The perceived autonomy support scale for exercise settings (PASSES): Development, validity, and cross-cultural invariance in young people

Martin S. Hagger[a],*, Nikos L.D. Chatzisarantis[b,1], Vello Hein[c],
Maret Pihu[c], Istvan Soós[d], Istvan Karsai[e]

[a]*School of Psychology, University of Nottingham, University Park, Nottingham, Nottinghamshire, NG7 2RD, UK*
[b]*University of Exeter, Exeter, Devon, UK*
[c]*Faculty of Exercise and Sports Sciences, University of Tartu, Ülikooli 18, 50090 Tartu, Estonia*
[d]*School of Health, Natural, and Social Sciences, University of Sunderland, Darwin Building, Wharncliffe Street, Sunderland, Tyne and Wear, SR1 3SD, UK*
[e]*Institute of Physical Education and Sport Science, Faculty of Natural Science, University of Pécs, Ifjúság út 6, 7624 Pécs, Hungary*

Abstract

Objective: The study aimed to develop a perceived autonomy support scale for exercise settings (PASSES) in young people.

Design: Cross-sectional questionnaire survey.

Methods: In Study 1,432 school pupils responded to an initial pool of perceived autonomy support items with physical education (PE) teachers as the source of support. The validity of the initial factor structure of the PASSES was evaluated using confirmatory factor analysis. In Study 2, three versions of the PASSES were developed measuring perceived autonomy support from three sources: PE teachers, parents, and peers. British ($N = 210$), Estonian ($N = 268$), and Hungarian ($N = 235$) school pupils completed each

*Corresponding author.

E-mail addresses: martin.hagger@nottingham.ac.uk (M.S. Hagger), nikos.chatzisarantis@plymouth.ac.uk (N.L.D. Chatzisarantis), vello@ut.ee (V. Hein), istvan.soos@sunderland.ac.uk (I. Soós).

[1]Nikos L.D. Chatzisarantis is now with the School of Psychology, University of Plymouth, Portland Square, Drake Circus, Plymouth, Devon PL4 8AA, UK.

version. The proposed model of perceived autonomy support established in Study 1 was tested for structural invariance and mean differences across the three cultures.

Results: In Study 1, the deletion of items contributing to model misspecification produced a final 12-item PASSES which exhibited acceptable fit with the data. The perceived autonomy support factor also demonstrated discriminant and convergent validity with regulation styles from the perceived locus of causality. In Study 2, the hypothesized model exhibited acceptable goodness-of-fit statistics in all samples and for all sources. The structure of the model was found to be invariant across the cultural groups for each source. Contrary to hypotheses, mean levels of perceived autonomy support from parents and peers were found to be higher in Estonian participants relative to their British and Hungarian counterparts.

Conclusion: Results support the use of the PASSES as a valid measure of perceived autonomy support in exercise settings for three different sources in young people.

Self-determination theory is a dialectic, organismic theory of human motivation that has provided insight into the interpersonal and intrapersonal influences on social behaviour in many contexts (Deci & Ryan, 1985, 2000). In the exercise context, research has consistently highlighted the importance of autonomous forms of motivation in people's uptake and adherence to exercise behaviour for health gains (Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997; Vallerand & Losier, 1999). As a consequence, research adopting self-determination theory has focused on the social conditions which give rise to autonomous forms of motivation (e.g., Chatzisarantis, Biddle, & Meek, 1997; Sarrazin, Vallerand, Guillet, Pelletier, & Cury, 2002; Standage, Duda, & Ntoumanis, 2003a; Wilson & Rodgers, 2004).

One aspect of the social environment that has been shown to be effective in promoting autonomous motivation is the interpersonal style of significant others who provide instruction and feedback with regard to goal-directed behaviours (Reeve, 2002). Research has shown that when significant others in leadership roles such as teachers and managers display behaviours that are supportive of their subordinates' autonomy, the subordinates demonstrate higher levels of autonomy toward tasks in those environments and exhibit greater persistence, commitment, enjoyment, and well-being (e.g., Black & Deci, 2000; Deci, Vallerand, Pelletier, & Ryan, 1991; Gagné, Ryan, & Bargmann, 2003; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Mageau & Vallerand, 2003; Reeve, Bolt, & Cai, 1999; Williams, Freedman, & Deci, 1998). Importantly, it is individuals' interpretation of the behaviours of these significant others' as autonomy-supportive that has the most consistent influence on behavioural engagement (Reeve, 2002). Perceived autonomy support is defined as the beliefs of students or learners that significant others such as teachers, coaches, parents, and friends support self-initiation, opportunities for choice, independent problem-solving, and involvement in decision making as well as acknowledging feelings and avoiding making pressurising demands (Mageau & Vallerand, 2003). It is expected that individuals who deem significant others to display these autonomy-supportive characteristics will be more likely to approach tasks with an autonomous motivational style (Black & Deci, 2000).

Research on perceived autonomy support has shown that it is an important influence on autonomous forms of motivation and behaviours in social contexts such as education (Reeve, 2002; Reeve et al., 1999) and exercise (Hagger et al., 2003; Standage, Duda, & Ntoumanis, 2003b).

Such research has highlighted the need for valid and reliable psychometric measures of perceived autonomy support. However, few studies have subjected their measures of perceived autonomy support to rigorous evaluation to support their psychometric integrity. The purpose of the present study is to develop a valid psychometric scale for measuring perceived autonomy support in exercise settings using a rigorous, a priori, hypothesis-testing approach.

Self-determination theory and perceived autonomy support

Central to self-determination theory is the distinction between autonomous and controlling forms of motivation. This distinction is often viewed on a continuum reflecting the perceived origin or cause of an individual's motivated behaviour in a given context. This continuum is known as the *perceived locus of causality* (PLOC, Ryan & Connell, 1989). Autonomous motivation reflects engaging in a behaviour because it satisfies personally relevant goals and services the innate psychological needs for autonomy, competence, and relatedness. The prototypical form of autonomous motivation is *intrinsic motivation*, which lies at one extreme of the PLOC continuum and represents behavioural engagement with no external contingency or reinforcement. *Identified regulation* is a motivational construct that lies adjacent to intrinsic motivation on the continuum and represents motivation to engage in a behaviour because the behaviour results in personally relevant outcomes. Adjacent to identified regulation lies *introjected regulation* which reflects participation in behaviours for perceived internal pressures such as avoiding negative affective states like shame or guilt or gaining contingent self-worth or pride. *External regulation* reflects the prototypical form of extrinsic motivation. Located at the opposite extreme to intrinsic motivation on the continuum, external regulation reflects engaging in behaviours due to external pressures from others.

Given that intrinsic motivation and identified regulation, the most autonomous form of extrinsic motivation, are associated with increased engagement and persistence in tasks (Deci & Ryan, 2000), researchers have sought to identify the autonomy-supportive behaviours displayed by significant others that enhance levels of relative autonomous motivation (e.g., Reeve et al., 1999). In social contexts such behaviours are those that support learning and interests such as listening, encouraging choice and opportunity, providing informational feedback, providing a meaningful rationale, offering encouragement and hints, responding to questions, and making perspective-acknowledging statements (Deci, Ryan, & Williams, 1996; Reeve & Jang, 2006). This has been supported empirically and the level of perceived autonomy support given by significant others is associated with autonomous forms of motivation and behavioural persistence in a number of domains (e.g., Gagné, 2003; Williams, 2002) including exercise (Hagger et al., 2003; Koka & Hein, 2003; Vansteenkiste, Simons, Lens, & Sheldon, 2004; Wilson & Rodgers, 2004).

Measuring perceived autonomy support

Despite a number of research articles including perceived autonomy support as an independent predictor of motivation and psychological and behavioural outcomes, few studies have provided a systematic evaluation of the measures of perceived autonomy support. Numerous measures have

been developed, such as the climate questionnaire series used in the health (Williams, Cox, Kouides, & Deci, 1999), learning (Black & Deci, 2000), work (Baard, Deci, & Ryan, 2004), and exercise and sport (Hagger et al., 2003) contexts. While such measures have exhibit acceptable internal consistency statistics, none have been evaluated using a rigorous, hypothesis-testing approach such as confirmatory factor analyses (CFAs) to establish the factor structure of the perceived autonomy support construct. In addition, many of these measures have been adapted from research in other domains. For example, scales measuring perceived autonomy support in the exercise domain have typically adapted items from research in educational contexts (e.g., Hagger et al., 2003; Standage et al., 2003a). Importantly, such adaptations have not been evaluated for their psychometric integrity and factor structure either, so there is no substantive evidence to support their validity.

In addition, few studies have examined how perceived autonomy support differs according to the source of the support. Studies in education have identified academic leaders (Reeve et al., 1999) as important sources of autonomy support while research in exercise settings have identified coaches (Sarrazin et al., 2002) and physical education (PE) teachers (Hagger et al., 2003) as salient sources. Yet no study has provided evidence that varying the source of autonomy support within such measures has an affect on the validity of the measure and the perceived understanding of the perceived autonomy support construct by respondents. The present investigation aims to resolve these issues by developing a measure of perceived autonomy support for exercise settings based on an exhaustive review of previous measures of perceived autonomy support using a rigorous, hypothesis-testing approach with CFA. Such an approach is often considered the gold standard in the development of psychological instruments as it permits the a priori specification of a proposed model which is then tested against observed data. Further, it uses latent variables which explicitly model the random error associated with the questionnaire items that make up the construct, thereby making the latent variable representing the construct ostensibly error free.

Cross-cultural research in self-determination theory

While the positive effects of autonomous forms of motivation on behavioural engagement and adherence have been noted within a number of different cultural contexts, few studies have examined cross-cultural differences in the hypotheses of self-determination theory. The theory itself assumes the effects of autonomous motivation to be universal and therefore consistent across cultural groups. Researchers have therefore sought to establish whether cultural values, such as individualism and collectivism, influence the average levels of perceived autonomy support and the effects of perceived autonomy support on autonomous forms of motivation as proposed by self-determination theory. Recent cross-cultural research in cultures that vary in their cultural values has examined the levels and patterns of influence among these key variables from self-determination theory. For example, in an educational context, Chirkov and Ryan (2001) found that participants from a culture with a predominantly individualist cultural norm (United States) tended to view significant others like parents and teachers as more autonomy supportive than participants from a collectivist culture (Russia). However, perceived autonomy support predicted academic motivation and psychological well-being in both cultures. It is therefore likely that while

there are cross-cultural differences in the average levels of the motivational styles offered by self-determination theory, the patterns of influence tend to be consistent.

Given these cross-cultural findings, the present study also aims to evaluate the appropriateness of the proposed measure of perceived autonomy support in three independent samples from nations with different cultural orientations: Great Britain, Estonia, and Hungary. According to Hofstede (1983) and others (Oyserman, Coon, & Kemmelmeier, 2002; Watkins et al., 1998), Eastern European nations like Estonia and Hungary tend to endorse a more collectivist orientation while Great Britain has a predominantly individualist cultural orientation. Given that autonomy support is considered a universal perception, it is expected that the structure of the proposed measure of perceived autonomy support could be replicated in each national sample and would be invariant at the structural level (i.e., same number of scale items, each item accounted for by the same perceived autonomy support factor). However, it is expected that there will be differences in the average levels of perceived autonomy support given the precedence set by Chirkov and Ryan (2001), such that British participants with an individualist cultural background report higher levels of perceived autonomy support than participants from the collectivist cultures of Estonia and Hungary.

The present study

Two studies aimed to develop a new measure of perceived autonomy support for exercise settings among young people. Specifically, the purpose of these studies was fourfold: (1) To develop a measure of perceived autonomy support for exercise settings from an initial pool of items that exhibits construct validity and internal reliability using a rigorous, a priori approach with CFA (Study 1); (2) To test the discriminant and convergent validity of the perceived autonomy support for exercise settings scale with a valid measure of motivational styles from the PLOC (Study 1), with significant correlations expected between perceived autonomy support and autonomous forms of regulation (Reeve, 2002)[2]; (3) To test whether the developed measure was replicable in independent samples of adolescents from three European nations and could be replicated for the three most salient interpersonal influences on young people's exercise behaviour, namely, parents and peers (e.g., Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Wu, Pender, & Noureddine, 2003). It was expected that the perceived autonomy support would exhibit acceptable fit with the data for each of the three sources within each sample (Study 2); and (4) To examine whether the factor structure and latent mean structure of the developed measures was invariant across the three national samples with an invariant factor structure of the proposed model across the samples expected (Study 2). However, we expected some variation in the mean levels of perceived autonomy support across the cultural groups as previous cross-cultural research has found cross-cultural differences in the average levels of perceived autonomy support (Chirkov & Ryan, 2001) with levels of perceived autonomy support lower in the

---

[2]Discriminant validity refers to the extent that perceived autonomy support construct was independent of measures of like constructs. It was hypothesized that perceived autonomy support would be empirically distinct from autonomous regulation styles from the perceived locus of causality. Convergent validity refers to whether the proposed perceived autonomy support construct demonstrates a theoretically predictable pattern of relationships with conceptually related constructs.

collectivist cultures (Estonia and Hungary) relative to the predominately individualist culture (Great Britain).

Study 1

Method

Participants

Participants were recruited from four co-educational high schools in the South East Region of England ($N = 432$; M age $= 13.95$, SD $= 1.51$) and comprised approximately equal numbers of girls ($N = 234$; M age $= 13.82$, SD $= 1.44$) and boys (N $= 198$; M age $= 14.11$, SD $= 1.58$). School statistics from the previous year indicated that the majority of the pupils in each school were of white European ethnicity, with less than 10% from other ethnic minority groups. Data from the National Office for Standards in Education indicated that the school pupils were from a background that matched the socio-economic distribution of British schools based on an income means test used to determine whether the child was eligible for free school meals. There was no significant difference in age across the gender groups. Permission was obtained from the school principals for data to be collected in their schools and data collection was completed in lessons during normal school hours. Parental consent was obtained via a pre-printed letter and form sent home with pupils detailing the study requirements. If parents felt the need for their child to be excluded from participating in the study they were asked to complete and return the form to the child's form-room teacher. No forms were returned.

Measures

Initial item generation and item pool: We identified an initial pool of items for the measure of perceived autonomy support based on a content analysis of measures (e.g., climate questionnaires) and methods adopted by previous research to tap perceived autonomy support in general experimental (e.g., Pelletier & Vallerand, 1996), educational (e.g., Black & Deci, 2000; Reeve & Jang, 2006), health (e.g., Kasser & Ryan, 1999; Williams, Rodin, Ryan, Grolnick, & Deci, 1998), occupational (e.g., Baard et al., 2004), and sport and exercise domains (e.g., Hagger, Chatzisarantis et al., 2005; Hagger et al., 2003; Pelletier, Fortier, Vallerand, & Briere, 2001; Wilson & Rodgers, 2004). This initial pool of items was circulated to two experts in self-determination theory who were asked to match the questionnaire items to the key autonomy-supportive behaviours identified by Reeve and colleagues (Reeve, 2002) as those most frequently displayed by autonomy supportive teachers in concurrent validity studies (Reeve et al., 1999) and significantly associated with indices of intrinsic motivation (Reeve & Jang, 2006). These components included taking time to listen, provision of choice or opportunity, provision of informational feedback, offering encouragement and hints, responding to questions, and acknowledgement of understanding or empathy. Item wording was modified to incorporate PE teachers as the source of autonomy support and leisure-time exercise as the target behaviour. Autonomy support for exercise during participants' free time outside of school was the target because it represents much larger scope for young people to engage in the duration and frequency of activity that would yield health benefits, as exercise time within PE lessons is limited and

unlikely to result in substantial health benefits. The experts met with perfect agreement in matching the items with the components of perceived autonomy support after the deletion of redundant items with similar content.

Response scales: Responses to each of the 14 modified perceived autonomy support items were made on 7-point Likert-type scales. The response scales were anchored by *strongly disagree* (1) and *strongly agree* (7).

Behavioural regulations in exercise questionnaire (*BREQ*): Regulation styles from the PLOC continuum were measured using Mullan, Markland, and Ingledew's (1997) BREQ. The BREQ is a validated measure of intrinsic, identified, introjected, and extrinsic forms of regulation with participants required to make their responses on 5-point Likert-type scales.

Research design and procedure

Prior to data collection, pupils were told that they were participating in a survey on young people and would be asked to complete the study questionnaire. Participants were presented with the questionnaire containing the developed perceived autonomy support items and the BREQ in quiet classroom conditions. Pupils were isolated from each other so that they could not copy or discuss responses. All of the questionnaires were completed anonymously to preserve confidentiality. Participants were informed that they had the right to withdraw at any time.

Data analysis

The EQS computer program (Bentler, 2004) was used to test the adequacy of the confirmatory factor analytic models tested in the present study. A robust maximum likelihood method was used for all analyses to protect the estimation of the models from any violations of the assumption of normality (Satorra & Bentler, 1988). The adequacy of the proposed models was evaluated using the comparative fit index (CFI, Bentler, 1990), non-normed fit index (NNFI, Marsh, Balla, & McDonald, 1988), standardized root-mean square of the residuals (SRMR, Hu & Bentler, 1995), and root-mean square error of approximation (RMSEA, Hu & Bentler, 1999) and its 90% confidence intervals (90% CI). Values greater than .90 for the CFI and NNFI indexes were considered acceptable for a well-fitting model (Bentler, 1990), although values greater than .95 are preferable (Hu & Bentler, 1999). Values of .08 or less for the SRMR and RMSEA are indicative of adequate model fit (Hu & Bentler, 1999). In addition, the 90% CI of the RMSEA should be narrow, its lower bound close to zero, and its upper bound ideally less than .08 for a well-fitting model (Bollen & Long, 1993).

In addition to the examination of overall goodness-of-fit indexes, we also examined the adequacy of the solution estimates of the model in each sample, such the parameter estimates that represent the relative contribution of each indicator to the hypothesized latent factor or factor loading, largest standardized residuals, and composite reliability (ρ_c) estimates as recommended by Jöreskog (1993).

Results

Initial CFA model

An initial CFA model was hypothesized to explain the variance/covariance matrices among the initial set of 14 items generated to measure perceived autonomy support in an exercise setting

from PE teachers. A single latent factor was specified representing perceived autonomy support with the factor set a priori as indicated by all the items from the pool. Each hypothesized relationship between the latent factor and indicant item or factor loading was a free parameter in the model with the exception of a single item which was randomly set to unity to define the scale of the factor, as is the norm in CFA models. The initial model was modified to exclude items that were not adequately explained by the proposed latent perceived autonomy support factor or contributed substantially to any misspecification in the model. Items were scheduled for deletion were associated with large standardized residuals ($> \pm 2.00$) or exhibited low factor loadings (Ford, MacCallum, & Tait, 1986; Motl & DiStefano, 2002).

Goodness-of-fit statistics supported the adequacy of the original model representing the covariances among the initial pool of items for the proposed perceived autonomy support scale ($\chi^2 = 175.779$, df $= 77$, $p < .01$; CFI $= .955$; NNFI $= .947$; SRMR $= .040$; RMSEA $= .044$; 90% CI lower bound (LB) $= .044$; 90% CI upper bound (UB) $= .065$). However, one item was responsible for the standardized residuals greater than ± 2.00 and another exhibited a low factor loading (.438) that was close the acceptable .400 minimum (Ford et al., 1986). Examination of the content of these items revealed at one referred to sharing experiences ("I feel I am able to share my experiences of active sports and/or vigorous exercise with my PE teacher") and the other with assistance ("My PE teacher helps me to do active sports and/or vigorous exercise in my free time"). It may be that sharing experiences may not have been most obviously associated with support but perhaps more with relatedness and the item referring to help may have been ambiguous as to whether it means support or actual physical help or intervention which would be less consistent with the notion of autonomy support. These items were deleted from the analysis and a model including the 12 remaining items respecified. This model exhibited much improved fit with the data ($\chi^2 = 119.942$, df $= 54$, $p < .01$; CFI $= .966$; NNFI $= .959$; SRMR $= .036$; RMSEA $= .053$; 90% CI LB $= .040$; 90% CI UB $= .066$) and no misspecifications according to the standardized residuals and factor loadings were all significant and acceptable in magnitude. Standardized factor loadings and item information for the modified model are provided in Table 1.

Discriminant and convergent validity with regulation styles from perceived locus of causality

In addition to establishing the adequacy of the factor structure of the newly developed measure of perceived autonomy support in exercise settings, we also tested its discriminant and convergent validity with measures of the conceptually related but distinct regulation styles from the PLOC. We therefore specified a CFA which included the four constructs from the BREQ as latent factors correlated with the perceived autonomy support latent factor indicated by the items from the PASSES. The model therefore included latent factors representing the intrinsic regulation (indicated by three items), identified regulation (four items), introjected regulation (four items), and external regulation (four items) motivational styles from the BREQ measure and the modified 12-item PASSES. Correlations among the factors were also free parameters in the model.

The model exhibited adequate goodness-of-fit statistics ($\chi^2 = 510.619$, df $= 340$, $p < .01$; CFI $= .942$; NNFI $= .935$; SRMR $= .064$; RMSEA $= .049$; 90% CI LB $= .040$; 90% CI UB $= .057$) and the factor loadings were satisfactory for all factors. Descriptive statistics, factor correlations, and composite reliability statistics are provided in Table 2. Importantly, correlations

Table 1
Standardized factor loadings and standard errors from the confirmatory factor analysis of the perceived autonomy support scale in exercise settings in Study 1

Item	Factor loading	SE
1. I feel that PE teacher provides me with choices, options, and opportunities about whether to do active sports and/or vigorous exercise in my free time	.677	.066
2. I think that my PE teacher understands why I choose to do active sports and/or vigorous exercise in my free time	.701	.086
3. My PE teacher displays confidence in my ability to do active sports and/or vigorous exercise in my free time	.703	.094
4. My PE teacher encourages me to do active sports and/or vigorous exercise in my free time	.702	.086
5. My PE teacher listens to me about my active sports and/or vigorous exercise in my free time	.720	.089
6. My PE teacher provides me with positive feedback when I do active sports and/or vigorous exercise in my free time	.793	.094
7. I am able to talk to my PE teacher about the active sports and/or vigorous exercise I do in my free time	.665	.081
8. My PE teacher makes sure I understand why I need to do active sports and/or vigorous exercise in my free time	.678	.089
9. My PE teacher answers my questions about doing active sports and/or vigorous exercise in my free time	.715	.084
10. My PE teacher cares about the active sports and/or vigorous exercise I do in my free time	.787	.089
11. I feel I am able to share my experiences of active sports and/or vigorous exercise with my PE teacher	.637	.079
12. I trust my PE teacher's advice about the active sports and/or vigorous exercise I do in my free time	.671	.098

between the regulation style factors and the perceived autonomy support factor were significantly different from unity as the upper bound of the 95% confidence intervals about the correlations did not include the value of 1.00, supporting the hypothesis of discriminant validity (Bagozzi & Yi, 1994). In addition, perceived autonomy support was significantly and positively correlated to intrinsic and identified regulation and not related to introjected and external regulation supporting the hypothesis of convergent validity of the perceived autonomy support factor with autonomous forms of regulation. This finding is in keeping with theory as perceptions of autonomy support are consistent with autonomous motivational styles. Interestingly, correlations among the items from the BREQ adhered to the simplexlike pattern noted in previous studies (Mullan et al., 1997; Ryan & Connell, 1989). Finally, composite reliability estimates were also satisfactory for all the latent factors.

Conclusion

Results from Study 1 indicate that a 12-item perceived autonomy support scale for exercise settings (PASSES) adequately fit data from the initial pool of perceived autonomy support items derived from previous measures and exhibited satisfactory composite reliability. In addition, the PASSES exhibited satisfactory discriminant validity with the motivational styles from the PLOC

Table 2
Descriptive statistics, composite reliability estimates, and factor correlations among the perceived autonomy support scale in exercise settings and behavioural regulation in exercise questionnaire latent factors in Study 1

Factor		M	SD	ρ_c	1	2	3	4
1.	Perceived autonomy support	4.531	1.034	.922	–			
2.	BREQ–external regulation	2.560	1.373	.823	−.027	–		
3.	BREQ–introjected regulation	3.567	1.362	.767	−.014	.884[**]	–	
4.	BREQ–identified regulation	4.611	1.454	.821	.335[**]	.238[**]	.367[**]	
5.	BREQ–intrinsic regulation	4.820	1.513	.886	.296[**]	−.017	.031	–

Note: BREQ, behavioural regulation in exercise questionnaire; ρ_c, composite reliability coefficient.
[**]$p < .01$.

continuum. Furthermore, correlations between perceived autonomy support and the motivational styles exhibited a predictable pattern, with perceived autonomy support correlating positively and significantly with autonomous forms of motivation, which is in accordance with self-determination theory. This preliminary evidence supports the validity and reliability of the perceived autonomy support construct with PE teachers as the salient source. Study 2 aimed to extend this analysis by examining the validity and reliability of the PASSES from other salient sources for young people in the exercise settings and across different cultures.

Study 2

Method

Participants

Participants were recruited from co-educational high schools in Great Britain, Estonia, and Hungary. British participants ($N = 210$; M age $= 13.19$, SD $= 1.12$; Boys $n = 93$; M age $= 13.28$, SD $= 1.03$; Girls, $n = 116$, M age $= 13.10$, SD $= 1.18$) were recruited from two government-run high schools in the South East of England. School statistics indicated that the school pupils were of white European ethnicity and eligibility statistics for free school meals indicated that the socio-economic distribution of the schools was similar to the average for British schools. Data from the Estonian sample ($N = 268$; M age $= 15.04$, SD $= 0.91$; Boys $n = 117$; M age $= 15.04$, SD $= 0.96$; Girls, $n = 151$, M age $= 15.05$, SD $= .87$) were collected in three government-run high schools. Details on the socio-economic status of the participants were given by the school 'director'. The school draws its students from an area characterized as 'middle-class' and the director judged the school population to match the distribution of socio-economic status levels among town-dwelling school children in Estonia. The majority of the pupils were Estonian nationals, although a substantial minority were children of Estonian-born Russian immigrants that spoke fluent Estonian as required by the school. The Hungarian sample ($N = 235$; M age $= 14.02$, SD $= 14.02$; Boys $n = 114$; M age $= 13.89$, SD $= 0.92$; Girls, $n = 121$, M age $= 14.13$, SD $= 1.05$) was recruited from three government-run secondary schools. Details on ethnicity were not available, but the local government register indicated that the catchment areas from which the school pupils

were drawn were of a lower socio-economic status. As in Study 1, consent from school principals and parents for school pupils to participate in the study was obtained prior to data collection.

Measure

We developed language-specific versions of the 12-item PASSES developed in Study 1. In addition, we also reworded the items so that they made reference to two other important sources of autonomy support: parents and peers. This was to evaluate whether the scale was sufficiently flexible to be used to measure perceptions of autonomy support for a range of salient sources for young people in physical activity settings. Standardized back-translation techniques (Brislin, 1986) were used to develop Estonian and Hungarian language versions of the PASSES for each source. Responses to items were made using the same 7-point Likert-type response scales used in Study 1 with the *strongly disagree* (1) and *strongly agree* (7) endpoints.

Design and procedure

As in Study 1, participants were told that they were participating in a survey on young people and were instructed to complete the PASSES under quiet classroom conditions. They were told that their responses would remain anonymous and the data would be used for research purposes only. They were informed that they had the right to withdraw at any time.

Data analysis

Data were analysed using single- and multi-sample CFAs using the EQS computer program (Bentler, 2004). As before, the robust maximum likelihood method was used for all analyses (Satorra & Bentler, 1988) and the goodness-of-fit of the proposed models was evaluated using multiple goodness-of-fit criteria (Hu & Bentler, 1999). In addition, the solution estimates including factor loadings, largest standardized residuals, and composite reliability estimates (ρ_c) were examined to further evaluate the integrity of the models.

Results

Single-sample analyses

We aimed to test whether the factor structure of the 12-item PASSES developed in the previous sample was replicable within each national sample. We also aimed to test whether the PASSES was appropriate to evaluate perceived autonomy support from three salient sources in exercise settings for young people: PE teachers, parents, and peers. CFAs were therefore estimated for each source with the 12-items set to load on a single perceived autonomy support factor and a single loading arbitrarily set to unity to define the factor scale. This was done for each sample such that three CFAs were estimated for each sample, one analysis per source. Goodness-of-fit statistics are given in Table 3. In all cases, the model satisfied cutoff criteria for goodness-of-fit, supporting the replicability of the model in each sample and supporting the factor structure of the PASSES for the other sources of autonomy support. We also examined the solution estimates for each model for all samples. Factor loadings for the CFA models are provided in Table 4. The loadings were all large and significant and exceeded the required minimum (Ford et al., 1986). In addition, examination of the standardized residuals indicated very few misspecifications in the models and none exceeding ± 2.00.

Table 3
Goodness-of-fit statistics for single-sample confirmatory factor analyses of the perceived autonomy support scale for exercise settings in Study 2

Model	SB-χ^{2a}	df	CFI	NNFI	SRMR	RMSEA	90% CI for RMSEA	
							LB	UB
British								
12-item modified PASSES model (PE teacher)	120.266[**]	54	.953	.942	.050	.077	.058	.095
12-item modified PASSES model (Peer)	111.686[**]	54	.949	.938	.052	.071	.052	.090
12-item modified PASSES model (Parent)	90.806[**]	54	.975	.970	.038	.057	.036	.077
Congeneric model	2111.342[**]	594	.653	.632	.160	.111	.105	.115
Discriminant validity model	823.182[**]	591	.947	.943	.053	.043	.036	.050
Estonian								
12-item modified PASSES model (PE teacher)	93.251[**]	54	.967	.960	.043	.052	.034	.069
12-item modified PASSES model (Peer)	90.836[**]	54	.969	.962	.043	.051	.032	.068
12-item modified PASSES model (Parent)	64.042[**]	54	.992	.990	.030	.026	.001	.049
Congeneric model	1977.668[**]	594	.676	.657	.127	.093	.089	.098
Discriminant validity model	787.382[**]	591	.954	.951	.050	.035	.028	.042
Hungarian								
12-item modified PASSES model (PE teacher)	98.592[**]	54	.965	.958	.045	.059	.040	.077
12-item modified PASSES model (Peer)	104.521[**]	54	.948	.936	.051	.063	.045	.081
12-item modified PASSES model (Parent)	89.888[**]	54	.961	.952	.056	.053	.033	.072
Congeneric model	2156.999[**]	594	.557	.530	.144	.106	.101	.111
Discriminant validity model	814.951[**]	591	.936	.932	.056	.040	.033	.047

Note: df, model degrees of freedom; CFI, Robust comparative fit index; NNFI, robust non-normed fit index; SRMR, standardized root-mean squared residuals; RMSEA, robust root-mean square error of approximation; 90% CI, 90% confidence interval; UB, upper bound of confidence interval; LB, lower bound for confidence interval.
[**]$p < .01$.
[a]Sattora-Bentler scaled Chi-Square.

We also wanted to demonstrate the discriminant validity of the perceived autonomy support factors from different sources within the PASSES. We therefore estimated congeneric and discriminant validity models in each sample. The congeneric model included all items from the PASSES for each source of perceived autonomy support and hypothesized that these all loaded on the same factor and did not differentiate between the sources. This model therefore did not assume discriminant validity. The fit of this model was compared with a discriminant validity

Table 4
Standardized factor loadings from the confirmatory factor analyses of the perceived autonomy support scale in exercise settings in Study 2

Item	British			Estonian			Hungarian		
	PE teacher	Peer	Parent	PE teacher	Peer	Parent	PE teacher	Peer	Parent
1	.695	.628	.734	.636	.650	.756	.722	.592	.639
2	.731	.730	.806	.787	.644	.739	.801	.561	.681
3	.761	.788	.858	.634	.713	.765	.796	.645	.730
4	.721	.686	.768	.697	.729	.746	.624	.648	.698
5	.710	.797	.856	.655	.648	.785	.626	.660	.748
6	.762	.754	.833	.779	.754	.749	.702	.723	.732
7	.715	.751	.774	.658	.755	.781	.692	.718	.702
8	.703	.789	.808	.673	.619	.794	.693	.655	.680
9	.745	.693	.774	.690	.633	.640	.769	.586	.642
10	.743	.752	.791	.797	.685	.756	.725	.505	.620
11	.674	.730	.818	.538	.688	.699	.513	.746	.661
12	.679	.808	.801	.558	.571	.651	.574	.626	.655

model in which items from each source of perceived autonomy from the PASSES were set to load on their respective factors representing the PE teacher, parent, and peer sources. According to Mulaik and Millsap (2000), discriminant validity is supported if the goodness-of-fit of the discriminant validity model is superior to the congeneric model. Ideally, the goodness-of-fit statistics for the congeneric model would fall short of acceptable limits. In addition, discriminant validity is further supported if the correlations among the factors representing the perceived autonomy support factors were significantly different from unity (Bagozzi & Yi, 1994).

Goodness-of-fit statistics for the congeneric and discriminant validity models in each sample are provided in Table 3. In every case, the fit of the congeneric models was inferior to that of the discriminant validity model and the goodness-of-fit statistics were acceptable for the discriminant validity models but not the congeneric models. Correlations among the three factors representing perceived autonomy support from the different sources are given in Table 5. The correlations were all significant, but were significantly different from unity in each case, supporting their discriminant validity. Interestingly, perceived autonomy support from parents and peers were more strongly related compared to their associations with PE teachers. These data provide evidence to support the discriminant validity of the measures of perceived autonomy support from the different sources in each sample. Finally, descriptive statistics and composite reliability coefficients for the latent factors within each sample are given in Table 5. The perceived autonomy support factors for each source exhibited excellent reliability in all samples.

Multi-sample analysis

Multi-sample CFAs were estimated to evaluate the equivalence of the factor structure of the PASSES across the three cultural samples. These analyses were conducted separately for the PASSES data from each source of autonomy support. The invariance routine suggested by Byrne, Shavelson, and Muthén (1989) as adopted. An initial baseline model was estimated in which the

Table 5
Descriptive statistics and intercorrelations among the perceived autonomy support scale for exercise settings constructs in Study 2

Factor	M	SD	ρ_c	1	2	3
1. PAS-PE teacher						
British	4.281	1.057	.928	–		
Estonian	4.180	1.109	.910			
Hungarian	3.997	1.212	.917			
2. PAS-Peers						
British	4.322	1.173	.937	.346[**]		
Estonian	4.712	1.089	.909	.357[**]	–	
Hungarian	4.233	1.305	.893	.290[**]		
3. PAS-Parents						
British	4.550	1.219	.956	.231[**]	.738[**]	
Estonian	4.968	1.134	.935	.374[**]	.783[**]	
Hungarian	4.599	1.298	.846	.234[**]	.705[**]	–

Note: ρ_c, composite reliability coefficient.
[**]$p < .01$.

hypothesized model was specified for each sample in a single analysis to evaluate whether the unitary factor was feasible. Thereafter, two nested models were estimated. The first constrained the factor loadings to be invariant across the sample. As one item was arbitrarily fixed to unity to define the scale of the latent factor as is customary in CFA models, the analysis was repeated using an alternative item fixed to unity in order to test the invariance of all the factor loadings. The second model included constraints that fixed the factor variances and error variances to be equivalent across the samples.

A robust maximum likelihood method was used and goodness-of-fit of the data with the baseline and constrained models was evaluated using the multiple criteria and cutoff values as before. Byrne et al. advocate the use of the likelihood ratio test (change in the goodness-of-fit χ^2) to establish whether there were significant changes in the model fit relative to baseline as a result of the introduction of constraint parameters. However, recent research has suggested that the use of such a sensitive test of invariance in multi-sample CFA models may result in the rejection of acceptable models (Cheung & Rensfold, 2002). Researchers have therefore advocated the use the incremental fit indices to evaluate changes in model fit due to the introduction of constraint parameters. Cheung and Rensfold (2002) suggest that a difference of −.01 or less in the GFI and NNFI when comparing multi-sample analyses is indicative of variations that are largely unsubstantial, an approach that has been reported elsewhere (e.g., Hagger, Biddle, & Wang, 2005).

Results of the multi-sample CFAs for each source of perceived autonomy support were shown in Table 6. For each source, the baseline model fit the data well. Constraining the factor loadings to be equivalent resulted in virtually no change in the model fit in any case, supporting the invariance of the factor loadings across samples. This is considered the minimum acceptable criterion to be satisfied for multi-sample invariance to be confirmed (Byrne et al., 1989).

Table 6

Goodness-of-fit statistics for multi-sample confirmatory factor analysis models for the perceived autonomy support scale for exercise settings in Study 2

Model	SB-χ^{2a}	df	CFI	NNFI	SRMR	RMSEA	90% CI for RMSEA	
							LB	UB
Physical education teachers								
Baseline	313.256**	162	.957	.948	.046	.063	.052	.073
FL invariant	357.361**	184	.951	.947	.068	.063	.053	.073
FL, FV/EV invariant	486.011**	210	.928	.924	.107	.075	.066	.083
Peers								
Baseline	309.986**	162	.955	.945	.049	.062	.051	.072
FL invariant	347.477**	184	.951	.947	.065	.061	.051	.072
FL, FV/EV invariant	653.779**	210	.870	.877	.122	.094	.086	.102
Parents								
Baseline	267.571**	162	.972	.966	.043	.052	.041	.063
FL invariant	295.210**	184	.971	.969	.054	.051	.039	.061
FL, FV/EV invariant	566.488**	210	.911	.906	.106	.085	.076	.093

Note: df, model degrees of freedom; CFI, robust comparative fit index; NNFI, robust non-normed fit index; SRMR, standardized root-mean squared residuals; 90% CI, 90% confidence interval; RMSEA, robust root-mean square error of approximation; UB, upper bound of confidence interval; LB, lower bound for confidence interval; FL, factor loadings; FV, factor variances; EV, error variances.
** $p < .01$.
[a]Sattora–Bentler scaled Chi-square.

Subsequent nested models that tested the invariance of the factor and error variances to be equivalent resulted in a substantial drop in the incremental fit indexes in all cases. Therefore the hypothesis that factor variances and error variances were invariant had to be rejected.

Structured latent means analysis

The PASSES data sets from the three national samples were also subjected to an examination of the equivalence of the item mean values (intercepts) and structured latent means in perceived autonomy support for each source.[3] Model comparisons in the latent means analysis were

---

[3]The latent means analysis involved estimating the hypothesized model in the samples using multi-sample CFA and constraining the intercept (means) of the observed items on the latent factors and the latent means of the SPA factor to be equivalent. The models constraining the mean values to be equal were compared with a baseline model that estimated the means but did not contain invariance constraints on the means. As is convention in latent means models, parameters found to be invariant in the multi-sample analyses were retained in this analysis. In this case, only the factor loadings were constrained to be invariant. Making comparisons in the means of the latent perceived autonomy support factor across samples required the mean value for the perceived autonomy support factor in one reference sample to be fixed at unity. This permitted the testing of mean differences in perceived autonomy support between the reference sample and the other samples, but meant that the mean of the perceived autonomy support factor in the reference sample could not be constrained (because it was a fixed parameter) and that the full compliment of mean comparisons

evaluated using two absolute fit indexes based on the goodness-of-fit χ^2 value, Akaike's information criterion (AIC) and the expected cross-validation index (ECVI), and a fit index based on non-centrality, the RMSEA. Lower values for these indexes indicate better fit relative to other models. The incremental fit indexes based on model residuals were not used as these include comparisons with a 'null model' which in latent means analyses are difficult to interpret when making comparisons. LM tests were used to identify which of the constrained parameters would contribute to significantly improve model goodness-of-fit if they were included as a free parameter in the model.

The CFA models constraining the item intercepts exhibited acceptable fit with the data for the parents and peer sources but not for the PE teacher analysis. Furthermore, model fit according to the AIC and ECVI decreased with the inclusion of invariant latent means in the models for all three sources. Of utmost interest is the result of the LM-tests which flagged which of the latent means that were not invariant across the samples. There were no significant differences in the latent mean scores for perceived autonomy support from PE teachers across the national groups. However, the latent means for the perceived autonomy support factor from parents in the British ($z = -4.085$, $p < .01$) and Hungarian ($z = -4.739$, $p < .01$) samples were significantly lower compared to the mean level for the Estonian participants. Similarly, the latent mean scores for perceived autonomy support factor from peers were significantly lower for the British ($z = -3.820$, $p < .01$) and Hungarian ($z = -3.172$, $p < .01$) samples than the mean scores in the Estonian sample. There were no significant differences between British and Hungarian samples for the mean levels of perceived autonomy support from parents and peers (Table 7).

Conclusion

The results of Study 2 broaden and deepen the initial validation of the PASSES in Study 1 by replicating the proposed model in three different national samples and for three different sources of autonomy support. As expected, the 12-item PASSES was replicated in three samples with different cultural orientations, a nation with a predominantly individualist background (Great Britain) and two cultures with a predominately collectivist orientation (Estonia and Hungary). This provided some support for the universality of the perceived autonomy support construct, and supports the general premise from self-determination theory that these constructs are universal (Deci & Ryan, 2000). In addition, the structure of the PASSES was replicated for three different sources of autonomy support: PE teachers, peers, and parents. These sources have been viewed as the important significant others that are likely to influence young peoples' exercise behaviour (e.g., Hagger, Chatzisarantis et al., 2005) and therefore valid measures for each source are important if researchers are to tap the entire compliment of autonomy supportive influences in exercise settings. Finally, the present findings also found that perceived autonomy support tended to be rated higher by British participants, an individualist culture, compared to the ratings of those from a collectivist culture (Estonia and Hungary), a fact that has been supported by cross-cultural research on intrinsic motivation (Chirkov & Ryan, 2001).

(*footnote continued*)
among the samples could not be made. As a consequence, the analysis was repeated with the latent mean score of another sample acting as the reference in order for the full set of mean comparisons to be made.

Table 7
Goodness-of-fit statistics for multi-sample latent mean analysis models for the modified perceived autonomy support scale for exercise settings in Study 2

Model	SB-χ^{2a}	df	AIC	ECVI	RMSEA	90% CI for RMSEA	
						LB	UB
PE teachers							
Baseline	349.048[**]	181	92.780	1.001	.062	.052	.071
Item intercepts invariant	914.937[**]	206	607.447	1.869	.081	.071	.090
Factor means invariant[b]	912.143[**]	207	608.740	1.868	.080	.080	.089
Peers							
Baseline	342.646[**]	182	133.697	.992	.060	.050	.070
Item intercepts invariant	468.438[**]	206	217.607	1.240	.066	.056	.075
Factor means invariant[b]	454.911[**]	207	204.162	1.224	.065	.055	.075
Parents							
Baseline	269.377[**]	181	64.783	.889	.044	.032	.055
Item intercepts invariant	331.101[**]	206	74.579	1.047	.050	.038	.060
Factor means invariant[b]	342.445[**]	207	90.379	1.065	.050	.038	.060

Note: df, model degrees of freedom; AIC, Akaike's information criterion; ECVI, expected cross-validation index; RMSEA, root-mean square error of approximation; 90% CI, 90% confidence interval; UB, Upper bound of confidence interval; LB, lower bound for confidence interval.
[**] $p < .01$.
[a]Sattora–Bentler scaled Chi-square.

Discussion

The present investigation aimed to develop a valid PASSES for young people using a rigorous, hypothesis-testing, a priori approach. It also sought to replicate the model in independent samples from different European cultures and examine the invariance of the factor structure and mean levels of the latent perceived autonomy support variables across the cultural groups. The first study produced a 12-item unidimensional model of perceived autonomy support from PE teachers that exhibited good fit with a sample of young people and exhibit a logical pattern of correlations and discriminant validity with sources of regulation from the PLOC. The second study replicated the proposed model in three independent samples from Great Britain, Estonia, and Hungary and also produced well-fitting models with items from the PASSES modified to include two additional sources of autonomy support: parents and peers. These models also exhibited structural invariance across the three cultural samples. Testing the invariance of the latent means revealed that Estonian participants reported the highest levels of perceived autonomy support from the parent and peer sources relative to British and Hungarian participants, who exhibit no differences. There were no cross-cultural differences in the means for the perceived autonomy support from PE teachers.

The main goal of the present research was achieved. It appears that the PASSES is a valid instrument to measure autonomy support from a range of salient sources with good internal consistency and exhibits very little variation in structure across cultures. In addition, it appears to be relatively flexible in that it can be used to tap perceived autonomy support from a number of

different sources salient to young people in exercise settings. Importantly, the scale was developed from first principles and was sourced from a cross-section of different perceived autonomy support scales identified in an exhaustive literature search. Furthermore, it accommodates many of the accepted characteristics of autonomy supportive behaviour identified in the self-determination theory literature including listening, providing choice, providing informational feedback, offering encouragement and hints, being responsive to questions, and acknowledgement of understanding or empathy (Reeve, 2002; Reeve et al., 1999; Reeve & Jang, 2006). The PASSES therefore has strong credentials to support its use in exercise settings and from a number of salient sources of autonomy support.

A number of important and interesting findings arise from the evaluation of this instrument. In Study 1, the pattern of relationships among regulation styles from the PLOC and the perceived autonomy support measure were consistent with the predictions of self-determination theory. As expected, perceived autonomy support correlated most strongly with intrinsic motivation and with identified regulation, the most autonomous form of extrinsic motivation. However, correlations with the less autonomous forms of extrinsic motivation were non-significant. We expected this to be the case. Individuals who perceive their PE teachers not to be autonomy supportive are less likely to be intrinsically motivated, but low perceived autonomy support does not lead inevitably to less-autonomous forms of motivation. Future studies may seek to examine whether perceived controlling behaviours exhibited by significant others (see Reeve & Jang, 2006) are associated with the opposite direction of effects with the PLOC regulation styles. Finally, it is interesting to note that the regulation styles from the PLOC exhibited the expected simplexlike pattern of intercorrelations, which consistent with previous findings (Mullan et al., 1997; Ryan & Connell, 1989).

Perceived autonomy support from parent and peer sources tended to be more strongly correlated than either of these sources with perceived autonomy support from teachers, a finding that was consistent in all samples. Possible reasons for this may be the context in which the support is provided, the degree of importance that young people attach to a particular source, and the typical exposure that young people have to each source. Turning first to context, parents and peers influence often occurs outside of school and therefore may encourage activity in similar contexts while PE teachers' influence is largely confined to school contexts. Furthermore, young people are more likely to attach high value to parents' and, particularly, peers' beliefs when it comes to pastime choices, while less value may be attached to the PE teacher because the relationship is likely to be more distant. Related to this, young people clearly have less exposure to instruction and feedback from their PE teachers compared with their parents and peers which may affect the value attached to the support given. Together these factors may explain why there is more consistency in the relations between perceived autonomy support from parents and peers relative to relations between autonomy support from these sources and that from PE teachers.

In Study 2, there was a great deal of consistency in the average ratings of the perceived autonomy support, particularly when PE teachers were the source. There were, however, significant differences in perceived autonomy support when the source was parents and peers. Levels were significantly higher in the Estonian sample for the parent and peer sources compared to the British and Hungarian children, although there were no differences across the British and Hungarian samples. Previous research suggests that perceived autonomy support from teachers and parents tend to be lower in collectivist cultures (Chirkov & Ryan, 2001). This trend does not

appear to be reflected in the current analyses. Estonians, who reported the highest levels of perceived autonomy support for the parent and peer sources, are generally considered more collectivist in cultural orientation relative to British people who tend to have a more individualist orientation (Hofstede, 1983). Furthermore, the Hungarian culture is also considered collectivist in nature although their levels of autonomy support were equivalent to those from the British participants.

Possible reasons for this may be the changing nature of the profile of cultural orientations in Eastern European nations, particularly among young people. Research has suggested that while these societies tend to be regarded as endorsing predominantly collectivist cultural norms (Oishi, Diener, Lucas, & Suh, 1999), socio-political changes and modernization in these nations such as the introduction of a free market economy may alter the balance between individualist and cultural values (Allik & Realo, 2004). For example, recent research has suggested that people in Estonia tend to self-stereotype themselves as individualist even though the academic community tends to compartmentalize Estonia as a collectivist culture (Realo, 2003). Younger populations in Eastern Europe may therefore have a more differentiated view of their self in terms of cultural values, endorsing both individualist and collectivist values. As a consequence, young people from these nations may exhibit less variation across cultures in psychological constructs than expected.

Limitations and avenues for future research

The present study presents the PASSES as a valid measure of perceived autonomy support in with good internal consistency, discriminant and convergent validity with measures of regulation styles from self-determination theory, and structural validity across cultures. A strength of the present study is that it adopted a rigorous, hypothesis-testing approach with the proposed unidimensional model of perceived autonomy support presented a priori and tested in a number of independent samples. This suggests that the present instrument is appropriate to measure perceived autonomy support in exercise settings with young people. In addition, the instrument has demonstrated considerable flexibility when it referred to other sources of autonomy support relevant to young people in exercise settings.

However, while the present analysis supports its for a number of sources and across cultures, researchers are encouraged to provide validity statistics for the PASSES if it is modified for sources of autonomy support that fall outside those tested in the present study or if it is used for an age or demographic group that deviates from the young people tested here. This would ensure that the measure is appropriate for that sample and would provide additional data to further support the validity of this instrument. Future research would aim to determine whether the PASSES is appropriate for older age groups. In addition, future research might also seek to evaluate changes in the average ratings of the different sources of perceived autonomy support in young people as a function of age to test whether this construct varies according to the changing importance of peer groups and other authoritative figures during adolescence. Researchers may also seek to adopt the PASSES as a measure in longitudinal models examining the effects of autonomy support on forms of motivation and behaviour in exercise settings. It would also be important to contrast the present measure of perceived autonomy support for exercise settings with a valid and reliable measure of perceived controlling interpersonal style in similar settings. This would provide insight into the concurrent validity of perceived autonomy support and also

engender studies that examine the entire complement of interpersonal styles on motivation and behaviour in exercise contexts. It might also be interesting to evaluate the relationships between perceived autonomy support among adolescents in a PE contexts and the level of actual autonomy supportive behaviours displayed by the adolescents' PE teachers. This would not only provide further evidence for the concurrent validity of the PASSES, but would also indicate the degree to which perceptions align with actual behaviours.[4] Finally, the present instrument may also serve as a basis for the development of valid and reliable instruments to measure perceived autonomy support in other contexts such as educational and workplace settings.

Acknowledgements

References

Allik, J., & Realo, A. (2004). Individualism–collectivism and social capital. *Journal of Cross-Cultural Psychology*, *35*, 29–49.

Baard, P. P., Deci, E. L., & Ryan, R. M. (2004). Intrinsic need satisfaction: A motivational basis of performance and well-being in two work settings. *Journal of Applied Social Psychology*, *34*, 2045–2068.

Bagozzi, R. P., & Yi, Y. (1994). Advanced topics in structural equation models. In R. P. Bagozzi (Ed.), *Advanced methods for marketing research* (pp. 1–51). Oxford: Blackwell.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238–246.

Bentler, P. M. (2004). EQS structural equations modeling software (Version 6.1) [Computer software]. Encino, CA: Multivariate Software.

Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science Education*, *84*, 740–756.

Bollen, K. A., & Long, J. S. (1993). *Testing structural equation models*. Newbury Park, CA: Sage.

Brislin, R. W. (1986). The wording and translation of research instruments. In W. J. Lonner, & J. W. Berry (Eds.), *Field methods in educational research* (pp. 137–164). Newbury Park, CA: Sage.

Byrne, B. M., Shavelson, R. J., & Muthén, B. (1989). Testing for the equivalence of factor covariance and means structures: The issue of partial measurement invariance. *Psychological Bulletin*, *105*, 456–466.

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

Cheung, G. W., & Rensfold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, *9*, 233–255.

Chirkov, V. I., & Ryan, R. M. (2001). Parent and teacher autonomy support in Russian and US adolescents: Common effects on well-being and academic motivation. *Journal of Cross-Cultural Psychology*, *32*, 618–635.

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

Deci, E. L., & Ryan, R. M. (2000). The "What" and "Why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*, 227–268.

---

[4]We are grateful to two anonymous reviewers for making this suggestion for future research.

Deci, E. L., Ryan, R. M., & Williams, G. C. (1996). Need satisfaction and the self-regulation of learning. *Learning and Individual Differences*, *8*, 165–183.

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation in education: The self-determination perspective. *Educational Psychologist*, *26*, 325–346.

Ford, J., MacCallum, R., & Tait, M. (1986). The application of factor analysis in psychology: A critical review and analysis. *Personnel Psychology*, *39*, 291–314.

Gagné, M. (2003). The role of autonomy support and autonomy orientation in prosocial behavior engagement. *Motivation and Emotion*, *27*, 199–223.

Gagné, M., Ryan, R. M., & Bargmann, K. (2003). Autonomy support and need satisfaction in the motivation and well-being of gymnasts. *Journal of Applied Sport Psychology*, *15*, 372–390.

Hagger, M. S., Biddle, S. J. H., & Wang, C. K. J. (2005). Physical self-perceptions in adolescence: Generalizability of a multidimensional, hierarchical model across gender and grade. *Educational and Psychological Measurement*, *65*, 297–322.

Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. *Journal of Educational Psychology*, *97*, 376–390.

Hagger, M. S., Chatzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: A trans-contextual model. *Journal of Educational Psychology*, *95*, 784–795.

Hofstede, G. (1983). Dimensions of national cultures in fifty countries and three regions. In J. B. Deregowski, S. Dziuraciec, & R. C. Annis (Eds.), *Explications in cross-cultural psychology* (pp. 335–355). Lisse, Holland: Swets & Zeitlinger.

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

Hu, L.-T., & Bentler, P. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling, Concepts issues and applications* (pp. 76–99). London: Sage.

Jöreskog, K. G. (1993). Testing structural equation models. In K. A. Bollen, & J. S. Long (Eds.), *Testing structural equation models* (pp. 294–316). Newbury Park, CA: Sage.

Kasser, V., & Ryan, R. M. (1999). The relation of psychological needs for autonomy and relatedness to vitality, well-being, and mortality in a nursing home. *Journal of Applied Social Psychology*, *29*, 935–954.

Koka, A., & Hein, V. (2003). Perceptions of teacher's feedback and learning environment as components of motivation in physical education. *Psychology of Sport and Exercise*, *4*, 333–346.

Mageau, G. A., & Vallerand, R. J. (2003). The coach-athlete relationship: A motivational model. *Journal of Sport Sciences*, *21*, 883–904.

Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin*, *103*, 391–410.

Motl, R. W., & DiStefano, C. (2002). Longitudinal invariance of self-esteem and method effects associated with negatively worded items. *Structural Equation Modeling*, *9*, 562–578.

Mulaik, S. A., & Millsap, R. E. (2000). Doing the four-step right. *Structural Equation Modeling*, *7*, 36–73.

Mullan, E., Markland, D., & Ingledew, D. K. (1997). A graded conceptualisation of self-determination in the regulation of exercise behaviour: Development of a measure using confirmatory factor analysis. *Personality and Individual Differences*, *23*, 745–752.

Oishi, S., Diener, E. F., Lucas, R. E., & Suh, E. M. (1999). Cross-cultural variations in predictors of life satisfaction: Prespectives from needs and values. *Personality and Social Psychology Bulletin*, *25*, 980–990.

Oyserman, D., Coon, H. M., & Kemmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin*, *128*, 3–72.

Pelletier, L. G., Fortier, M. S., Vallerand, R. J., & Briere, N. M. (2001). Associations among perceived autonomy support, forms of self-regulation, and persistence: A prospective study. *Motivation and Emotion*, *25*, 279–306.

Pelletier, L. G., & Vallerand, R. J. (1996). Supervisors' beliefs and subordinates' intrinsic motivation: A behavioral confirmation analysis. *Journal of Personality and Social Psychology*, *71*, 331–340.

Realo, A. (2003). Comparison of public and academic discourses: Estonian individualism and collectivism revisited. *Culture and Psychology*, *9*, 47–77.

Reeve, J. (2002). Self-determination theory applied to educational settings. In E. L. Deci, & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 183–203). Rochester, NY: University of Rochester Press.

Reeve, J., Bolt, E., & Cai, Y. (1999). Autonomy-supportive teachers: How they teach and motivate students. *Journal of Educational Psychology*, *91*, 537–548.

Reeve, J., & Jang, H. (2006). What teachers say and do to support students' autonomy during a learning activity. *Journal of Educational Psychology*, *98*, 209–218.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, *57*, 749–761.

Ryan, R. M., Frederick, C. M., Lepes, D., Rubio, N., & Sheldon, K. M. (1997). Intrinsic motivation and exercise adherence. *International Journal of Sports Psychology*, *28*, 335–354.

Sarrazin, P., Vallerand, R. J., Guillet, E., Pelletier, L. G., & Cury, F. (2002). Motivation and dropout in female handballers: A 21-month prospective study. *European Journal of Social Psychology*, *32*, 395–418.

Satorra, A., & Bentler, P. M. (1988). *Scaling corrections for statistics in covariance structure analysis*. Los Angeles, CA: University of California at Los Angeles, Department of Psychology.

Standage, M., Duda, J. L., & Ntoumanis, N. (2003a). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology*, *95*, 97–110.

Standage, M., Duda, J. L., & Ntoumanis, N. (2003b). Predicting motivational regulations in physical education: The interplay between dispositional goal orientations motivational, climate and perceived competence. *Journal of Sports Sciences*, *21*, 631–647.

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.

Vansteenkiste, M., Simons, J., Lens, W., & Sheldon, K. M. (2004). Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology*, *87*, 246–260.

Watkins, D., Adair, J., Akande, A., Gerong, A., McInerney, D., Sunar, D., et al. (1998). Individualism-collectivism, gender, and the self-concept: A nine culture investigation. *Psychologia*, *41*, 259–271.

Williams, G. C. (2002). Improving patients' health through supporting the autonomy of patients and providers. In R. Deci, & E. L. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 233–254). Rochester, NY: University of Rochester Press.

Williams, G. C., Cox, E. M., Kouides, R., & Deci, E. L. (1999). Presenting the facts about smoking to adolescents: The effects of an autonomy supportive style. *Archives of Pediatrics and Adolescent Medicine*, *153*, 959–964.

Williams, G. C., Freedman, Z. R., & Deci, E. L. (1998). Supporting autonomy to motivate glucose control in patients with diabetes. *Diabetes Care*, *21*, 1644–1651.

Williams, G. C., Rodin, G. C., Ryan, R. M., Grolnick, W. S., & Deci, E. L. (1998). Autonomous regulation and long-term medication adherence in adult outpatients. *Health Psychology*, *17*, 269–276.

Wilson, P. M., & Rodgers, W. M. (2004). The relationship between perceived autonomy support, exercise regulations and behavioral intentions in women. *Psychology of Sport and Exercise*, *5*, 229–242.

Wu, S. Y., Pender, N., & Noureddine, S. (2003). Gender differences in the psychosocial and cognitive correlates of physical activity among Taiwanese adolescents: A structural equation modeling approach. *International Journal of Behavioral Medicine*, *10*, 93–105.