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## Students' Motivational Processes and Their Relationship to Teacher Ratings in School Physical Education: A Self-Determination Theory Approach

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*In the present study, we used a model of motivation grounded in self-determination theory (Deci & Ryan, 1985, 1991; Ryan & Deci, 2000a, 2000b, 2002) to examine the relationship between physical education (PE) students' motivational processes and ratings of their effort and persistence as provided by their PE teacher. Data were obtained from 394 British secondary school students (204 boys, 189 girls, 1 gender not specified; M age = 11.97 years; SD = .89; range = 11-14 years) who responded to a multisection inventory (tapping autonomy-support, autonomy, competence, relatedness, and self-determined motivation). The students' respective PE teachers subsequently provided ratings reflecting the effort and persistence each student exhibited in their PE classes. The hypothesized relationships among the study variables were examined via structural equation modeling analysis using latent factors. Results of maximum likelihood analysis using the bootstrapping method revealed the proposed model demonstrated a good fit to the data,  $\chi^2(292) = 632.68$ ,  $p < .001$ ; comparative fit index = .95; incremental fit index = .95, standardized root mean square residual = .077; root mean square error of approximation (RMSEA) = .054 (90% confidence interval of RMSEA = .049-.060). Specifically, the model showed that students who perceived an autonomy supportive environment experienced greater levels of autonomy, competence, and relatedness and had higher scores on an index of self-determination. Student-reported levels of self-determined motivation positively predicted teacher ratings of effort and persistence in PE. The findings are discussed with regard to enhancing student motivation in PE settings.*

**Key words:** autonomy support, need satisfaction, self-determined motivation

In view of the physiological, psychological, and resulting societal costs of sedentary lifestyles (Booth, Chakravarthy, Gordan, & Spangenburg, 2002; Hoffman, Rice, & Sung, 1996; Parliamentary Office of Science and Technology, 2001; Sallis & Owen, 1999; U.S. Department of Health and Human Services, 1996), physical education (PE) has been advanced as an arena in which to combat the reported reductions in physical activity participation.

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According to Biddle and Chatzisarantis (1999), PE has at least three obvious advantages for promoting physical activity. First, the school milieu contains students at the age when change in activity behavior is most likely. Second, the PE context permits use of strategies on a school-wide basis, thus, enabling practically all members of an age cohort to be targeted. Third, a structure to deliver physical activity is already in place. To best capitalize on the infrastructure provided by PE, however, comprehending the theoretical mechanisms underpinning positive motivation patterns within this context would be an important avenue of research. A theoretical framework forming the conceptual foundation for a number of contemporary PE studies (e.g., Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003, 2005) and ones addressing the personal and situational factors that elicit different motivation types is self-determination theory (Deci & Ryan, 1985, 1991; Ryan & Deci, 2000a, 2000b, 2002).

### Self-Determination Theory

As opposed to viewing motivation as a dichotomy (e.g., internal versus external motivation; deCharms, 1968), self-determination theory distinguishes between different reasons that form the impetus for action or inaction. Indeed, different types of motivation have been advanced to account for motivated behavior, namely intrinsic motivation (self-determined behavior), extrinsic motivation (controlled behavior) and amotivation (nonintentional behavior). With the latter in mind, although referred to as a type of motivation in the literature (e.g., Ryan & Deci, 2000a, 2000b), it is important to note that amotivation represents an absence of motivation characterized by a lack of any action or when people act passively (Ryan & Deci, 2002).

Intrinsic motivation represents the prototype of self-regulation and is characterized by undertaking behaviors for the enjoyment, interest, and satisfaction inherent in the activity itself (Deci & Ryan, 1985; Ryan & Deci, 2000a). For example, a student who participates in basketball because he/she enjoys the pleasure, fun, and satisfaction that stem from playing basketball would be intrinsically motivated. That is, their participation is self-endorsed and not directed by "separable" consequences (e.g., rewards, payment, threats, etc.).

Extrinsic motivation is characterized by the impetus (or motivation) for action being instrumental in nature (cf. Deci & Ryan, 1985). Going beyond early work in which extrinsic motivation was operationalized with respect to controlling elements (i.e., events underpinned by an external locus of causality in which behavior is directed by rewards, deadlines, good player awards, etc.) and simply contrasted against intrinsic motivation (e.g., Deci, 1971), self-determination theory considers four distinct types of extrinsic motivation that vary in their degree of self-determination. That is, Deci and Ryan (1985, 1991; Ryan & Deci, 2002) proposed that extrinsic motivation is not always controlling but can also be self-endorsed (i.e., personally controlled motivation to attain a desired consequence). Indeed, both self-determined and controlling behaviors are intentional but differ distinctly in their regulatory processes (Deci, Vallerand, Pelletier, & Ryan, 1991). Positioned on a continuum of self-determination, from low to high levels, extrinsic motivation comprises external regulation (low degree of self-determination), introjected regulation (moderately low degree of self-determination), identified regulation (moderately high degree of self-determination), and integrated regulation (high degree of self-determination).<sup>1</sup>

External regulation represents the least autonomous type of extrinsic motivation and refers to actions that are carried out to gain an external reward and/or avoid punishment. For example, a student who partici-

pates in PE to receive praise from the PE teacher (reward) and/or avoid confrontation with her/his parents (coercion) would be classed as being externally regulated. Introjected regulation represents a form of extrinsic motivation characterized by the individual internalizing external regulations (Ryan & Deci, 2002). With introjected regulation, self-imposed sanctions direct the impetus for action (e.g., shame, self-guilt, ego enhancement, pride) as opposed to external constraints that underlie external regulation (e.g., rewards, punishment, etc.). Importantly, however, while introjected regulation is internal to the individual, his/her actions are not experienced as fully part of the self, as the person is still governed by an external locus of causality (Ryan & Deci, 2000b). An example of introjected regulation is a student who participates in an after school physical activity program not because he/she wants to but because he/she feels it is what "good students" do. As such, he/she would be acting to avoid feelings of self-guilt. Identified regulation is relatively self-determined and refers to behaviors stemming from the conscious valuing of an activity. When manifesting identified regulation, the individual is "identifying" with an activity important to one's aims/goals (Ryan & Deci, 2000a). Accordingly, the person performs such actions willingly to achieve personally valued outcomes (i.e., "this activity can help me achieve something important"). An example of this regulation is a student who actively participates in PE because he/she views it as important for developing his/her sports skills (e.g., "I can improve at sport by participating in PE").

The final regulation embraced by the self-determination framework is amotivation. Assumed to be similar to learned helplessness (Seligman, 1975), amotivation represents a state in which individuals engage passively in activities without any sense of intention, or they not act (Ryan & Deci, 2000a, 2002). Amotivation stems from a lack of competence, the belief that an activity is unimportant, and/or when an individual does not perceive contingencies between her/his behavior and desired outcome(s) (Ryan & Deci, 2000a, 2000b; Vallerand, 1997). In PE, an amotivated student may attend the class but just go "through the motions," without directing actions toward an intended outcome.

It is proposed that these motivational styles form a continuum of self-determination (Deci & Ryan, 1985). Further, the correlations between the regulatory styles are hypothesized to conform to a simplex-ordered correlation structure in which the subscales adjacent along the self-determination continuum (e.g., external regulation and amotivation) are expected to be more positively correlated than those more distant (e.g., amotivation and intrinsic motivation; see Ryan & Connell, 1989). A recent meta-analysis encompassing work from sport, exercise, and PE settings supported this pattern of associations (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003).

Deci and Ryan (1985, 1991; Ryan & Deci, 2000a, 2000b) proposed that intrinsic motivation and certain forms of extrinsic motivation (e.g., identified regulation) enhance psychological functioning and, thus, lead to positive motivational consequences. In contrast, it is proposed that motivational types low in self-determination (e.g., external regulation and amotivation) correspond to maladaptive motivational consequences. Recent research in the context of school PE has supported the notion that adaptive student *self-reported* motivational responses (e.g., effort, intention to exercise) are linked to self-determined motivation (Ntoumanis, 2001; Standage et al., 2003, 2005).

In the present work, we sought to go beyond the student's self-reported responses. Specifically, we asked each student's respective PE teacher to provide ratings pertaining to the amount of motivated behavior each student generally put forth in the PE class. Such an estimate of student-motivated behavior was likely to be a more accurate assessment and less subject to bias than student self-reported responses. In the PE context, a recent study conducted by Ferrer-Caja and Weiss (2000) found intrinsic motivation to be positively associated with teacher ratings of effort, choice of challenging tasks, and persistence in the class activities. Consistent with the results of Ferrer-Caja and Weiss (2000) and in accordance with the tenets of self-determination theory (Deci & Ryan, 1985, 1991; Ryan & Deci, 2000a, 2000b, 2002), we hypothesized that self-determined motivation would positively relate to the teacher's rating of the students' motivated-behavior in PE.

Central to the self-determination framework is the assumption that the nature of the social context influences an individual's motivation, well being, and performance. According to Deci and Ryan (1985, 1991), autonomy-supportive environments (i.e., social contexts that support choice, initiation, and understanding, while minimizing the need to perform and act in a prescribed manner) as opposed to controlling environments facilitate self-determined motivation, healthy development, and optimal psychological functioning. While extant work supports a positive relationship between perceptions of an autonomy-supportive environment and self-determined types of motivation in PE (e.g., Hagger et al., 2003), self-determination theory also holds that intrinsic motivation and optimal psychological functioning are not a direct function of social factors but mediated by three innate psychological needs. That is, it is assumed that for self-determination and optimal psychological functioning to occur, social contexts must fulfill the needs for autonomy (i.e., the need to be agentic, give input, self-endorse activities and beliefs), competence (i.e., the need to effectively interact with one's environment and yield wanted effects and outcomes), and relatedness (i.e., the need to feel connected and close with significant others;

Ryan & Deci, 2000a, 2000b, 2002). Initial empirical work has supported both the positive relationship between perceptions of an autonomy supportive environment and need satisfaction and the positive link between satisfaction of these needs and self-determined motivation in school PE (Standage et al., 2003, 2005).

To recapitulate, consistent with past work and the tenets of self-determination theory (Deci & Ryan, 1985, 1991; Ryan & Deci, 2002) the purpose of the present work was to examine a model of motivational processes grounded in self-determination theory.<sup>2</sup> Specifically, a structural equation model was tested, hypothesizing that: (a) perceptions of an autonomy-supportive environment would positively predict autonomy, competence, and relatedness; (b) autonomy, competence, and relatedness would positively predict self-determined motivation; and (c) self-determined motivation would positively predict positive teacher ratings of student effort and persistence.

## Method

### Participants

Participants were 394 ( $M$  age = 11.97 years,  $SD$  .89; boys = 204, girls = 189; 1 participant did not specify his/her gender) Year 7 (ages = 11–12 years) and Year 8 (ages = 13–14 years) secondary school children and 9 teachers (5 men and 4 women) from two state schools located in southeast England. Data were collected from 12 PE classes. Prior to the collection of data, the School Human Subjects Committee of a large UK university issued consent to conduct the study, and the head teachers of the two schools provided written consent, acting in loco parentis, according to the ethical guidelines of the British Psychological Society (2000).

### Procedures

Before participating in their scheduled PE lesson, participants responded to a multisection inventory. An investigator 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. It was emphasized to the students that: (a) there were no right or wrong responses to any of the items, (b) their PE teacher would not see their responses in order to elicit honest responses about their own perceptions of the PE class/experience, (c) the data (i.e., completed questionnaires) would be treated in strictest confidence and remain locked in a filing cabinet at the host university, and (d) the data would be analyzed in terms of group responses rather than as individual re-

sponses. Participants also had the option to withdraw from the study at any time without negative repercussions. To this end, no student refused to participate, nor did any withdraw from the study. The questionnaire took approximately 20 min to complete, after which the students were thanked for their cooperation.

In addition to the students' self-reported responses, teacher ratings were obtained, indicating each participant's motivated behavior within the PE class (effort and persistence). The teachers completed the ratings for each student and returned the rating sheets to the university within a week. These scores were then matched to the child's self-reported responses using a coding system (date of birth/number of siblings/gender/class). Consistent with past work (e.g., Ferrer-Caja & Weiss, 2000), data were collected toward the end of the academic term so as to allow the students sufficient time to form perceptions of the class climate. In this study, the data were collected 7 months into the academic term. To this end, collecting data at this juncture would also permit the PE teacher to have a more accurate perception of each student's effort and persistence towards PE tasks.

### Measures

*Autonomy Support.* To assess the degree to which the students perceived the PE teacher supported their autonomy in PE, we used a modified version of the 6-item Learning Climate Questionnaire (LCQ; Williams & Deci, 1996). That is, we slightly amended the items of the LCQ to target the PE context. Example items included, "we feel that the PE teacher provides us with choices and options," and, "the PE teacher encourages us to ask questions." Students responded to the items on a seven-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Cronbach alpha coefficients from past work with college-aged medical science students revealed reliable scores to be provided to this scale (Williams & Deci, 1996).

*Autonomy.* Autonomy was measured using five items that have been used in previous work to assess autonomy from a self-determination theory perspective in PE (Standage et al., 2003). Participants responded to the items (e.g., "I have some choice in what I want to do" and "I have a say regarding what skills I want to practice"), preceded by the stem, "In this PE class...." Students responded using a seven-point Likert-type scale anchored by 1 (strongly disagree) to 7 (strongly agree). Via Cronbach's alpha coefficients, prior research in PE with British children (Standage et al., 2003) supported the reliability of scores produced by this scale.

*Competence.* Competence was assessed using the five-item Perceived Competence subscale of the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, & Tammen, 1989). This version of the IMI applies to sport or the origi-

nal scale, as developed by Ryan (1982) to assess competence within Deci and Ryan's (1985) Cognitive Evaluation Theory (a subtheory of self-determination theory). Reworded to target the PE context, an exemplary item is: "I am pretty skilled at PE." Participants responded using a seven-point Likert-type scale anchored by 1 (strongly disagree) to 7 (strongly agree). Using Cronbach alpha coefficients, previous PE based-research involving British children of a similar age showed that the competence subscale of the IMI produces reliable scores (Ntoumanis, 2001; Standage et al., 2003).

*Relatedness.* Relatedness was assessed using the acceptance subscale of the Need for Relatedness Scale (Richer & Vallerand, 1998). Originally developed to assess satisfaction of the need for relatedness in the workplace aligned with the tenets of self-determination theory, the stem was modified in the present study to be PE-specific: "With the other students in my PE class I feel...." The stem was followed by five items, including "close," "valued," and "supported," to which the participants responded on a seven-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Via Cronbach's alpha coefficients, previous PE work with British children (Standage et al., 2003) reported reliable scores pertaining to this scale.

*Motivational Regulations.* The different types of motivational regulation were assessed using the Perceived Locus of Causality scale devised by Goudas, Biddle, and Fox (1994), which was based on the work of Ryan and Connell (1989). Goudas et al. (1994) also included an amotivation subscale adapted from the Academic Motivation Scale (Vallerand et al., 1992). These additional items were used in the present work. Participants responded to the items using the stem, "I take part in this PE class...." Example items (four for each subscale) are: "because PE is fun" (intrinsic motivation), "because it is important for me to do well in PE" (identified regulation), "because I'll feel bad about myself if I didn't" (introjected regulation), "because I'll get into trouble if I don't" (external regulation), and "but I really don't know why" (amotivation). Students responded using a seven-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Previous work with British school children (Goudas et al., 1994; Ntoumanis, 2001; Wang & Biddle, 2001) supported the reliability of scores (via Cronbach's alpha coefficients) and factorial structure (via confirmatory factor analysis) of this scale.

To examine motivation within the hypothesized structural equation model (SEM) consistent with past work (e.g., Vallerand, Fortier, & Guay, 1997; Wang & Biddle, 2001), we assigned weights to the motivational items according to their respective location on the self-determination continuum to form a self-determined motivation index (SDI).<sup>3</sup> Amotivation was not used in the equation, as the SDI is concerned with the degree

to which one's motivation is self-determined, whereas the amotivation subscale assesses not being motivated. Because there were four items per subscale, four indexes were formed using the following formula:

$$2 \times \text{intrinsic motivation} + \text{identified regulation} - \text{introjected regulation} - 2 \times \text{external regulation}$$

In addition to forming a total score, the four indexes served as indicators of the latent variable SDI.

*Teacher Rating of Motivated Behavior.* Using the five-item adapted PE version of the *Teacher Rating of Academic Achievement Motivation* (TRAAM; Stinnett, Oehler-Stinnett, & Stout, 1991) as modified by Ferrer-Caja and Weiss (2000), teachers rated each student in their class with respect to the motivated behaviors students typically exhibited (indexed by effort, choice of challenging tasks, and persistence). Each item was preceded by the stem, "In this physical education class, the student..." An example item from this scale is: "often makes effort to learn how to perform physical education skills." Teachers responded to the five items using a five-point Likert-type scale anchored by 1 (strongly disagree) to 5 (strongly agree). Past work conducted in a PE setting (Ferrer-Caja & Weiss, 2000, 2002) found scores stemming from this adapted version of the TRAAM to be internally reliable (via Cronbach alphas).

## Results

### Descriptive Statistics

Table 1 contains the means, standard deviations, range, skewness and kurtosis characteristics, and alpha coefficient (Cronbach, 1951) values for all measures. As shown, alpha coefficients ranged from .68 to .91. With respect to the adapted TRAAM measure (Ferrer-Caja & Weiss, 2000), an inspection of the item-total scale score correlations revealed that the reverse scored items, "prefers easy tasks to more difficult tasks" and "gives up easily on tasks that are difficult or challenging," were problematic ( $r < .40$ ). Thus, these items, which captured more of participants' task challenge preference, were eliminated from the descriptive analyses and explored further in the measurement model underpinning the hypothesized model of motivational processes. A recalculation of the Cronbach's alpha coefficient revealed that excluding these items markedly improved the alpha coefficient for the scale (from .67 to .91).

The bivariate correlations (see Table 2) revealed that perceptions of an autonomy-supportive climate were positively associated with autonomy, competence, re-

latedness, intrinsic motivation, identified regulation, introjected regulation, SDI, and the teachers' ratings of motivated behaviors and negatively linked to external regulation and amotivation. Autonomy, competence, and relatedness were all positively associated with intrinsic motivation, identified regulation, introjected regulation SDI, and the teachers' ratings of motivated behaviors and negatively linked to external regulation and amotivation. Intrinsic motivation, identified regulation, introjected regulation, and SDI corresponded positively with the teachers' ratings of motivated behaviors, while external regulation and amotivation were negatively associated with these ratings. Finally, the associations among the motivation types were consistent with the proposed simplex pattern of associations (Ryan & Connell, 1989).

### Structural Equation Modeling Analysis

The adequacy of the models tested was analyzed via SEM using Version 5.0 of the statistical program AMOS (Arbuckle, 2003). Because normality is assumed when maximum likelihood analysis (MLE) is used, the initial step was to examine the normality of the data. An inspection of Mardia's multivariate coefficient indicated the data distribution to be nonnormal. Thus, we used the MLE method in conjunction with the bootstrapping procedure, as it does not require distributional assumptions but estimates the standard errors for parameter estimates using the bootstrap algorithm of Efron (1982).

**Table 1.** Descriptive statistics and internal consistency for each measure

Subscale	<i>M</i>	<i>SD</i>	Actual range	Kurtosis	Skewness	$\alpha$
Autonomy support	4.22	1.25	1-7	-.45	-.23	.85
Autonomy	3.89	1.28	1-7	-.38	-.05	.80
Competence	4.87	1.43	1-7	-.03	-.74	.87
Relatedness	4.60	1.38	1-7	-.22	-.45	.89
Intrinsic motivation	4.80	1.61	1-7	-.61	-.46	.89
Identified regulation	5.05	1.43	1-7	-.01	-.66	.85
Introjected regulation	3.88	1.34	1-7	-.37	.06	.68
External regulation	3.71	1.58	1-7	-.72	.15	.81
Amotivation	2.86	1.60	1-7	-.23	.75	.85
SDI	3.34	6.21	-15-17	-.27	-.22	.89
Teacher rating of motivated behavior	4.02	.90	1-5	.55	-.94	.91

*Note.* *M* = mean; *SD* = standard deviation; SDI = self-determined motivation index.

The overall fit of the analyzed model to the data was examined using the chi-square test ( $\chi^2$ ). A nonsignificant  $\chi^2$  indicates the model has an acceptable fit to the sample data. However, because sample size influences the  $\chi^2$  statistic (Marsh, Balla, & McDonald, 1988), supplementary fit indexes were also used. To this end, a 2-index presentation strategy proposed by Hu and Bentler (1999) was adopted. This approach advances the use of the standardized root mean square residual (SRMR) as a measure of absolute fit, together with a supplementary incremental fit index. With regard to the latter, we used the comparative fit index (CFI) and the incremental fit index (IFI). We also used an additional measure of absolute fit, namely the root mean square error of approximation (RMSEA). Hu and Bentler (1999) proposed that values close to or greater than .95 for the CFI and IFI and values of (or less) than .08 and .06 for the SRMR and RMSEA, respectively, are indicative of good model fit. In addition to the fit indexes, we also examined the proportion of variance explained by the independent variable(s) for the dependent variable of interest by examining the squared multiple correlation (SMC) values.

To test the hypothesized model, we followed the model-building approach recommended by Anderson and Gerbing (1988, in which the first step is to examine the adequacy of a confirmatory factor analysis of the measurement model. Results of this analysis revealed an unsatisfactory fit of the data to the model,  $\chi^2 (390) = 1333.11, p < .001$ ; CFI = .87; IFI = .87, SRMR = .129; RMSEA = .078 (90% CI of RMSEA = .074–.083). To detect the source for this lack of fit, we examined the modification indexes, standardized residuals, and SMC values. An examination of these indexes suggested the two TRAMM items identified in the descriptive statistics sec-

tion (“prefers easy tasks to more difficult tasks” and “gives up easily on tasks that are difficult or challenging”) and two autonomy items (“I feel that I do PE because I want to” and “I feel a certain freedom of action”) to be problematic. These items were removed, and the modified measurement model was reanalyzed. As Hoffmann (1995) indicated, when assessing a measurement model, such a procedure is considered acceptable as it preserves the general structure of the originally hypothesized model but with only the best indicators. The revised measurement model revealed a good fit to the study data,  $\chi^2 (284) = 551.35, p < .001$ ; CFI = .96; IFI = .96, SRMR = .049; RMSEA = .049 (90% CI of RMSEA = .043–.055).

The second part of the model building approach examined the proposed path model of motivational processes. Results of the SEM analysis revealed the model was a good fit to the data,  $\chi^2 (292) = 632.68, p < .001$ ; CFI = .95; IFI = .95, SRMR = .077; RMSEA = .054 (90% CI of RMSEA = .049–.060).<sup>4</sup> The standardized solution of the model (see Figure 1) shows perceptions of an autonomy supportive environment to positively predict autonomy, competence, and relatedness. In turn, autonomy, competence, and relatedness positively predicted self-determined motivation. Self-determined motivation positively predicted teacher ratings of effort and persistence.

SMC values revealed autonomy support to predict 40, 22, and 34% of the variance in autonomy, competence, and relatedness scores, respectively. Autonomy, competence, and relatedness cumulatively accounted for 43% of the variance in self-determined motivation scores. Finally, self-determined motivation accounted for 11% of the variance in teacher ratings of motivated behavior responses.

**Table 2.** Bivariate correlations among the study variables

Subscale	1	2	3	4	5	6	7	8	9	10	11
1. Autonomy support	—										
2. Autonomy	.65	—									
3. Competence	.38	.42	—								
4. Relatedness	.49	.50	.43	—							
5. Intrinsic motivation	.55	.68	.52	.48	—						
6. Identified regulation	.43	.59	.47	.41	.85	—					
7. Introjected regulation	.22	.28	.23	.16	.43	.54	—				
8. External regulation	-.26	-.39	-.34	-.26	-.40	-.29	.18	—			
9. Amotivation	-.36	-.49	-.49	-.36	-.62	-.59	-.12	.61	—		
10. SDI	.47	.63	.50	.44	.82	.70	.04	-.82	-.74	—	
11. Teacher rating of motivated behavior	.28	.31	.37	.20	.32	.30	.11	-.16	-.30	.29	—

Note: SDI = self-determined motivation index; bivariate correlations of .11 and above are significant at the  $p < .05$ ; bivariate correlations of .16 and above are significant at the  $p < .001$  level.

Significant standardized indirect effects revealed that autonomy support had positive effects on self-determined motivation ( $\beta = .47, p < .05$ ) and the teacher ratings of effort and persistence ( $\beta = .15, p < .05$ ). Additionally, autonomy ( $\beta = .08, p < .05$ ), competence ( $\beta = .14, p < .05$ ), and relatedness ( $\beta = .06, p < .05$ ) had weak, yet significant, positive indirect effects through self-determined motivation on the teacher ratings.

## Discussion

The present study investigated a model of motivational processes grounded in self-determination theory (Deci & Ryan, 1985, 1991; Ryan & Deci, 2000b, 2002). Specifically, we explored a model that encompassed the following theory-based hypotheses: (a) an autonomy supportive environment would positively predict autonomy, competence, and relatedness; (b) autonomy, competence, and relatedness would facilitate self-determined motivation; and (c) positive teacher ratings of student effort and persistence in PE would be a function of self-determined motivation. Results from the present research supported each of these predictions.

As hypothesized, perceptions of autonomy support positively predicted autonomy, competence, and relatedness. This finding is consistent with the theoretical tenets of self-determination theory, which hold that perceptions of autonomy support provide the social conditions required to foster self-determined motivation by satisfying the three innate psychological needs (Ryan & Deci, 2000b). In showing that perceptions of autonomy support are positively related to autonomy, competence, and relatedness, the present data are also consistent with recent work in school PE (Standage et al., 2003, 2005). From an applied perspective, the findings suggest that PE teachers should try to foster social contexts that support student choice, initiation, personal volition, and understanding to facilitate the satisfaction of students' innate psychological needs (see Ryan & Deci, 2002). Adding support to the veracity of promoting such contexts and congruent with past work (e.g., Hagger et al., 2003), the indirect effects showed student perceptions of autonomy support to positively predict self-determined motivation through autonomy, competence, and relatedness. To this end, it may be that autonomy supportive conditions permit the internalization of students' reasons for partaking in PE to be autonomous (self-determined) in nature (cf. Reeve, 2002).

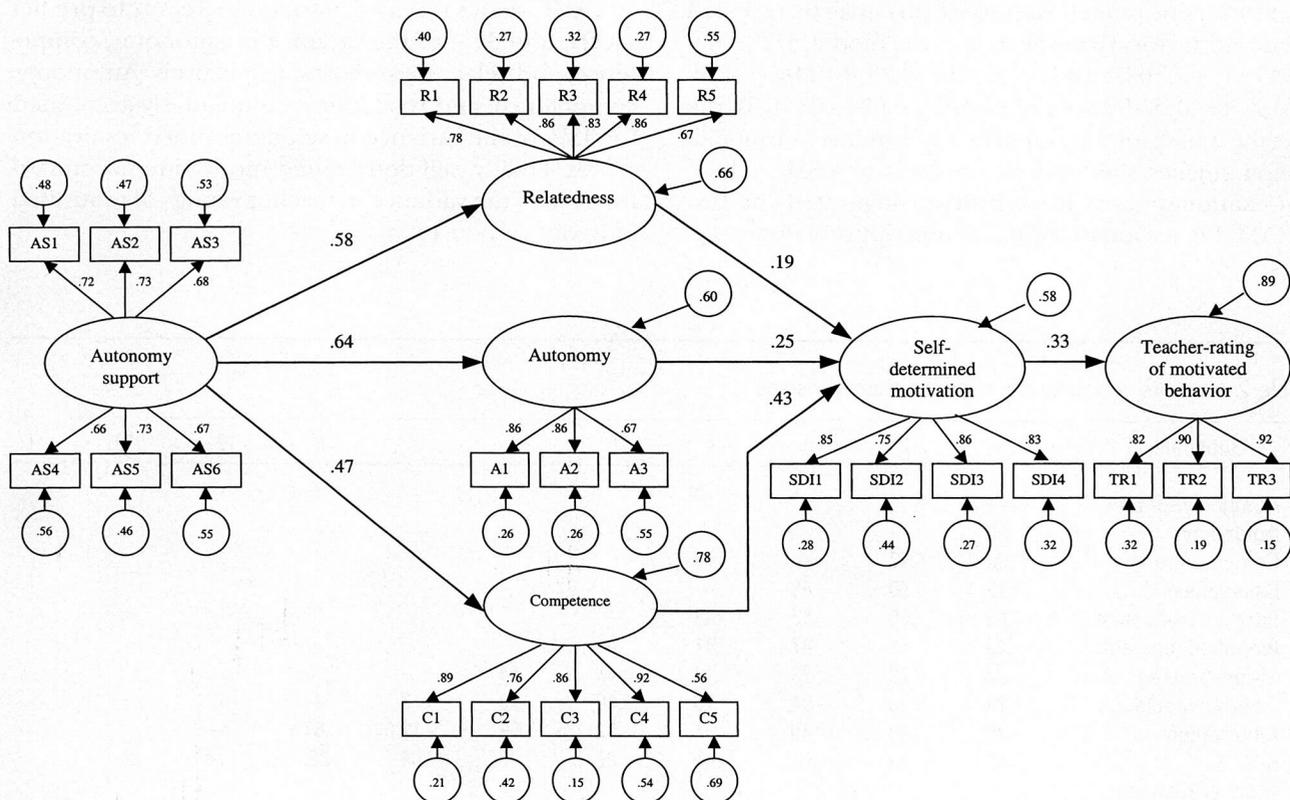


Figure 1. Standardized solution of the path model; solid lines represent significant standardized parameter estimates, ellipses represent latent variables, squares with abbreviated names/letters and numbers represent factor indicators, values in circles represent error terms.

While the present study provides some insight into the social factors required to engender need satisfaction, future work may benefit from adopting a multidimensional approach to potential environmental influences. That is, while the present work supported the promotion of autonomy support in the teacher-created environment, research aimed at also considering the social supports for competence and relatedness may further enhance our knowledge of "healthy" PE class environments (Standage et al., 2005).

In accordance with previous research in PE (Standage et al., 2003, 2005), perceptions that the teacher-created social context satisfied autonomy, competence, and relatedness corresponded positively to students' level of self-determined motivation. The present results, therefore, support Deci and Ryan's (Deci & Ryan, 1991; Ryan & Deci, 2000a, 2002) proposal that psychological need satisfaction is fundamental to autonomous motivation. Akin to some past work in PE (e.g., Ntoumanis, 2001), competence emerged as the main predictor of self-determined motivation. As such, the findings from the current research and certain previous cross-sectional studies suggest competence to have the strongest predictive effects on self-determined PE motivation, at least in the *short-term*. To this end, Deci and Ryan (1985) and others (Vallerand, 1997) argued that the relative impact of autonomy, competence, and relatedness will vary depending on the functional significance of the situation at hand. The present findings, therefore, may be attributed to the fact that physical competencies are publicly visible and salient in PE; thus, the functional significance of competence may be greater than those for autonomy and relatedness in this setting.

Self-determination theory specifies that self-determined forms of motivation correspond to greater levels of performance and persistence. Our results support this theoretical postulation and are congruent with past empirical work in this area (e.g., Ferrer-Caja & Weiss, 2000) by showing self-reported levels of self-determined motivation positively correspond to teacher ratings of how hard students try and the degree to which they persevere. As shown in Figure 1, the path between self-determined motivation and teacher-rated motivated behavior is relatively weak, explaining 11% of the variance in teacher ratings of students' effort and persistence in PE classes. However, we concur with Ferrer-Caja and Weiss (2000) who, having found a comparable percentage of variance, argued that such values are meaningful if PE teachers can increase their students' motivated behavior by such amounts. Moreover, while the variance might appear small, it is important to consider that the data concerning these two variables were obtained from separate individuals (i.e., the student and the teacher, respectively), and, therefore, the explained variance was not inflated as when the same individual rates multiple scales. It should be acknowledged, however, that, although expected to be more ac-

curate/less subject to bias than self-reported ratings of effort and persistence, the estimates provided by the teachers could be restricted by the teachers potentially not knowing *all* students sufficiently well enough to provide a precise evaluation. As such, future work would do well to go beyond assessments of self and/or significant others' perceptions, and move toward objectively assessed levels of physical activity *within* and *outside* of school PE classes. After initial work ascertaining the most appropriate measures of physical activity for children and adolescents (e.g., Allor & Pivarnik, 2001; Ekelund, Westerterp, & Sjöström, 2002; for a review, see Cooper, 2003), longitudinal work assessing objective physical activity levels should provide researchers with greater insight into how being motivated in differing ways (e.g., intrinsically vs. extrinsically) impacts actual physical activity levels over time. Such work would provide much needed information as to the role the PE context can potentially play in promoting active living.

In the present study, we used the SDI to provide information about the level at which students' motivation toward PE was more or less self-determined. While it would have been insightful to have modeled all motivational regulations independently, it has been argued that the SDI facilitates an adequate test of comprehensive SEM models, such as that examined in the present work (Vallerand, 1997). Although useful for reducing the number of indicators in SEM models, an index of self-determined motivation may mask some important information, such as which motivational regulation(s) best predict the dependent variable(s) of interest (Vallerand, 1997). In future work, researchers would do well to test the predictive use of each distinct motivational regulation on teacher ratings and other markers of student motivated-behavior.

In conclusion, the present results reinforced a number of the theoretical tenets of self-determination theory. First, the teacher providing autonomy support enhanced the level of reported autonomy, competence, and autonomy experienced by the student. Moreover, via these important psychological needs, autonomy support indirectly led to self-determined motivation. Second, perceptions of autonomy, competence, and relatedness positively predicted self-determined motivation toward PE. Third, self-determined motivation was positively linked to teacher ratings of effort and persistence. Collectively, the results of the present research support Deci and Ryan's framework as a model of motivation that can advance our knowledge of motivational processes in PE settings.

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- in a way congruent with the social values, which they have accepted as their own ("important to me;" Deci & Ryan, 1985). 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). For this reason, this construct is neither assessed nor elaborated on in the present study.
2. A fundamental tenet of Deci and Ryan's theorizing is the premise that the psychological processes and constructs embraced by self-determination theory are universal to all cultures, across gender, and throughout developmental periods (Deci & Ryan, 2000, 2002; Ryan & Deci, 2000a, 2002). Past work in physical education (Ntoumanis, 2001; Standage et al., 2005) and education (Vallerand et al., 1997) supported the gender invariance of motivational models grounded in self-determination. Accordingly, for the purpose of this paper, data from boys and girls were analyzed in a combined fashion.
3. The self-determined motivation index is also referred to as the relative autonomy index in the extant literature.
4. An alternative model tested postulated a direct path from autonomy support to self-determined motivation and direct paths from autonomy, competence, and relatedness to teacher rating of motivated behavior. Although the fit indexes of this alternative model,  $\chi^2$  (288) = 591.45,  $p < .001$ ; comparative fit index = .95; incremental fit index = .95, standardized root mean square residual = .066; root mean square error of approximation (RMSEA) = .052 (90% confidence interval of RMSEA = .046–.058), were comparable to the final model, the added paths were nonsignificant (i.e., their  $z$  scores were less than 1.96). This is not surprising, because self-determination theory does not predict these direct paths. Therefore, we did not explore this model further.

## Notes

1. Self-determination theory (Deci & Ryan, 1985, 1991) embraces integrated regulation as a type of extrinsic motivation. Integrated regulation refers to identifications that have been incorporated within the self, meaning they have been assessed and brought into congruence with individuals' other values and needs (Ryan & Deci, 2000a). For example, an individual who says, "I participate in physical activity because it is important to me to be physically healthy," illustrates the principle underlying integrated regulation. Rather than partake in physical activity because social values dictate, individuals high in integrated regulation feel, behave, and think

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## Appendix A. Questionnaire items used in the study

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### Autonomy support

In this PE class...

we feel that the PE teacher provides us with choices and options.

we feel understood by our PE teacher.

the PE teacher shows confidence in our abilities to do well in PE.

the PE teacher encourages us to ask questions.

the PE teacher listens to how we would like to do things.

the PE teacher tries to understand how we see things before suggesting new ways to do things.

### Autonomy

In this PE class...

I can decide which activities I want to practice.

I have a say regarding what skills I want to practice.

I feel that I do PE because I want to.

I feel a certain freedom of action.

I have some choice in what I want to do.

### Competence

I think I am pretty good at PE.

I am satisfied with my performance at PE.

When I have participated in PE for awhile, I feel pretty competent.

I am pretty skilled at PE.

I can't do PE very well.

### Relatedness

With the other students in this PE class I feel...

Supported

Understood

Listened to

Valued

Safe

### Motivation

I take part in this PE class...

#### *Intrinsic motivation*

because PE is fun.

because I enjoy learning new skills.

because PE is exciting.

because of the enjoyment that I feel while learning new skills/techniques.

#### *Identified regulation*

because I want to learn sport skills.

because it is important for me to do well in PE

because I want to improve in sport.

because I can learn skills which I could use in other areas of my life.

#### *Introjected regulation*

because I want the teacher to think I'm a good student.

because I would feel bad about myself if I didn't.

because I want the other students to think I'm skilful.

because it bothers me when I don't.

#### *External regulation*

because I'll get into trouble if I don't.

because that's what I am supposed to do.

so that the teacher won't yell at me.

because that's the rule.

#### *Amotivation*

but I don't really know why.

but I don't see why we should have PE.

but I really feel I'm wasting my time in PE.

but I can't see what I'm getting out of PE.

### Teacher ratings of motivated behavior

In the physical education class, the [student name]...

Gives up easily on tasks that are difficult or challenging

Often makes effort to learn how to perform physical education skills

Prefers easy tasks to more difficult tasks

Will try a new task again even if she/he was not successful the first time

Is not discouraged easily even after failures.

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