British Journal of Educational Psychology (2001), **71**, 225–242 *Printed in Great Britain*

A self-determination approach to the understanding of motivation in physical education

Nikos Ntoumanis*

Leeds Metropolitan University, UK

Background. It is widely acknowledged that Physical Education (PE) can play a potentially important role in enhancing public health by creating positive attitudes toward exercise and by promoting health-related fitness programmes. However, these initiatives will have limited success if students are not motivated to participate actively in their PE lessons.

Aim. A sequence of motivational processes, proposed by Vallerand (1997), was tested in this study. The sequence has the form 'social factors→psychological mediators→types of motivation→consequences'.

Sample. Participants were 424 British students aged 14–16 years from Northwest England.

Method. Questionnaires were used to measure cooperative learning, self-referenced improvement, and choice of tasks (social factors), perceived competence, autonomy, and relatedness (psychological mediators), intrinsic motivation, identification, introjection, external regulation, and amotivation (types of motivation), and boredom, effort, and future intention to exercise (consequences).

Results. A SEM analysis showed that perceived competence was the major psychological mediator. Intrinsic motivation was related to positive consequences, whereas external regulation and amotivation were predictors of negative consequences. A multisample analysis indicated that the model was largely invariant across gender.

Conclusions. The findings underline the importance of perceived competence and intrinsic motivation in compulsory PE.

The importance of physical education (PE) in contemporary school education is now recognised worldwide. In Britain, for example, the 1986 and 1988 Education Acts included PE as one of the foundation subjects in the national curriculum. In US, Sallis and McKenzie (1991) reported that prominent professional organisations, such as the American Academy of Physical Education, and the American Academy of Pediatrics

*Requests for reprints should be addressed to Dr Nikos Ntoumanis, Faculty of Cultural and Education Studies, School of Leisure and Sports Studies, Leeds Metropolitan University, Beckett Park Campus, Leeds, LS6 3QS, UK (e-mail: N.Ntoumanis@lmu.ac.uk).

Committees on Sports Medicine and School Health, have made strong arguments in favour of physical education programmes, and have emphasised the role of these programmes in public health. Sallis and McKenzie (1991) argued that positive experiences in PE could influence children to adopt physically active adult lifestyles which can improve public health. It is, therefore, important to understand the motivational, cognitive, and affective processes that can determine whether children will regard PE as a valuable, enjoyable, and rewarding experience, or as a worthless, boring, and humiliating one.

To this direction, the self-determination approach to motivation (Deci & Ryan, 1985, 1991; Deci, Vallerand, Pelletier, & Ryan, 1991; Frederick & Ryan, 1995; Vallerand, Deci, & Ryan, 1987) can be particularly helpful. This theoretical perspective has been applied successfully to education and sport and has shown the important role of different types of motivation in inducing a number of different cognitive, behavioural, and affective outcomes. Self-determination theory argues that behaviour can be broadly categorised as intrinsically motivated, extrinsically motivated, or amotivated. According to Deci and Ryan (1991), intrinsically motivated behaviours can occur without external rewards (e.g., trophies), are undertaken out of interest in the activity itself rather than the outcomes of the activity, and are optimally challenging. In contrast, extrinsically motivated behaviours are evident when the activity is carried out as a means to an end and not for its own sake. Lastly, amotivated behaviour can be found in situations where individuals are neither intrinsically nor extrinsically motivated. Amotivation refers to situations where individuals perceive no contingencies between outcomes and their actions, where they experience feelings of incompetence and uncontrollability (Vallerand, Pelletier, Blais, Briere, Senecal, & Vallieres, 1992).

Four types of extrinsic motivation have been described by Deci and Ryan (1985, 1991): external regulation, introjected regulation, identified regulation, and integrated regulation. External regulation represents behaviours which are regulated through external means, such as rewards or punishment (e.g., 'I take part in PE because I'll get into trouble if I don't'). Introjected regulation refers to behaviours which are beginning to be internalised, but they are not fully self-determined. These behaviours can be performed, for example, in order to gain social recognition or avoid internal pressures and feelings of guilt (e.g., 'I take part in PE because I would feel bad about myself if I didn't'). With identified regulation, behaviour becomes more self-determined. The outcomes of the behaviour are highly valued and the latter is performed with less pressure even if it is not particularly pleasant (e.g., 'I take part in PE because I want to improve my sport skills'). Lastly, integrated regulation represents the most self-determined form of the internalisation process. It refers to behaviours which are performed out of choice in order to harmonise and bring coherence to different parts of the self (e.g., 'I take part in PE because it is very important for me to have a healthy life style'). Deci and Ryan (1991) emphasised that although identified regulation represents fully integrated and self-determined forms of behaviour, it is still an extrinsically motivated behaviour because it is performed in order to achieve personal goals and not for its inherent appeal.

The different types of motivated behaviours can be ordered along a self-determination continuum. From lower to higher levels of self-determination, they are amotivation, external regulation, introjected regulation, identified regulation, inte-

grated regulation, and intrinsic motivation. External regulation and introjected regulation are considered to be controlling forms of motivation, whereas identified regulation, integrated regulation, and intrinsic motivation are viewed as self-determined forms. Vallerand (1997) proposed a comprehensive model of motivation which posits that the different motivational types are influenced by a number of social factors. However, the influence of these social factors is exerted through the satisfaction of certain psychological needs. Lastly, the model predicts that the different types of motivation will lead to important cognitive, affective, and behavioural consequences. Vallerand (1997) proposed that this motivational sequence of 'social factors → psychological mediators → types of motivation → consequences' can be encountered at a global, contextual, and situational motivational level.

Vallerand and Losier (1999) argued that this sequence can be applied to the context of sport and physical activity. There are numerous social factors in physical activity which can play an important role in determining student motivation. For example, Vallerand and Losier proposed that cooperation fosters self-determined forms of behaviour. This is in agreement with Ames' (1992) suggestion that motivational climates which emphasise cooperation bring students together to help each other learn and improve. Cooperation makes an activity inherently more interesting whereas competition among students can undermine their intrinsic motivation toward the activity.

Another important social factor may be the emphasis placed by the PE teacher on student self-referenced improvement. A motivational climate which employs self-referenced criteria (e.g., improvement of individual performance levels) to judge the degree of student improvement will foster perceived competence and self-determined forms of motivation, because it will reduce the controlling nature of interpersonal comparison (Ames, 1992). In contrast, comparative criteria (e.g., being first) are more difficult to meet and can undermine perceptions of competence and intrinsic interest in an activity. Lastly, a third important social factor in explaining the motivational sequences in physical education may be the availability of choice of behaviours and tasks (Vallerand & Losier, 1999). For example, a PE teacher who provides choice of tasks and gives leadership roles encourages autonomy and improvisation and reduces controlling pressures for uniform behaviour (Blanchard & Vallerand, 1996, cited in Vallerand & Losier, 1999).

Vallerand's (1997) model posits that the influence of social factors on the different types of motivation is exerted through the satisfaction of three psychological needs. These are the needs for autonomy, competence, and relatedness. The need for autonomy refers to individuals' efforts to have a say over their behaviour, to feel like the 'origin' and not the 'pawn' of their actions (deCharms, 1968). The importance of the need to feel competent and achieve desired outcomes has been identified several decades ago (e.g., see effectance competence theory; White, 1959). In physical activity settings there is a considerable research evidence to suggest that individuals' perception of their physical competence has a significant effect on their performance, behaviour, cognition, and affect (Weiss & Ebbeck, 1996). Lastly, the need for relatedness refers to individuals' efforts to be accepted by others and interact effectively with them within a social context. Research on participation motives in sport (for a review see Weinberg & Gould, 1999) has frequently identified the need to be with friends or make new friends

as one of the major motives for sport participation.

Deci and Ryan (1985) predicted that social factors which increase perceptions of competence, autonomy, and relatedness, will satisfy these needs and foster self-determination, whereas social factors which undermine such perceptions will promote controlling or amotivated forms of behaviour. These predictions have been verified in sport in a study by Blanchard and Vallerand (1996; cited in Vallerand, 1997) which showed that increased team cohesion and an autonomy-supportive interpersonal style of basketball coaches increased perceptions of the three psychological mediators, which in turn increased self-determined motivation.

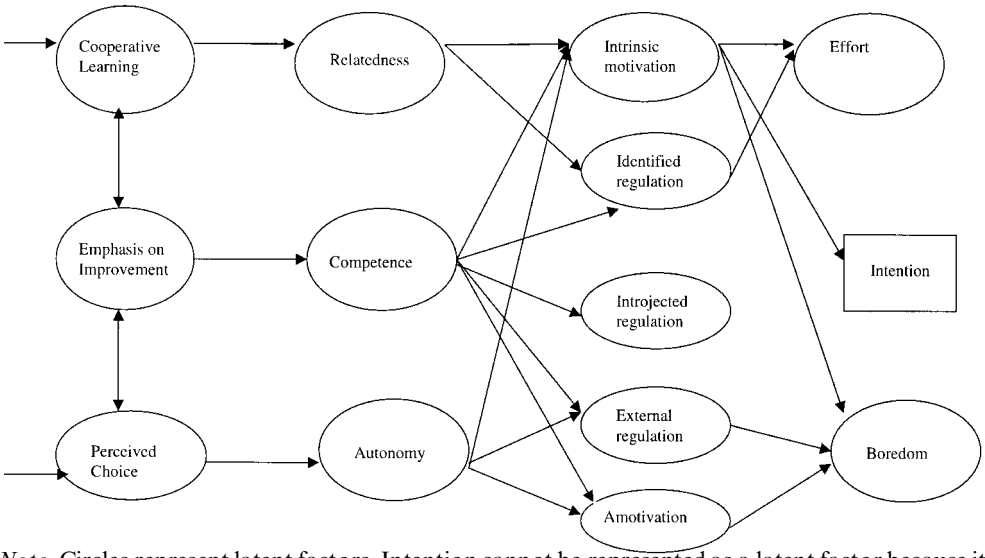
The last stage of Vallerand's (1997) model refers to the cognitive (e.g., concentration levels), affective (e.g., enjoyment, boredom), and behavioural (e.g., effort and persistence at a particular task) consequences of different motivational types. Based on Deci and Ryan's theorising (1991), Vallerand (1997) proposed that positive outcomes should result from self-determined forms of motivation (intrinsic motivation, and identified regulation), whereas negative outcomes should result from less self-determined forms of motivation (especially amotivation and external regulation). Support for this prediction has been given in the context of work, interpersonal relationships, education, and sport.

For example, in the context of education, Vallerand, Pelletier, Blais, Briere, Senecal, and Vallieres (1993) reported that self-determined types of motivation were related to concentration and positive emotions in class, academic satisfaction, reported grades, and future intentions with schooling. In contrast, amotivation and external regulation were negatively related or unrelated to these outcomes. However, it should be noted that most of the relationships were moderate to small. In sport, Pelletier, Fortier, Vallerand, Tuson, Briere, and Blais (1995) found that intrinsic motivation was positively related to self-reported effort and intentions to play sport in the future, and negatively related to distractions in training. The inverse pattern of relationships was observed with amotivation. It is worth noting that in both studies by Vallerand *et al.* (1993) and Pelletier *et al.* (1995) introjected regulation was unrelated to most positive and negative outcomes.

In view of the aforementioned importance of motivated behaviour in PE, the purpose of the present study was to test in this context the motivational sequence described by Vallerand (1997) and Vallerand and Losier (1999). To date, there are no studies which have tested this motivational sequence despite its intuitive appeal and the strong theoretical and empirical support in other life contexts.

It was hypothesised (see Figure 1) that cooperative learning would predict perceptions of relatedness, emphasis on improvement would predict perceived competence, and perceived choice would predict levels of autonomy. It was also hypothesised that relatedness would be more strongly related to self-determined motivational forms. Autonomy was expected to predict intrinsic motivation positively and external regulation and amotivation negatively. Owing to the central role of perceived competence in physical activity (Horn & Harris, 1996; Van Rossum, Musch, & Vermeer, 1999), it was hypothesised that perceived competence would be the most important psychological mediator in the model. It was expected to relate positively to self-determined forms of motivation and negatively to less self-determined and controlling motivational forms.

Figure 1. Original model of motivational processes in PE



Note. Circles represent latent factors. Intention cannot be represented as a latent factor because it has only one item (indicator).

Three important outcomes of motivated behaviour in PE were measured: effort, boredom, and intention to be physically active after the school years. It was expected that effort would be predicted by intrinsic motivation and identified regulation. It was also hypothesised that boredom would be positively predicted by external regulation and amotivation and negatively predicted by intrinsic motivation. Finally, it was expected that the intention to be physically active would be predicted by the most self-determined form of motivation, that is, intrinsic motivation. In view of the findings by Vallerand *et al.* (1993) and Pelletier *et al.* (1995), introjected regulation was not expected to relate to any of the outcomes.

It should be noted that Vallerand (1997) has argued that although mean differences may exist as a function of a number of individual and situational variables (e.g., gender, age, culture) the motivational processes which the model describes should be similar in all individuals. Therefore, a further purpose of the present study was to examine the invariance of the motivational processes in PE across gender.

Method

Participants

Responses were obtained from 428 students (218 females, 206 males, 4 did not specify their gender) aged between 14 and 16 years (M = 14.84, SD = .52) from two schools in Northwest England. A number of different classes in the two schools were chosen after previous arrangement with the PE teachers, in order to minimise any potential interference with the school programme.

Instruments

Social factors

Students' perception of whether they have a choice of behaviours and tasks in PE lessons was assessed with three items taken from the Perception of Choice subscale of the PE Class Climate Scale developed by Biddle, Cury, Goudas, Sarrazin, Famose, and Durand (1995). An example item is 'In this PE class, students are often given the opportunity to plan their own activities'. Cooperation in the class and emphasis by the PE teacher on students' self-referenced improvement were assessed with the Cooperative Learning and Improvement subscales of the Perceived Motivation Climate in Sport Questionnaire-2 (Newton, Duda, & Yin, 2000). Example items are 'In this PE class, students help each other learn' (cooperative learning), and 'In this PE class, the PE teacher makes sure students improve on skills they're not good at' (improvement). There is evidence in the literature regarding the validity and reliability of the three subscales (for a review of motivational climates scales in physical activity, see Ntoumanis & Biddle, 1999).

Psychological mediators

Perceptions of competence were measured with five items from the Competence subscale of the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989). An example item is 'I think I am pretty good in this PE class'. McAuley *et al.* (1989) reported that the competence subscale had a Cronbach's alpha of .84.

There are no published scales to measure relatedness and autonomy in physical activity and, therefore, the author developed two sets of two items each to measure the two psychological mediators. Example items are 'I can decide which activities I want to practise in this PE class' (autonomy), and 'Taking part in this PE class makes me feel closer to the other students' (relatedness).

Motivational types

The different motivational types were measured with a questionnaire developed by Goudas, Biddle, and Fox (1994). Students were asked to respond to four items for each subscale which followed the stem 'I take part in this PE class …'. Example items are 'Because PE is fun' (Intrinsic Motivation), 'Because I want to learn sport skills' (Identified Regulation), 'Because I want the teacher to think I'm a good student' (Introjected Regulation), and 'Because I'll get into trouble if I don't' (External Regulation). Goudas *et al.* (1994) showed that all five subscales[1] measuring had Cronbach's alphas above .70.

Consequences

Boredom was assessed with three items developed by Duda, Fox, Biddle, and Armstrong (1992) to measure children's affective responses in physical activity. The authors reported a Cronbach's alpha of .70 for this subscale. An example item is 'When playing in this PE class I am usually bored'. Effort was measured with four items from the Effort subscale of the Intrinsic Motivation Inventory (McAuley *et al.*, 1989). The alpha coefficient reported in the same study was .84. An example item from this subscale is 'I try very hard in this PE class'. Lastly, the intention of being physically active in the future after leaving school was assessed with a single item developed by the

present author ('I intend to do sport even after I have left school'). A complete list of all items used in this study can be found in the Appendix.

Procedure

Informed consent was obtained from the headteachers of two state schools. The students were told that the questionnaires were anonymous and were reassured that their responses would not be available to their teachers or parents. They were also offered the option to decline participation or withdraw at any time. Only around 5% of them decided not to participate and were asked to remain silent throughout the questionnaire completion. All questionnaires were completed under the supervision of an experienced researcher.

Data analysis

The data were analysed in two parts. In the first part, Cronbach's alphas were calculated to assess the internal reliability of the subscales. Also, descriptive statistics were computed. In the second part, a structural equation modelling analysis with latent factors was carried out to test the model in Figure 1, using EQS 5.7 (Bentler, 1995). Also, the derived model was tested for equality of constraints across gender using multisample analysis.

Results

Preliminary analyses

Table 1 presents the means, standard deviations, and Cronbach's alphas[2] for the variables used in this study. An inspection of the mean scores shows that the PE classes provided opportunities for cooperative learning and they encouraged individual improvement. However, the students perceived that they did not have enough choice of activities and behaviours in these classes as the mean score of the choice subscale was below the midpoint (i.e., 3) of the 5-point scale. Of the three psychological mediators, perceived competence had the highest mean. Perceptions of relatedness and autonomy were low, particularly the latter which had a mean score of 2.75 on a 7-point scale. The students in general exhibited a self-determination profile with higher scores on intrinsic motivation and identified regulation and lower scores on extrinsic regulation, introjected regulation, and amotivation. Lastly, they tended to report positive intentions to be physically active after leaving school, high levels of effort, and low levels of boredom.

A covariance structure analysis, alternatively known as Structural Equation Modelling (SEM), was used to test the model in Figure 1. The input covariance matrix was based on the correlation matrix presented in Table 2. SEM is an advanced statistical technique which allows researchers to analyse all variables simultaneously and test complex models. Vallerand (1997) has recommended the use of SEM because it is a useful technique which can help the multidimensional approach to motivation by the self-determination theory. In contrast to previous research where all the different types of motivation were combined into a self-determination index, in this study all types were assessed independently. In this way, it was possible to ascertain how the different psychological mediators related to each motivational type and which type was the best predictor of various consequences.

Table 1. Means, standard deviations, and Cronbach's alphas for all variables

	Range	*M*	SD	α
Social Factors				
Choice	1–5	2.43	.91	.63
Cooperative Learning	1–5	3.31	.84	.73
Improvement	1–5	3.70	.73	.64
Psychological Mediators				
Competence	1–7	4.69	1.30	.85
Autonomy	1–7	2.75	1.43	.43
Relatedness	1–7	3.67	1.48	.65
Motivational Types				
Amotivation	1–7	2.72	1.50	.81
External Regulation	1–7	3.53	1.68	.82
Introjected Regulation	1–7	3.34	1.32	.67
Identified Regulation	1–7	4.82	1.53	.84
Intrinsic Motivation	1–7	4.80	1.54	.87
Consequences				
Effort	1–7	5.04	1.39	.81
Boredom	1–7	2.75	1.44	.72
Intention to be Physically Active	1–7	4.33	2.31	

Note. The Intention to be Physically Active has no alpha coefficient, because it is a single-item variable. Also, instead of alpha, a correlation coefficient is given for Autonomy and Relatedness, because they both consist of only two items.

The testing of a comprehensive theoretical model with SEM may require the reduction of the number of indicators per latent factor, especially when the sample size is not particularly large compared to the number of variables in the model (Marsh, Richards, Johnson, Roche, & Tremayne, 1994; Vallerand, 1997). This can be achieved by combining the items into pairs (Marsh *et al.*, 1994). That is, the first two items in each subscale are averaged to form the first item pair, and then the second two items are averaged to form the second item pair, and so forth. Marsh *et al.* (1994) suggested the use of item pairs because item pair scores are more reliable, tend to be more normally distributed, and because the ratio of the number of measured variables to the number of study participants is halved. In this study, the use of item pairs resulted in two observed variables as indicators of each latent factor. The indicators are not depicted in Figure 1 for reasons of presentational simplicity.

To examine the hypotheses of this study, the model in Figure 1 was tested using SEM. Owing to the fact that the normalised estimate of Mardia's coefficient was relatively large (multivariate kurtosis = 28.61), the data were analysed using robust maximum likelihood analysis. This analysis is recommended by Bentler (1995) when the data are not normally distributed. In order to evaluate the adequacy of the fit of the proposed model to the data, various indices of fit that are provided by EQS were examined. These were the ratio of Satorra-Bentler's scaled χ^2 (used with robust maximum likelihood analysis) to the degrees of freedom (χ^2/d.f.), the Robust Comparative Fit Index (RCFI), the Bentler-Bonett Nonnormed Fit Index (NNFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardised Root

Table 2. Correlation matrix for the variables in the model

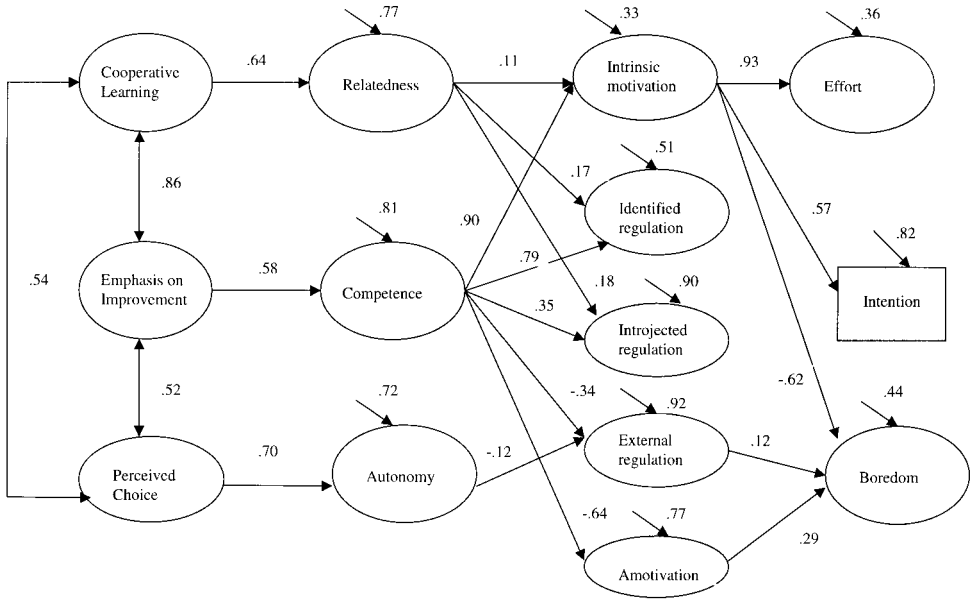
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Choice		.35**	.29**	.24**	.49**	.32**	−.08	−.16**	.15**	.29**	.28**	.25**	−.17**	.06
2. Cooperative Learning			.44**	.36**	.17**	.44**	−.30**	−.24**	.17**	.42**	.45**	.40**	−.31**	.16**
3. Improvement				.27**	.13**	.28**	−.25**	−.09	.16**	.34**	.35**	.34**	−.30**	.13**
4. Competence					.15**	.38**	−.47**	−.31**	.33**	.67**	.71**	.73**	−.62**	.44**
5. Autonomy						.27**	.04	−.11*	.10*	.11*	.09	.05	−.04	.05
6. Relatedness							−.21**	−.16**	.26**	.38**	.42**	.34**	−.27**	.20**
7. Amotivation								.51**	−.07	−.58**	−.60**	−.58**	.59**	−.37**
8. External Regulation									.23**	−.30**	−.41**	−.33**	.41**	−.22**
9. Introjected Regulation										.46**	.35**	.32**	−.18**	.31**
10. Identified Regulation											.82**	.72**	−.58**	.55**
11. Intrinsic motivation												.72**	−.65**	.55**
12. Effort													−.70**	.42**
13. Boredom														−.40**
14. Intention														

* $p < .05$ ** $p < .01$

Mean Square Residual (SRMR). A good fit of a specified model to the data is generally indicated when the χ^2/d.f. ratio is less than 3, the RCFI and NNFI indices are above .85 (ideally above .90), and the RMSEA and SRMSR are less than .07 (ideally less than .05).

The indices of fit showed that the hypothesised model fit the data reasonably well but there was room for improvement: $\chi^2(306) = 802.66$, $p < .01$; χ^2/d.f. = 2.62; RCFI = .89; NNFI = .87; RMSEA = .07; SRMSR = .07. On the basis of the results of the modification tests provided by the EQS (Lagrange Multiplier and Wald), the model was revised. This decision was considered appropriate bearing in mind that the motivational sequence described by Vallerand (1997) has never been tested in physical activity and, therefore, the model was of an exploratory nature. The paths between autonomy and intrinsic motivation, autonomy and amotivation, and identified regulation and effort were dropped because they were non-significant. A path was added between relatedness and introjected regulation and, also, the residuals of the motivational types were allowed to be correlated. The revised model (see Figure 2 for standardised path coefficients) had a better fit to the data: $\chi^2(302) = 661.36$, $p < .01$; χ^2/d.f. = 2.19; RCFI = .92; NNFI = .90; RMSEA = .06; SRMR = .06.

Figure 2. Revised model of motivational processes in PE (all paths are significant)



For simplicity, only the structural model (paths connecting latent factors) is presented in Figure 2. The measurement model (paths connecting latent factors with their indicators) has been omitted from Figure 2, but the relevant information is presented in Table 3.

The revised model was subjected to multisample SEM to examine its invariance

Table 3. Factor loadings and residuals in the revised structural equation model

Factors	Variables	Factor loadings	Residuals
Cooperative Learning	Indicator 1	.613	.790
	Indicator 2	.768	.641
Improvement	Indicator 1	.541	.841
	Indicator 2	.462	.887
Choice	Indicator 1	.814	.581
	Indicator 2	.562	.827
Relatedness	Indicator 1	.724	.689
	Indicator 2	.890	.455
Competence	Indicator 1	.780	.626
	Indicator 2	.821	.571
Autonomy	Indicator 1	.614	.790
	Indicator 2	.722	.692
Intrinsic Motivation	Indicator 1	.855	.519
	Indicator 2	.862	.508
Identified Regulation	Indicator 1	.867	.498
	Indicator 2	.815	.579
Introjected Regulation	Indicator 1	.814	.581
	Indicator 2	.652	.758
External Regulation	Indicator 1	.970	.242
	Indicator 2	.713	.701
Amotivation	Indicator 1	.767	.641
	Indicator 2	.902	.432
Effort	Indicator 1	.673	.740
	Indicator 2	.849	.528
Boredom	Indicator 1	.771	.637
	Indicator 2	.632	.775

Note. All factor loadings were significant at the $p < .01$ level.

across gender. In multisample analysis usually the factor loadings, the variances and covariances of the independent variables, and the path coefficients are constrained to be equal across different groups. With EQS, the validity of the equality constraints can be tested simultaneously at a multivariate level using the Lagrange Multiplier Test.

The multisample analysis[3] for males and females showed that the model in Figure 2 was largely invariant across gender: $\chi^2(644) = 1188.79$, $p < .01$; $\chi^2/\text{d.f.} = 1.84$; RCFI = .90; NNFI = .89; RMSEA = .04; SRMSR = .07. Only one constraint had to be released, that is, the path coefficient between relatedness and intrinsic motivation. The path was b = .17 for females and b = .07 (non-significant) for males.

Discussion

The purpose of this study was to examine in PE the pattern of motivational sequences described by Vallerand (1997) and Vallerand and Losier (1999). The results were largely supportive of the proposed pattern of sequences and, in addition, showed that similar motivational processes occur irrespective of gender.

Moderate to strong paths connected the three social factors of cooperation,

improvement, and choice, with the three psychological mediators of relatedness, competence, and autonomy respectively. Situations in a PE class where students have the chance to work together and help each other learn (e.g., when they are taught a new skill), make them feel closer and more connected to their fellow students. Weiss and Smith (1999) found that some of the dimensions of friendships in sport describe situations where children spend time playing together. In the present study it was also found that students felt competent when they perceived that their PE teachers emphasised improvement based on self-referenced standards. This finding is in line with Ames' (1992) work which showed that when individual criteria are used by teachers to evaluate and reward student performance, students feel less threatened by the evaluation process and more competent, because the evaluated outcomes are more controllable. In contrast, in situations where comparative criteria are used (e.g., being the best in the class), perceptions of competence are more fragile because competition is intense and the evaluated outcomes are more uncontrollable (Ames, 1992).

The availability of choice of activities and behaviours in PE was positively related to perceptions of autonomy. As Epstein (1989) argued, classrooms which increase students' involvement in the design of tasks, and give them leadership roles and decision-making opportunities, will foster a sense of ownership in the learning process and make the students more responsible for their own learning. It is worth noting, however, that in the present study the mean scores for choice and autonomy were low. This is an important finding which can be attributed to the fact that PE teachers in Britain have to follow a very prescriptive national curriculum which often does not provide chances for student initiative and leadership roles. It is also possible that PE teachers are not well trained or do not feel comfortable to experiment with teaching styles which reduce their control over the class, and provide a great degree of student involvement. A follow-up qualitative study could provide some answers to these hypotheses.

Lack of autonomy in PE classes may explain the absence of links between this variable and self-determined forms of motivation. In contrast, it is evident from Figure 2 that of the three psychological mediators of the motivational sequence perceived competence had the largest effects on the different motivational types. Deci and Ryan (1985) argued that the relative impact of each psychological mediator will vary depending on the functional significance of the situation. If in a given situation perceptions of competence are more relevant and important, then perceptions of competence will have a greater impact on motivation. Feltz's (1988) review clearly shows that in all forms of physical activity perceived competence plays a central role.

In PE the role of perceived competence is crucial, because some students do not have any prior experience with most or all sport activities (Papaioannou, 1994). Therefore, those with prior experience who feel and are physically competent are more likely to find PE interesting and fun, and want to participate in it to further develop their sport skills (i.e., they have self-determined motivation). In support of this argument, Goudas and Biddle (1994) found that perceived competence explained a significant amount of variance (68%) in intrinsic motivation scores of British PE students.

Students perceiving themselves as highly competent are less likely to be externally motivated or amotivated in PE as shown by the negative path coefficients in Figure 2. However, those who perceive that they lack physical competence usually find the PE

experience meaningless (amotivation), and engage in it only because it is the rule or because of fear of punishment (external regulation). Conceptually similar results have been reported with Canadian college students in a study by Vallerand *et al.* (1993). Perceived competence was negatively related to amotivation, unrelated to external regulation, and positively related to intrinsic motivation.

In Figure 2, relatedness is a positive, albeit weak, predictor of intrinsic motivation, identified regulation, and introjected regulation. This is in agreement with literature reviews (e.g., Weiss & Ebbeck, 1996) which have shown that many individuals participate in physical activity because they need to relate to and be friends with other people, and because they want to feel accepted by a social milieu. Physical education provides ample opportunities for students to interact with other students (teammates and opponents), learn new sport skills together, and strive for individual and team achievement.

It is worth noting that introjected regulation was positively predicted by both perceptions of relatedness and competence. This may seem surprising because introjected regulation is more a controlling than an autonomous type of motivation. However, as suggested by Vallerand, Fortie, and Guay (1997), in the area of education introjected regulation may not always be maladaptive. In the context of PE, for example, some students may decide to be actively involved because otherwise they would be afraid of being isolated from other students. With regard to the results pertaining to perceived competence, a very interesting study by Weiss and Duncan (1992) showed that peer acceptance in youth sport was highly and positively related to levels of physical competence. Therefore, adolescents who are physically competent may want to engage actively in PE because they want to prove they are skilful and, thus, receive peer acceptance and recognition.

The last part of the model tested the relationship between the various motivational types and a number of motivational outcomes. Levels of efforts were strongly predicted by intrinsic motivation. This makes sense because the students who find PE exciting and fun are likely to exert high effort to learn new motor skills and accomplish a certain level of competence. A positive relationship between intrinsic motivation and self-reported effort in sport was also reported by Pelletier *et al.* (1995). Contrary to the hypothesis of this study, identified regulation did not predict effort in PE. This finding is surprising, because students with a high level of identified regulation are expected to report that it is important to them to develop their sport skills. The explanation for this finding may lie on the very high correlation between intrinsic motivation and identified regulation ($r = .82$) which makes it difficult to disentangle the unique effects of the two variables on motivational outcomes.

The intention to be physically active after the school years was positively predicted only by intrinsic motivation. Similar positive relationships between intrinsic motivation and future intentions toward an activity were reported by Biddle *et al.* (1995) in PE, by Pelletier *et al.* (1995) in sport, and by Vallerand *et al.* (1993) in education. This finding is particularly important considering the significant role of PE in promoting a physically active life style which can improve public health (Sallis & McKenzie, 1991). Furthermore, when students are intrinsically motivated they are less likely to feel bored in PE. In contrast, feelings of boredom will be evident when students feel pressured to participate in PE (external regulation), or when they feel that they waste

their time in it (amotivation).

The revised model in Figure 2 was largely invariant across gender. The only difference found was in the size of the path coefficient between relatedness and intrinsic motivation which was larger for females. This finding indicates that females are more intrinsically motivated toward PE when they feel that the PE activities bring them together with other students. In contrast, for males relatedness is not a significant predictor of intrinsic motivation. These gender differences are not surprising since females generally value more intimacy and affiliation (Smith, 1998).

A limitation of this study relates to the cross-sectional nature of the research design which does not permit the testing of reciprocal links which are likely to appear over time. Despite this limitation, the results of the study are interesting and have important practical implications. It is evident that positive social factors such as promotion of cooperative learning, emphasis on individual improvement, and choice of tasks can lead to positive motivational outcomes in PE. It is, therefore, important that such and other similar positive experiences are provided by PE teachers and PE curricula. It is also clear that perceptions of competence have a central role in PE and the satisfaction of the need for competence can lead to self-determined forms of behaviour. To enhance student competence, teachers should develop criteria based on self-referenced improvement (Ames, 1992). Lastly, it is important that intrinsic motivation is fostered and promoted in PE, because it can lead to positive outcomes and may facilitate the general aim of physical activity in adult life. Special attention should be given to those who feel pressured to participate or believe that they waste their time in PE. Usually, these students have low competence, find PE activities boring, and are the prime candidates for leading a sedentary life. Therefore, interventions should be developed to increase their perceived physical competence and intrinsic motivation toward PE. To this direction, Epstein's (1989) research on the motivational dimensions of the classroom structure can be particularly helpful.

Future research should look at the influence of additional social factors such as peer and parental influence on the motivation of students. Cognitive outcomes such as levels of attention and learning could also be measured. Lastly, future research should examine developmental differences in the motivational processes in PE. The present study had a homogeneous age group and such differences could not be tested. However, from a theoretical and applied perspective it is imperative to understand whether the relative importance of different social factors on motivational variables as well as the consequences of the latter will vary as a function of age.

Notes

1. The scale used in this study, as well as the Academic Motivation Scale and the Sport Motivation Scale, do not measure integrated regulation, although the latter is, according to Deci and Ryan (1985, 1991), a type of extrinsic motivation. The reason is that these scales were developed mainly with older children and adolescents, however, as Vallerand (1997) noted, integrated regulation is more often encountered in adults.

2. The relatively low alphas for choice, emphasis on improvement, and introjected regulation maybe attributed to the small number of items per subscale, which can, sometimes, result in the underestimation of alpha (see Cronbach, 1951). Concerns regarding low internal reliability centre on the argument that measurement error, resulting from low internal reliability, can reduce the magnitude of the relationships between observed variables. However, this problem can be dealt with by using unobserved, latent factors (see Figure 1), because relations between latent factors are not influenced by measurement error (Byrne, 1994).

3. EQS has not incorporated the robust maximum likelihood analysis in multisample testing.

References

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

Bentler, P.M. (1995). *EQS structural equations program manual.* Encino, CA: Multivariate Software.

Biddle, S.J.H., 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.

Byrne, B. M. (1994). *Structural equation modelling with EQS and EQS/Windows: Basic concepts, applications, and programming.* Thousand Oaks, CA: Sage.

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

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

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

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

Deci, E.L., Vallerand, R.J., Pelletier, L.G., & Ryan, R.M. (1991). Motivation in education: The self-determination perspective. *The Educational Psychologist, 26*, 352–346.

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 measures* (pp. 20–47). Morgantown, WV: Fitness Information Technology.

Duda, J.L., Fox, K., Biddle, S.J.H., & Armstrong, N. (1992). Children's achievement goals and beliefs about success in sport. *British Journal of Educational Psychology, 62*, 313–323.

Epstein, J.L. (1989). Family structures and student motivation: A developmental perspective. In C. Ames & R. Ames (Eds.), *Research on motivation in education: Vol. 3* (pp. 259–295). San Diego, CA: Academic Press.

Feltz, D.L. (1988). Self-confidence and sports performance. *Exercise and Sports Science Reviews, 16*, 423–457.

Frederick, C., M., & Ryan, R.M. (1995). Self-determination in sport: A review using cognitive evaluation theory. *International Journal of Sport Psychology, 26*, 5–23.

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.

Horn, T.S., & Harris, A. (1996). Perceived competence in young athletes: Research findings and recommendations for coaches and parents. In F.L. Smoll & R.E. Smith (Eds.), *Children and youth in sport: A biopsychological perspective* (pp. 309–329). Dubuque, IA: Brown & Benchmark.

Marsh, H.W., Richards, G.E., Johnson, S., Roche, L., & Tremayne, P. (1994). Physical self-description questionnaire: Psychometric properties and a multitrait-multimethod analysis of relations to existing instruments. *Journal of Sport and Exercise Psychology, 16*, 270–305.

McAuley, E., Duncan, T.E., & Tammen, V.V. (1989). Causal attributions and affective reactions to disconfirming outcomes in motor performance. *Journal of Sport and Exercise Psychology, 11*, 187–200.

Newton, M.L., 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 Sports Sciences, 18*, 275–290.

Ntoumanis, N., & Biddle, S.J.H. (1999). A review of motivational climate in physical activity. *Journal of Sport Sciences, 17*, 643–665.

Papaioannou, A. (1994). Development of a questionnaire to measure achievement orientations in

physical education. *Research Quarterly for Exercise and Sport, 65*, 11–20.
Pelletier, L.G., Fortier, M.S., Vallerand, R.J., Tuson, K.M., Briere, N.M., & Blais, M.R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The Sports Motivation Scale (SMS). *Journal of Sport and Exercise Psychology, 17*, 35–53.
Sallis, J.F., & McKenzie, T.L. (1991). Physical education's role in public health. *Research Quarterly for Exercise and Sport, 62*, 124–137.
Smith, P. (1998). Social development. In M.E. Eysenck (Ed.), *Psychology: An integrated approach* (pp. 293–323). New York: Longman.
Vallerand, R.J. (1997). Toward a hierarchical model of intrinsic and extrinsic motivation. In M. Zanna (Ed.), *Advances in experimental social psychology* (pp. 271–360). New York: Academic Press.
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., Deci, E.L., & Ryan, R.M. (1987). Intrinsic motivation in sport. *Exercise and Sport Sciences Review, 15*, 389–425.
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., Pelletier, L.G., Blais, M.R., Briere, N.M., Senecal, C., & Vallieres, E.F. (1992). The academic motivation scale: A measure of intrinsic, extrinsic, and amotivation in education. *Education and Psychological Measurement, 52*, 1003–1017.
Vallerand, R.J., Pelletier, L.G., Blais, M.R., Briere, N.M., Senecal, C., & Vallieres, 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.
Van Rossum, J.H.A., Musch, E., & Vermeer, A. (1999). Perceived motor competence: Self-referent thinking in physical education. In Y.V. Auweele, F. Bakker, S. Biddle, M. Durand, & R. Seiler (Eds.), *Psychology for physical educators* (pp. 187–210). Champaign, IL: Human Kinetics.
Weinberg, R.S., & Gould, D. (1999). *Foundations of sport and exercise psychology* (2nd ed.). Champaign, IL: Human Kinetics.
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, 114*, 177–191.
Weiss M.R., & Ebbeck, V. (1996). Self-esteem and perceptions of competence in youth sport: Theory, research, and enhancement strategies. In O. Bar-Or (Ed.), *The encyclopaedia of sports medicine: Vol. 5. The child and adolescent athlete* (pp. 364–382). Oxford: Blackwell Science.
Weiss, M.R., & Smith, A.L. (1999). Quality of youth sport friendships: Measurement development and validation. *Journal of Sport and Exercise Psychology, 21*, 145–166.
White, R.W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review, 66*, 297–333.

Received 19 April 2000; revised version received 10 October 2000

Appendix

Social factors

In this PE class...

Cooperative Learning
Students help each other learn
Students help each other to get better and excel
Students work together as a team
The PE teacher encourages students to help each other learn

Improvement
Students are encouraged to work on their weaknesses
The PE teacher makes sure students improve on skills they're not good at.
The PE teacher emphasises that we need to improve at each lesson
The PE teacher emphasises always to try our best

Choice
Students are often given the opportunity to plan their own activities
Students are often given the opportunity to say what they think about a certain activity
Students have a choice of what activities they take part in

Psychological mediators

Perceived Competence
I think I am pretty good in this PE class
I am satisfied with my performance in this PE class
After playing in this PE class for a while I feel pretty skilful
I am pretty skilled at the activity/sport in this PE class
I can't play the activity/sport very well in this PE class (reversed)

Autonomy
I have my own say regarding which skills I want to practise in this PE class
I can decide which activities I want to practise in this PE class

Relatedness
Playing in this PE class makes me feel closer to the other students
The different activities in this PE class make me feel more connected to the other students

Motivational types

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 really don't 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

Consequences

Effort
I don't try very hard in this PE class (reversed)
I put a lot of effort in when I play in this PE class
I try very hard when I play in this PE class
It is important to me to do well in this PE class

Boredom
When playing in this PE class, I usually wish the game would end quickly
When playing in this PE class I am usually bored
In this PE class I often daydream instead of thinking what I am doing

Intention
I intend to do sport even after I have left school