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ORIGINAL ARTICLE

How students' perceptions of teachers' autonomy-supportive behaviours affect physical activity behaviour: an application of the trans-contextual model

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Abstract

The aim of this study was to assess a modified version of the trans-contextual model (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003) based on self-determination theory (Deci & Ryan, 1985) and the theory of planned behaviour (Ajzen, 1985). The modified version included two additional components: use of learning strategies and positive general feedback. It was hypothesized that students' perceptions of how they use learning strategies taught by their physical education (PE) teachers and perceived positive general feedback would influence students' intrinsic motivation, intentions, and physical activity behaviour in a leisure-time context through intrinsic motivation in PE. A structural equation model supported the hypotheses and demonstrated that the use of learning strategies and perceived positive general feedback in PE indirectly influenced intrinsic motivation in leisure time through the effect of intrinsic motivation in PE. There was a direct effect of perceived positive general feedback on physical activity behaviour as well as an indirect effect through the motivational sequence.

Keywords: *Trans-contextual model, perceived autonomy support, physical education, physical activity*

Introduction

One of the main objectives of physical education (PE) is to provide young people with the necessary skills, knowledge, and competence to choose and participate in health-related physical activity in their leisure time (Ntoumanis, 2001). Recently, researchers adopting hypotheses from self-determination theory and the theory of planned behaviour have constructed a trans-contextual model to understand the factors important to achieving this objective (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003). The model proposed a motivational sequence in which perceived autonomy support in PE predicted autonomous motivation, intentions, and behaviour in a leisure-time physical activity context (for a review, see Hagger & Chatzisarantis, 2007).

Component theories of the trans-contextual model

Self-determination theory is central to the trans-contextual model and provides a basis for the development of autonomous forms of motivation and the trans-contextual influence of autonomous forms of motivation on intentional behaviour (Ryan & Connell, 1989). Research in self-determination theory has shown that social factors that support autonomous motivation, such as the behaviours of significant others (e.g. PE teacher), enhance autonomous motivation and behavioural persistence in educational contexts (Black & Deci, 2000; Reeve, 2002). Self-determination theory focuses on the extent to which behaviours are autonomous or self-determined. This theory is founded on the premise that there are innate psychological needs for autonomy (to feel self-determined in one's actions rather than feeling controlled), competence (to feel

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competent in dealing with one's environment), and relatedness (to feel that one has satisfying and supportive social relationships) (Deci & Ryan, 1985; Ryan & Deci, 2000). The theory argues that people seek to satisfy an inherent need for self-determination or autonomy and the experience of choice, congruence, and initiative that characterize autonomy is a necessary aspect of healthy and optimal functioning. Self-determination theory makes the distinction between autonomous and controlling forms of motivation. Autonomous motivation reflects engaging in behaviour because it satisfies personally relevant goals and services innate psychological needs for autonomy, competence, and relatedness. Intrinsic motivation is the prototypical form of autonomous motivation and refers to engaging in a behaviour for its own sake in the absence of any external reward (Deci & Ryan, 1985), while extrinsic forms of motivation are considered controlling in nature and reflect an individual's motivation to perform an activity when reinforced by external contingencies such as avoiding feelings of threat or guilt, gaining a reward, or avoiding punishment.

The theory of planned behaviour (Ajzen, 1985) is a social cognitive model that aims to describe the processes that underpin intentional action. Central to the theory is intention, which is a motivational construct and the most proximal predictor of volitional behaviour. Intention mediates the effects of three belief-based constructs on behaviour: attitude, subjective norms, and perceived behavioural control. Attitude is the degree to which performance of the behaviour is positively or negatively evaluated. Subjective norm is the perceived social pressure to engage in behaviour. Perceived behavioural control refers to a person's beliefs that he or she has the capacities, faculties, abilities, and resources to engage in the target behaviour, and has been compared with Bandura's (1997) self-efficacy construct (Ajzen, 1991). The attitude, subjective norms, and perceived behavioural control constructs reflect underlying sets of beliefs that people hold towards their performance of the target behaviour. These three constructs have been shown to predict unique variance in intentions in research on physical activity (Hagger, Chatzisarantis, & Biddle, 2002a).

Previous empirical research with the trans-contextual model

The results of previous tests of the trans-contextual model indicated that an important step in promoting autonomous forms of motivation to participate in leisure-time physical activity might begin in school PE. Previous research has shown that perceived

autonomy support in PE influenced autonomous motivation in PE (Hagger *et al.*, 2003, 2005). Perceived autonomy support from teachers also predicted autonomous forms of motivation in a different context, that of leisure-time physical activity. Leisure-time autonomous motivation also positively influenced physical activity intention and behaviour via the mediation of attitudes and perceived behavioural control. In this model, perceived autonomy support from teachers was viewed as a general autonomy-supportive behaviour from teachers and did not reflect specific forms of teachers' instructional behaviours.

Extending the trans-contextual model: Specific components of perceived autonomy support

Reeve and Jang (2006) investigated the relationships between different instructional behaviours and perceived autonomy support. Teachers' instructional behaviours that support students' psychological needs (e.g. autonomy, competence, relatedness) may be perceived by students as autonomy supportive. For instance, giving students time to work on a problem in their own way (providing autonomy) or teaching a new skill (enhancing competence) are considered autonomy-supportive behaviours (Reeve & Jang, 2006). The authors identified several autonomy-supportive instructional behaviours, including allowing pupils time to work on tasks in their own way, praise that is informational feedback on performance, offering encouragement, offering hints, and being responsive to student-generated questions. Research has shown that students' perceptions of teachers' positive general feedback is related to intrinsic motivation in PE (Koka & Hein, 2005). Despite this support for the influence of perceived positive general feedback on students' intrinsic motivation in PE, past work has not tested the effect of perceived positive general feedback on intrinsic motivation in a leisure-time context and physical activity behaviour. Besides the influence of perceived teachers' positive feedback on intrinsic motivation in PE, the teaching-learning process also involves other components that may influence students' intrinsic motivation in PE and also in a leisure-time context outside of school.

The teaching-learning process is characterized by the interaction between teacher's and students' behaviour. The ways that students learn reflect, in part, how teachers teach them. Some researchers (Solmon & Boone, 1993; Solmon & Lee, 1996) have noted that cognitive variables produce informative data about how students mediate instruction in PE settings. Solmon and Lee (1997) investigated the cognitive processes that mediate teachers' instruction in PE classes. The authors found that numerous

cognitive variables, such as self-regulation, confidence-efficacy, attention-concentration, willingness to engage, and the use of strategies to learn skills were related to a learning-involved goal perspective and the belief that success is attributed to motivation and effort. Furthermore, Hein and M     (2004) tested the mediating role of cognitive processes in PE in the context of the relationship between people's perceptions of a learning-oriented environment and physical activity intention. Findings indicated that the use of learning strategies was one of the most important mediators of this relationship.

When students perceive that their teacher has provided information on how to perform better, has allowed them to work independently, and has given them the opportunity to use learning strategies, they are more likely to feel that the teacher has supported their autonomy. For example, the teacher may provide some additional hints concerning learning strategies to students on how to improve their performance (e.g. "Peter, while practising a new skill, try to think about a similar skill you already know" or "Jane, when you watch your friend practising a new skill, try to practise that skill in your mind"). In this way, teachers can encourage and support autonomous experiences in PE by identifying students' inner motivational resources and creating opportunities for students that foster a sense of choice and interest. Therefore, teachers that provide students with knowledge about the use of learning strategies enable them to feel more independent in the learning process and perceive that their autonomy has been supported. In this study, we assume that the students' responses to measures about the use of learning strategies reflect instructional behaviours that may be categorized as autonomy-supportive. The students' self-reports about the use of learning strategies presume that their teachers have previously instructed them on the learning strategies and how to use these strategies.

Deci and Ryan's (1985) self-determination theory states that individuals' intrinsic motivation towards a particular activity will vary as a function of the degree to which they perceive themselves to be competent at that activity. Accordingly, students who have been taught to use learning strategies are likely to feel more autonomous in their actions. In addition, students who have knowledge of the use of learning strategies tend to perceive themselves as more competent. On the other hand, knowledge of the use of learning strategies also affects physical activity behaviour independently and may consequently be related to willingness to participate in leisure-time physical activity. If students already have knowledge about how to use learning strategies, they are able to regulate their own learning without the teacher's intervention.

The present study and hypotheses

While the trans-contextual model accounts for significant variance in autonomous motivation across contexts and health-related physical activity behaviour (Hagger & Chatzisarantis, 2007; Hagger *et al.*, 2003, 2005), studies have not differentiated between specific components of perceived autonomy support. The present study aims to resolve this issue by incorporating specific components of perceived autonomy support such as the use of learning strategies and providing positive general feedback in an extended trans-contextual model. The model will contribute to present knowledge by establishing how specific components of perceived autonomy support in PE are translated into leisure-time physical activity intentions and behaviour.

First, based on self-determination theory (Deci & Ryan, 1985), which emphasizes the importance of an autonomy-supportive context on people's sense of competence and intrinsic motivation, we hypothesized that students' perceptions of how they use learning strategies in PE taught by their teachers would influence students' intrinsic motivation in PE. Second, we hypothesized that the use of learning strategies and perceived teachers' positive general feedback would influence intrinsic motivation in a leisure-time context via the mediation of intrinsic motivation in PE as hypothesized in the trans-contextual model. In accordance with the trans-contextual model (Hagger *et al.*, 2003, 2005), we also hypothesized that intrinsic motivation in PE influences intrinsic motivation in leisure time, intrinsic motivation in leisure time influences intention through attitudes and perceived behavioural control, and intention predicts physical activity behaviour.

Overall, consistent with the trans-contextual model, we hypothesized that there would be a significant overall effect of use of learning strategies and perceived teachers' positive general feedback on physical activity behaviour via the motivational sequence proposed in the trans-contextual model. The overall effect was expected to be indirect through the motivational sequence in the model that includes intrinsic motivation in PE and leisure-time contexts, attitudes, perceived behavioural control, and physical activity intention.

Methods

Research participants and design

The participants were 399 students (123 males, 276 females; mean age 14.7 years, $s = 1.4$, range = 12–18) studying in five different state high schools in Estonia. Students were taking PE as a required course (two times a week, 45 min per lesson). In

all cases, the students, school principals, and teachers granted prior consent for data to be collected in their schools. Students were informed that they would be asked to complete a series of short questionnaires over the coming weeks as part of a survey on young people. Students completed the questionnaires in taught lesson time and they were separated so that they could not copy responses. To preserve confidentiality, participants were asked not to report their names. Prospective responses were matched with baseline responses using birth date and gender.

A prospective design was employed with psychological variables being assessed at three points in time. In the first wave of data collection, intrinsic motivation in PE (Ryan & Connell, 1989), use of learning strategies from the Cognitive Processes Questionnaire in Physical Education (CPQPE; Solomon & Lee, 1997), and perceived teachers' positive general feedback from the Perceptions of the Teacher's Feedback (PTF) questionnaire (Koka & Hein, 2005) were assessed using self-report questionnaires. In the second wave of data collection, which took place after a one-week interval, we administered measures of the components from the theory of planned behaviour (Ajzen & Madden, 1986) and intrinsic motivation in a leisure-time physical activity context using the Behavioural Regulations in Exercise Questionnaire (BREQ; Mullan, Markland, & Ingledew, 1997). A one-week delay was employed to avoid presenting similar motivational measures on a single occasion thereby reducing common-method variance. The perceived behavioural control, attitudes, and intention components from the theory of planned behaviour were measured. Subjective norms were excluded because this is not the most theoretically relevant social influence construct for understanding behaviour (Courneya & McAuley, 1994; Courneya, Plotnikoff, Hotz, & Birkett, 2000) and has been consistently shown to be a weak predictor of physical activity intentions relative to attitude and perceived behavioural control (Blue, 1995; Godin & Kok, 1996; Hausenblas, Carron, & Mack, 1997). In addition, recent research found that subjective norms had no significant effect on physical activity intentions among Estonian school pupils in a test of the theory of planned behaviour (Hagger et al., 2007).

After 5 weeks, physical activity behaviour was assessed by self-report using an adaptation of the Leisure-Time Exercise Questionnaire (LTEQ; Godin & Shephard, 1985). A 5-week inter-test period was employed because this represents a long-range prediction of behaviour relative to the comparatively short-range effects previously studied using the theory of planned behaviour (Hagger, Chatzisarantis, & Biddle, 2002b).

Measures

Intrinsic motivation in PE and leisure-time contexts.

Intrinsic motivation in PE was assessed through the intrinsic motivation subscale from the modified version of Ryan and Connell's (1989) measure in an educational setting (Hagger et al., 2003). Intrinsic motivation was measured via the common stem question, "Why do you participate in PE?", followed by four reasons (e.g. "because PE is fun"). Responses were measured on 4-point Likert scales ranging from "very true" (4) to "not true at all" (1). Intrinsic motivation in a leisure-time physical activity context was assessed by the intrinsic motivation subscale from Mullan and colleagues' (1997) BREQ. Responses to the four intrinsic motivation items from the BREQ (e.g. "I exercise because it is fun") were measured on 7-point scales ranging from "very true" (7) to "not true at all" (1).

The theory of planned behaviour. Three items drawn from Courneya and McAuley (1994) and Ajzen and Madden (1986) were used to measure behavioural intentions. The intention items (e.g. "I intend to do active sports and/or vigorous physical activities in the next four weeks ...") were measured using 7-point Likert scales anchored by "strongly agree" (7) to "strongly disagree" (1). Attitudes were assessed in response to the following statement: "Participating in active sports and/or vigorous physical activities during my leisure time in the next 5 weeks is ...". Responses were measured on four 7-point semantic-differential items with the following adjectival end points: bad-good, harmful-beneficial, unenjoyable-enjoyable, useful-useless, and boring-interesting. One adjective reflected moral evaluations (bad-good), two adjectives reflected instrumental evaluations (useful-useless, harmful-beneficial), and two adjectives reflected affective evaluations (unenjoyable-enjoyable, boring-interesting). Perceived behavioural control was assessed through three items (e.g. "I feel in complete control over whether I do active sports and/or vigorous physical activities in my leisure time in the next 5 weeks") measured on 7-point Likert scales ranging from "complete control" (7) to "no control" (1).

Use of learning strategies and teacher's positive general feedback in PE. Use of learning strategies was assessed by responses to the CPQPE (Solomon & Lee, 1997). This subscale consisted of five items (e.g. "When the teacher explains a skill, I practise the skill in my mind", "When I am practising a skill, I try to think how it is like something I already know") rated on 5-point Likert scales ranging from "strongly agree" (5) to "strongly disagree" (1). Perception of teachers' positive general feedback

was measured by three items (e.g. "The teacher often praises me") from the PTF questionnaire (Koka & Hein, 2005). Responses were made on 5-point Likert scales with choices ranging from "strongly agree" (5) to "strongly disagree" (1).

Self-reported physical activity behaviour. Physical activity behaviour was assessed at the third wave of data collection through an adaptation of the second item from Godin and Shephard's (1985) LTEQ. The period of the activity was adapted from "the last week" to "the last 4 weeks" and the scale specified the frequency of the activity during this period. The questionnaire asked two questions regarding how many times and how often the individual had engaged in vigorous exercise or active sports for at least 20 min over the past 4 weeks. Specifically, participants were requested to consider an average week (7 days) and to report how many times per week they engaged in vigorous physical activity over the last 4 weeks. In keeping with definitions of leisure-time activities (Godin, Jobin, & Bouillon, 1986), the questionnaire did not include physical activity that was performed during normal school time since PE is compulsory. The LTEQ exhibits satisfactory validity and reliability statistics when administered concurrently with more "objective" behavioural measures (e.g. Jacobs, Ainsworth, Hartman, & Leon, 1993). In addition, this two-item version of the LTEQ has demonstrated satisfactory construct validity and reliability in confirmatory factor analyses (Hagger & Chatzisarantis, 2005; Hagger, Chatzisarantis, & Harris, 2006).

Translation procedures

Standardized back-translation techniques (Brislin, 1986) were used to produce an Estonian version of the questionnaire. First, a bilingual translator translated the questionnaire items into Estonian, and then two independent bilingual translators translated it back into English. The back-translated versions were then compared with the original English version and any inconsistencies and errors were highlighted. These inconsistencies were removed in a further translation and the back-translation comparison process was repeated until the versions were identical, as recommended by Bracken and Barona (1991). The final versions exhibited no discrepancies with the original English version of the measures when back-translated.

Data analyses

The LISREL 8.51 statistical software was employed to conduct the confirmatory factor analysis (CFA) and structural equation modelling. First, multiple

imputations were used to replace missing observations with observations from cases with a similar profile of scores. Multiple imputations were chosen to generate estimates that better reflect the true variability and uncertainty in the data than regression methods. In this method, the results are combined and the average is reported as the estimate. There were 40 different missing-value data points, which represented 0.37% of the data points in the set. The adequacy of the CFA model was evaluated using recommended incremental goodness-of-fit indexes: comparative fit index (CFI), the non-normed fit index (NNFI), and the root mean square error of approximation (RMSEA). Simulation studies have shown that these fit indices are least influenced by sample size (Fan, Thompson, & Wang, 1999). For the CFI and NNFI, cut-off values of 0.90 are generally considered to represent acceptable fit (Bentler, 1990), although values approaching 0.95 are preferable (Hu & Bentler, 1999). Browne and Cudeck (1989) suggest that a RMSEA of 0.05 or less indicates good fit, and that values up to 0.08 represent errors that approximate to those expected in the population. The hypothesized relationships among the model constructs were tested in a structural equation model using LISREL 8.51 (Figure 1). Model fit was evaluated using the goodness-of-fit indexes cited previously.

Several tests of mediation were conducted to control the study hypotheses according to Baron and Kenny's (1986) criteria for mediation. Four criteria that require satisfaction for mediation to be supported: (1) the dependent variable should be correlated with the independent or predictor variable(s); (2) the mediator should be correlated with the independent variable(s); (3) the mediator should have a significant unique effect on the dependent variable when it is included alongside the independent variable(s) in a multivariate test of these relationships; and (4) the effect of independent variable(s) on the dependent variable should be significantly attenuated or nullified when the mediator is included as an independent predictor of the dependent variable (Baron & Kenny, 1986).

Results

Preliminary analysis

Overall means, standard deviations, and correlations for study variables are provided in Table I. Distributional properties of the responses to all items were examined. Results revealed skewness values greater than unity, which indicated that not all variables were normally distributed. Therefore, normal scores were computed for ordinal variables before the estimation of the measurement model and the

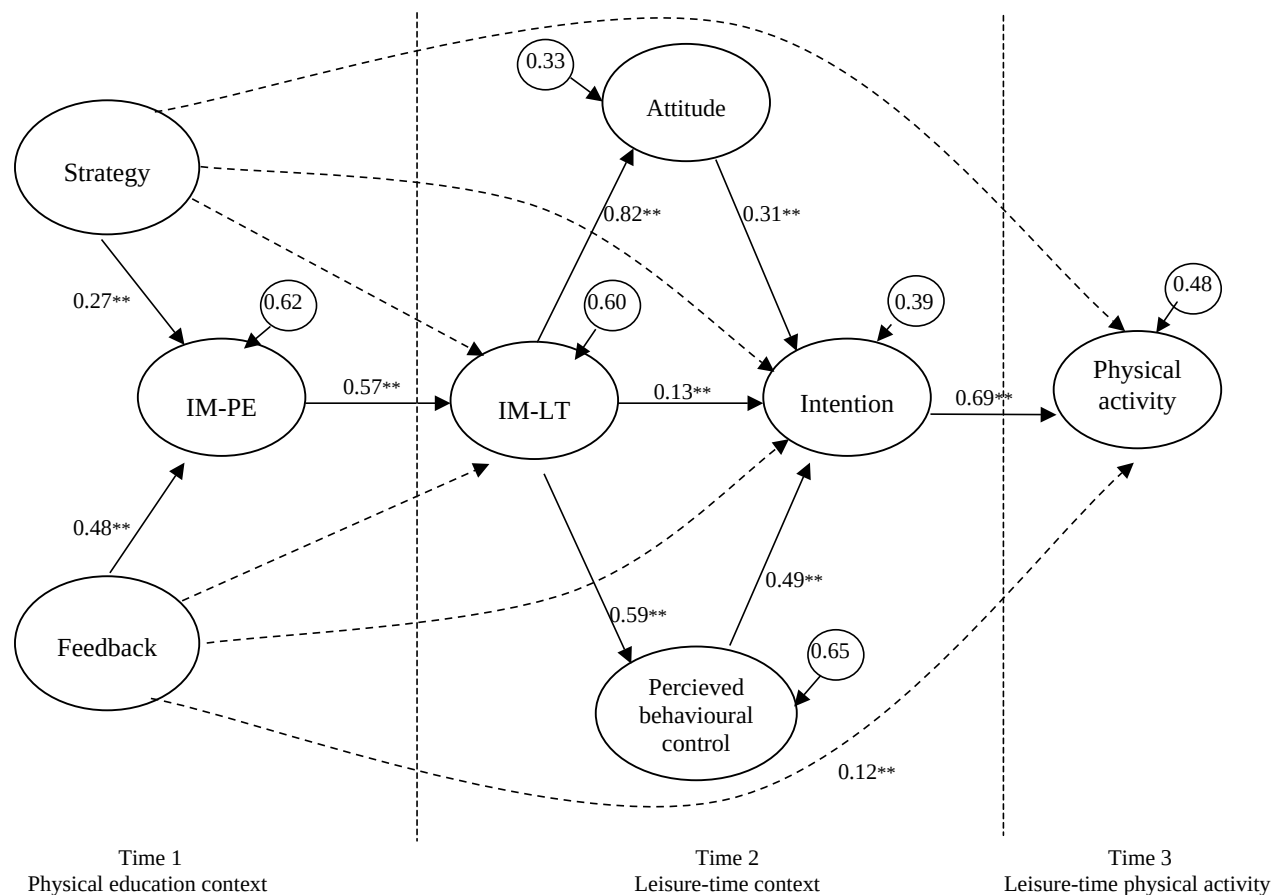


Figure 1. Hypothesized structural equation model of use of learning strategies and perceived teachers' positive general feedback in PE lessons affecting leisure-time physical activity. IM-PE = intrinsic motivation in physical education; IM-LT = intrinsic motivation in a leisure time-context. The paths with broken lines were set to be freed but were expected to be zero. For clarity, the indicators of the latent factors were not included. ** $P < 0.01$.

structural equation model with a maximum likelihood method (Jöreskog, Sörbom, du Toit, & du Toit, 2001).

The confirmatory factor analysis produced a well-fitting measurement model (Table II, Model 1) where each factor was adequately explained by the set of indicator items. (The factor loadings and solution estimates from the confirmatory factor analysis are available upon request from the first

author.) Examining the solution estimates of these models indicated that the factor loadings all exceeded the recommended minimum and the variance average extracted was higher than 0.50 as suggested by Diamantopoulos and Sigauw (2000). Factor correlations among the constructs were significantly different from unity according to the criteria specified by Bagozzi and Kimmel (1995), supporting the discriminant validity of the constructs.

Table I. Descriptive statistics, reliability and correlations among latent variables

	Mean	s	α	1	2	3	4	5	6	7
1. Use of learning strategies	2.69	1.01	0.75	—						
2. Positive general feedback	3.21	0.99	0.88	0.30*	—					
3. Intrinsic motivation in PE	2.95	0.82	0.89	0.41*	0.56*	—				
4. Intrinsic motivation in leisure time	4.86	1.62	0.91	0.34*	0.37*	0.63*	—			
5. Attitudes	5.49	1.18	0.88	0.27*	0.34*	0.49*	0.80*	—		
6. Perceived behavioural control	5.19	1.37	0.86	0.12*	0.23*	0.31*	0.56*	0.67*	—	
7. Intentions	4.73	1.57	0.87	0.13*	0.24*	0.31*	0.62*	0.69*	0.74*	—
8. Leisure-time physical activity	4.36	1.27	0.84	0.09	0.28*	0.27*	0.50*	0.53*	0.53*	0.72*

* $P < 0.01$

Table II. Measurement fit indexes and structural equation models

Models	χ^2	d.f.	CFI	RMSEA	CI ₉₀ RMSEA	NNFI
Model 1	677.08	349	0.96	0.049	0.043–0.054	0.95
Model 2	732.34	361	0.95	0.051	0.046–0.056	0.94
Model 3	817.03	362	0.94	0.056	0.051–0.061	0.93
Model 4	861.75	363	0.93	0.059	0.054–0.064	0.93
Model 5	879.70	362	0.91	0.060	0.055–0.065	0.91

Note: Model 1 = Measurement model with all study variables; Model 2 = hypothesized structural model; Model 3 = structural equation model in which the path from intrinsic motivation in PE to intrinsic motivation in leisure time is fixed to 0; Model 4 = structural equation model in which the paths from attitudes and perceived behavioural control to intention were fixed to zero; Model 5 = structural equation model in which the path from intention to physical activity is fixed to zero.

Main analyses

The main purpose of the structural equation model was to examine the influence of the perceived teachers' positive general feedback and use of learning strategies in PE on students' intrinsic motivation in PE and in leisure-time physical activity and also, indirectly through the TPB constructs, leisure-time physical activity behaviour. It was proposed that students' perceptions of teachers' positive general feedback and use of learning strategies in PE would affect intrinsic motivation in PE directly and also have an indirect effect on intrinsic motivation in a leisure-time context, intentions, and physical activity behaviour in leisure time. In addition, the model was constructed so that intrinsic motivation in PE had a direct effect on leisure-time intrinsic motivation. Intrinsic motivation in leisure time was set to predict physical activity intention directly and indirectly via attitudes and perceived behavioural control. Attitudes and perceived behavioural control were included as indirect predictors of physical activity behaviour in leisure-time mediated by intentions. Finally, the direct effects of both perceived positive general feedback and use of learning strategies on intrinsic motivation in a leisure-time context, intentions, and physical activity were specified as free parameters in the model, but were expected to be zero.

Examination of the fit indexes revealed that the proposed structural model reproduced the observed covariance matrix satisfactorily (Table II, Model 2). Overall, 52% of the variance in physical activity behaviour was explained. Examining the path coefficients in the model (Figure 1), perceived teachers' positive general feedback ($\beta = 0.48$, $P < 0.01$), and use of learning strategies ($\beta = 0.27$, $P < 0.01$) in PE predicted intrinsic motivation in PE as hypothesized. There were no significant direct effects of perceived teachers' positive general feedback and use of learning strategies on intrinsic motivation in a leisure-time context, as specified in the hypothesized model. However, as was expected there were significant

indirect effects of the use of learning strategies ($\beta = 0.15$, $P < 0.01$) and perceived teachers' positive general feedback ($\beta = 0.27$, $P < 0.01$) on intrinsic motivation in leisure time.

To confirm the complete mediation of the effects of positive general feedback and use of learning strategies on intrinsic motivation in leisure time by intrinsic motivation in PE, we performed a mediation analysis using Baron and Kenny's (1986) criteria. The use of learning strategies and perceived teachers' general positive feedback were significantly correlated with both the motivation constructs satisfying the first two criteria for mediation (see Table I). Furthermore, the significant path from intrinsic motivation in PE to intrinsic motivation in leisure time satisfied the third criterion for mediation (see Figure 1). Finally, to confirm the fourth criterion, an alternative model (Table II, Model 3) was estimated in which the direct path from intrinsic motivation in PE to intrinsic motivation in leisure time was fixed to zero. In this alternative model, the direct effects of the use of learning strategy and perceived teachers' general positive feedback on intrinsic motivation in leisure time were significant, indicating that complete mediation occurred. The path coefficients were $\beta = 0.27$ ($P < 0.01$) and $\beta = 0.34$ ($P < 0.01$), respectively. There was a significant difference in the model goodness-of-fit chi-square ($\Delta\chi^2 = 84.29$, $\Delta d.f. = 1$, $P < 0.01$) for the model that included this path as a free parameter (Table II, Model 2) and the model that did not (Table II, Model 3).

Intrinsic motivation in a leisure-time context exerted a direct influence on attitudes ($\beta = 0.82$, $P < 0.01$), perceived behavioural control ($\beta = 0.59$, $P < 0.01$), and intentions ($\beta = 0.13$, $P < 0.01$). The effects of attitudes ($\beta = 0.31$, $P < 0.01$) and perceived behavioural control ($\beta = 0.49$, $P < 0.01$) on intention and its effect on physical activity behaviour ($\beta = 0.69$, $P < 0.01$) were also significant. To test the mediation of the effect of intrinsic motivation in leisure time on intentions by attitudes and perceived behavioural control, the paths from attitudes and

perceived behavioural control to intention were fixed to zero (Table II, Model 4). Results showed that the relationship between intrinsic motivation in leisure time and intention was significantly increased from $\beta = 0.13$ ($P < 0.01$) to $\beta = 0.73$ ($P < 0.01$), indicating the existence of partial mediation. There was also a significant difference in model goodness-of-fit between the model (Table II, Model 2) that included these paths as a free parameter and the model (Table II, Model 4) that did not ($\Delta\chi^2 = 129.41$; $\Delta d.f. = 2$, $P < 0.01$).

Results showed that significant direct effects of use of learning strategies and perceived positive general feedback on intention did not emerge. However, significant indirect effects of learning strategies ($\beta = 0.16$, $P < 0.01$) and perceived positive general feedback ($\beta = 0.21$, $P < 0.01$) on intention were observed. The model indicated the existence of a significant direct effect ($\beta = 0.12$, $P < 0.01$) of perceived positive general feedback on physical activity behaviour, but not for use of learning strategies. There was also a significant indirect effect of perceived positive general feedback on physical activity behaviour ($\beta = 0.14$, $P < 0.01$). To determine whether the effect of perceived positive general feedback on physical activity behaviour was partially mediated via the motivational sequence, the path from intention to behaviour was fixed to zero (Table II, Model 5). There was a significant difference in model goodness-of-fit between the model (Table II, Model 2) that included this path as a free parameter and the model (Table II, Model 5) that did not ($\Delta\chi^2 = 147.36$; $\Delta d.f. = 1$, $P < 0.01$). The path coefficient from perceived positive general feedback to physical activity increased ($\beta = 0.30$, $P < 0.01$), indicating the existence of partial mediation. This restricted model accounted for 9% of variance in the physical activity behaviour, which is the amount of variance that can be attributed to positive general feedback.

Finally, results of the modified version of the trans-contextual model showed that the total effects of use of learning strategies ($\beta = 0.10$, $P < 0.05$) and perceived positive general feedback ($\beta = 0.20$, $P < 0.01$) on physical activity intention were indirect only via the motivational sequence. The total effect of perceived positive general feedback ($\beta = 0.26$, $P < 0.01$) on physical activity behaviour comprised both indirect and direct effects.

Discussion

The main purpose of this study was to determine whether the use of learning strategies and perceived positive general feedback such as praise and encouragement from the teacher influenced physical activity behaviour in a modified version of the

trans-contextual model. A primary hypothesis of the present study was that students' perceptions of the use of learning strategies in PE would influence their intrinsic motivation in PE. The structural equation models in the present study provided support for this hypothesis. Students perceiving that the use of learning strategies enabled them to learn more independently were more likely to have felt more involved in the learning process and felt more competent. The adoption and use of learning strategies provided by teachers in PE are specific instances or components of an autonomy-supportive teaching style (Reeve, 2002). In addition, involvement and competence are characteristics of intrinsic motivation and therefore students' perceptions of learning strategies are theoretically related to intrinsic motivation. Therefore, results of this study are congruent with previous research in education that have reported the importance of more general aspects of autonomy support in facilitating autonomous forms of motivated behaviour within this context (Hagger *et al.*, 2005; Reeve, 2002; Standage, Duda, & Ntoumanis, 2003).

The results of the study also supported previous findings in which teachers' positive general feedback significantly predicted students' intrinsic motivation in PE (Koka & Hein, 2003, 2005). This part of the model is unique and adds to the literature because it illustrates that specific components of an autonomy-supportive teaching style in PE such as the use of learning strategies and perception of general positive feedback may facilitate intrinsic motivation in PE.

We also hypothesized that use of learning strategies and perceived teachers' positive general feedback would influence intrinsic motivation in a leisure-time context via the mediation of intrinsic motivation in PE. The results indicated that the effect of the use of learning strategies and perceived teachers' positive general feedback on intrinsic motivation in a leisure-time context was completely mediated via intrinsic motivation in PE, thus supporting the hypothesis. This suggests that intrinsic motivation in PE is an important and necessary factor in the process of translating the effect of teachers' behaviour, such as teaching students to use learning strategies, into intrinsic motivation in a leisure-time physical activity context. This is consistent with previous research that has highlighted the mediation of the relationship between perceived autonomy support from PE teachers and autonomous motivation in a leisure-time context by autonomous motivation in PE (Hagger *et al.*, 2003, 2005). In general, these findings support the major premise of the trans-contextual model – that autonomous forms of motivation can be transferred from one context to another.

These results indicate that students who use the learning strategies suggested to them by their teachers will foster their intrinsic motivation to do physical activity in PE and in their leisure time. Such strategies promote autonomous learning among students and may be viewed as a specific type of autonomy-supportive teaching behaviour. This is congruent with the findings of other studies about the role of social factors in forming autonomously regulated behaviours (Black & Deci, 2000; Ferrer-Caja & Weiss, 2000). For example, Black and Deci (2000) have demonstrated that an autonomy-supportive teacher might provide students with the necessary information about a challenging activity or task while also encouraging them to seek other information to solve the problem in their own way. Ferrer-Caja and Weiss (2000) have also noted that when students perceive their PE class to promote learning and participation, they focus on the behaviour within this context and evaluate their success using self-referenced sources, such as effort and improvement.

Practically, teachers are advised give hints to students on how it would be easier to learn new skills, using statements such as: "When you are practising a skill, try to think how it is like something you already know", "When I'm explaining to you a new skill, rehearse it in your mind", or "It might be helpful to talk yourself through the practice". Besides giving hints, teachers can support students' autonomy by giving them time to practise on their own and giving them time to communicate between themselves. When students have been taught how to use learning strategies and given time to practise independently, they will likely start to rehearse the new skills and relate them to what they already know (e.g. "I try to go over in my mind the correct way to perform the skills I have learnt in PE"). These kinds of instructional hints reflect the behaviours that students perceive to be autonomy-supportive and enhance intrinsic motivation to practise not only in PE but also in their leisure time.

Learning strategies and perceived positive general feedback had indirect effects on physical activity intention through the motivational sequence identified in the trans-contextual model. This points to the complex mechanism by which teachers using these specific autonomy-supportive behaviours in PE lessons facilitate students' intentions to be physically active in school PE and in their leisure time. This finding is congruent with previous tests of the trans-contextual model (Hagger *et al.*, 2003, 2005), which demonstrated that perceived autonomy support influenced students' leisure-time physical activity intention through the motivational sequence.

The present test of the trans-contextual model (see Figure 1) indicated that the effect of intrinsic

motivation in a leisure-time context on exercise intention is direct and indirect via the belief-based constructs that determine physical activity intentions in a leisure-time context, namely attitude and perceived behavioural control (Chatzisarantis, Biddle, & Meek, 1997; Hagger *et al.*, 2005). Although some previous studies found no significant direct effect of intrinsic motivation on intention (Chatzisarantis & Biddle, 1998; Chatzisarantis *et al.*, 1997; Hagger *et al.*, 2002a,b, 2003), there is considerable evidence to support the indirect effect of intrinsic motivation on exercise intention mediated by attitudes and perceived behavioural control (Chatzisarantis, Hagger, Biddle, & Karageorghis, 2002; Hagger & Armitage, 2004; Hagger *et al.*, 2002a). In the present study, the indirect effect from intrinsic motivation in a leisure-time context to intentions to participate in exercise behaviour was stronger via perceived behavioural control than via attitude. Previous tests of the trans-contextual model in this respect have demonstrated somewhat different results. For example, in the study by Hagger *et al.* (2005), the relative strength of the indirect effect of leisure-time motivation on physical activity intention for British, Greek, and Polish students was stronger via attitude than perceived behavioural control. However, for a Singaporean sample, the indirect effect of leisure-time motivation on physical activity intention was stronger via perceived behavioural control, consistent with the current study. This result seems to suggest that, for Estonian students, perceived behavioural control plays a greater role in transforming physical activity motivation into physical activity intention in leisure time.

Interestingly, the results indicated that perceived positive general teacher's feedback also had a direct effect on physical activity behaviour. This is, in general, consistent with the study of Hagger *et al.* (2005) in which perceived autonomy support measured as a general construct also had a direct effect on physical activity behaviour. Previous research has suggested that these significant, albeit small, effects may indicate more spontaneous, impulsive routes to behaviour rather than more reflective, deliberate routes directed through intentions (Hagger *et al.*, 2006). However, it must be stressed that the effects are generally quite small and the current study suggests that teachers high in positive general feedback in PE should be successful in promoting students' physical activity behaviour in their leisure time through the proposed motivational sequence.

Besides these relationships, the presented model with the specific components of perceived autonomy support explained a greater amount of variance in physical activity behaviour (52%) than a model where the perceived autonomy support was not

differentiated (28%) (Hagger *et al.*, 2003). Similarly, the cross-cultural test of the trans-contextual model conducted by Hagger *et al.* (2005), where perceived autonomy support also was not differentiated, accounted for a smaller amount of explained variance in physical activity behaviour for British (20%), Greek (22%), and Singaporean (44%) samples than our study, but not a Polish sample (57%).

Although the present study provided some interesting findings about the influence of specific components of PE teachers' autonomy-supportive behaviours on students' leisure-time physical activity behaviour, there are also some limitations that must be acknowledged.

The sample included more female than male participants because there were usually more females than males in the classes that participated in the study. However, studies using constructs from self-determination theory in PE contexts have consistently supported the invariance of relations among some components of the trans-contextual model across gender, meaning that the pattern of relationships among the model constructs is largely the same for both boys and girls (Standage, Duda, & Ntoumanis, 2005, 2006). Therefore, we pooled the data for boys and girls in the present study. A further limitation of the current study was that the extended version of the trans-contextual model did not include need-related constructs from self-determination theory, such as psychological needs for competence, autonomy, and relatedness, as important mediators between autonomy-supportive behaviours and motivation (Ryan & Deci, 2000). Thus, further extension of the model through the inclusion of these needs may help to provide a more complete understanding of the motivational processes predicting physical activity intention and behaviour.

Overall, the present study is unique because it provides additional evidence to support the processes in the trans-contextual model and also incorporates specific components of teachers' autonomy-supportive instructional behaviour such as students' perception of the use of learning strategies and teachers' positive general feedback into the model. An important finding of the model is that intrinsic motivation in a PE context mediated the effects of perceived general positive feedback and the use of learning strategies on intrinsic motivation in a leisure-time context. Moreover, results revealed that the effect of perceived teachers' positive feedback on students' physical activity behaviour may be direct but also mediated by the motivational sequence identified by the trans-contextual model, whereas the use of learning strategies influences the physical activity intention indirectly via the motivational sequence.

From an applied perspective, these results highlight the importance of providing positive general feedback to students in PE classes and teaching them how to use learning strategies to promote their intrinsic motivation in PE and leisure-time contexts. When teachers are autonomy-supportive, they have more opportunity to influence students' physical activity behaviour in their leisure time. However, there may be other specific types of autonomy-supportive behaviours that affect students' motivation in both contexts. Researchers are encouraged to develop an instrument to measure these specific types of autonomy support. Such research will help to uncover the specific behaviours of teachers that will be the most effective for facilitating students' motivation in both PE and leisure time and thereby enhance physical activity behaviour.

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