE”), and intrinsic motivation (e.g., “because PE is fun”). Previous validation studies with Greek student populations (Hagger et al., 2005; Barkoukis & Hagger, 2009) have demonstrated that the scale has satisfactory psychometric properties.

Motivational regulations in LTPA: Motivational regulation in leisure time contexts was measured using the Behavioral Regulation in Exercise Questionnaire (BREQ; Mullan et al., 1997). Participants responded to a stem question (“Why do you engage in exercise?”) based on four regulations, each relating to a different regulation style: external regulation (e.g., “I exercise because other people say I should”), introjected regulation (e.g., “I feel ashamed when I miss an exercise session”), identified regulation (e.g., “it’s important to me to exercise regularly”), and intrinsic motivation (e.g., “I enjoy my exercise sessions”). Responses were given on a 5-point Likert scale (1 = not at all true for me, 5 = completely true for me).

Planned behaviour theory:

The constructs of the TPB were assessed following established guidelines (Ajzen, 2002) and prior research using the TPB framework in Greek populations (Barkoukis et al., 2010). Specifically, attitudes were measured using a 7-point semantic differential scale in response to the following statement: “Participating in active sports and/or vigorous physical activities during my leisure time in the next 5 weeks is...”. The participants evaluated five pairs of opposing adjectives: bad–good, harmful–beneficial, not enjoyable–enjoyable, useful–useless, and boring–interesting. Subjective norms were captured using two items (e.g., “People important to me think that I should do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks”), which were rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Perceived behavioral control (PBC) was assessed with three items (e.g., “I feel in complete control over whether I do active sports and/or vigorous physical activities in my leisure time in the next 5 weeks”) using a 7-point scale from 1 (no control) to 7 (complete control). Finally, behavioral intentions were measured through three items (e.g., “I intend to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks”) using a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). This methodological approach provided a thorough assessment of all central TPB variables while aligning with previous culturally relevant studies.

Data analysis

Descriptive statistics and correlation coefficients were used to summarize the data and were computed using SPSS version 28.0. The validity of the measures and the hypotheses of our proposed model were tested with confirmatory factor analysis path analysis respectively conducted using the MPLUS 8 software. Multiple recommended indices of good fit were used to evaluate the goodness of fit of the proposed model with the data. In particular, the comparative fit index (CFI), the standardized root mean squared residual (SRMR) and the root mean squared error of approximation (RMSEA) were computed. CFI values close or above .90 were deemed

satisfactory to attest factorial validity, whereas values close or above .95 ascertain adequate model fit. Values of .08 or less for the RMSEA and SRMR are indicative of an acceptable model fit (Hu & Bentler, 1999).

Results

Descriptive statistics and correlation coefficients among the variables used in the analysis are reported in Tables 1 and Table 2. The CFA supported the factorial validity of the scales used in the present study. In particular, the analysis revealed acceptable fit indices for the perceived autonomy support ($\chi^2=15.750$, $p = .07$, CFI = .98, RMSEA = .05, SRMR = .03), perceived controlling ($\chi^2=155.73$, $p < .001$, CFI = .93, RMSEA = .05, SRMR = .08), need satisfaction ($\chi^2=137.66$, $p < .001$, CFI = .93, RMSEA = .05, SRMR = .04), need frustration ($\chi^2= 65.88$, $p < .05$, CFI = .97, RMSEA = .03, SRMR = .04), motivation in PE ($\chi^2= 11.23$, $p = .66$, CFI = 1.00, RMSEA = .00, SRMR = .02), motivation in LTPA ($\chi^2= 128.71$, $p < .001$, CFI = .94, RMSEA = .05, SRMR = .07), and planned behaviour theory variables ($\chi^2= 46.49$, $p = .25$, CFI = .99, RMSEA = .02, SRMR = .04). The correlations among the subscales in each measure and among different measures were in the expected direction supporting its construct and discriminant validity.

The hypothesized relationships among the variables in the proposed model are depicted in Figure 1. The results of the path analysis indicated that the model exhibited adequate fit with the data ($\chi^2(37) = 77.894$, $p = .000$; CFI = .964; SRMR = .072; RMSEA = .066, RMSEA CI₉₀ upper limit = .046, RMSEA CI₉₀ lower limit = .087). Specifically, regarding the first hypothesis, the results of the analysis revealed statistically significant negative relationships between perceived autonomy support and both autonomy need frustration ($\beta = -.273$, $p < .001$) and competence need frustration ($\beta = -.184$, $p = .002$) with small-to-medium effect sizes. In addition, perceived autonomy support had significant large-sized direct effects on need satisfaction for autonomy ($\beta = .647$, $p < .001$) and relatedness ($\beta = .637$, $p < .001$) and significant medium-sized direct effects on competence ($\beta = .393$, $p < .001$). With respect to perceptions of a controlling climate, the results indicated statistically significant small-to-medium-sized effects on frustration of the needs for both competence ($\beta = .245$, $p < .001$) and relatedness ($\beta = .301$, $p < .001$). However, perceptions of a controlling climate did not predict the satisfaction of the needs for autonomy ($\beta = .054$, $p = .332$), competence ($\beta = -.082$, $p = .195$), and relatedness ($\beta = .017$, $p = .760$). In addition, the results indicated a statistically significant direct effect of perceived autonomy support on self-determined motivation in PE ($\beta = .270$, $p = .002$), with a small-to-medium effect size. In addition, perceptions of a controlling climate negatively predicted self-determined motivation in leisure contexts ($\beta = -.167$, $p = .012$), with a small-to-medium effect size. However, perceived controlling climate did not predict PE self-determined motivation ($\beta = -.025$, $p = .707$).

Table 1. Descriptive statistics of variables used in the analysis.

	Mean(SD)	Skewness	Kurtosis	Cronbach a
Autonomy support	5.62 (1.09)	-0.967	0.786	.83
Controlling climate	2.29(0.77)	0.374	-0.627	.70
Autonomy satisfaction	5.20(1.21)	-0.520	-0.523	.71
Competence satisfaction	5.69(1.04)	-1.023	1.437	.75
Relatedness satisfaction	5.26(1.16)	-0.542	-0.114	.77
Autonomy thwarting	3.24(1.44)	0.413	-0.449	.68
Competence thwarting	2.46(1.36)	0.830	0.179	.76
Relatedness thwarting	2.26(1.23)	0.952	0.200	.73
Intention	5.76(1.44)	-1.139	0.569	.82
Attitude	6.50(1.11)	-3.172	10.715	.96
PBC	5.72(1.29)	-0.818	-0.375	.71
Subjective Norm	3.76(1.33)	0.385	0.254	-

Note: PBC = Perceived behavioural Control

Table 2. Analysis of correlation

	1	2	3	4	5	6	7	8	9	10	11
1. Autonomy support											
2. Controlling climate	-.45**										
3. Autonomy satisfaction	.62**	-.24**									
4. Competence satisfaction	.43**	-.26**	.44**								
5. Relatedness satisfaction	.63**	-.27**	.59**	.56**							
6. Autonomy thwarting	-.49**	.22**	-.53**	-.18**	-.28**						
7. Competence thwarting	-.44**	.42**	-.38**	-.47**	-.46**	.45**					
8. Relatedness thwarting	-.18**	.31**	-.19**	-.22**	-.31**	.12	.50**				
9. Intention	.16*	-.13*	.15*	.37**	.30**	.07	-.18**	-.11			
10. Attitude	.14*	-.13	.08	.27**	.18**	.01	-.12	-.10	.55**		
11. PBC	.17**	-.11	.27**	.32**	.24**	-.03	-.17**	-.10	.66**	.48*	
12. Subjective Norm	.03	.05	.11	.13*	.08	.07	.07	.08	.14*	.07	.16**

Note: * $p < .05$, ** $p < .001$

The analysis indicated that the satisfaction of the need for autonomy was significantly and negatively associated with autonomy need frustration ($\beta = -.343$, $p < .001$), with a medium effect size. Similarly,

competence need satisfaction showed a significant negative relationship with competence need frustration ($\beta = -.333, p < .001$), again with a medium effect size, and relatedness need satisfaction was significantly negatively related to relatedness need frustration ($\beta = -.240, p < .001$), with an effect size ranging from small to medium. Additionally, the path analysis revealed that self-determined motivation in PE significantly predicted self-determined motivation in leisure contexts ($\beta = .359, p < .001$), with a medium-sized direct effect. Notably, need satisfaction for autonomy ($\beta = -.079, p = .333$), competence ($\beta = .078, p = .276$) and relatedness ($\beta = -.064, p = .446$) did not predict self-determined motivation in PE. Similarly, need frustration for competence ($\beta = -.150, p = .063$) and relatedness ($\beta = .004, p = .956$) did not predict self-determined motivation in PE. However, autonomy need frustration predicted self-determined motivation ($\beta = -.207, p = .004$) with a small-to-medium effect size. Further to this, need satisfaction for autonomy ($\beta = .057, p = .491$), competence ($\beta = .027, p = .714$), and relatedness ($\beta = -.028, p = .743$) did not predict self-determined motivation in leisure time. A similar pattern emerged for competence need frustration ($\beta = -.015, p = .853$), but need frustration for autonomy ($\beta = .167, p = .025$) and relatedness ($\beta = -.143, p = .029$) predicted self-determined motivation in leisure time.

With respect to the effect of motivational regulation on physical activity beliefs, the results indicated a statistically significant direct effect of self-determined motivation in leisure time on PBC ($\beta = .272, p < .001$), attitudes ($\beta = .185, p = .003$), and subjective norms ($\beta = -.240, p < .001$), with small-to-medium effect sizes. In addition, physical activity intentions were predicted by PBC ($\beta = .513, p < .001$) and attitudes ($\beta = .296, p < .001$), with medium-to-large and small-to-medium effect sizes, respectively. However, there was no effect of subjective norms on physical activity intentions ($\beta = .031, p = .499$).

Regarding the indirect effects, the analysis revealed several statistically significant pathways. Firstly, perceived autonomy support showed a significant indirect effect on physical activity intentions through the sequential path of self-determined motivation in PE, self-determined motivation in leisure time, and perceived behavioral control (PBC) ($\beta = .014, p = .023$), with a small effect size. Another significant, albeit small, indirect path was identified that included autonomy need satisfaction, autonomy need frustration, self-determined motivation in leisure time, self-determined motivation in PE, and PBC ($\beta = .002, p = .048$). Additionally, perceptions of a controlling climate had a significant negative indirect effect on physical activity intentions via self-determined motivation in leisure time and PBC ($\beta = -.023, p = .032$), with a small effect size. A further significant indirect effect was observed for the effect of self-determined motivation in PE on physical activity intentions, mediated by self-determined motivation in leisure time and PBC ($\beta = .050, p = .001$), again with a small effect size. Moreover, there was a notable indirect path of self-determined motivation in PE on intentions through self-determined motivation in leisure time and attitudes ($\beta = .020, p = .015$). Finally, self-determined motivation in leisure time exhibited a significant indirect effect on intentions via PBC ($\beta = .140, p < .001$) and via attitudes ($\beta = .055, p = .007$), both with small effect sizes. No significant indirect effects were found through the variable of subjective norms.

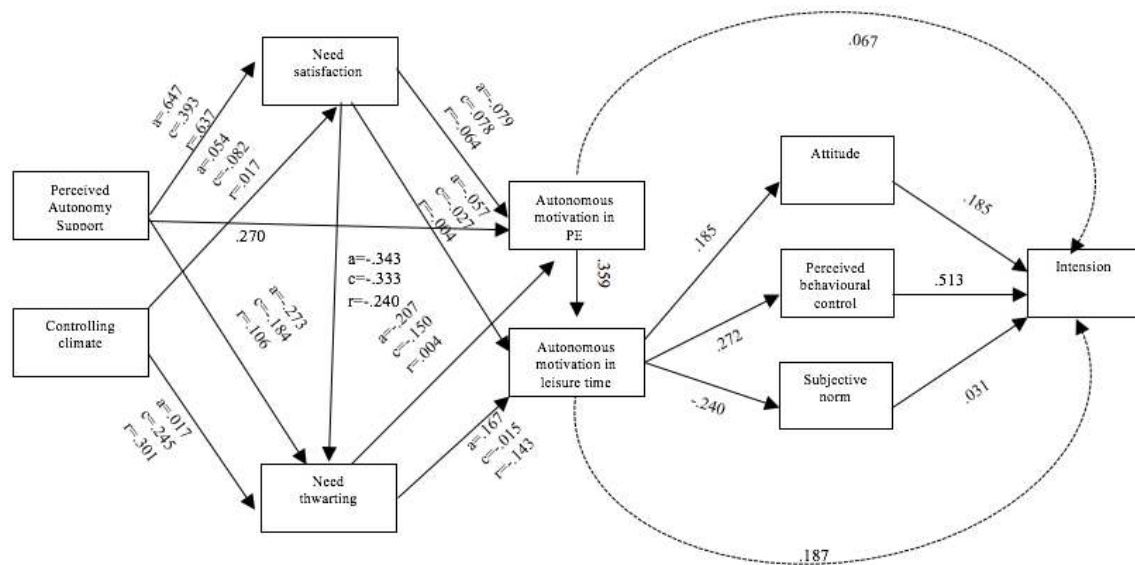


Figure 1. Effect of motivational climate on LTPA intentions

Note: a = need for autonomy, c = need for competence, r = need for relatedness.

Beta lower than .200 are not statistically significant

Discussion

The objective of this study was to integrate the effects of a controlling climate and psychological need frustration into the TCM and investigate their roles in the suggested theoretical framework. The path analysis results indicated a positive association between perceptions of an autonomy-supportive climate and both need satisfaction and self-determined motivation in PE and leisure activities. Perceptions of a controlling climate were found to have a positive association with need frustration and a negative association with self-determined motivation in PE and leisure activities. No significant correlations were observed between need satisfaction and self-determined motivation in PE and leisure time; however, the frustration of the need for relatedness was negatively associated with self-determined motivation in PE. The findings revealed significant transfer of motivation across contexts, as self-determined motivation in PE positively predicted self-determined motivation in leisure contexts. Furthermore, self-determined motivation during leisure time showed positive associations with both physical activity behavior and social cognition variables. Through this process, self-determined motivation in PE ultimately contributed to stronger intentions to engage in future physical activity, highlighting a motivational transfer process from educational to recreational settings.

The current findings offer empirical validation for three fundamental propositions of the TCM. Specifically, (1) students' perceptions of autonomy support significantly predicted their self-determined motivation within PE contexts, (2) this PE-based self-determined motivation subsequently influenced their self-determined motivation toward LTPA, and (3) both forms of self-determined motivation ultimately contributed to stronger intentions to participate in future LTPA. These sequential relationships demonstrate how motivation transfer across educational and recreational domains and influences future behavioral planning. Additionally, our findings add to an extensive body of evidence offering support to the TCM-proposed motivational sequence linking autonomy support in school physical education with LTPA (Barkoukis & Hagger, 2013; Hagger & Chatzisarantis, 2016; Tilga et al., 2021). These findings also lend further support to the notion that the interpersonal teaching style of physical educators can determine their students' beliefs about and actual participation in physical activity (Haerens et al., 2015; Tilga et al., 2021). The present study extends the TCM by investigating the role of a controlling climate in shaping LTPA cognition and behavior. In particular, our findings indicated that perceptions of a controlling climate were positively associated with need frustration and negatively associated with need satisfaction and self-determined motivation during both PE and leisure time. These findings are in line with previous evidence suggesting that controlling motivational climates are associated with maladaptive motivation (Curran & Standage, 2017; Langan et al., 2016). Importantly, perceptions of a controlling motivational climate seem to directly influence self-determined motivation in leisure time. This finding signifies an important process, suggesting that controlling motivational climates undermine motivation to participate in physical activity. Since autonomy-supportive and controlling behaviors are interrelated but independent (De Meyer et al., 2016), specific actions should be taken to diminish controlling interpersonal teacher-student interactions. Moreover, interventions based on TCM that aim to promote LTPA should also incorporate guidelines to help educators avoid controlling behaviors (Jang & Reeve, 2006; Reeve, 2009; Reeve et al., 2019).

The present study also extended the TCM by investigating the role of the satisfaction and frustration of basic needs in the motivational processes leading to LTPA. With respect to students' need satisfaction, contrary to our expectations and previous research (Barkoukis et al., 2010; Chen et al., 2020), need satisfaction did not predict self-determined motivation in PE or leisure time. The lack of significant associations between basic need satisfaction and self-determined motivation may have occurred due to these effects being masked by the effects of other psychological predictors of motivation, such as an autonomy-supportive climate. As noted by Barkoukis et al., need satisfaction across the three basic needs may share common variance with an autonomy-supportive climate. Indeed, there were high correlations among the need satisfaction across the three needs and an autonomy-supportive climate (see Table 1). As such, it seems that self-determined motivation in PE may be a stronger determinant of motivation in leisure time (Vallerand, 1997, 2007) than the satisfaction of basic psychological needs.

Moreover, we extended the TCM by providing support for the addition of need frustration as a predictor and mediator in the model. In particular, the path analysis showed that autonomy need frustration predicted self-determined motivation in both PE and leisure time. Frustration of the needs for competence and relatedness also predicted self-determined motivation in PE and leisure time, respectively. According to prior research, need frustration negatively affects PE self-determined motivation (Trigueros et al., 2019). Specifically, autonomy need frustration positively affects self-determined motivation in leisure time, whereas relatedness need frustration negatively affects this motivation type (Ryan & Deci, 2017). These findings provide indications of the underlying mechanism explaining the effect of need frustration on self-determined motivation. Firstly, autonomy need frustration has emerged as a predictor of motivation in different contexts, indicating an important role for perceptions of autonomy in the formation of self-determined motivation (Ryan & Deci, 2017). According to Deci and Ryan (2000), the frustration of basic psychological needs can lead to the development of compensatory motives, which are considered need substitutes. Therefore, in our study, when the students experienced frustration of the need for autonomy, they may have compensated by attempting to gain approval through developing motivation for participation physical activity during their leisure time, which allows a larger degree

of autonomy compared to more structured competitive sport. Secondly, competence need frustration seems to influence self-determined motivation within the same context (i.e., PE) but not in leisure time, potentially because competence is evaluated in PE lessons, whereas it is not a crucial factor of participating in recreational physical activities. If the measure of motivation for physical activity during leisure time had been focused on organized and competitive sport (e.g., by using the Sport Motivation Scale), competence need frustration may have emerged as a significant predictor of self-determined motivation. Thirdly, relatedness need frustration seemed to influence self-determined motivation in leisure time. Indeed, our findings showed that when social conditions thwarted the students' need for relatedness, this undermined their motivation to engage in leisure-time physical activity. This finding implies that students project the lack of approval and acceptance by their peers in school PE classes to other relevant contexts (e.g., sports teams) (Bartholomew et al., 2011). Previously, need frustration has been associated with suboptimal development conditions (Deci et al., 2006) and has been shown to predict diminished functioning (Bartholomew et al., 2011). Nevertheless, the trans-contextual effects of need frustration remain elusive, and further research in this area is warranted.

The current study has limitations that should be acknowledged. Specifically, the data gathered were correlational in nature. While we established the temporal ordering of the variables consistent with our hypotheses, the design does not permit definitive causal conclusions to be drawn. As noted by Hagger and Chatzisarantis (2009), the causal inferences in this work rest on theoretical foundations rather than empirical proof of causation. To contextualize these relationships, we have integrated supporting evidence from studies using methods better suited to causal inference (e.g., experiments), which collectively lend credibility to the proposed model. A further limitation is that autonomy support from peers and significant others was not considered. Future research should include relevant assessments in order to better understand the effects of the social environment on self-determined motivation. The final limitation of the present study is the sample, which comprised students attending private primary schools only. These students may differ from those attending public schools in terms of their socioeconomic status and opportunities for physical activity during leisure time. Therefore, future research would benefit from exploring these motivational relationships in the context of public schools.

The expansion of the TCM to incorporate controlling climates and need frustration has yielded a novel understanding of how adverse social factors may undermine motivation in both educational and recreational physical activity settings. This work represents the first study to simultaneously assess need satisfaction and frustration within this framework and demonstrates that these constructs represent distinct rather than opposite phenomena, with need frustration exhibiting unique predictive utility in explaining motivational outcomes. This evidence highlights that future investigations of self-determined motivation must consider both the facilitating role of need satisfaction and the detrimental effects of need frustration to fully capture the complexity of motivational processes in physical activity contexts.

The practical implications of these findings require careful consideration in educational contexts, especially in PE. It is imperative that PE teachers possess the skills necessary to recognize and avoid controlling behaviors in their interactions with students, as such behaviors may inadvertently stifle students' intrinsic motivation and engagement with physical activity. Additionally, our findings suggest that PE teachers should refrain from implementing practices that undermine students' psychological needs. Indeed, when these needs are frustrated, there may be a noticeable decline in students' motivation not only within the context of PE classes but also in their leisure time. By fostering a supportive, autonomy-enhancing environment, PE teachers can play a vital role in promoting lifelong engagement in physical activity, thereby contributing positively to students' overall well-being. In this regard, training programs and ongoing professional development for PE teachers should prioritize motivational and psychological frameworks that support a needs-based approach. Placing emphasis on the importance of autonomy support and the avoidance of controlling tactics will empower teachers to create a more inclusive, motivating, and health-promoting PE environment for all students.

Conclusion

The findings of this study provide valuable insights into the motivational processes that link PE experiences to LTPA intentions, as outlined by the TCM. By incorporating both autonomy-supportive and controlling motivational climates, as well as examining psychological need satisfaction and frustration, this research extends previous work on the TCM and underscores the importance of teachers' interpersonal styles in shaping students' motivation. The results confirm that an autonomy-supportive climate enhances self-determined motivation in both PE and leisure-time contexts, whereas a controlling climate undermines motivation and exacerbates psychological need frustration. Notably, autonomy need frustration emerged as a key predictor of diminished motivation, highlighting the critical role of autonomy in fostering sustained engagement in physical activity. Additionally, this study contributes to the growing body of literature by demonstrating that psychological need frustration, particularly for autonomy and relatedness, has distinct and meaningful effects on motivation across different contexts. While need satisfaction did not directly predict self-determined motivation—possibly due to shared variance with autonomy-supportive climate, the negative impact of need frustration reinforces the importance of minimizing controlling behaviors in PE settings. These findings suggest

that interventions aimed at promoting LTPA should not only emphasize autonomy-supportive teaching strategies but also actively discourage controlling practices that frustrate students' psychological needs.

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