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A Model of Contextual Motivation in Physical Education: Using Constructs From Self-Determination and Achievement Goal Theories to Predict Physical Activity Intentions

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Assessing the motivational responses of 328 secondary school students, this study examined a model of student motivation in physical education that incorporated constructs from achievement goal and self-determination theories. The focus was on the prediction of students' intention to partake in physical activity outside of physical education. Structural equation modeling analysis supported a model in which an autonomy-supportive climate, and to a lesser extent perceptions of a mastery climate, positively impacted hypothesized mediating variables (i.e., autonomy, competence, relatedness) to foster self-determined motivation. Self-determined motivation was found to positively predict, whereas amotivation was a negative predictor of leisure-time physical activity intentions.

In recent years, there has been growing concern regarding the number of children and adolescents adopting sedentary lifestyles (cf. Biddle, Sallis, & Cavill, 1998). Not only does inactivity have profound effects on the health of the young (e.g., as a contributor to child obesity; Sallis, Patterson, Buono, & Nader, 1988), but also such incapacity toward physical activity when young may have ramifications for health across the life span (Sallis & McKenzie, 1991). Moreover, it has been suggested that a physically active lifestyle in adulthood may originate from an active lifestyle in one's adolescent years (cf. Shephard & Trudeau, 2000). A context in which health enhancement, via the fostering of physical activity, may be achieved and extended to virtually all children is physical education (PE; Haywood, 1991; Sallis et al., 1992). However, despite holding such promise for the promotion of public health, interest and participation in PE has been shown to decline with age (Van Wersch, Trew, & Turner, 1992). With this in mind, a fundamental concern for researchers interested in both optimizing the motivation of young people in PE settings and potentially impacting physical well-being among the general population is an understanding of the diverse motivational processes that account for varying levels of PE student investment.

A theoretical approach that may offer an insight into the motivation of the wide variety of students engaged in PE is self-determination theory (Deci & Ryan, 1985, 1991). Despite successful applications to the contexts of education (Ryan & Connell, 1989; Vallerand & Bissonnette, 1992; Vallerand, Fortier, & Guay, 1997) and sport (cf. Vallerand, 2001), research grounded in this theoretical framework within the PE context has, to date, been scarce.

Self-Determination Theory

Self-determination theory (Deci & Ryan, 1985, 1991) addresses the degree to which the motivation toward activities is deemed to be internal (i.e., degree of self-involvement) and how varying levels of this self-determination influence the selection of actions that render desired motivational outcomes. According to Deci and Ryan (1985, 1991), the innate psychological needs of autonomy (the belief that one is the origin and regulator of his or her actions), competence (the belief that one can efficaciously interact with the environment), and relatedness (the seeking and development of secure and connected relationships with others in one's social context) underpin self-determined motivation. That is, the extent to which these mediating needs are fulfilled by what is available from the social context influences the extent to which the motivation adopted by the individual is considered self-determined. To this end, several different types of self-regulatory styles have been identified (Deci & Ryan, 1985), each having specific consequences for learning, performance, personal experience, and well being (Deci & Ryan, 1991, 2000; Ryan & Deci, 2000). On the basis of the theoretical tenets of self-determination theory (Deci & Ryan, 1985, 1991), these different self-regulations are hypothe-

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sized to form a continuum[1] ranging from high to low levels of self-determination and can be broadly categorized as intrinsic motivation, extrinsic motivation, and amotivation.

Self-Regulations

At the self-determined apex of the continuum is intrinsic motivation. *Intrinsic motivation* refers to highly autonomous behaviors engaged in for the feelings of fun, pleasure, and satisfaction that stem from participation in an activity (Deci & Ryan, 1985; Ryan & Deci, 2000). Although previous research has studied the determinants and consequences of intrinsic motivation from a unidimensional approach (e.g., Deci, 1971; Vallerand & Reid, 1984), recent research has adopted a multidimensional perspective (e.g., Pelletier et al., 1995; Vallerand et al., 1993). Specifically, Vallerand and his colleagues (e.g., Vallerand et al., 1992, 1993) have proposed a tripartite taxonomy of intrinsic motivation, consisting of intrinsic motivation to know (engagement in an activity to experience pleasure and satisfaction from learning, exploring, and attempting to understand something new), intrinsic motivation toward accomplishments (engagement in an activity for the satisfaction and pleasure experienced when attempting task mastery or in creating something new), and intrinsic motivation to experience stimulation (engagement in an activity for feelings of sensory pleasure, fun, excitement, and aesthetic enjoyment). These subdimensions of intrinsic motivation have been found to be highly interrelated (Pelletier et al., 1995).

Whereas intrinsically motivated actions represent self-determined behaviors that are performed for the inherent pleasures that emanate from an activity, extrinsic motivation embraces a broad variety of behaviors that are characterized by an individual's goal of action being governed by some separable consequence. Positioned on the self-determination continuum, from low to high levels of inherent self-determination, extrinsic motivation comprises external regulation, introjected regulation, identified regulation, and integrated regulation.

External regulation refers to extrinsic motivation as posited by the traditional dichotomized studies of extrinsic versus intrinsic motivation (e.g., Deci, 1971; Lepper, Greene, & Nisbett, 1973) and describes nonautonomous behaviors that are governed by externally controlled constraints, such as rewards, threats, and payments. Introjected regulation pertains to actions performed by individuals as they feel that they should begin to accept and value given structures. With introjected regulation, the value placed on the activity is still governed by external pressures (e.g., guilt, anxiety, rules), as the individual has still to accept the action as one's own. Thus, this regulation does not represent self-determination (Deci & Ryan, 1991). The distinguishing characteristic between introjected regulation and external regulation is that regulatory pressures shift from external to internalized sources of control. That is, external regulation stems from the perception that one "must" partake in an activity, whereas introjected regulation derives from the feeling that one "should" participate.

Identified regulation refers to relatively self-determined behaviors that occur when individuals place value on and judge an activity as important to the self. With identified regulation, activities are performed freely but represent a means to an end (e.g., fitness gains, weight loss). Therefore, contrary to intrinsic motivation, various actions and skills that may not be considered inherently pleasurable are willingly engaged in for the consequential benefits that derive from participation. The most self-determined extrinsic motivation is termed *integrated regulation* and occurs when identified regulations have been incorporated to the self, meaning that they have been assessed and brought into congruence with the individual's other values and needs (Ryan & Deci, 2000). For example, an individual who says, "I participate in physical activity because it is important to me" illustrates the principle underlying integrated regulation. It is significant to note that although integrated regulation shares many of the same attributes of intrinsic motivation (Ryan & Deci, 2000), it is still considered extrinsic because the instrumental action is performed to achieve a personal goal.[2]

The final regulation embedded in the self-determination framework is termed *amotivation* and is assumed to be similar to learned helplessness (Seligman, 1975). Amotivation is manifested when individuals do not perceive contingencies between their behaviors and subsequent outcomes (Seligman, 1975), do not value the activity (Ryan, 1995), or feel incompetent (Deci, 1975). Amotivated individuals lack the intention to act (Ryan & Deci, 2000) and are neither intrinsically nor extrinsically motivated.

Hierarchical Model of Intrinsic and Extrinsic Motivation

Incorporating the fundamental tenets of self-determination theory (Deci & Ryan, 1985, 1991), Vallerand (1997, 2001) has recently proposed a hierarchical model of intrinsic and extrinsic motivation. This model contends that motivation operates at three levels, namely the global (or personality), contextual (or life domain), and situational (or state) levels (see Vallerand, 1997, 2001; Vallerand & Rousseau, 2001). At each level of generality, Vallerand (1997, 2001) has proposed the motivational sequence of "social factors → psychological mediators → types of motivation → consequences" to operate. Figure 1 illustrates this sequential pattern of motivational processes. It should be noted that in their writings, Deci and Ryan (1985, 1991; Ryan & Deci, 2000) posited the same logical pattern of associations.

Of particular interest to the present investigation is an examination of the proposed motivational sequence at the contextual level of motivation. Contextual motivation pertains to one's usual motivational orientation toward a distinct context, such as sport,

[1] The self-regulations described by Deci and Ryan (1985, 1991) are hypothesized to conform to a simplex structure (Ryan & Connell, 1989). Specifically, the correlations between adjacent regulations (i.e., external regulation and amotivation) are presumed to be more positively correlated than those more distant (i.e., amotivation and intrinsic motivation). Previous work using the Sport Motivation Scale (SMS; Pelletier et al., 1995) has supported the presence of this simplex pattern of relationships (see Li & Harmer, 1996).

[2] Self-determination theory (Deci & Ryan, 1985, 1991) embraces integrated regulation as a type of extrinsic motivation. However, this regulation was excluded from the present study because pilot data collected during the development of the SMS (Pelletier et al., 1995) revealed that this regulation did not emerge as a perceived reason for participation in the physical domain. Furthermore, this type of motivation is more often encountered among adults rather than children, as younger populations may be too young to experience or have achieved a sense of integration within the self (Vallerand, 1997, 2001). For these reasons, this construct is not assessed, nor elaborated on further, in the present study.

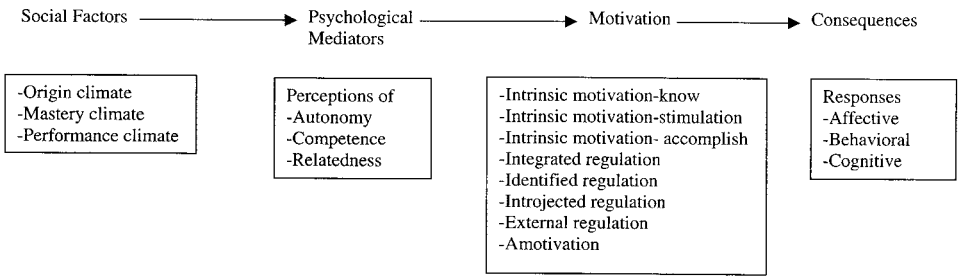

Figure 1. The proposed sequential pattern of relationships hypothesized to underlie human motivation. Copyright 1999 from "An Integrative Analysis of Intrinsic and Extrinsic Motivation in Sport," by R. J. Vallerand and G. F. Losier, *Journal of Applied Sport Psychology, 11,* p. 145. Reproduced by permission of Taylor & Francis, Inc., http://www.routledge-ny.com.

the academic classroom, or PE. Having reviewed the types of motivation embraced by self-determination theory (Deci & Ryan, 1985, 1991), we now review the other theoretical constructs that constitute the proposed sequence of relationships in the following sections.

Social Factors: A Self-Determination Perspective

Self-determination theory (Deci & Ryan, 1985, 1991) makes important assumptions about the nature of social contexts that satisfy or thwart the needs for autonomy, competence, and relatedness. According to the theorizing of Deci and Ryan (1985, 1991), autonomy-supportive environments, as opposed to controlling situations, are assumed to facilitate self-determined motivation. Research in classroom-based education has supported this assumption (e.g., Deci, Nezlek, & Sheinman, 1981; Ryan & Grolnick, 1986). Pulling from the work of deCharms (1968), autonomy-supportive environments refer to situations in which individuals regard themselves to be the origin of their behavior. In contrast, controlling situations refer to events in which individuals perceive themselves to be pawns to external forces (e.g., rewards, others).

To date, no known research has examined the relationship between perceptions of autonomous (origin) versus controlling (pawn) environments and the psychological perceptions of autonomy, relatedness, and competence in the context of PE. We hypothesize, however, that aligned with research conducted in exercise settings (Cadorette, Blanchard, & Vallerand, 1996, as cited in Vallerand, 1997) and sport (Blanchard & Vallerand, 1996), perceptions of an autonomy-supportive environment are positively associated with reported autonomy, competence, and relatedness.

Social Factors: Achievement Goal Perspective

The majority of the research examining situational influences in PE has been grounded in contemporary goal perspective frameworks of motivation (e.g., Ames, 1992; Nicholls, 1989). On the basis of work conducted in the classroom (Ames, 1992; Ames & Archer, 1988), researchers have examined how perceptions of contextual cues, referred to as the *motivational climate*, influence the achievement-related cognitions, behaviors, and affective responses of PE students (Goudas & Biddle, 1994; Papaioannou, 1994; Treasure & Roberts, 2001). Specifically, this research has centered on two dimensions of the motivational climate, namely mastery and performance structures (Ames, 1992; Ames & Archer, 1988). Mastery (or task-involving) climates refer to structures that support hard work, learning, cooperation, task mastery, and integrate students as an integral part of learning. In contrast, performance (or ego-involving) climates refer to situations that foster normative comparisons, focus on interpersonal competition, and entail the punishment of mistakes. In mastery climates, as opposed to performance climates, students have been found to exhibit adaptive achievement patterns (Ames, 1992; Ntoumanis & Biddle, 1999).

Self-Determination Theory and Achievement Goal Theory: Possible Links

Recent studies from an achievement goal perspective have examined the relationship between perceptions of the PE class climate and intrinsic motivation (e.g., Cury et al., 1996; Goudas & Biddle, 1994; Papaioannou, 1994). In this work, intrinsic motivation has been invariably associated with perceptions of a mastery climate, whereas perceptions of a performance climate have been unrelated to intrinsic motivation. Recently, Deci and Ryan (2000) pointed out that there is a "general convergence of evidence from achievement goal theories and [self-determination theory] concerning the optimal design of learning environments" (p. 260). Specifically, both frameworks posit that intrinsic motivation is thwarted in environments in which social comparison predominates, normative comparisons operate, and rewards are provided contingent on performance. In contrast, both bodies of literature propose that environments that promote choice and self-mastery provide situations in which intrinsic motivation is nurtured. Although a consistent association between a mastery climate and intrinsic motivation has emerged in the extant literature (e.g., Cury et al., 1996; Goudas & Biddle, 1994), previous studies have not addressed the assumption that autonomy, competence, and relatedness must be satisfied to foster intrinsic motivation in the context of PE. In view of the robust support for this relationship in past work (cf. Ntoumanis & Biddle, 1999), we hypothesized that perceptions of a mastery climate would fulfill these needs and positive associations emerge in the present study. In contrast, because a performance climate can be deemed more controlling, we propose that a perceived ego-involving climate is negatively related to relatedness and autonomy and unrelated to competence. With reference to the latter hypothesized association, it has not been

corroborated in the extant literature that perceptions of a performance climate lead to low levels of competence; rather, it has been shown that perceptions of competence are not necessarily enhanced in such environments (Cury et al., 1996; Dorobantu & Biddle, 1997; Goudas & Biddle, 1994).

In an initial attempt to test Vallerand's (1997, 2001) motivational sequence at the contextual level in the PE setting, Ntoumanis (2001) posited that the cooperation, improvement, and choice (i.e., opportunities to plan one's own activities) facets of a mastery environment would predict relatedness, competence, and autonomy, respectively. Responses from 424 British students (mean age = 14.84 years; 206 men, 218 women, and 4 nonspecified) largely supported the proposed relationships when analyzed via structural equation modeling. A limitation of this study was the assessment of autonomy and relatedness by two-item measures that were only moderately associated; this may have deflated the relationships between these variables and the various motivational regulations. In the present study, we attempted to overcome this limitation by using multi-item assessments of autonomy and relatedness that were expected to display high levels of internal reliability.

Another drawback of the Ntoumanis (2001) study was that the social context measures used assessed only selected mastery dimensions aligned with achievement goal theory. As described above, we sought to assess the implications of three facets of the social environment on students' motivation toward PE, namely the emphasis placed on task goals (or perceptions of an overall mastery-oriented climate), the emphasis placed on ego goals (or perceptions of an overall performance-oriented climate), and the degree to which the environment supports autonomy (i.e., an origin climate).

Intention to Partake in Physical Activity in One's Leisure Time

The final stage of the motivational sequence (Deci & Ryan, 1985, 1991; Vallerand, 1997, 2001) refers to the affective, cognitive, and behavioral consequences of the different self-regulatory styles. Self-determination theory (Deci & Ryan, 1985, 1991) proposes that intrinsic and internalized self-regulations (i.e., identified regulation) enhance psychological functioning. Recent research in a variety of contexts including education supports the notion that adaptive motivational responses stem from self-determined motivation (cf. Vallerand, 1997). In contrast, regulations characterized by low levels of self-determination (e.g., external regulation and amotivation) have been shown to be associated with maladaptive responses (e.g., Ryan & Connell, 1989; Vallerand & Bissonnette, 1992; Vallerand et al., 1997).

Given the expectation (e.g., Sallis et al., 1992) that PE should promote and foster physical activity participation beyond the boundaries of the PE curricula, the motivational consequence of interest in this study was students' reported intentions to engage in physical activity in their free time. Recent PE-based literature has identified intention to partake in physical activity in one's leisure time as a relevant variable when trying to assess the likelihood of future exercise-related activity (Lintunen, Valkonen, Leskinen, & Biddle, 1999; Ntoumanis, 2001). Papaioannou (2000) found that behavioral intentions predicted actual exercise behavior 6 and 14 months later with a sample of Greek PE students. On the basis of past work (Ntoumanis, 2001) and the theoretical tenets of self-determination theory (Deci & Ryan, 1985, 1991), we expected that self-determined regulations would positively predict, introjected regulation would not predict, and external regulation and amotivation would negatively predict intention to partake in physical activity in one's leisure time.

The Proposed Model

The major purposes of the present study were as follows: (a) to add situational constructs embedded in achievement goal and self-determination theories to the sequence of associations embraced by self-determination theory and (b) to examine how these constructs impact self-regulation styles in PE through the mediators of autonomy, competence, and relatedness. Using structural equation modeling (SEM), we also examined which self-regulations could predict students' intention to be physically active in their leisure time.

Method

Participants and Procedures

Participants were 328 children (160 boys, 138 girls, 30 gender not specified; mean age = 13.56 years, *SD* = 0.59, range = 12–14 years) attending two secondary schools situated in the Midland and Northern districts of England. Both schools were located in predominantly middle class areas, and data were collected from several classes taught by seven PE teachers. Prior to the collection of data, we obtained permission to conduct the study from the School Human Subjects Committee and informed consent from the head teachers of two state schools who were asked to act in *loco parentis*, in accordance with the British Psychological Society guidelines. The children were requested to anonymously respond to a multisection inventory (assessing their perceptions of the PE class climate, autonomy, competence, relatedness, motivation, and leisure-time physical activity intentions) prior to their scheduled PE lesson. PE is a compulsory subject for most children in the United Kingdom, thus all participants were required to partake in the lessons. Having explained the purpose of the study, one of the investigators distributed the inventory and was on hand to help any participant who had questions pertaining to the wording and/or meaning of the questionnaire items. In addition, we emphasized to the participants that there were no right or wrong responses and that they should answer honestly regarding their feelings toward PE. Participants were also offered the option to withdraw from the study at any time without any negative repercussions. The inventory took approximately 20 min to complete.

Measures

Origin climate. The degree to which the children perceived the teacher and the class climate to be autonomous (origin) versus controlling (pawn) was assessed by the Origin Climate Questionnaire (deCharms, 1976). This 24-item self-report inventory consists of six subscales that assess the dimensions of Internal Control (e.g., "We get to decide what we want to do in this class"), Instrumental Activity (e.g., "The teacher lets us try new ways of doing things"), Reality Perception (e.g., "The class rules are made just to help the teacher"), Personal Responsibility (e.g., "The teacher lets good students help those who are not doing so well"), Self-Confidence (e.g., "We do many things in this class that I can do well"), and Goal Setting (e.g., "In this class I get to do things that I want to"). Responses were made on a 4-point frequency scale anchored by 1 (*never*) and 4 (*always*). The scores for each of the six subscales were then summed to give a total origin climate score. Previous work in the context of education

has supported the validity of this measure (Ryan & Connell, 1989; Ryan & Grolnick, 1986).

Motivational climate. Participants' perceptions of the motivational climate were assessed using the English version of the L' Echelle de Perception du Climat Motivational (EPCM; Biddle et al., 1995). The EPCM is a 19-item self-report inventory developed to assess the degree to which students perceive their PE class climate to emphasize mastery–task goals or performance–ego goals. When completing the EPCM, participants were asked to think about what their PE class is usually like and to respond to the stem "In this PE class _____." An example item from the Mastery subscale is "The pupils are happy when they do their best to learn." A Performance subscale example is "Pupils try to do better than one another." Responses were made on a 5-point Likert scale anchored by 1 (*strongly disagree*) and 5 (*strongly agree*). The EPCM has demonstrated acceptable reliability in PE-based research with similar-aged French school students (Biddle et al., 1995; Cury et al., 1996).

Perceived competence. Perceived competence toward PE was assessed using the five items from the Perceived Competence subscale of the 18-item Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989). This version of the IMI represents the application of the original IMI developed by Ryan and colleagues (Ryan, 1982; Ryan, Mims, & Koestner, 1983) to sport. In the present study, the stem was reworded to target the PE context, with participants responding to the stem "How good are you at PE?" An example item from the Competence subscale is "I think I am pretty good at PE." Responses were indicated on a 7-point Likert scale anchored by 1 (*strongly disagree*) and 7 (*strongly agree*). The Competence subscale of the IMI has demonstrated acceptable reliability with similar-aged participants in previous PE-based research involving British children (Goudas & Biddle, 1994).

Relatedness. Relatedness was assessed using the Acceptance subscale of the Need for Relatedness Scale (Richer & Vallerand, 1998). Originally developed to assess the need for relatedness in the workplace, the stem was modified in the present study to ask the question "With the other students in my PE class I feel _____." The stem is followed by five items, such as "close," "valued," and "supported," to which the participants respond on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

Autonomy. The participants' sense of autonomy was measured using five items derived from previous research assessing perceptions of autonomy in PE and various life domains (Blais, Vallerand, & Lachance, 1990; Ntoumanis, 2001). Sample items include "I have some choice in what I want to do" and "I have a say regarding what skills I want to practice." Participants responded to the stem "In this PE class _____" on a 7-point Likert scale anchored by 1 (*strongly disagree*) and 7 (*strongly agree*).

Motivation. Motivation toward PE was assessed by an adapted version of the SMS (Pelletier et al., 1995). The SMS is a 28-item inventory subdivided into seven subscales that assess the multifaceted motivational regulations proposed by self-determination theory (Deci & Ryan, 1985, 1991). These regulations consist of Intrinsic Motivation to Know (e.g., "For the fun of discovering new skills/techniques"), Intrinsic Motivation Toward Accomplishments (e.g., "For the satisfaction I experience while I am perfecting my abilities"), Intrinsic Motivation to Experience Stimulation (e.g., "For the excitement I feel when I am really involved in the activity"), Identified Regulation (e.g., "Because it is one of the best ways I have chosen to develop other aspects of myself"), Introjected Regulation (e.g., "Because I must do PE to feel good about myself"), External Regulation (e.g., "To show others that I am good at PE"), and Amotivation (e.g., "I used to have good reasons for doing PE, but I am now asking myself why I have to"). Participants responded to the stem "I do PE _____" using a 7-point scale ranging from 1 (*does not correspond at all*) to 7 (*corresponds exactly*). Previous research in the sporting domain has provided support for the factor structure and reliability of this measure (Li & Harmer, 1996; Pelletier et al., 1995).

Intention to partake in leisure-time physical activity. Students' intention to be physically active in their leisure time over the period of 1 month was assessed with three items used by Chatzisarantis, Biddle, and Meek (1997). On the basis of the work of Ajzen and Madden (1986) and worded in a manner to correspond to behavioral criterion in time, context, target, and action (Ajzen & Fishbein, 1980), participants responded to three questions ("I am determined to exercise/play sport at least 3 times a week during the next month," "I intend to exercise/play sport at least 3 times a week during the next month," and "I plan to exercise/play sport at least 3 times a week during the next month"). Responses were indicated on a 7-point scale ranging from 1 (*very unlikely*) to 7 (*very likely*). Chatzisarantis et al. (1997) reported alpha coefficients of .89 and .90 for pre-and postexercise intentions, respectively, with similar-aged PE participants.

Data Analysis

Initially, the factor structure of the EPCM and SMS were examined via confirmatory factor analysis (CFA) prior to the main analyses. Several indices of fit were examined to assess the adequacy of the a priori EPCM and SMS models to the data (Hu & Bentler, 1999). No CFA was conducted on the Origin Climate Questionnaire (deCharms, 1976), as no a priori model has been specified in previous education-based literature.

All SEM analyses in the present study were performed using Version 4.0 of the statistical program AMOS (Arbuckle, 1999). SEM refers to a set of statistical techniques (including CFA and path modeling), with most assuming multivariate normality (Ullman, 2001). In each analysis using SEM techniques, therefore, we initially evaluated the multivariate normality of the data using Mardia's multivariate kurtosis coefficient.

Subsequently, several indices were used to assess the model fit (Hu & Bentler, 1999). The overall fit of the model to the data was examined using the chi-square test. A nonsignificant chi square indicates the model to be an acceptable fit to the sample data. However, because the chi-square statistic is influenced by sample size (Marsh, Balla, & McDonald, 1988), supplementary fit indices were assessed.

To assess the covariance structures in the present study, we used a two-index presentation strategy (Hu & Bentler, 1999). This approach advances the use of the standardized root mean-square residual (SRMR) as a measure of absolute fit index together with a supplementary incremental fit index. With the latter in mind, in the present study, we used the comparative fit index (CFI) as our incremental fit index. An additional measure of absolute fit was also used, namely the root mean-square error of approximation (RMSEA).

As an absolute fit index, the SRMR assesses the degree to which the a priori structure reproduces the data, and for well-specified models, the SRMR value should be .08 or less (Hu & Bentler, 1999). The RMSEA also represents a measure of absolute fit and assesses the amount of unfitted residuals between the implied and observed covariance matrices. Values close to .06 reflect a good fit between the proposed model and the data (Hu & Bentler, 1999). Finally, the CFI is an incremental fit index that compares the proportionate improvement of the target model with a more restrictive model (typically a null model). Hu and Bentler (1999) proposed that cutoff values of close to .95 be used as indicators of acceptable fit.

The main analyses used SEM to examine the proposed model outlined in the introduction. To assess the proposed model, we used the same fit indices that were used in the CFA analyses.

Results

CFA

Results suggested that the data for the EPCM (Mardia's multivariate coefficient = 27.98) and the SMS (Mardia's multivariate coefficient = 25.46) models were nonnormal in distribution. Thus, in the present study, we used the maximum-likelihood estimation

Table 1
Descriptive Statistics and Internal Consistency for Each Measure

Variable	*M*	*SD*	Range	Skewness	Kurtosis	α
Origin climate	2.47	0.38	1–4	−.554	1.150	.76
Mastery climate	3.85	0.58	1–5	−.412	0.420	.80
Performance climate	3.45	0.59	1–5	−.092	−0.384	.74
Autonomy	4.08	1.26	1–7	−.281	0.059	.81
Relatedness	4.48	1.25	1–7	.291	0.126	.91
Perceived competence	5.14	1.29	1–7	−.666	−0.044	.85
Self-determined motivation	4.18	1.12	1–7	−.116	0.033	.91
Introjected Regulation	3.94	1.32	1–7	.051	−0.473	.66
Amotivation	2.83	1.29	1–7	.533	−0.083	.69
Intention to partake in physical activity	5.33	1.56	1–7	−.816	−0.093	.89

and applied the bootstrapping approach, which does not require a distributional assumption and estimates the standard errors for parameter estimates using the bootstrap algorithm of Efron (1982). In the present sample, 1,000 bootstrap replication samples were drawn with replacement from the data set (see Yung & Bentler, 1996, for a discussion on the application of bootstrapping to covariance structures).

Although not attaining the standards for CFI and RMSEA values as advanced by Hu and Bentler (1999), a CFA for the EPCM, $\chi^2(147, N = 328) = 378.89, p < .01$, CFI = .89, SRMR = .07, RMSEA = .07, yielded reasonably good fit indices, thus, supporting the presence of two higher order factor structures, namely Mastery and Performance. These findings were comparable with the results observed with a French sample (Biddle et al., 1995).[3] Likewise, the application of the SMS to the PE context appeared to be tenable on the basis of the results of the CFA, $\chi^2(329, N = 328) = 738.53, p < .01$, CFI = .92, SRMR = .07, RMSEA = .06.[4] The results did, however, suggest one modification, which is not in contrast to Deci and Ryan's work (1985, 1991). That is, the correlations between the three Intrinsic Motivation and Identified Regulation factors were very high (r range = .86–.99), and in most cases, the 95% confidence intervals of these correlations exceeded 1.00. These findings suggest a lack of discriminant validity, and, accordingly, these four dimensions were combined to represent self-determined motivation. A second modification that was contrary to the predictions of self-determination theory was suggested. More specifically, the External Regulation subscale of the SMS deviated from the expected simplex pattern. That is, the subscale displayed positive relationships with motivational regulations characterized by high levels of self-determination (r range = .70–.93).

An examination of the items "To show others that I am good at PE," "Because it allows me to be well thought of by people I know," "For the prestige of being seen as a good athlete," and "Because people around me think it is important to be in good shape" suggests that the External Regulation subscale of the SMS taps a concern with the demonstration of superior physical competence to others rather than the controlling and externally regulated construct proposed by Deci and Ryan (1985). On the basis of the observed empirical and conceptual questions regarding this subscale, we chose to exclude it from subsequent analyses and incorporated three types of motivation into the path model, namely, self-determined motivation, introjected regulation, and amotivation.

Descriptive Statistics and Scale Reliabilities

Descriptive statistics and alpha coefficients (Cronbach, 1951) for all measures are presented in Table 1. As shown, most of the alpha coefficients ranged from .74 to .91 and were deemed acceptable on the basis of Nunnally's (1978) criterion of .70 for the psychological domain. The Introjected Regulation (α = .66) and Amotivation (α = .69) subscales of the SMS (Pelletier et al., 1995), however, exhibited alpha coefficients slightly below the .70 value but were retained because of their theoretical importance.

With respect to the Origin Climate Questionnaire, four items appeared problematic when adapted from the classroom setting to the PE context. The four items in question referred to being presented with problems to work on ("The teacher gives us the answer to a problem when we ask him/her" and "We must try and do a problem ourselves before the teacher will help us out") and the usage of extra time ("In this class I can decide how to use the extra time" and "The teacher tells us how to use our extra time"). We observed that the item total scale score correlations for these items were low (–.38 to .10). Thus, we decided to eliminate these items from further analyses. Recalculation of Cronbach's alpha coefficient revealed that the exclusion of these items improved the alpha coefficient from .70 to .76.

The intercorrelation matrix is presented in Table 2. An inspection of the bivariate correlations suggests that perceptions of a mastery and origin climate are positively and moderately associated with perceptions of autonomy, relatedness, and competence. Performance climate, in contrast, was weakly and negatively related with all three variables. Autonomy, relatedness, and competence displayed positive and moderate relationships with self-determined motivation, weak to moderate positive relationships with introjected regulation, and weak to moderate negative relationships with amotivation. Correlations among the motivational types suggest that they conform to a simplex pattern (Ryan & Connell, 1989). Finally, intention to partake in physical activity was positively and moderately associated with self-determined

[3] Details of the factor solution, factor loadings, covariances, and error residuals for the CFA on the EPCM (Biddle et al., 1995) are available from Joan L. Duda.

[4] Details of the factor solution, factor loadings, covariances, and error residuals for the CFA on the SMS (Pelletier et al., 1995) are available from Joan L. Duda.

Table 2
Bivariate Correlations Among Study Variables

Variable	1	2	3	4	5	6	7	8	9	10
1. Origin climate	—									
2. Mastery climate	.46	—								
3. Performance climate	−.27	.07	—							
4. Autonomy	.51	.37	−.13	—						
5. Relatedness	.51	.39	−.11	.71	—					
6. Competence	.30	.22	−.11	.37	.48	—				
7. Self-determined motivation	.38	.34	−.01	.47	.54	.49	—			
8. Introjected Regulation	.21	.16	.02	.33	.34	.24	.58	—		
9. Amotivation	−.08	−.05	.08	−.06	−.13	−.35	−.21	.09	—	
10. Physical activity intention	.26	.19	−.07	.38	.45	.46	.44	.29	−.24	—

Note. Bivariate correlations of .11 and above are significant at $p < .05$; bivariate correlations of .14 and above are significant at $p < .01$.

motivation, weakly related to introjected regulation, and negatively associated with amotivation.

SEM

On the basis of the aforementioned adjustments, the modified hypothesized model (see Figure 2) specified that perceptions of mastery and autonomy-supportive environments in PE would facilitate perceptions of competence, relatedness, and autonomy (Deci & Ryan, 1985, 1987, 1991; Vallerand, 1997, 2001). In contrast, perceptions of a performance climate were expected to be negatively related to autonomy and relatedness and unrelated to competence. Consistent with Vallerand's (1997) perspective, autonomy, relatedness, and competence were assumed to independently mediate the influence of the class climate on different self-regulations. It was hypothesized that these motivational mediators would be positively related to self-determined motivation and negatively associated with amotivation. We also hypothesized that, consistent with previous PE-based work, relatedness would be related to introjected regulation (Ntoumanis, 2001). That is, if a students' investment in PE is regulated in an introjected manner, then the student feels a sense of obligation to participate. Among adolescents, particularly, feeling like one "should" do something is more likely when the person feels more connected with others in that context.

Aligned with previous work (e.g., Ntoumanis, 2001) and statistical recommendations (R. J. Vallerand, personal communication, October 4, 2001), the residuals of the motivational types were allowed to be correlated. Specifically, because the theoretical tenets of self-determination theory (Deci & Ryan, 1985, 1991) would not classify these variables as orthogonal constructs, these variables need to be considered as mutually correlated predictors. Moreover, as the motivational types are dependent variables in the SEM analysis, the only acceptable way of presenting their interrelationship is to allow their residuals to be correlated. On the basis of previous research (e.g., Biddle et al., 1995; Lintunen et al., 1999; Ntoumanis, 2001), we hypothesized that self-determined motivation would be positively related, introjected regulation unrelated, and amotivation negatively related to intention to partake in physical activity. With respect to model covariances, the model proposed a positive covariance between mastery and origin climate

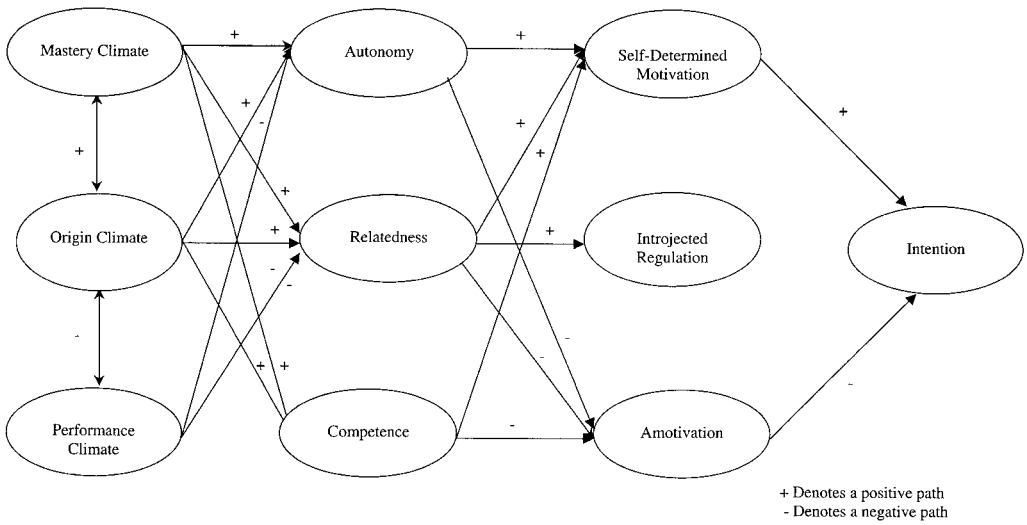

Figure 2. Hypothesized model of contextual motivation in physical education.

and a negative covariance between origin and performance climate. Finally, on the basis of previous motivational climate research in the context of PE (Biddle et al., 1995; Cury et al., 1996), performance and mastery dimensions were expected to be independent constructs.

The model was examined via SEM using the maximum-likelihood method. Again, the bootstrapping technique was used, as the data were nonnormal in distribution (Mardia's multivariate coefficient = 16.65). Given concerns pertaining to measurement error, it would have been preferable to use a full latent factor model using numerous indicator variables to assess each variable. However, because such an approach would yield an unacceptably low sample size to ratio of estimated parameters, we used the averages of each scale as single-item indicators of latent constructs. In this procedure, the unreliability of each construct is modeled by setting the error variance of each measure to 1 minus the alpha coefficient multiplied by the variance of the observed variable (cf. Hayduk, 1987). As a result, this technique eliminates the bias in parameter estimates that results from measurement error (Pedhazur & Pedhazur Schmelkin, 1991).

Results showed that the hypothesized covariance structure (see Figure 2) did not display a good fit to the data, $\chi^2(24, N = 328) = 267.37$, $p < .01$, CFI = .76, SRMR = .12, RMSEA = .18. To revise the model, we examined modification indices. These suggested that the paths between mastery climate and competence, between performance climate and autonomy, between performance climate and relatedness, between autonomy and amotivation, and between relatedness and amotivation be removed from the model, as they were nonsignificant. Although these paths were dropped, additional paths and correlations of error terms were suggested by the modification indices. On the basis of recommendations regarding model respecification (MacCallum, 1995), we chose to add three additional paths that were consistent with previous research and aligned with self-determination theory (Deci & Ryan, 1985, 1991). First, consonant with the theorizing of Deci and Ryan (1985, 1991), we added a path between autonomy and competence. Second, in line with sport-based research (e.g., Evans, 1985; Weiss & Duncan, 1992), which suggests that competence can increase peer acceptance and social interactions in the physical domain, we included a path between competence and relatedness. Finally, a path between autonomy and relatedness was added, in line with Deci and Ryan's (1991) assertion that autonomy and relatedness are, in general, complementary and not antithetical constructs.

An examination of the indices of fit suggested the revised model to adequately fit the data, $\chi^2(25, N = 328) = 70.58$, $p < .01$, CFI = .96, SRMR = .06, RMSEA = .08. Results, however, suggested that the path between mastery climate and relatedness be removed from the model, as it was nonsignificant (.07). Furthermore, a path between autonomy and introjected regulation was added. Subsequently, the model was reassessed and remained adequate, $\chi^2(25, N = 328) = 69.09$, $p < .01$, CFI = .96, SRMR = .06, RMSEA = .07. The standardized solution of the final model is presented in Figure 3.

The indirect effects (see Table 3) indicated that origin climate positively influenced self-determined motivation through autonomy, competence, and relatedness. Mastery climate also positively mediated self-determined motivation through autonomy. Moreover, mastery and origin climates had a positive effect on intention to be physically active through autonomy, competence, relatedness, and self-determined motivation. Finally, autonomy, competence, and relatedness positively influenced intention to partake in physical activity through self-determined motivation.

Discussion

The present study was designed to examine a proposed model of motivation within the context of PE. Specifically, a model of motivation that considered the situational dimensions embedded in achievement goal theory (Nicholls, 1984, 1989) as a supplement to the constructs that constitute the proposed sequence of relationships embraced by self-determination theory (Deci & Ryan, 1985, 1991) was explored. In the present work, we aimed to provide greater insight into the motivational processes that account for varying levels of student motivation and also to examine the degree to which this motivation in turn predicts students' intention

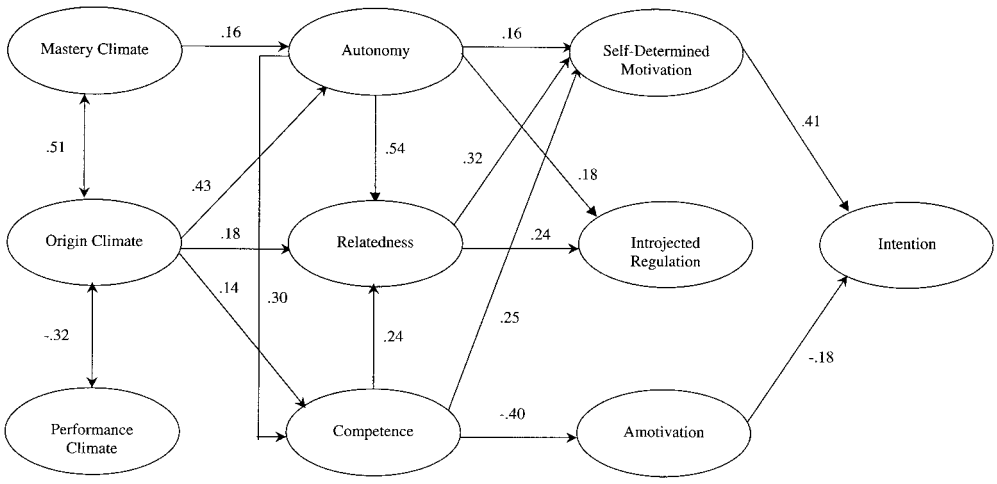

Figure 3. Revised model of contextual motivation in physical education. For visual simplicity, measurement terms (thetas and epsilons) are not shown. All paths are significant (i.e., *z* scores are greater than 1.96).

Table 3
Standardized Parameter Estimates of Indirect Effects

Parameter	Effect
Mastery climate → self-determined motivation	.07
Mastery climate → Introjected Regulation	.05
Mastery climate → Amotivation	−.02
Mastery climate → physical activity intention	.03
Origin climate → self-determined motivation	.29
Origin climate → Introjected Regulation	.19
Origin climate → Amotivation	−.10
Origin climate → physical activity intention	.14
Autonomy → physical activity intention	.20
Competence → physical activity intention	.20
Relatedness → physical activity intention	.13

Note. All z values greater than 1.96 ($p < .05$).

to partake in physical activity in their leisure time. The proposed model was supported after slight alterations, a finding that suggests that it may be beneficial for researchers to turn their attention to complementary motivational frameworks (Duda & Hall, 2001).

Influence of Social Factors

With regard to the social context, the present findings suggest that the manner in which students perceive situational cues, as engendered by the PE teacher, have important implications for student investment. Congruent with previous classroom-based work (Deci et al., 1981; Ryan & Grolnick, 1986; Vallerand et al., 1997), perceptions of an autonomy-supportive environment positively predicted important motivation-related constructs. Specifically, students felt more autonomous, competent, and related when perceiving an autonomy-supportive climate that was low in controlling features. These findings are consistent with previous research in the contexts of exercise (Cadorette et al., 1996, as cited in Vallerand, 1997) and sport (Blanchard & Vallerand, 1996).

The results as they relate to the proposed implications of situational factors assumed by achievement goal theory (Nicholls, 1984, 1989) were less clear. Indeed, of the three hypothesized paths from mastery climate to the needs of autonomy, competence, and relatedness, only the path between mastery climate and autonomy was fully supported. With respect to the latter finding, the present data support the notion that students report higher levels of personal autonomy when they perceive the environment to support elements of self-referenced progress and learning (cf. Ames, 1992). Thus, it appears that when situational cues support personally based competence and the student's belief that success is achieved through hard work and a desire to learn, students feel that they have greater control (or autonomy) of their achievement in the PE class (Treasure & Roberts, 2001).

In contrast to Ntoumanis (2001), who, using the cooperative learning items of the Perceived Motivational Climate in Sport Questionnaire–2 (PMCSQ-2; Newton, Duda, & Yin, 2000), found a moderate to strong path between cooperative learning and relatedness, the path between mastery climate and relatedness in the present study was dropped because it was nonsignificant (.07). From a theoretical perspective, mastery climates are assumed to foster "feelings of belongingness" and cooperation (Ames, 1992). The present findings, therefore, depart from theoretical postulations and are not consonant with our hypothesis. A plausible explanation for the present result may reside with our use of the EPCM (Biddle et al., 1995) to assess the participants' overriding perceptions of the PE class climate. It should be noted that the EPCM Mastery scale does not incorporate a cooperative learning subscale and/or items but defines and measures perceptions of a mastery climate in terms of learning, effort, and personal improvement. By defining a mastery climate in such a manner, the EPCM fails to account for interpersonal factors that are embedded in sport-based measures of the motivational environment (e.g., PMCSQ-2; Newton et al., 2000). All in all, the present results provide further support for Biddle's (2001) assertion that the dimensions that constitute mastery and performance climates in PE have yet to be clearly established and consistently examined. It is interesting to note that there has been a paucity of work designed to assess which structures of the environment underlie students' perceptions of the situational goal perspectives operating in PE classes. Moreover, of the few studies that have been conducted with English-speaking populations, most have been guided by the dimensions of the climate identified by Papaioannou (1994) in his work with Greek PE students. Taking into consideration potential cultural differences in the objective and subjective PE environment and issues of equivalence in item translation, it would be beneficial for researchers to generate new items, refine existing items, and develop improved inventories to assess students' perceptions of the motivational climate in PE. Such work should draw from the theoretical contributions of achievement goal theorists (Ames, 1992; Ames & Archer, 1988; Nicholls, 1989) and may include items designed to tap mastery and performance aspects of the classroom structure (e.g., design of tasks, variety of tasks, task challenge, task choice) and student–teacher related interactions (e.g., perception of teacher's evaluation criteria, belief about what students are recognized for, nature of the teacher's feedback, the meaning of mistakes). Finally, we believe that in developing such measures, researchers should be careful not to capture dispositional tendencies (i.e., goal orientations) and incorporate affective consequences of situationally emphasized goals in their assessments of the PE environment (cf. Duda & Whitehead, 1998).

Aligned with the sport research work of Kowal and Fortier (2000), perceptions of a mastery climate did not predict perceptions of competence in PE. Although contrary to the work of Kavussanu and Roberts (1996) in college level PE and the predictions of Vallerand and Rousseau (2001), this finding is consistent with the study by Ames and Archer (1988), who found a nonsignificant association between a mastery climate and perceived competence in the academic setting. Given that a mastery climate and effort are closely tied, it may be that mastery cues do not emphasize relative standing compared with others, as social comparison information is, for the most part, absent in such environments (cf. Ames, 1992). Furthermore, in present study, we used an overall assessment of a mastery climate that does not embrace environmental components that would significantly elevate competence (e.g., positive feedback).

Motivational Mediators

The present data support the theoretical precept (Deci & Ryan, 1985, 1991) that perceptions of autonomy, competence, and relatedness are important mediators of the social context–motivational

regulations relationship. Previous work in PE and sport that has considered the relative impact of autonomy, competence, and relatedness on self-determined regulations (e.g., intrinsic motivation) has yielded equivocal findings (e.g., Blanchard & Vallerand, 1996; Kowal & Fortier, 2000; Ntoumanis, 2001). In the present study, perceptions of competence and relatedness were found to be more predictive of self-determined motivation than autonomy. We would argue that PE teachers, in general, are aware of the importance of fostering competence among children of all abilities, and the present data support the continuance of such efforts. Less is known about the role of relatedness in the PE domain. To this end, although peers clearly have the potential to impact other students' motivation in PE, a paucity of work has examined their potential positive and negative influence on motivation. Indeed, in addition to a positive association with self-determined motivation, we found, as hypothesized, an association between relatedness and introjected regulation. A similar finding was reported by Ntoumanis (2001), who argued that children may engage in PE because they do not wish to be isolated from the group.

Contrary to the findings of Ntoumanis (2001), autonomy also emerged as a predictor of self-determined motivation in the present work. The relative strength of the autonomy path was, however, weak. Recently, Ferrer-Caja and Weiss (2000) reported similar findings[5] in their attempt to integrate aspects of achievement goal (Nicholls, 1989) and cognitive evaluation[6] (Deci, 1975; Deci & Ryan, 1985) theories. The relationship between autonomy and self-determined motivational types should be reexamined in future work, as disparity appears to exist with reference to the implications of perceived autonomy present in PE. Mean values for autonomy in the present study were lower than the perceived competence and relatedness scores but still could be considered moderate. Ntoumanis (2001), with a similar sample, found low scores for autonomy. It may be that the perceived autonomy of students can be prone to fluctuations dependent on the class climate (i.e., mastery or performance) promoted by the PE teacher, the nature of the task (scope for student choice), and the time of year (e.g., term assessments).

Departing from the theoretical tenets of self-determination theory (Deci & Ryan, 1985, 1991), the results of the SEM analysis suggested a path from autonomy to introjected regulation. Such a finding is consistent with the sport-based work of Pelletier et al. (1995), who found a positive association between coaches' autonomy support and introjected regulation. Behaviors considered introjected are not classed as self-determined. Rather, they are actions performed by an individual when he or she feels that he or she should begin to accept and value given structures (e.g., self-imposed sanctions, such as guilt, anxiety, pride; Deci & Ryan, 2000). A feasible explanation for the present findings may reside with the measurement of introjected regulation ("Because it is absolutely necessary to do PE if one wants to be in shape," "Because I must do PE to feel good about myself," "Because I would feel bad if I was not taking the time to do it," and "Because I must do PE regularly"). That is, all these items involve the incentive for behavior emanating from within the individual, but there is a sense of some external contingency. Although not representing self-determined behavior per se (i.e., it is not yet apparent that the individual is engaging in PE because she or he wants to and/or enjoys the activity), introjected students may have started to take in the values inherent in PE (e.g., health benefits) and thus participate in this context.

Coupled with the findings of Pelletier et al. (1995), the present findings suggest that the antecedents of introjected regulation may differ in the physical domain when compared with other life contexts. One potential explanation may reside with the recent upsurge of attention given by government agencies and health associations in their promotion of active lifestyles (cf. Biddle et al., 1998). As a result, parents (in the case of children and adolescents), peers, and the media may be more likely to pose a consistent and compelling message regarding the benefits associated with participation in physical activities. This coherent message, coupled with the ensuing health, social, and intrinsic consequences of regular physical activity engagement, may result in students' behavior in PE becoming more internalized than in other life contexts. That is, it might be the case that the benefits of physical activity engagement (e.g., feel better, look better, interact with others) come to fruition even when students are participating in PE because they think they should be doing this rather than as a function of personal intrinsic desire. Perhaps in other life contexts, such as the academic classroom, engagement that is introjected regulated would not be as reinforcing or advantageous. To this end, the present findings revealed positive associations between both relatedness and autonomy and introjected regulation. Thus, it might be the case that some students in PE were still feeling introjected in terms of the initial reasons for engaging in PE regulation but were at an advanced stage of internalization of this behavior (i.e., moving toward identified regulation). Future work in PE, going beyond cross-sectional designs, would ascertain whether as the mediators of autonomy, competence, and relatedness overtime become increasingly fulfilled, students' reliance on introjected reasons for participation weakens. Should this be the case, it may be that introjected regulation toward PE may actually have an adaptive motivational function for some students (i.e., serves as the impetus for internalization).

Consistent with previous PE research (Ferrer-Caja & Weiss, 2000; Goudas & Biddle, 1994; Ntoumanis, 2001), perceived competence emerged as a crucial construct in predicting self-determined motivation. Not only were perceptions of competence toward PE influential in predicting self-determined motivation, but, in line with the findings of Ntoumanis (2001), a negative path coefficient emerged between competence and amotivation. This result, coupled with the nonsignificant paths between autonomy and amotivation and relatedness and amotivation, supports the theoretical premise that perceptions of competence play a pivotal role in predicting positive and negative engagement in PE. Although limited relatedness and/or feelings of autonomy in PE could be considered undesirable, it is unlikely that such perceptions elicit the same level of negative feelings or dissatisfaction associated with the public demonstration of lack of physical competence in this domain. That is, in PE situations in which a number of students have little, if any, sporting experience (Papaioannou, 1994), the performing of sport tasks in conditions that elicit feed-

[5] The path was $\beta = .22$ for girls and $\beta = .14$ (nonsignificant) for boys.

[6] Cognitive evaluation theory (Deci, 1975; Deci & Ryan, 1985) is a subtheory embraced within the self-determination framework (Deci & Ryan, 1985, 1991).

back pertaining to normative ability may make it difficult for students who doubt their competence to maintain active, unself-conscious involvement (Nicholls, 1989).

The present findings are also consistent with Deci and Ryan's (Deci & Ryan, 1985, 1991; Ryan & Deci, 2000) theoretical conceptualization of amotivation and the recent empirical work of Pelletier, Dion, Trison, and Green-Demers (1999). Pelletier and colleagues identified lack of ability beliefs as one of four components of amotivation in their multidimensional approach to amotivation. Future empirical work should attempt to delineate in greater detail the additional antecedents and consequences of the amotivation construct. That is, although perceived incompetence is one cause of amotivation, Ryan and Deci (2000) identified lack of activity importance and lack of success expectancy as important precursors of amotivation. Future research might also ascertain the importance that competence valuation (e.g., Elliot et al., 2000) and activity expectancy (e.g., Eccles, 1983) have on the various motivational regulations including amotivation.

Although the present findings support the importance of autonomy, competence, and relatedness to the social context–self-regulation relationship, modification indices suggested that the present model of motivation could be improved by specifying relationships between the mediating variables. Because autonomy, competence, and relatedness are assumed to be central determinants of optimal functioning and are in many ways complementary constructs (Deci & Ryan, 1991), we examined three theoretically justifiable relationships.

An interesting result in the present work relates to the observed path between competence and relatedness. Research in the context of sport (e.g., Evans, 1985; Weiss & Duncan, 1992) suggests that children that are physically competent are more likely to be accepted by their peers. Future research should address whether children form relationships in PE commensurate with perceptions of competence. If this is the case, an important avenue for future PE research is to address how the social context can be structured to support children of all levels of ability and, through this parity, hopefully affiliations with others.

The present results also supported a path from autonomy to relatedness. A link between an autonomy-supportive climate and perceptions of relatedness has also emerged in previous research (Blanchard & Vallerand, 1996; Cadorette et al., 1996, as cited in Vallerand, 1997). However, the present data suggest that to experience interpersonal connections with others in the context of PE, an individual needs to possess a sense of personal autonomy. This finding insinuates that when students feel that they have a degree of personal control, they also feel more efficacious in initiating connections with others. Alternatively, it is plausible that feelings of belongingness allow for and foster a sense of personal influence and control, as the individual feels supported in his or her actions. As these constructs may share a reciprocal relationship (e.g., Deci & Ryan, 1991; Ryan, 1993; Ryan & Lynch, 1989), longitudinal research would do well to examine whether personal autonomy provides opportunities to develop relatedness with others and/or whether over time feelings of being related may foster and enhance perceptions of autonomy.

The final additional path to emerge was between autonomy and competence. Deci and Ryan (1985) asserted that situational influences that enhance perceptions of competence would only facilitate intrinsic motivation in the presence of some self-determination (autonomy). Specifically, to be "intrinsically motivated, one must feel that one's competent actions come from the self" (Ryan, 1993, p. 22). The present finding is consistent with the results of Goudas, Biddle, and Fox (1994), who found a direct positive path between an index of relative autonomy and perceived competence in a sample of PE students participating in football and netball. We concur with Markland (1999), who suggested that future research would benefit from determining under what conditions competence and autonomy do and do not interact and the nature of such interactions when they emerge.

Self-Regulations

Self-determination theory posits that self-determined motivation leads to positive consequences, such as high quality learning, investment, and creativity in academic activities (Ryan & Deci, 2000). In line with theoretical tenets and consistent with previous work in PE (Lintunen et al., 1999; Ntoumanis, 2001), the results of the present study found self-determined motivation toward PE to predict intentions to be physically active in one's leisure time. Not only does this finding support the theoretical proposition that self-determined motivation yields adaptive motivational responses, but it also provides credit for the argument that PE is a key physical activity context that has the potential to create positive intentions for future participation patterns (Biddle et al., 1998; Sallis et al., 1992). An interesting and important avenue for future research would be to examine the extent to which motivational constructs (including intention) pertinent to the PE setting predict objectively assessed physical activity levels.

Aligned with the predictions of self-determination theory (Deci & Ryan, 1985, 1991), a negative path between amotivation and students' intention to partake in physical activity in their leisure time emerged. Because amotivation represents little or no motivation, one would not expect children who do not perceive any viable reason for engaging in PE to display a willingness to pursue similar activities in their free time outside of PE class.

Limitations

It is important to note that inherent within Deci and Ryan's (1985, 1991) self-determination framework (and Vallerand's, 1997, extensions) is the proposition that the sequence of associations (i.e., social factors–needs–motivation–consequences) and the nature of relationships are robust and universal to all individuals. That is, it is assumed that the degree to which the social context fulfills the needs of autonomy, competence, and relatedness should impact motivation and subsequent consequences in theoretically expected ways, irrespective of context, culture, and gender. Although it would have been insightful in the present work to examine both gender and school effects and the interaction of these variables, the size and composition of the present sample did not permit such tests. In addition to examining the invariance of the self-determination framework, subsequent work should consider potential individual, group, class, and school level variability in the variables embraced by the self-determination framework (Deci & Ryan, 1985, 1991). The application of hierarchical linear modeling (or multilevel modeling) techniques (cf. Goldstein, 1995) that permit the hierarchical and concurrent examination of individual,

group, and cross-level effects within a hierarchical structure will be most useful in such investigations.

From a methodological perspective, although the findings suggest the SMS to be tenable in the PE context, our results revealed the External Regulation subscale to be problematic. Specifically, the correlations of this subscale with the other subscales revealed a deviation from the proposed simplex pattern of associations (Ryan & Connell, 1989). A closer inspection of the items of this subscale suggested that the demonstration of physical competence to others was assessed, rather than the controlling and externally regulated construct embraced by self-determination theory (Deci & Ryan, 1985, 1991). That is, there appears to be a discrepancy between the External Regulation item content and its theoretically targeted construct. This same limitation does not appear for the Academic Motivation Scale (Vallerand et al., 1992), but future work might address this issue.

Conclusion

Various position statements and guidelines have called for increases in, and the maintenance of, physical activity (i.e., American College of Sports Medicine, 2000; U.S. Department of Health and Human Services, 1996). The importance of PE in fulfilling such mandates is underpinned by the perspective of Sallis and colleagues (1992), who stated that "the setting with the most promise for having a public health impact is the schools because virtually all children can be reached in schools" (p. S251). To fulfill such an objective, a thorough understanding of student motivation is undoubtedly pivotal. Recently, Duda and Hall (2001) have argued that it is important for researchers to explore models of motivation that complement, extend, and synthesize existing knowledge. The present findings were generally consistent with a model of student motivation in the context of PE that incorporates constructs from self-determination and achievement goal theories.

From an applied perspective, the findings provide some insight into how physical educators may begin to combat the decrease in interest and participation levels of students. Specifically, the data suggest that PE teachers should seek to promote class structures that are autonomy-supportive and mastery focused, as these dimensions facilitate, via important psychological mediators, self-determined motivation. Finally, students that were self-determined within the context of PE had higher intention to be physically active in their leisure time. To this end, the data suggest that PE has the potential to promote physical activity to a large number of young people and potentially facilitate public health (Sallis et al., 1992).

References

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior.* Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I., & Madden, T. (1986). Prediction of goal-directed behavior: Attitudes, intentions and perceived behavioral control. *Journal of Experimental Social Psychology, 22,* 453–474.

American College of Sports Medicine. (2000). *ACSM's guidelines for exercise testing and prescription* (6th ed.). Baltimore: Williams & Wilkins.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84,* 261–271.

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology, 80,* 260–267.

Arbuckle, J. L. (1999). AMOS (Version 4. 0) [Computer software]. Chicago: SmallWaters Corporation.

Biddle, S. J. H. (2001). Enhancing motivation in physical education. In G. C. Roberts (Ed.), *Advances in motivation in sport and exercise* (pp. 101–127). Champaign, IL: Human Kinetics.

Biddle, S., Cury, F., Goudas, M., Sarrazin, P., Famose, J. P., & Durand, M. (1995). Development of scales to measure perceived physical education class climate: A cross national project. *British Journal of Educational Psychology, 65,* 341–358.

Biddle, S. J. H., Sallis, J., & Cavill, N. (1998). *Young and active? Young people and health enhancing physical activity: Evidence and implications.* London: Health Education Authority.

Blais, M. R., Vallerand, R. J., & Lachance, L. (1990). *L'échelle des Perceptions d' Autonomie dans les Domaines de Vie* [The Perceived Autonomy in Life Domains Scale]. Unpublished manuscript, University of Quebec at Montreal, Montreal, Quebec, Canada.

Blanchard, C., & Vallerand, R. J. (1996). *The mediating effects of perceptions of competence, autonomy, and relatedness on the social factors–self-determined situational motivation relationship.* Unpublished manuscript, University of Quebec at Montreal, Montreal, Quebec, Canada.

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,* 343–360.

Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16,* 297–334.

Cury, F., Biddle, S., Famose, J., Goudas, M., Sarrazin, P., & Durand, M. (1996). Personal and situational factors influencing intrinsic interest of adolescent girls in school physical education: A structural equation modeling analysis. *Educational Psychology, 16,* 305–315.

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

deCharms, R. (1976). *Enhancing motivation: Change in the classroom.* New York: Irvington.

Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18,* 105–115.

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

Deci, E. L., Nezlek, J., & Sheinman, L. (1981). Characteristics of the rewarder and intrinsic motivation of the rewardee. *Journal of Personality and Social Psychology, 40,* 1–10.

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

Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology, 53,* 1024–1037.

Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: Integration in personality. In R. A. Dienstbier (Ed.), *Nebraska symposium on motivation: Perspectives on motivation* (Vol. 38, pp. 237–288). Lincoln: University of Nebraska.

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,* 227–268.

Dorobantu, M., & Biddle, S. J. H. (1997). The influence of situational and individual goals on the intrinsic motivation of Romanian adolescents towards physical education. *European Yearbook of Sport Psychology, 1,* 148–165.

Duda, J. L., & Hall, H. K. (2001). Achievement goal theory in sport: Recent extensions and future directions. In R. N. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of research in sport psychology* (2nd ed., pp. 417–434). New York: Wiley.

Duda, J. L., & Whitehead, J. (1998). Measurement of goal perspectives in

the physical domain. In J. L. Duda (Ed.), *Advances in sport and exercise psychology measurement* (pp. 21–48). Morgantown, WV: FIT Press.

Eccles, J. (1983). Expectancies, values and academic behaviors. In J. T. Spence (Ed.), *The development of achievement motivation* (pp. 283–331). Greenwich, CT: JAI Press.

Efron, B. (1982). *The jackknife, the bootstrap and other resampling plans.* Philadelphia: Society for Industrial and Applied Mathematics.

Elliot, A. J., Falar, J., McGregor, H. A., Campbell, W. K., Sedikides, C., & Harackiewicz, J. M. (2000). Competence valuation as a strategic intrinsic motivation process. *Personality and Social Psychology Bulletin, 26,* 780–794.

Evans, J. R. (1985). *The process of team selection in children's self-directed and adult directed games.* Unpublished doctoral dissertation, University of Illinois at Urbana−Champaign.

Ferrer-Caja, E., & Weiss, M. R. (2000). Predictors of intrinsic motivation among adolescent students in physical education. *Research Quarterly for Exercise and Sport, 71,* 267–279.

Goldstein, H. (1995). *Multilevel statistical models.* London: Edward Arnold.

Goudas, M., & Biddle, S. (1994). Perceived motivational climate and intrinsic motivation in school physical education classes. *European Journal of Psychology of Education, 9,* 241–250.

Goudas, M., Biddle, S. J. H., & Fox, K. R. (1994). Perceived locus of causality, goal orientations, and perceived competence in school physical education classes. *British Journal of Educational Psychology, 64,* 453–463.

Hayduk, L. A. (1987). *Structural equation modeling with LISREL.* Baltimore: Johns Hopkins University Press.

Haywood, K. M. (1991). The role of physical education in the development of active lifestyles. *Research Quarterly for Exercise and Sport, 62,* 151–156.

Hu, L., & Bentler, P. M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6,* 1–55.

Kavussanu, M., & Roberts, G. C. (1996). Motivation in physical activity contexts: The relationship of perceived motivational climate to intrinsic motivation and self-efficacy. *Journal of Sport and Exercise Psychology, 18,* 264–280.

Kowal, J., & Fortier, M. S. (2000). Testing relationships from the hierarchical model of intrinsic and extrinsic motivation using flow as a motivational consequence. *Research Quarterly for Exercise and Sport, 71,* 171–181.

Lepper, M. R., Greene, D., & Nisbett, R. E. (1973). Undermining children's intrinsic interest with extrinsic rewards: A test of the "overjustification" hypothesis. *Journal of Personality and Social Psychology, 28,* 129–137.

Li, F., & Harmer, P. (1996). Testing the simplex assumption underlying the Sport Motivation Scale: A structural equation modeling analysis. *Research Quarterly for Exercise and Sport, 67,* 396–405.

Lintunen, T., Valkonen, A., Leskinen, E., & Biddle, S. (1999). Predicting physical activity intentions using a goal perspectives approach: A study of Finish youth. *Scandinavian Journal of Medicine and Science in Sport, 9,* 344–352.

MacCallum, R. C. (1995). Model specification: Procedures, strategies, and related issues. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 16–36). Newbury Park, CA: Sage.

Markland, D. (1999). Self-determination moderates the effects of perceived competence on intrinsic motivation in an exercise setting. *Journal of Sport and Exercise Psychology, 21,* 351–362.

Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indices in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin, 102,* 391–410.

McAuley, E., Duncan, T., & Tammen, V. V. (1989). Psychometric properties of the intrinsic motivation inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport, 60,* 48–58.

Newton, M., Duda, J. L., & Yin, Z. (2000). Examination of the psychometric properties of the Perceived Motivational Climate in Sport Questionnaire–2 in a sample of female athletes. *Journal of Sport Sciences, 18,* 275–290.

Nicholls, J. G. (1984). Conceptions of ability and achievement motivation. In R. Ames & C. Ames (Eds.), *Research on motivation in education: Student motivation* (Vol. 1, pp. 39–73). New York: Academic Press.

Nicholls, J. G. (1989). *The competitive ethos and democratic education.* Cambridge, MA: Harvard University Press.

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

Ntoumanis, N., & Biddle, S. J. H. (1999). A review of psychological climate in physical activity settings with particular reference to motivation. *Journal of Sport Sciences, 17,* 643–665.

Nunnally, J. C. (1978). *Psychometric theory.* New York: McGraw-Hill.

Papaioannou, A. (1994). Development of a questionnaire to measure achievement orientations in physical education. *Research Quarterly for Exercise and Sport, 65,* 11–20.

Papaioannou, A. (2000). *Attitudes, perceptions and behaviors (1) in the PE lesson, (2) in sport settings, (3) towards a healthy lifestyle, of individuals differing in gender, age, social class, religion and motor deficiency* (Tech. Rep. No. 631). Thrace, Greece: Democritus University of Thrace.

Pedhazur, E. J., & Pedhazur Schmelkin, L. (1991). *Measurement, design, and assessment: An integrated approach.* Hillsdale, NJ: Erlbaum.

Pelletier, L. G., Dion, S., Trison, K., & Green-Demers, L. (1999). Why do people fail to adopt environmental protective behaviors? Toward a taxonomy of environmental amotivation. *Journal of Applied Social Psychology, 29,* 2481–2504.

Pelletier, L. G., Fortier, M. S., Vallerand, R. J., Tuson, K. M., Brière, N. M., & Blais, M. R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The Sport Motivation Scale (SMS). *Journal of Sport and Exercise Psychology, 17,* 35–53.

Richer, S., & Vallerand, R. J. (1998). Construction et validation de L'échelle du Sentiment d'Appartenance Sociale [Construction and validation of the Perceived Relatedness Scale]. *Revue Européene de Psychologie Appliquée, 48,* 129–137.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43,* 450–461.

Ryan, R. M. (1993). Agency and organization: Intrinsic motivation, autonomy, and the self in psychological development. In R. Dienstbier (Ed.), *Nebraska symposium on motivation* (pp. 1–56). Lincoln: University of Nebraska Press.

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality, 63,* 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,* 749–761.

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

Ryan, R. M., & Grolnick, W. S. (1986). Origins and pawns in the classroom: Self-report and projective assessments of individual differences in children's perceptions. *Journal of Personality and Social Psychology, 50,* 550–558.

Ryan, R. M., & Lynch, J. (1989). Emotional autonomy versus detachment: Revisiting the vicissitudes of adolescence and young adulthood. *Child Development, 60,* 340–356.

Ryan, R. M., Mims, V., & Koestner, R. (1983). Relation of reward

contingency and interpersonal context to intrinsic motivation: A review and test using cognitive evaluation theory. *Journal of Personality and Social Psychology, 45,* 736–750.

Sallis, J. F., & McKenzie, T. L. (1991). Physical education's role in public health. *Research Quarterly for Exercise and Sport, 62,* 124–137.

Sallis, J. F., Patterson, T. L., Buono, M. J., & Nader, P. R. (1988). Relation of cardiovascular fitness and physical activity cardiovascular risk factors in children and adults. *American Journal of Epidemiology, 127,* 933–941.

Sallis, J. F., Simons-Morton, B., Stone, E., Corbin, C., Epstein, L. H., Faucette, N., et al. (1992). Determinants of physical activity and interventions in youth. *Medicine and Science in Sports and Exercise, 24*(Suppl.), S248–S257.

Seligman, M. E. P. (1975). *Helplessness: On depression development, and death.* San Francisco: Freeman.

Shephard, R. J., & Trudeau, F. (2000). The legacy of physical education: Influences on adult lifestyle. *Pediatric Exercise Science, 12,* 34–50.

Treasure, D. C., & Roberts, G. C. (2001). Students' perceptions of the motivational climate, achievement beliefs and satisfaction in physical education. *Research Quarterly for Exercise and Sport, 72,* 165–175.

Ullman, J. B. (2001). Structural equation modeling. In B. G. Tabachnick & L. S. Fidell (Eds.), *Using multivariate statistics* (4th ed., pp. 653–771). Needham Heights, MA: Allyn & Bacon.

U.S. Department of Health and Human Services. (1996). *A report of the Surgeon General: Physical activity and health.* Atlanta, GA: Centers for Disease Control and Prevention.

Vallerand, R. J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 29, pp. 271–360). New York: Academic Press.

Vallerand, R. J. (2001). A hierarchical model of intrinsic and motivation in sport and exercise. In G. C. Roberts (Ed.), *Advances in motivation in sport and exercise* (pp. 263–320). Champaign, IL: Human Kinetics.

Vallerand, R. J., & Bissonnette, R. (1992). Intrinsic, extrinsic, and amotivational styles as predictors of behavior: A prospective study. *Journal of Personality, 60,* 599–620.

Vallerand, R. J., Fortier, M. S., & Guay, F. (1997). Self-determination and persistence in a real-life setting: Toward a motivational model of high school dropout. *Journal of Personality and Social Psychology, 72,* 1161–1176.

Vallerand, R. J., & Losier, G. F. (1999). An integrative analysis of intrinsic and extrinsic motivation in sport. *Journal of Applied Sport Psychology, 11,* 142–169.

Vallerand, R. J., Pelletier, L. G., Blais, M. R., Brière, N. M., Senécal, C., & Vallières, E. F. (1992). The Academic Motivation Scale: A measure of intrinsic, extrinsic, and amotivation in education. *Educational and Psychological Measurement, 52,* 1003–1019.

Vallerand, R. J., Pelletier, L. G., Blais, M. R., Brière, N. M., Senécal, C., & Vallières, E. F. (1993). On the assessment of intrinsic, extrinsic, and amotivation in education: Evidence on the concurrent and construct validity of the Academic Motivation Scale. *Educational and Psychological Measurement, 53,* 159–172.

Vallerand, R. J., & Reid, G. (1984). On the causal effects of perceived competence on intrinsic motivation: A test of cognitive evaluation theory. *Journal of Sport Psychology, 6,* 94–102.

Vallerand, R. J., & Rousseau, F. L. (2001). Intrinsic and extrinsic motivation in sport and exercise: A review using the hierarchical model of intrinsic and extrinsic motivation. In R. N. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of sport psychology* (2nd ed., pp. 389–416). New York: Wiley.

Van Wersch, A., Trew, K., & Turner, I. (1992). Post-primary school pupils' interest in physical education: Age and gender differences. *British Journal of Educational Psychology, 62,* 56–72.

Weiss, M. R., & Duncan, S. C. (1992). The relationship between physical competence and peer acceptance in the context of children's sports participation. *Journal of Sport and Exercise Psychology, 14,* 177–191.

Yung, Y. F., & Bentler, P. M. (1996). Bootstrapping techniques in analysis of mean and covariance structures. In G. A. Marcoulides & R. E. Schumacker (Eds.), *Advanced structural equation modeling: Issues and techniques* (pp. 195–226). Mahwah, NJ: Erlbaum.

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