Psychology of Sport & Exercise 39 (2018) 10–19

Contents lists available at ScienceDirect

Psychology of Sport & Exercise

journal homepage: www.elsevier.com/locate/psychsport

Associations between students' perceptions of physical education teachers' interpersonal styles and students' wellness, knowledge, performance, and intentions to persist at physical activity: A self-determination theory approach

Behzad Behzadnia[a,c,*], Paul J.C. Adachi[c], Edward L. Deci[b,c,d], Hasan Mohammadzadeh[a]

[a] Department of Motor Behavior, Faculty of Sport Sciences, Urmia University, Urmia, Iran
[b] IPPE, Australian Catholic University, North Sydney, Australia
[c] Department of Psychology, University of Rochester, Rochester, NY, United States
[d] University of Southeast Norway, Honefoss, Norway

ARTICLE INFO

Keywords:
PE teachers' autonomy support
Autonomous motivation
Basic psychological need satisfaction
Wellness
Sport performance

ABSTRACT

Objectives: Grounded in self-determination theory (SDT), the present study examined whether collegiate physical education (PE) teachers' autonomy support versus control would relate to college students' wellness, knowledge, performance, and intentions to persist at physical activity beyond the PE classes. The mediating roles of students' basic psychological need satisfaction and need frustration as well as their types of motivation (autonomous and controlled) were also modeled.
Design: Cross-sectional study.
Methods: One hundred and forty college students (M_{age} = 21.69, SD = 1.89) in PE classes completed questionnaires measuring their perceptions of PE teachers' autonomy support and control, as well as their own basic psychological need satisfaction and frustration and their autonomous and controlled motivation. The student outcomes were self-reports of the students' wellness (i.e., well-being and ill-being), teacher-administered tests of knowledge, teacher ratings of performance, and students' self-reports of intentions to persist at physical activity in the future.
Results: Students' perceptions of teachers' autonomy support were positively associated with each of the positive student outcomes. Students' perceptions of teachers' control were related to students' well-being (negatively), knowledge (negatively), and ill-being (positively). Students' experiences of psychological need satisfaction were significantly positively related to their autonomous motivation and marginally to their controlled motivation. Their experiences of need frustration were related only positively to controlled motivation. As expected, path analyses showed that perceived autonomy support was positively related to the positive outcomes via need satisfaction and frustration and autonomous motivation, and that perceptions of teachers' control were related to students' ill-being (positively) and knowledge (negatively) through need frustration.
Conclusions: Consistent with SDT, the findings suggest that teachers' autonomy support is important for student's psychological need satisfaction, type of motivation, and in turn the outcomes of well-being, knowledge, performance, and intention to persist in the domain of college PE programs. Practical and theoretical implications, along with limitations and future research suggestions are discussed.

Among the most crucial educational processes for students are acquiring new knowledge and skills while experiencing wellness and the desire to continue learning (Ryan & Deci, 2016). Importantly, optimal teaching methods, which includes autonomy-supportive behaviors (e.g., taking students' internal frame of reference, offering choice, providing meaningful rationales for requested actions), can promote a variety of positive outcomes (Jang, Reeve, & Halusic, 2016; Ryan & Deci, 2016, 2017). In the context of physical education (PE), researchers have assessed the relation between teachers' interpersonal behaviors and a range of important PE outcomes such as motivation, persistence, and well-being (e.g., Cheon, Reeve, & Moon, 2012; Ntoumanis, 2001; Taylor & Ntoumanis, 2007; Tessier, Sarrazin, &

* Corresponding author. Department of Motor Behavior, Faculty of Sport Sciences, Urmia University, Postal Code: 5756151818, Nazlu Campus, Urmia, Iran.
E-mail address: behzadniaa@gmail.com (B. Behzadnia).

https://doi.org/10.1016/j.psychsport.2018.07.003
Received 22 May 2017; Received in revised form 9 July 2018; Accepted 9 July 2018
Available online 11 July 2018
1469-0292/

Ntoumanis, 2010). However, much of the PE research has not examined the relation between teacher's interpersonal behaviors and students' sport performance. Furthermore, of the small number of PE studies that have examined sport performance, limited measures of performance have typically been used. In the present study, we have separated the concepts of knowledge and performance and have used a comprehensive assessment of performance involving teachers' ratings. Accordingly, we have addressed the important, specific question of whether teachers' interpersonal behaviors are related to students' actual performance during game play, and we have used a widespread measure of performance to address the issue. Further, we have used college students for our sample because most PE studies have been done with elementary or secondary students (e.g., Cheon, Reeve, & Ntoumanis, 2018; Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015).

In addition to examining the link between teachers' autonomy-supportive behaviors and students' positive outcomes, it is also important to investigate how more controlling teaching behaviors (e.g., using punishments and rewards, failing to provide choice or meaningful rationales for requested actions) relate to less desirable outcomes such as negative affect. There is, however, a dearth of research examining the relations of collegiate PE teachers' controlling teaching styles with their students' psychological need frustration (vs. satisfaction), controlled motivation (vs. autonomous motivation) and ill-being (vs. well-being) in addition to collegiate-level learning and performance outcomes (see Bartholomew et al., 2018 for a recent study with middle school students). Because, to our knowledge, there are limited studies examining these associations among college PE students, it is unclear whether these processes are comparable to those from earlier periods of development. In the current study we took a self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2017) approach, to examine how collegiate PE teachers' autonomy-supportive and controlling approaches relate to students' psychological need satisfaction, motivation, well-being, learning, performance, and persistence in college PE.

1. Self-determination theory

1.1. Types of motivation

One of the key distinctions within SDT is between autonomous motivation and controlled motivation. When autonomously motivated, people behave with a sense of willingness and volition, as they experience enjoyment or see personal value in the activity or behavior in which they are engaged. In contrast, when their motivation is controlled they behave with a sense of obligation and pressure from external sources (e.g., controlling rewards and punishments, which constitutes external regulation) and internal sources (e.g., guilt and contingent self-esteem, which constitutes introjected regulation), and they feel as though they *have* to do the activity or behavior (Ryan & Connell, 1989). Note that autonomous and controlled motivation differ from amotivation, which refers to a lack of desire or intention to engage in an activity. According to SDT, both autonomous and controlled types of motivation energize and direct behavior, but they result in different quality outcomes (Ryan & Deci, 2016). For example, autonomous motivation, which comprises intrinsic motivation (i.e., inherent enjoyment and interest in the activity itself) and well-internalized extrinsic motivation (i.e., identified regulation, which means personally valuing the activity) has been shown to yield greater psychological well-being, better performance on activities in various domains, including PE (Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008), elevated prosocial behavior (Cheon et al., 2018), higher intentions to participate in the activities in the future (Lim & Wang, 2009; Ntoumanis, 2005; Standage, Duda, & Ntoumanis, 2003), and enhanced sportspersonship in sport (Ntoumanis & Standage, 2009). In contrast, controlled forms of motivation were associated with higher levels of antisocial behavior (Cheon et al., 2018), ill-being, such as negative affect in PE students (Ntoumanis, 2005), and antisocial moral attitudes in sport (Ntoumanis & Standage, 2009).

1.2. Basic psychological needs

Another critical component of SDT is the proposition that all human beings have three fundamental psychological needs, the satisfactions of which are essential for autonomous motivation, wellness, and learning (Deci & Ryan, 2000; Ryan & Deci, 2000). One need is for *autonomy*, which concerns the desire to experience willingness, self-regulation, volition, and choice (Deci & Ryan, 1985; deCharms, 1968). The second need is *competence*, which concerns the desire to be effective in interacting with the environment and expressing one's capabilities (Deci, 1975; White, 1959); and the third need is *relatedness*, which concerns the desire to be securely attached and meaningfully connected with individuals or groups (Baumeister & Leary, 1995; Deci & Ryan, 2000; Ryan, 1995). According to SDT, when people's basic psychological needs are satisfied, the individuals are likely to be autonomously motivated, and more positive outcomes are likely to follow. However, when people's needs are frustrated, they are more likely to experience controlled motivation as well as relatively negative outcomes (Ryan & Deci, 2017). In short, the distinction between need satisfaction and need frustration is crucial because these two different experiences are related to different motivations and outcomes (Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013).

In the context of PE, research has shown that secondary school students' experiences of need satisfaction were related to their autonomous motivation (Haerens et al., 2015, 2017), whereas experiences of need frustration were related to their controlled motivation and amotivation (Bartholomew et al., 2018; Haerens et al., 2015; Haerens et al., 2017, Study 2). Similarly, research in sport settings has shown that athletes' (elite sport schools) experiences of need satisfaction were related to autonomous motivation, well-being, and performance progress (Haerens et al., 2017, Study 1), whereas adolescent athletes' need frustration was related to greater ill-being (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011, Study 2) and doping intentions (Ntoumanis, Barkoukis, Gucciardi, & Chan, 2017).

1.3. Teachers' autonomy support and controlling approaches

Given that basic psychological need satisfaction is associated with high quality motivation and a range of positive outcomes, support for these needs from others is crucial (Ryan & Deci, 2017). Specifically, PE teachers' interpersonal styles that are need-supportive facilitate students' need satisfaction, autonomous motivation, and positive educational outcomes (Cheon, Reeve, & Song, 2016; Jang, Reeve, Ryan, & Kim, 2009). For example, teachers can support students' autonomy by providing them with choices and options, and taking their perspectives. In contrast, when PE teachers' interpersonal styles are controlling (e.g., by pressuring students to perform or behave in certain ways), they can thwart and frustrate their students' psychological needs leading to controlled motivation (Deci & Ryan, 2000; Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013) and negative outcomes (e.g., Cheon & Reeve, 2015).

The current study examines whether students' perceptions of their PE teachers' autonomy support and controlling approaches are related to their own basic need satisfactions and frustrations, their autonomous and controlled motivations, and the outcomes of well-being and ill-being (i.e., of wellness). Importantly, this study is the first to explore the relations of both autonomy-supportive and controlling PE teachers' styles to the additional PE outcomes of knowledge, performance, and intentions to persist at physical activity, which we describe next.

2. PE outcomes at the collegiate level

PE courses, which are mandatory elements of university studies in

Iran, are intended to promote wellness through both physical activities and related conceptual learning (Wuest & Bucher, 1999). The current study examined four outcomes relevant to the PE domain in a sample of Iranian university students. The first outcome was wellness (self-reported as high positive and low negative affects); the second was knowledge about the PE activities (assessed by a written test); the third was performance at the activities (assessed by teachers' ratings), and the fourth was self-reported intentions to continue doing the physical activities after the course ends. We now elaborate each.

2.1. Well-being and ill-being

One important outcome that has been studied in PE and education more broadly is students' well-being. For example, research has shown that secondary PE students' perceptions of teachers' autonomy-support, as well as their own need satisfaction and autonomous motivation relate positively to well-being (Standage, Duda, & Ntoumanis, 2005) and negatively to ill-being (Ntoumanis, 2005; Standage et al., 2005). However, there is limited work examining whether PE students' perceptions of teachers' controlling behaviors or styles and their own basic need frustration are related to their well-being and ill-being (i.e., their wellness). We hypothesize that when PE classes were autonomy-supportive, students would experience both satisfaction of the basic psychological needs and autonomous motivation, which, in turn, would be related to enhanced well-being. In contrast, teachers' controlling behaviors, are more likely to be associated with basic need frustration, controlled motivation, and students' ill-being (Ryan & Deci, 2017).

2.2. Knowledge

Knowledge structures, which are cognitive processes that enable one to know 'how to do' activities and 'what to do' in specific game-play situations, are important for skill acquisition and performance in PE (Anderson, 1987; McGee & Farrow, 1987; A. M.; Williams, Davids, & Williams, 1999). Knowledge is stored as cognitive representations and can be activated in different situations. Furthermore, research has shown that expertise in sports results from interactions between high levels of knowledge and skill levels (Abernethy, Thomas, & Thomas, 1993; French & Thomas, 1987; McPherson & Thomas, 1989). According to SDT, autonomous motivation is crucial for the refinement and integration of knowledge (Deci & Ryan, 1985; Ryan & Deci, 2017). However, most previous motivation research in PE has not distinguished between knowledge and performance even though they are conceptually distinct constructs. Thus, in the current study we investigated them separately (Pintrich, 2003), first expecting need satisfaction and autonomous motivation to relate positively to knowledge.

2.3. Performance

Game-play performance is an important PE outcome that has been shown in initial work to be influenced by teachers' interpersonal styles (Behzadnia, Mohammadzadeh, & Ahmadi, 2017). Studies that have assessed performance in PE, however, have typically not evaluated game-play performance in a way that reflects which skills students learned and how well they performed them during actual game play (e.g., Cheon et al., 2012; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). For example, Vansteenkiste et al. (2004) showed that autonomy-supportive teachers' styles, relative to controlling styles, positively related to autonomous motivation and exercise performance in high school students, using a single item measure of exercise performance (ranging from *very bad* to *very good*). In other studies, students' grades have been used to assess performance. Yet, as stated by Krijgsman et al. (2017), this grade-focus could undermine students' interests and intrinsic motivation (Ames, 1992).

Another study in the middle and high-school PE domain (Cheon et al., 2012) found that autonomy-supportive teaching positively impacted students' skill development, but the researchers used students' self-reports, rather than observations by teachers or outside raters. We further note that the researchers either did not measure sport performance in PE lessons or did not distinguish between the different sports, which may also be important given that each sport requires different abilities and performance elements (e.g., Aelterman et al., 2012; Taylor, Ntoumanis, Standage, & Spray, 2010; Wareham & Rennie, 1998). While these studies provide important initial evidence of a link between autonomy support and performance, we aimed to use a refined measure of performance, by assessing students' game-play performance during PE activities via performance ratings by their teachers regarding students' basic movements, skill executions, and decision making during game play (Memmert & Harvey, 2008; Oslin, Mitchell, & Griffin, 1998). In addition, measuring students' sport performance in PE lessons would provide important feedback related to their actual performance in real environments (Behzadnia, Mohammadzadeh, et al., 2017).

2.4. Intention to persist

Given that PE can foster continued engagement with healthy physical activity behaviors after the PE class ends, we were also interested in the motivational outcome of students' intentions to persist in physical activities in the future. The concept of intention to persist is considered a proximal antecedent of behavior (e.g., Deci, 1975; Terry & O'Leary, 1995), and Sheeran (2002) has demonstrated that intentions strongly predict actual behaviors. In PE, research has shown that students' autonomous motivation for PE in secondary school positively predicted their intentions to engage in physical activities in university (Haerens, Kirk, Cardon, De Bourdeaudhuij, & Vansteenkiste, 2010). Furthermore, autonomy-supportive teaching in college (Behzadnia & Deci, 2017) and school (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Lim & Wang, 2009; Ntoumanis, 2005; Wang, Morin, Ryan, & Liu, 2016) PE programs has been found to be associated with students' intentions to engage in physical activity in the future.

3. The present study

In line with SDT's assertions that basic need satisfaction versus frustration and autonomous versus controlled motivations represent distinct processes with unique outcomes (Bartholomew et al., 2011; Haerens et al., 2015; Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013), the present study aimed to test a theory-based model in which students' perceptions of their teachers' autonomy-supportive versus controlling behaviors relate to students' basic need satisfaction versus frustration, and autonomous versus controlled motivations, which, in turn, relate to well-being and ill-being, game knowledge, game-play performance, and intentions to continue physical activity in the future. In summary, we tested the following hypotheses:

H1: Students' perceptions of teachers' autonomy support would be related to students' positive outcomes in PE through the mediational roles of higher need satisfaction (and/or lower need frustration) and autonomous motivation (and/or lower controlled motivation).

H2: Students' perceptions of teachers' controlling behaviors would be related to students' negative outcomes in PE through higher need frustration (and/or lower need satisfaction) and controlled motivation (and/or lower autonomous motivation).

4. Methods

4.1. Participants and procedure

Participants were 140 first-year college students enrolled in university PE courses in Iran (46 males, 94 females; aged 18–25 years), from 4 classes. In these mandatory PE programs, students can choose from several PE activities, such as physical fitness, basketball,

volleyball, soccer, badminton, table tennis, and track and field. Students must sign up for one of these PE activities, to get PE credit for graduation. In the current study, data were collected from students playing basketball and badminton, because the scheduling of these classes conduced to the most reliable for data collection. Furthermore, these classes were indoor, whereas some outdoor classes (e.g., soccer, track and field) were cancelled due to rain. Sixty-nine percent of students played basketball, and the remaining students played badminton. After gaining the department's and teachers' permission to gather data from the teachers and students, teachers were told that data would be collected during the last session of the semester. The last session was selected so that both the teachers and students would have had considerable experience with each other, thus allowing for more accurate student perceptions of the teachers' styles and also more accurate teacher perceptions of the students' performance. Students were told that this study was being conducted to learn more about psychological factors that influence students' experiences and behaviors in PE classes. Participants completed the measures as a paper-and-pencil survey. Identifying information was not collected. The deputy for research and technology and the University's Ethical Review Board approved the study as being in accordance with guidelines laid down in the Declaration of Helsinki.

All of the measures had previously been translated into and used in Persian, except for the basic psychological needs scale which is discussed below. The internal consistency for all scales is shown in Table 1.

4.2. Measures

4.2.1. Perceived autonomy-supportive and controlling teacher styles

We assessed students' perceptions of instructors' autonomy-support using the short five-item version of the Learning Climate Questionnaire (LCQ; G. C. Williams & Deci, 1996). Students responded to the stem, "In this PE class …". The LCQ includes items such as "I feel that my instructor provides me choices and options." To measure controlling styles, we used the four-item Controlling Teacher Scale (CTS; Jang et al., 2009; Jeon, 2004), which includes items such as "My PE instructor puts a lot of pressure on me." These scales previously had been translated into Persian for an Iranian sample (Aghdasi & Behzadnia, 2016; Ahmadi, Amani, & Behzadnia, 2015). Responses ranged from 1 (*not at all true*) to 7 (*very true*).

In the current study, confirmatory factor analysis (CFA) tested the proposed two-factor model for teachers' interpersonal styles. Initially, the fit indices were not satisfactory, χ^2 = (24) 93.89; p = < .001; RMSEA = .15; RMSEA 90% CI = .12 to .18; CFI = .83; SRMR = .14. The problem concerned the loading of one of the CTS items on the latent construct (viz., "My PE instructor tries to control everything I do"). After removing the item from the analysis, the fit indices yielded a good fit, χ^2 (18) = 28.02; p = .29; RMSEA = .06; RMSEA 90% CI = .00 to .11; CFI = .97; SRMR = .065. All item loadings in the final model were above .36, p < .001.

4.2.2. Basic psychological needs

Haerens et al. (2015) adapted the full Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015) to the context of the PE domain, and in the current study, we adapted the short version (12-items) of the BPNSFS to the PE domain. Each need was assessed with two items for satisfaction and two for frustration. Sample items for need satisfaction included: "I felt a sense of choice and freedom in the things I undertook" (autonomy); "I felt confident that I could do the exercises well" (competence); and "I experienced a warm feeling toward the class members I spent time with" (relatedness). Sample items for need frustration included: "I felt forced to do many exercises I wouldn't choose to do" (autonomy); "I felt disappointed with many of my performances" (competence); and "I felt excluded from the group I wanted to belong to" (relatedness). The stem for this scale was "During PE lessons …". The items were rated from 1 (*not at all true for me*) to 5 (*very true for me*).

The English version of the BPNSFS was translated into Persian by three Iranian bilingual researchers fluent in English. Back translations were done by two psychologists who were also fluent in English. Non-equivalencies and disagreements were resolved through discussions of English speaking researchers and psychologists.

CFA tested the proposed six-factor model for basic needs. The overall 12-item, 6-factor measurement model fit the data reasonably well, χ^2 = (39) 62.56; p = .009; RMSEA = .07; RMSEA 90% CI = .03 to .10; CFI = .96; SRMR = .04. All item loadings in the final model were above .67, p < .001. We also tested a 2-factor CFA for need satisfaction and need frustration, which had adequate fit, χ2 = (47) 85.24; p = .051; RMSEA = .077; RMSEA 90% CI = .05 to .10; CFI = .93; SRMR = .076.

4.2.3. Autonomous and controlled motivation

Students' types of motivation were assessed using the Learning Self-Regulation Questionnaire (SRQ-L; Black & Deci, 2000), which includes two factors: autonomous regulation (five items: e.g., "Because it was interesting to learn more about the nature of PE") and controlled regulation (seven items: e.g., "Because others might think badly of me if I didn't"). The stem for the questionnaire changed in accordance with the items that were used and included: "I participated actively in this PE class …", "I was likely to follow my instructor's suggestions for PE activities …", and "The reason that I worked to expand my knowledge of these activities is …. " The original version of the SRQ (Ryan & Connell, 1989) had been translated and validated previously in an Iranian sample (Behzadnia, Ahmadi, & Amani, 2017). The items were rated from 1 (*not at all true*) to 7 (*very true*).

CFA tested the proposed two-factor model for motivational regulation, but the initial fit indices were not satisfactory, χ^2 = (51) 120.70; p = < .001; RMSEA = .10; RMSEA 90% CI = .08 to .12; CFI = .85; SRMR = .10. The problem concerned the loadings of two of the items on the latent constructs. For autonomous regulation, the item "Because he/she (my instructor) seems to have insight about how best to learn PE" loaded poorly, and for controlled regulation, the item "Because a good grade in PE will look positive on my record" also loaded poorly. After removing the two items from the analysis, the fit indices yielded a satisfactory fit, χ^2 (32) = 54.81; p = .13; RMSEA = .07; RMSEA 90% CI = .04 to .10; CFI = .94; SRMR = .08. All item loadings in the final model were above .45, p < .001.

4.2.4. Wellness

Well-being was assessed with four Positive Affect (PA) items (e.g., pleased, enjoyment/fun), and ill-being was assess with five Negative Affect (NA) items (e.g., unhappy, worried/anxious) (Diener and Emmons (1984). Students were asked, "During PE learning activities, how much did you feel each of the following …. " Items were rated on a scale ranging from 1 (*not at all*) to 7 (*extremely*). Previous research reported acceptable internal reliability for this scale in the PE domain in an Iranian sample (Behzadnia & Ryan, in press).

4.2.5. Knowledge

To measure knowledge, a fifteen-question knowledge test developed by McGee and Farrow (1987) was used, with one version adapted for badminton and one for basketball. Each test assessed overall knowledge comprised of procedural knowledge ('what to do') and declarative knowledge ('how to do it'). It included questions about the rules, techniques, and strategies. A sample question concerning the *rules* for basketball, is: "when may a substitute enter the game? (a) *when the ball is in play*, (b) *during the first period only*, (c) *whenever requested by coach*, (d) *when the ball is dead.*" A sample for badminton *technique* is: "What is the biggest difference in hitting a clear and a smash? (a) *amount of wrist snap*, (b) *angle of the racket face*, (c) *amount of backswing*, (d) *speed of the forward swing.*" A sample for basketball *strategy* is "What is the basic purpose of a zone defense? (a) *To prevent the offensive team from scoring*

Table 1
Descriptive statistics, Cronbach's alpha (in brackets), and Bivariate Correlations between Variables.

		Total Sample	Gender		Sport		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
			Males	Females	Basketball	Badminton																					
		M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)																					
1	Autonomy Support	5.71 (.97)	5.46 (1.01)	5.84 (.93)	5.87 (.97)	5.37 (.89)	(.83)																				
2	Controlling Behaviors	3.41 (1.47)	3.58 (1.46)	3.32 1 (1.47)	3.17 (1.48)	3.92 (1.3)	**-.18**	(.67)																			
3	Need Satisfaction	4.30 (.65)	4.20 (.70)	4.35 (.62)	4.43 (.65)	4.03 (.58)	**.59**	-.14	(.79)																		
4	Autonomy	4.40 (.78)	4.35 (.74)	4.43 (.79)	4.64 (.63)	3.89 (.81)	**.58**	**-.25**	**.82**	(.79)																	
5	Competence	4.35 (.76)	4.21 (.89)	4.41 (.69)	4.42 (.81)	4.18 (.62)	**.31**	-.10	**.67**	**.37**	(.74)																
6	Relatedness	4.16 (.98)	4.05 (1.1)	4.21 (.91)	4.22 (1.03)	4.01 (.85)	**.47**	-.01	**.83**	**.56**	**.27**	(.78)															
7	Need Frustration	2.14 (.88)	2.38 (1.02)	2.02 (.77)	1.95 (.80)	2.56 (.89)	**-.32**	**.31**	**-.33**	**-.33**	**-.24**	**-.22**	(.77)														
8	Autonomy	2.35 (1.18)	2.53 (1.28)	2.27 (1.13)	2.08 (1.11)	2.94 (1.13)	**-.30**	**.28**	**-.23**	**-.35**	-.07	-.13	**.78**	(.72)													
9	Competence	2.13 (1.14)	2.41 (1.20)	1.99 (1.09)	2.05 (1.12)	2.31 (1.18)	-.16	**.25**	**-.22**	-.11	**-.27**	-.13	**.79**	**.46**	(.78)												
10	Relatedness	1.95 (1.12)	2.21 (1.19)	1.82 (1.07)	1.73 (1.08)	2.42 (1.06)	**-.26**	**.18**	**-.32**	**-.30**	**-.21**	**-.23**	**.71**	**.31**	**.34**	(.72)											
11	Autonomous Motivation	5.72 (1.17)	5.59 (1.03)	5.79 (1.23)	6.02 (1.10)	5.07 (1.04)	**.55**	**-.17**	**.53**	**.52**	**.38**	**.34**	**-.24**	**-.24**	-.10	**-.19**	(.83)										
12	Intrinsic	5.68 (1.22)	5.64 (1.09)	5.70 (1.28)	6.05 (1.13)	4.88 (1.02)	**.53**	**-.17**	**.55**	**.58**	**.39**	**.34**	**-.28**	**-.29**	-.11	**-.23**	**.87**	(.67)									
13	Identified	6.00 (1.03)	5.78 (.99)	6.11 (1.04)	6.21 (.99)	5.56 (.99)	**.51**	**-.17**	**.45**	**.43**	**.33**	**.30**	**-.28**	**-.25**	**-.19**	**-.20**	**.91**	**.63**	(.74)								
14	Controlled Motivation	5.12 (1.10)	4.97 (1.13)	5.19 (1.09)	5.17 (1.15)	5.00 (.99)	.11	.10	**.18**	**.20**	**.22**	.04	.01	.01	.03	-.03	**.33**	**.27**	**.34**	(.68)							
15	Introjection	5.07 (1.31)	4.96 (1.39)	5.12 (1.27)	5.11 (1.35)	4.98 (1.23)	.00	.15	.10	.13	**.18**	-.04	.03	.04	.06	-.04	**.27**	**.22**	**.28**	**.90**	(.50)						
16	External	5.60 (1.12)	5.42 (1.22)	5.68 (1.06)	5.63 (1.19)	5.51 (.95)	.03	.05	.12	.10	**.24**	-.02	-.06	-.04	-.05	-.06	**.26**	**.23**	**.30**	**.86**	**.87**	(.59)					
17	Positive Affect	5.87 (1.23)	5.74 (1.20)	5.93 (1.24)	6.27 (.95)	4.99 (1.32)	**.43**	**-.24**	**.50**	**.60**	**.25**	**.34**	**-.32**	**-.35**	-.15	**-.23**	**.58**	**.57**	**.49**	**.17**	.15	.13	(.86)				
18	Negative Affect	1.96 (1.07)	2.25 (1.04)	1.82 (1.05)	1.76 (1.00)	2.40 (1.08)	**-.28**	**.33**	**-.32**	**-.38**	−16	**-.21**	**.54**	**.44**	**.52**	**.26**	**-.25**	**-.26**	**-.27**	.02	.05	-.06	**-.42**	(.82)			
19	Knowledge	6.85 (2.33)	5.72 (2.53)	7.40 (2.03)	7.50 (2.16)	5.43 (2.08)	**.27**	**-.25**	**.28**	**.30**	.13	**.21**	**-.32**	**-.20**	**-.18**	**-.36**	**.35**	**.35**	**.36**	**.21**	.15	.14	**.34**	**-.32**	(.60)		
20	Performance	5.86 (1.92)	6.17 (1.79)	5.70 (1.98)	5.90 (2.02)	5.76 (1.72)	**.18**	-.07	.15	.16	.07	.12	-.06	.03	-.07	-.09	**.21**	.13	**.20**	-.03	-.04	-.06	**.28**	-.02	.03	(.85)	
21	Intention	4.82 (1.90)	4.86 (2.06)	4.79 (1.82)	5.12 (1.77)	4.16 (2.00)	**.50**	-.14	**.36**	**.44**	.09	**.29**	**-.23**	**-.33**	-.08	-.10	**.51**	**.49**	**.45**	.05	-.01	-.05	**.49**	**-.18**	**.18**	**.24**	(.94)

Notes: Values above .17 are significant at $p < .05$ (2-tailed); values above .22 are significant at $p < .01$ (2-tailed); and values above .29 are significant at $p < .001$. Bold values are significant. Values in the parentheses present the Cronbach's alphas.

easy shots, (b) *to prevent the offensive team from using the fast break*, (c) *to prevent the defensive team from tiring easily*, (d) *to prevent the defensive team from committing many fouls*". Six expert judges who had multiple years of teaching badminton and basketball at the university level indicated that the questions reflected the aims of the unit, thus supporting the questionnaire's validity.

Inter-item correlations indicated low correlations for three of the Knowledge items (Cronbach's α = .40), so, they were removed, which improved the Cronbach's α to 0.60. Items removed included two questions for technique and one for strategy in each sport.

4.2.6. Game performance assessment instrument

Participants' game-play performance was evaluated using the Game Performance Assessment Instrument (GPAI; Oslin et al., 1998). We adapted the GPAI to badminton and basketball, based on the Mitchell and Oslin (1999) and Memmert and Harvey (2008) studies. The GPAI is a multidimensional instrument that evaluates tactical understanding and the ability to solve tactical problems by choosing appropriate skills using the observable criteria/components of game-play performance. The criteria/components included, "*base* (return to recovery or home positions between skill attempts − appropriate position at mid court), *decision making* (makes appropriate choices about which skills to use, or what to do in different positions) and *skill execution* (executes chosen skills proficiently and efficiently)". Participants' game-play performance was assessed using a 10-point scale: score of 10 = *Very effective performance* (meets the criteria/components on every attempt), score of 8 = *Effective performance* (consistently meets the criteria/components, but not always), score of 6 = *Moderately effective performance* (meets the criteria/components, but not consistently), score of 4 = *Weak performance* (rarely meets the criteria/components), and score of 2 = *Very weak performance* (shows no awareness of the criteria/components).

The teachers attended two instructional sessions regarding the use of the GPAI, which provided them the means of observing and assessing student game-play performance, which they did during the final session of the semester while the students were playing the game. Observations were done during a 15–20 min period. The average mean of three criteria/components (i.e., base, decision making, and skill execution) provided the measure of the overall game-play performance. Previous research reported acceptable reliability for this scale in the PE domain in an Iranian sample (Behzadnia, Mohammadzadeh, et al., 2017).

4.2.7. Intentions

Intention to engage in the same sport during subsequent months was assessed with three items adapted from Chatzisarantis, Biddle, and Meek (1997). The three items included "I intend to play the sport (badminton/basketball) in the next semester/months" "I am determined to play the sport in the next semester/months" and "I plan to play the sport in the next semester/months." Items were rated on a scale ranging from 1 (*very unlikely*) to 7 (*very likely*). Previous research reported acceptable internal reliability of this scale in the PE domain in samples from the UK (Standage et al., 2003) and in college sports in Iran (Keshtidar & Behzadnia, 2017).

5. Results

5.1. Preliminary analyses

The univariate distributions of the study variables were examined for skewness and kurtosis values. Variables were considered to be non-normal if the values of skewness and kurtosis were greater than ± 2.00 (Tabachnick & Fidell, 2013). The variables were normally distributed, ranging from 1.29 to −1.17 for skewness, and from 1.38 to −.79 for kurtosis. Table 1 presents the descriptive statistics, reliability estimates, and bivariate correlations between each pair of the study variables. In line with our hypotheses, perceived teachers' autonomy support was positively correlated with need satisfaction, autonomous motivation, and the positive outcomes of positive affect (i.e., well-being), knowledge, performance, and intentions. Perceived teachers' control was positively correlated with need frustration and negative affect (i.e., ill-being). In addition, need satisfaction was positively correlated with autonomous and controlled motivation and with positive affect, knowledge, and intentions to persist, and it correlated negatively with negative affect. Need frustration was positively related with negative affect and negatively related to positive affect, knowledge, and intentions. Autonomous motivation was correlated positively with positive affect, knowledge, performance, and intention and it was correlated negatively with negative affect. Controlled motivation correlated positively with positive affect and knowledge.

Next, we conducted a MANOVA to test for mean gender differences on the study variables. The omnibus test was significant (Wilks' Lambda = .83, $F_{(11,\ 128)} = 2.44$, $p = 009$, *partial eta square* = .17). Follow up analyses showed that females perceived more autonomy support ($F_{(1,\ 139)} = 4.81$, $p = .03$, *partial eta square* = .03) and displayed greater knowledge ($F_{(1,\ 139)} = 18.10$, $p < .001$, *partial eta square* = .12) compared to males. Further, females were lower on need frustration ($F_{(1,\ 139)} = 5.37$, $p = .022$, *partial eta square* = .04) and negative affect ($F_{(1,\ 139)} = 5.05$, $p = .026$, *partial eta square* = .04). Thus, we included gender as a covariate in the path model.

5.2. Path model results

To examine the main hypotheses that students' need satisfaction and need frustration as well as autonomous and controlled motivation would mediate the relations of students' perceived teachers' autonomy support (H1) and control (H2) on the outcomes of positive and negative affect, knowledge, performance, and intentions to persist, we estimated a path model in Mplus (see Fig. 1). Specifically, we estimated paths from perceived teachers' autonomy support and control to the mediator variables of students' need satisfaction and frustration, and autonomous and controlled motivation, and from the mediator variables to the outcome variables of positive and negative affect, knowledge, performance, and intention to persist. In addition, consistent with SDT's contention that need satisfaction and frustration can conduce to autonomous and controlled motivations, we also included paths from the need variables to the motivation variables. Gender was included as a covariate, and covariances were estimated between teaching behaviors, between need satisfaction and frustration, between autonomous and controlled motivation, and between the outcomes, as these relations are theoretically grounded in SDT and consistent with past research. Although model fit was adequate: χ^2 (10) = 21.19, $p = .02$, CFI = .97, RMSEA = .089 (.034, .143), SRMR = .03, the modification indices suggested a path from autonomy support to intention in order to increase model fit. The inclusion of this path resulted in excellent model fit, so the path was retained in the final model, χ^2 (9) = 9.36, $p = .41$, CFI = 1.00, RMSEA = .017 (.000, .098), SRMR = .02. This direct relation from autonomy support toward intention also is consistent with SDT, which suggests that autonomy support can have direct relations with outcomes such as intention to continue (Ryan & Deci, 2017).

The results showed that autonomy support related significantly positively to need satisfaction and negatively to frustration, as well as positively to autonomous motivation and intentions. In addition, need satisfaction significantly positively related to autonomous motivation and positive affect, and there was a trend toward a positive relation to controlled motivation. Autonomous motivation related significantly positively to positive affect, knowledge, performance, and intentions to persist. In contrast, perceived teacher control related to need frustration, and need frustration related significantly positively to negative affect, and related negatively to positive affect and knowledge.

Given these significant paths, we then examined the indirect relations of perceived autonomy support and perceived control to the outcomes through the mediating variables, using bias-corrected bootstrapping (bootstrap samples = 5000, Hayes, 2013; see Table 2).

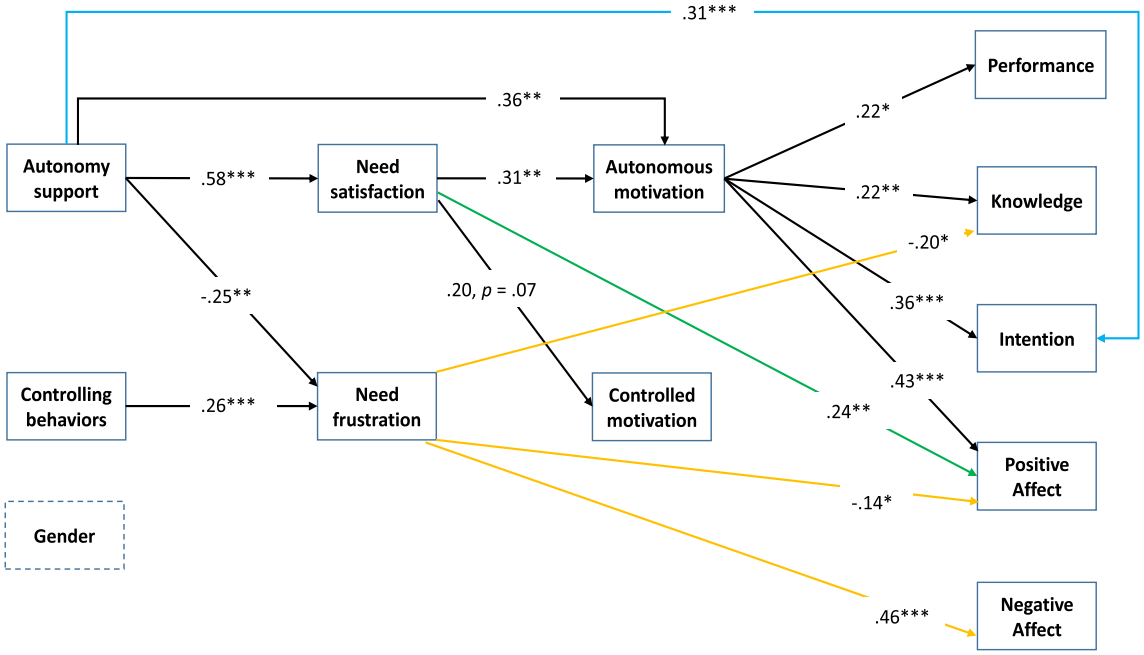

Fig. 1. The path model assessing the predictive effects of teachers' interpersonal styles on students' PE outcomes via need satisfaction and frustration, and autonomous and controlled motivation. The covariate of gender is indicted with dashed lines. Only significant paths and standardized regression weights from main variables are reported. Correlations among variables and paths from the covariate are not shown due to model complexity.

Table 2
Indirect effects of teachers' interpersonal behaviors on students' outcomes through need satisfaction and frustration, and autonomous and controlled motivation.

Indirect effect	β	95% CI
Autonomy support → need satisfaction → positive affect	14**	04, .25
Autonomy support → need satisfaction → autonomous motivation → positive affect	08*	03, .15
Autonomy support → need satisfaction → autonomous motivation → knowledge	04*	01, .09
Autonomy support → need satisfaction → autonomous motivation → performance	04†	01, .10
Autonomy support → need satisfaction → autonomous motivation → intention	07*	.02, .13
Autonomy support → need frustration → negative affect	-.11**	-.20, −.05
Autonomy support → need frustration → knowledge	05*	01, .11
Controlling behaviors → need frustration → negative affect	12**	04, .21
Controlling behaviors → need frustration → knowledge	-.05†	-.11, −.01
Autonomy support → autonomous motivation → positive affect	15**	.06, .29
Autonomy support → autonomous motivation → performance	08†	01, .20
Autonomy support → autonomous motivation → intention	13*	04, .27

Notes. †p = or < .10 *p < .05 **p < .01 ***p < .001. Bias-corrected 95% confidence intervals (bootstrap samples = 5000).

Consistent with H1, there were significant indirect relations from autonomy support to need satisfaction, need frustration, and/or autonomous motivation, to positive affect, knowledge, and intentions to persist. There were also trends from autonomy support to need satisfaction and/or autonomous motivation, to performance. In addition, we found some support for H2, as there were significant indirect relations from perceived teacher control to need frustration, to negative affect, and negatively to knowledge. Each indirect relation listed in Table 2 is unique.

5.3. Sport as a moderator

We also examined whether the pattern of results differed between the two sports (badminton versus basketball) by including sport as a moderator. The pattern of findings did not differ as a function of sport ($p > .05$ in χ^2_{diff} test between constrained and unconstrained models).

6. Discussion

In addition to helping students acquire new knowledge and skills, a critical goal for educators is to foster students' desire to continue learning and to support their wellness during the learning process (Ryan & Deci, 2017). Importantly, teachers' interpersonal styles can play a key role in these student outcomes (e.g., Jang, Kim, & Reeve, 2016). The goal of the present study, therefore, was to take an SDT-based approach to examine whether teachers' interpersonal styles related to college students' PE outcomes via students' psychological needs and motivation. Generally, the results supported our hypotheses, as path analysis showed that perceptions of teachers' autonomy support related positively to students' basic need satisfaction (and negatively to need frustration), autonomous motivation, and the positive outcomes of well-being, knowledge, performance, and intention to continue physical activity. Furthermore, perceptions of teachers' controlling behaviors were related to students' basic need frustration, and, need frustration was related to higher negative affect, lower positive affect, and lower knowledge. These findings built on of research in this domain with elementary and high school students, and, to our knowledge, this work is the first to find evidence of these SDT-based associations among college PE students, suggesting that these links are not limited to earlier developmental periods.

Importantly, the current findings are in line with SDT's notion that psychological needs and autonomous motivation are underlying mechanisms of the associations between autonomy support and positive PE outcomes (Ryan & Deci, 2017). Specifically, we found several significant indirect predictive relations from perceived teachers' autonomy support to well-being, knowledge, and intentions to persist, and there were trending indirect relations to performance, through students' need satisfaction and frustration, and autonomous motivation.

In line with SDT (Ryan & Deci, 2017), the results showed that autonomy support was indirectly positively related to well-being through

the mediators of need satisfaction and autonomous motivation, and negatively related to ill-being through the mediator of need frustration. In contrast, teachers' controlling behaviors indirectly positively related to ill-being through need frustration. The observed relations are in line with previous research in elementary PE (Ntoumanis, 2005; Standage et al., 2005), sport schools (Mouratidis et al., 2008), and sport domains (Felton & Jowett, 2013), suggesting that autonomy-supportive behaviors may facilitate students' well-being and reduce ill-being, whereas controlling behaviors may enhance students' ill-being (Deci & Ryan, 2013).

We believe the most important contribution of the current study is that we investigated the outcomes of knowledge and performance separately and used a comprehensive measure of performance, in contrast to the majority of studies that have not distinguished between these two outcomes and did not measure sport performance results from PE lessons. Of interest, autonomous motivation was significantly related to both knowledge and performance, suggesting that when college students are autonomously motivated in PE, they are more likely to acquire PE knowledge and to utilize effectively the skills they learn during game play. There were significant indirect predictive relations from autonomy support to knowledge and there were trends to performance, via need satisfaction and autonomous motivation. Furthermore, controlling teaching styles indirectly related to lower levels of knowledge through need frustration, although they were not related to performance. These results should encourage researchers to continue to examine knowledge and performance separately when possible. Furthermore, the observed associations with performance are in line with Haerens et al. (2017) findings that autonomy support from coaches were positively related to their ratings of athletes' performance, suggesting that autonomy supportive teaching styles, need satisfaction, and autonomous motivation may enhance not only students' well-being and intention to persist at an activity, but also their performance at the activity.

Of interest, we also found a significant direct association between autonomy support and intention to persist, independent of need satisfaction or frustration and autonomous motivation. This result suggests that there is something unique about teachers' autonomy support that may foster students' intention to continue to be physically active, beyond the facilitation of student's need satisfaction and autonomous motivation for physical activity. Yet, given the cross-sectional nature of the study, it is also possible that teachers recognize students who are putting in extra effort and hence are likely to continue to be physically active in the future, and give these students greater autonomy support than they do to the students who are less effortful. Longitudinal research designs are needed to examine the direction of effects, as well as to investigate how college teachers' teaching styles change or remain stable over time.

In addition, we investigated the relatively understudied predictive relations of perceived teachers' controlling behaviors on negative PE outcomes via need frustration and controlled motivation. The results showed that controlling behaviors were related to higher levels of students' need frustration, which, in turn, was associated with higher levels of negative affect and lower levels of knowledge. In contrast, there were no significant indirect relations through students' controlled motivation. Furthermore, previous research with secondary school students also found a lack of significant correlations between controlled motivation and positive outcomes such as engagement in PE (e.g., Aelterman et al., 2012). Thus, the present study replicates these findings at the collegiate level of PE.

The autonomous types of motivation (intrinsic and identified) were positively related (smaller in magnitude) to the controlled types of motivation (introjection, external regulation), which is consistent with past research demonstrating the simplex pattern of correlations within the motivational continuum. When controlling for the association between autonomous and controlled motivation in the path model, controlled motivation did not significantly relate to the outcomes, whereas autonomous motivation was related to each outcome except for negative affect. Consistent with past research in a myriad of domains, these findings support SDT's notion that autonomous motivation is, in fact, of higher quality than controlled motivation. That is, autonomous motivation was more strongly associated with positive PE outcomes than controlled motivation, when competing for shared variance. Consistent with SDT, we also found that students' perceptions of teachers' autonomy support were negatively associated with perceptions of teachers controlling behaviors. However, this correlation (−.18) appeared somewhat smaller than those obtained in the sports domain (Bartholomew et al., 2011) and in secondary school PE classes (Haerens et al., 2015; Haerens et al., 2017; Jang, Kim, et al., 2016). More research is needed to examine whether this smaller correlation replicates in collegiate PE samples, both from Iran and other geographic locations.

6.1. Practical implications

The current results suggest that when college PE teachers support their student's autonomy, such as providing their students with choices and options, understanding their perspectives, and listening to their opinions, the teachers can enhance students' need satisfaction and autonomous motivation, which, in turn, fosters well-being and the other positive educational outcomes of knowledge, performance, and intention to persist at physical activity. In contrast, when teachers take a more controlling approach to teaching, such as pressuring students to do certain activities and demanding that they behave in certain ways, their students' basic psychological needs will be frustrated, and, in turn, the outcomes will be less positive than if their needs were satisfied. Raising awareness among teachers of the impact of their interpersonal styles on students' psychological need satisfaction (vs. frustration) and motivation can provide teachers with important criteria to evaluate the effectiveness of their personal approaches to teaching.

For example, students often need first to learn various fundamental skills and actions (e.g., shooting form or passing plays in basketball; different swing techniques in badminton to make different types of shots) in order to develop their overall ability and perform well in PE. The process of learning some of these basic skills may lack excitement and might even be boring for students, and thus PE teachers may feel the need to be somewhat controlling and apply pressure to students in order to get them to put effort into these tasks. The take-home point from our results, however, is that this controlling style can often backfire and further damage students' need satisfaction, performance, and well-being. In order to be less controlling in one's teaching style, there are certain controlling behaviors that are best avoided, such as conditional regard tactics (i.e., either withdrawing support and affection when students do not do what the teacher wants, or giving more support and affection when students do what the teacher wants) or using rewards or punishments to try to motivate students or get them to behave a certain way. Instead, striving to instruct students in autonomy-supportive ways, such as acknowledging students' negative feelings toward certain tasks, providing them with specific rationales about why the basic skills are helpful for their game-play, and providing some choice when possible, will yield better results.

6.2. Directions for future research and limitations

Although the current research demonstrated predictive relations of collegiate PE teachers' autonomy-supportive behaviors to collegiate PE students' well-being, knowledge, performance, and intention to persist at physical activity, it is unclear whether support for the other psychological needs of competence and relatedness would also play a significant role in this association. Thus, in order to make causal conclusions, future experimental research should examine how collegiate PE teachers' supports for competence (e.g., providing students' with optimal challenges and informational feedback) and relatedness (e.g., showing students that they are personally cared for and valued) relate

to collegiate PE students' need satisfaction, motivation, and positive PE outcomes. Such experimental designs would enable researchers to test whether teaching styles cause increases in students need satisfaction, autonomous motivation, and positive PE outcomes such as well-being, learning, and performance.

In addition, we examined more positive than negative PE outcomes in the current study, and thus a greater inspection of negative PE outcomes is needed. For example, although the current research showed that controlling behaviors were associated with higher levels of negative affect and lower levels of knowledge through need frustration, further research is needed to better understand how control and basic need frustration leads to other maladaptive PE outcomes such as boredom, drop out, and increased sedentary behavior outside of the class. The current research would also be complemented by methodological variations, such as employing longitudinal investigations to examine how teachers' interpersonal behaviors relate to PE outcomes over time.

A limitation of the current study is that the sample size was relatively small. Thus, we could not test a latent variable model, and instead used the composites of basic need satisfaction and frustration, and autonomous and controlled motivation in the path model. Future research is thus needed to examine a latent variable model in which each basic need and motivation type (e.g., identified, introjected, etc.) is included separately, to measure the specific role of each variable. In addition to student reports of teachers' interpersonal styles, it would also be important to include other measures of teachers' autonomy-supportive and controlling behaviors, such as teacher or experimenter ratings. Moreover, future research should examine a wider variety of sports (e.g., volleyball) to address the multi-level structure in collegiate PE.

In addition, we did not examine the associations between teachers' interpersonal styles and students' amotivation in the current research. For example, it may be that teachers' controlling behaviors are related to higher levels of amotivation for physical activity, which, in turn, is associated with negative PE outcomes such as negative affect and dropout. Future research should include assessments of students' amotivation toward physical activity in PE classes.

7. Conclusion

In the current research, we took an SDT-based approach to examining whether teachers' interpersonal styles were associated with college students' PE outcomes via students' psychological needs and types of motivation. Overall, our hypotheses were supported, as the results showed that students' perceptions of their teachers' autonomy support were positively related to students' basic need satisfaction and autonomous motivation, and, in turn, to the positive outcomes of well-being (i.e., positive affect), knowledge, performance, and intention to continue with physical activity. In contrast, teachers' controlling behaviors were associated with students' basic need frustration, and, in turn, higher negative affect and lower positive affect and knowledge. These findings have important implications for teachers as they suggest that supporting students' choices and decision-making, and respecting them as autonomous individuals, while also minimizing controlling and pressuring behaviors, can help students learn new knowledge and skills while enhancing their well-being and desire to continue learning.

References

Abernethy, B., Thomas, K. T., & Thomas, J. R. (1993). Strategies of improving understanding of motor expertise. In J. L. Starkes, & F. Allard (Eds.). *Cognitive issues in motor expertise* (pp. 317–356). Amsterdam: Elsevier.

Aelterman, N., Vansteenkiste, M., Van Keer, H., Van den Berghe, L., De Meyer, J., & Haerens, L. (2012). Students' objectively measured physical activity levels and engagement as a function of between-class and between-student differences in motivation toward physical education. *Journal of Sport & Exercise Psychology, 34*(4), 457–480.

Aghdasi, M. T., & Behzadnia, B. (2016). Predicting psychological needs and well-being of athlete Students: The role of coaches. *Sport Psychology Studies, 5*(16), 1–18. https://doi.org/10.22089/spsyj.2016.731.

Ahmadi, M., Amani, J., & Behzadnia, B. (2015). Autonomy-supportive and controlling environment, motivation, and intention to continue sport participation in Adolescents: Study of self-determination theory. *Sport Psychology Studies, 3*(10), 99–112.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261.

Anderson, J. R. (1987). Skill acquisition: Compilation of weak-method problem situations. *Psychological Review, 94*(2), 192–210.

Bartholomew, K. J., Ntoumanis, N., Mouratidis, A., Katartzi, E., Thøgersen-Ntoumani, C., & Vlachopoulos, S. (2018). Beware of your teaching style: A school-year long investigation of controlling teaching and student motivational experiences. *Learning and Instruction, 53*, 50–63.

Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology Bulletin, 37*(11), 1459–1473.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497.

Behzadnia, B., Ahmadi, M., & Amani, J. (2017). The factorial structure of the self-regulation questionnaire in college physical education classes (SRQ-PE). *Research on Sport Management and Motor Behavior, 7*(13), 39–48.

Behzadnia, B., & Deci, E. L. (2017). Teachers' autonomy support and positive physical-education outcomes. *Paper presented at the 10th anniversary meeting of the society for the study of motivation, Boston, MA*.

Behzadnia, B., Mohammadzadeh, H., & Ahmadi, M. (2017). Autonomy-supportive behaviors promote autonomous motivation, knowledge structures, motor skills learning and performance in physical education. *Current Psychology*. https://doi.org/10.1007/s12144-017-9727-0.

Behzadnia, B., & Ryan, R. M. (in press). Eudaimonic and Hedonic Orientations in Physical Education and Their Relations with Motivation and Wellness. International Journal of Sport Psychology.

Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science Education, 84*(6), 740–756. https://doi.org/10.1002/1098-237x(200011)84:6<740::Aid-Sce4>3.0.Co;2–3.

deCharms, R. (1968). *Personal causation: The internal affective determinants of behavior.* New York: Academic Press.

Chatzisarantis, N. L. D., Biddle, S. J. H., & Meek, G. A. (1997). A self-determination theory approach to the study of intentions and the intention–behaviour relationship in children's physical activity. *British Journal of Health Psychology, 2*(4), 343–360.

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., ... Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion, 39*(2), 216–236.

Cheon, S. H., & Reeve, J. (2015). A classroom-based intervention to help teachers decrease students' amotivation. *Contemporary Educational Psychology, 40*, 99–111. https://doi.org/10.1016/j.cedpsych.2014.06.004.

Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers Be more autonomy supportive toward their students. *Journal of Sport & Exercise Psychology, 34*(3), 365–396.

Cheon, S. H., Reeve, J., & Ntoumanis, N. (2018). A needs-supportive intervention to help PE teachers enhance students' prosocial behavior and diminish antisocial behavior. *Psychology of Sport and Exercise, 35*, 74–88.

Cheon, S. H., Reeve, J., & Song, Y. G. (2016). A teacher-focused intervention to decrease PE students' amotivation by increasing need satisfaction and decreasing need frustration. *Journal of Sport & Exercise Psychology, 38*(3), 217–235. https://doi.org/10.1123/jsep.2015-0236.

Deci, E. L. (1975). *Intrinsic motivation.* New York: Plenum Press.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior.* New York: Plenum.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227–268. https://doi.org/10.1207/S15327965pli1104_01.

Deci, E. L., & Ryan, R. M. (2013). The importance of autonomy for development and well-being. In B. W. Sokol, F. M. E. Grouzet, & U. Muller (Eds.). *Self-regulation and autonomy: Social and developmental dimensions of human conduct* (pp. 19–46). Cambridge, England: Cambridge University Press.

Diener, E., & Emmons, R. A. (1984). The independence of positive and negative affect. *Journal of Personality and Social Psychology, 47*(5), 1105–1117.

Felton, L., & Jowett, S. (2013). "What do coaches do" and "how do they relate": Their effects on athletes' psychological needs and functioning. *Scandinavian Journal of Medicine & Science in Sports, 23*(2), e130–e139.

French, & Thomas (1987). The relation of knowledge development to children's basketball performance. *Journal of Sport Psychology, 9*, 15–32.

Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., & Van Petegem, S. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students' motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise, 16*, 26–36.

Haerens, L., Kirk, D., Cardon, G., De Bourdeaudhuij, I., & Vansteenkiste, M. (2010). Motivational profiles for secondary school physical education and its relationship to the adoption of a physically active lifestyle among university students. *European Physical Education Review, 16*(2), 117–139.

Haerens, L., Vansteenkiste, M., De Meester, A., Delrue, J., Tallir, I., Vande Broek, G., ... Aelterman, N. (2017). Different combinations of perceived autonomy support and control: Identifying the most optimal motivating style. *Physical Education and Sport Pedagogy,* 1–21.

Hagger, M. S., Chatzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: A trans-contextual model. *Journal of Educational Psychology, 95*(4), 784.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach.* Guilford Press.

Jang, H., Kim, E. J., & Reeve, J. (2016). Why students become more engaged or more disengaged during the semester: A self-determination theory dual-process model. *Learning and Instruction, 43*, 27–38. https://doi.org/10.1016/j.learninstruc.2016.01.002.

Jang, H., Reeve, J., & Halusic, M. (2016). A new autonomy-supportive way of teaching that increases conceptual Learning: Teaching in students' preferred ways. *The Journal of Experimental Education, 84*(4), 686–701. https://doi.org/10.1080/00220973.2015.1083522.

Jang, H., Reeve, J., Ryan, R. M., & Kim, A. (2009). Can self-determination theory explain what underlies the productive, satisfying learning experiences of collectivistically oriented Korean students? *Journal of Educational Psychology, 101*(3), 644.

Jeon, S. (2004). *A self-determination theory analysis of Korean students' motivation, engagement, and achievement.* Unpublished manuscript, University of Iowa.

Keshtidar, M., & Behzadnia, B. (2017). Prediction of intention to continue sport in athlete students: A self-determination theory approach. *PLoS One, 12*(2) e0171673.

Krijgsman, C., Vansteenkiste, M., van Tartwijk, J., Maes, J., Borghouts, L., Cardon, G., ... Haerens, L. (2017). Performance grading and motivational functioning and fear in physical education: A self-determination theory perspective. *Learning and Individual Differences, 55*, 202–211.

Lim, B. S. C., & Wang, C. K. J. (2009). Perceived autonomy support, behavioural regulations in physical education and physical activity intention. *Psychology of Sport and Exercise, 10*(1), 52–60.

McGee, R., & Farrow, A. (1987). *Test questions for physical education activities.* Champaign, IL: Human Kinetics.

McPherson, S. L., & Thomas, J. R. (1989). Relation of knowledge and performance in boys' tennis: Age and expertise. *Journal of Experimental Child Psychology, 48*(2), 190–211.

Memmert, D., & Harvey, S. (2008). The game performance assessment instrument (GPAI): Some concerns and solutions for further development. *Journal of Teaching in Physical Education, 27*(2), 220–240.

Mitchell, S. A., & Oslin, J. L. (1999). An investigation of tactical transfer in net games. *European Journal of Physical Education, 4*(2), 162–172.

Mouratidis, A., Vansteenkiste, M., Lens, W., & Sideridis, G. (2008). The motivating role of positive feedback in sport and physical education: Evidence for a motivational model. *Journal of Sport & Exercise Psychology, 30*(2), 240–268.

Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology, 71*(2), 225–242.

Ntoumanis, N. (2005). A prospective study of participation in optional school physical education using a self-determination theory framework. *Journal of Educational Psychology, 97*(3), 444.

Ntoumanis, N., Barkoukis, V., Gucciardi, D. F., & Chan, D. K. C. (2017). Linking coach interpersonal style with athlete doping intentions and doping use: A prospective study. *Journal of Sport & Exercise Psychology, 39*(3), 188–198.

Ntoumanis, N., & Standage, M. (2009). Morality in sport: A self-determination theory perspective. *Journal of Applied Sport Psychology, 21*(4), 365–380.

Oslin, J. L., Mitchell, S. A., & Griffin, L. L. (1998). The game performance assessment instrument (GPAI): Development and preliminary validation. *Journal of Teaching in Physical Education, 17*(2), 231–243.

Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology, 95*(4), 667.

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality, 63*(3), 397–427.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*(5), 749.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologists, 55*(1), 68–78.

Ryan, R. M., & Deci, E. L. (2016). Facilitating and hindering motivation, learning, and well-being in schools. In K. R. Wentzel, & D. Miele (Eds.). *Handbook of motivation at school* (pp. 96–119). New York: Routledge.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development and wellness.* New York: Guilford.

Sheeran, P. (2002). Intention—behavior relations: A conceptual and empirical review. *European Review of Social Psychology, 12*(1), 1–36.

Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology, 95*(1), 97.

Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology, 75*(3), 411–433.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6 ed.). Boston: Pearson.

Taylor, I. M., & Ntoumanis, N. (2007). Teacher motivational strategies and student self-determination in physical education. *Journal of Educational Psychology, 99*(4), 747.

Taylor, I. M., Ntoumanis, N., Standage, M., & Spray, C. M. (2010). Motivational predictors of physical education students' effort, exercise intentions, and leisure-time physical activity: A multilevel linear growth analysis. *Journal of Sport & Exercise Psychology, 32*(1), 99–120.

Terry, D. J., & O'Leary, J. E. (1995). The theory of planned behaviour: The effects of perceived behavioural control and self-efficacy. *British Journal of Social Psychology, 34*(2), 199–220.

Tessier, D., Sarrazin, P., & Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers' interpersonal style, students motivation and psychological need satisfaction in sport-based physical education. *Contemporary Educational Psychology, 35*(4), 242–253.

Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*(3), 263.

Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology, 87*(2), 246.

Wang, J. C. K., Morin, A. J. S., Ryan, R. M., & Liu, W. C. (2016). Students' motivational profiles in the physical education context. *Journal of Sport & Exercise Psychology,* 1–46.

Wareham, N., & Rennie, K. (1998). The assessment of physical activity in individuals and populations: Why try to be more precise about how physical activity is assessed? *International Journal of Obesity, 22*, S30–S38.

White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review, 66*(5), 297–233 https://doi.org/10.1037/h0040934.

Williams, A. M., Davids, K., & Williams, J. G. P. (1999). *Visual perception and action in sport.* Taylor & Francis.

Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and Social Psychology, 70*(4), 767–779. https://doi.org/10.1037//0022-3514.70.4.767.

Wuest, D. A., & Bucher, C. A. (1999). *Foundation of physical education and sports* (13 ed.). Boston: WCB/McGrawHill.