

RELATIONSHIPS BETWEEN PERCEIVED TEACHER'S AUTONOMY SUPPORT, EFFORT AND PHYSICAL SELF-ESTEEM

Vello Hein¹ and Agnese Caune²

¹*Institute of Sport Pedagogy and Coaching Sciences, University of Tartu, Estonia*

²*Madona State Gymnasium, Latvia*

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Abstract:

Grounded in self-determination theory (SDT), this study aimed at testing the hypothesis that students' perceptions of autonomy support from physical education (PE) teachers is related via the perceived need satisfaction for autonomy with self-determined motivation, which is in turn related to effort via physical self-esteem. School students from Latvia (n=382) and Estonia (n=345), aged 14-18 years, completed measures of perceived autonomy support from PE teachers, need satisfaction for autonomy, self-determined motivation, perceived effort and physical self-esteem. These study variables were found to be invariant across samples. The results of the structural model showed that perceived autonomy support from a teacher was directly related to perceived effort of students ($\beta=0.24$, $p<.01$), need satisfaction for autonomy ($\beta=0.81$, $p<.01$) and motivation ($\beta=0.30$, $p<.01$). The effect of motivation on perceived effort was partially mediated by physical self-esteem. The results of the proposed model highlighted the role of the students' perception autonomy support from teachers on their perceived effort and physical self-esteem via need satisfaction for autonomy and motivation.

Key words: *self-determination theory, motivational sequence model, outcomes in physical education*

Introduction

The learning outcomes of physical education are most often viewed from three aspects: cognitive (e.g. concentration), affective (e.g. enjoyment, boredom) and behavioural (e.g. effort, persistence at a task) (Bailey, 2006; Ntoumanis & Standage, 2009; Ommundsen & Kvaló, 2007). Students' perceived physical self-esteem and perceived effort as the affective learning and behavioural outcomes in physical education are considered to be important factors related with leisure-time physical activity. Physical activity as one of the salient features attributed to the physically educated person is the main target of school physical education. The purpose of the current study was to examine how the students' perceived effort and physical self-esteem as learning outcomes in PE could be predicted from perceived autonomy support from teachers and motivation on the basis of self-determination theory (SDT; Deci & Ryan, 2000).

Self-determination theory is widely used for the study of human motivation and personality (Deci & Ryan, 2000). The key elements of the theory concern the degree to which individuals fulfil their basic psychological needs. The more the needs will be satisfied, the more their behaviour will be self-

determined. According to this theory, motivation and optimal psychological functioning depend on the degree to which social factors (e.g. the degree to which a teacher supports students' autonomy) satisfy psychological needs.

A plethora of studies in a physical education setting have shown that high self-determined motivation is positively, whereas the low self-determined motivation is negatively related to physical self-esteem (Martín-Albo, Núñez, Domínguez, & Tomás, 2012; Standage, Gillison, Ntoumanis, & Treasure, 2012; Standage & Gillison, 2007; Thøgersen-Ntoumani & Ntoumanis, 2006, 2007; Wilson & Rodgers, 2002). Also, predictive variables of effort have been widely investigated on the base of self-determination theory (Ntoumanis, 2001; Pelletier, et al., 1995; Reeve, Jang, Hardre, & Omura, 2002; Zhang, 2009; Wang, Koh, & Chatzisarantis, 2009). A strong relation between motivation (identified, intrinsic) and effort were followed among British schoolchildren (Ntoumanis, 2001). This statement was later confirmed by Zhang (2009) among schoolchildren from the USA. In addition, the relationship between effort and physical activity was followed. Wang et al. (2009) investigated the impact of perceived coaching behaviour on the

psychological needs and achievement goals among young athletes and found that need satisfaction for autonomy, competence and relatedness were related with effort. Furthermore, Taylor, Ntoumanis, Standage, and Spray (2010) examined whether the changes in students' psychological needs were related with changes in effort over the three-month period. The results showed that at the beginning of the study the students with higher scores on the three psychological needs reported a higher level of effort and these relationships did not change over the study period.

Vallerand (1997), based on SDT, proposed motivational sequence model. This motivational sequence model posits that motivation is influenced by a number of social factors (e.g. teacher behaviour, learning environment). The influence of these social factors on motivation is exerted via the satisfaction of the three psychological needs (for autonomy, competence and relatedness). Lastly, the motivation will lead to cognitive, affective and behavioural consequences (Social factors → Psychological Mediators → Motivation → Consequence). The motivational sequence model has been explored to explain the antecedents of self-esteem (Hein & Hagger, 2007; Martín-Albo, et al., 2012; Standage & Gillison, 2007; Quested & Duda, 2011) and perceived effort (Ntoumanis, 2001; Standage, Duda & Ntoumanis, 2006). The results of Ntoumanis (2001), using this model, showed that intrinsic motivation was a strong predictor of perceived effort as students experiencing excitement and fun in physical education are likely to exert high effort to learn a new skill. Reeve et al. (2002) reported that an autonomy-supportive behaviour together with rationale explaining the importance of a learning activity facilitates students' self-determined motivation, which in turn was associated with students' greater effort invested in learning. The motivational sequence model proposed by Standage et al. (2006) demonstrated that the perceived autonomy support from a teacher positively predicted the needs for autonomy, competence and relatedness, which in turn predicted self-determined motivation and the latter predicted teacher's ratings on students' effort and persistence. The statement that the perceived autonomy support from a teacher and intrinsic motivation are predictive for effort was also later confirmed by Gillison, Standage and Skevington (2013).

As for self-esteem, self-determination theory holds that autonomous motivation promotes an individuals' true self-esteem (Deci & Ryan, 1995). The authors have noted that self-esteem will be enhanced only when one's actions are self-determined – that is only when one acts volitionally and experiences an inner sense of efficiency during the action. In school physical education several authors have found pupils' autonomous motivation towards PE to have a positive direct effect on reported gen-

eral self-esteem (Hein & Hagger, 2007; Standage & Gillison, 2007). Also, the link between autonomous motives and physical self-esteem was found among physically active adults (Wilson & Rodgers, 2002; Martín-Albo, et al., 2012). Martín-Albo with co-workers (2012) tested several competing models to evaluate the role of intrinsic motivation and physical self-concept as the predictors of satisfaction with life. The results supported the model in which physical self-concept mediated the relationships between intrinsic motivation and satisfaction with life. Standage and Gillison (2007) tested three models of motivational sequences where, beyond the effect of perceived autonomy from teacher on motivation via psychological need satisfaction, the effect of motivation on different relationships between general self-esteem and health-related quality of life was observed. In the first model autonomous motivation predicted general self-esteem which in turn predicted health-related quality of life. In the second model health-related quality of life predicted self-esteem, whereas in the third model both variables were predicted directly by autonomous motivation, however, with mutual relationships. Therefore, based on the aforementioned models, it is viable to suppose that further exploration of the motivational sequence model also allows the explanation of how the students' perceived autonomy support from a teacher is related to physical self-esteem and effort. A number of motivational theories have indicated that individuals with more positive self-evaluations will expend more effort (Amorose, 2001). In accordance with the self-determination theory, the student who is autonomously motivated toward physical activity will be more likely to have a positive perception of his or her own physique. Consequently, this allows for speculation that those students who consider themselves as physically good are willing to put more effort into learning skills or to exert more effort during exercise. Obviously, they will also be more persistent in their efforts to overcome obstacles.

Although the indirect and direct effects of psychological need satisfaction on adaptive outcomes have been explored in different models (e.g. Cox, Smith, & Williams, 2008; Standage, Duda, & Ntoumanis, 2003; Taylor, Ntoumanis, & Standage, 2008), the role of the perceived autonomy support from a teacher in the motivational sequence model to predict physical self-esteem and effort remains to be clarified. In this study it was hypothesized that self-determined motivation in PE is related to perceived effort directly and indirectly via perceived physical self-esteem. Also, it was hypothesized that there would be a significant overall effect of the perceived autonomy support from a teacher on perceived effort through the motivational sequence model (Figure 1).

According to Deci and Ryan (1985), SDT is a universal motivational theory and the measures of

its constructs do not depend on the cultural and individual differences. However, research in exercise psychology has indicated the differences in psychological constructs like physical self-esteem in accordance with different cultural peculiarities (e.g. Marsh, Marco, & Asci, 2002; Hagger, Biddle, Chow, Stambulova, & Kavussanu, 2003).

Therefore, the aim of the study was also to test the cross-cultural generalizability of the measurement parameters and of the proposed model. Despite Latvian and Estonian nations' similarities in history and geography, their languages belong to two distinct language families. Latvian language belongs to the Indo-European language group with similar cultural ties (e.g. Lithuanian and Poland). Estonian language belongs to the Baltic-Finnic subgroup of the Finno-Ugric languages, sharing close cultural and historical ties with the Finnish language and culture. Therefore, considering such ethnic differences it would be reasonable, before constructing the structural model, to test whether the invariances of the measured variables exist across the two observed nation groups.

Methods

Participants and procedures

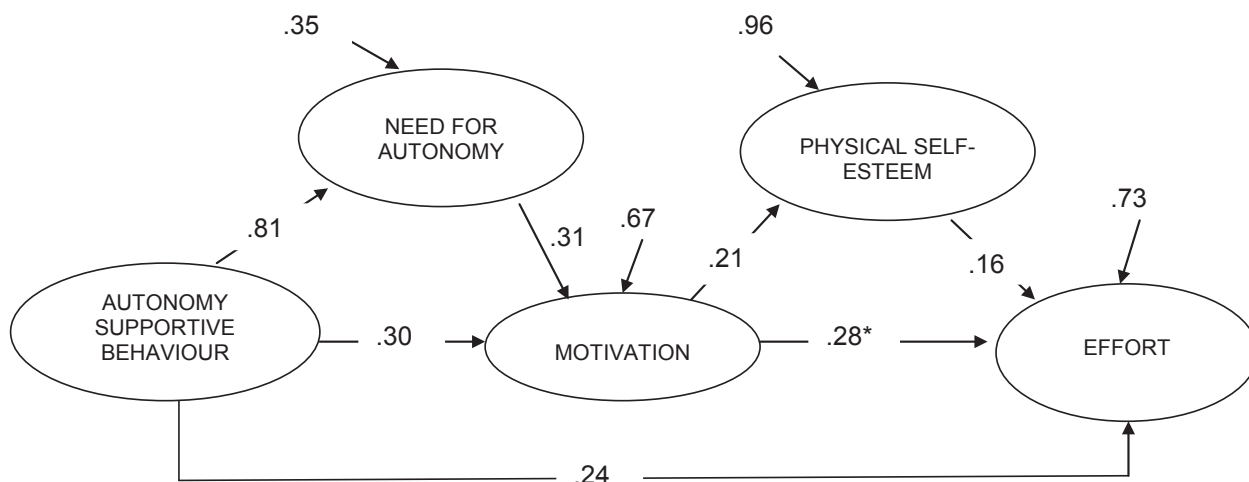
Participants (N=727) were recruited from several high schools in Latvia (boys=161, girls=221; mean age=16.53, SD=1.16) and in Estonia (127 boys and 218 girls, mean age=15.64, SD=1.24, range: 14 to 18). Convenience method was used for collecting the responses among the students from grades 8 to 12. The socio-economic status of the participants was not different between the two countries. Students took Physical Education (PE) as an obligatory course (two times a week, 45 minutes per

class). Consent for schoolpupils' participation in the study was obtained from their parents and the school principals prior to data collection. The students completed the questionnaires during PE classes and they were separated so that they could not copy the responses.

Measures

Motivation in PE. A modified version of Ryan and Connell's (1989) perceived locus of causality scale, presented by Standage, Duda and Ntoumanis (2005), was used to measure different types of motivation in PE. Example items for each type are "because PE is fun" (intrinsic motivation), "because it is important to me to do well in PE" (identified regulation), "because I would feel bad if I didn't" (introjected regulation), and "because I'll get into trouble if I don't" (external regulation). Cronbach alpha reliability coefficients for intrinsic motivation, identified regulation, introjected regulation, and external regulation subscales in this study were .89, .87, .63 and .71, respectively. These four motivational constructs were integrated into a single index of self-determined motivation by calculating the Self-Determination Index (SDI; Vallerand & Ratelle, 2002). According to Guay, Magee and Vallerand (2003), the weights were assigned to each item from the intrinsic motivation (+2), identified regulation (+1), introjected regulation (-1), and extrinsic regulation (-2) scales, and four RAI items were calculated based on the weighted composite of these scores. These items were used as indicators of a single latent Self-Determination Index (SDI) factor in subsequent analyses.

The participants' perception of the need satisfaction for autonomy in PE was measured using five



Note. MOTIVATION – self-determined motivation, NEED FOR AUTONOMY – need satisfaction for autonomy. To improve the clarity of the figure, the items were not included in the presented model. All paths are statistically significant; $p < .01$.

Figure 1. Hypothesized structural equation model of perceived autonomy supportive behaviour via self-determined motivation and physical self-esteem on effort.

items proposed by Standage et al. (2005). An example item was: "I feel certain freedom of action".

Students' perceptions regarding the importance of effort in PE was measured with four items from the effort subscale of the intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989). An example item was: "I try very hard in this PE class". The six items from the PSDQ scale (Marsh, Richards, Johnson, Roche, & Tremayne 1994) were used to measure physical self-esteem. An example item was: "I feel good about who I am and what I can do physically". The perceived autonomy support from a PE teacher was assessed by the items presented by Reeve and Halusic (2009). An example item was: "I feel that my PE teacher provides me with choices and options". All responses were made on a 7-point Likert scale except for the PSDQ, where the items were rated on a 6-point scale.

Translation procedures

Language-specific questionnaires to be used with the Estonian and Latvian samples were developed using standardized back-translation procedures by three independent bilingual translators (Brislin, 1986). The back-translation procedure was repeated iteratively until the original and back-translated English versions of the questionnaires were virtually identical.

Data analyses

The LISREL 8.8 statistical software was employed to conduct the confirmatory factor analyses (CFA) and structural equation modelling (SEM). The adequacy of the CFA models was estimated by 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). A cut-off value greater than .90 for the CFI and NNFI, and a cut-off value less than or equal to .08 for the RMSEA were considered adequate for model fit (Hu & Bentler, 1999). A sequential model testing was employed via multi-sample CFA to examine whether the measurement model displayed invariance across Latvian and Estonian samples. The invariance routine suggested by Byrne, Shavelson, and Muthen (1989) was followed in which measurement parameters are initially constrained to be equivalent across samples. The hypothesized relationships among the model constructs were tested by structural equation model using LISREL 8.8 (Figure 1). Model fit was evaluated using goodness-of-fit indexes cited previously.

Results

Preliminary analysis

Overall means, standard deviations, and correlations for the study variables are provided in Table 1. Distributional properties of the responses

to all the items were examined. A skewness value greater than one indicated that not all variables were normally distributed. Therefore, normal scores were computed for ordinal variables (Jöreskog, Sörbom, du Toit, & du Toit, 2001). A maximum likelihood method based on the asymptotic covariance matrix was used to estimate the CFA models. At first, before the SEM, the measurement model with all study variables and also the invariances of it across samples were estimated.

The CFA with all Latvian and Estonian students produced a well-fitting measurement model (Table 2, Model 1), where each factor was adequately explained by the set of indicator items. A multi-sample measurement model was conducted to explore the degree to which the model was equivalent for Latvian and Estonian samples. An initial baseline model was established (Table 2, Model 2A), and then three increasingly constrained models, according to the invariance routine suggested by Byrne et al. (1989) were used to examine the equality of factor loadings (Table 2, Model B), factor covariances (Table 2, Model 2C) and factor variances (Table 2, Model D) across the samples. Invariance of factor loadings is considered the minimum acceptable criterion for measurement invariance (Byrne, et al., 1989). While the chi-square differences per one degree of freedom (1 df) between Model A and Models B, C and D were significant, the incremental fit indexes (CFI, NNFI) showed that such a change reflected differences that were largely unsubstantial, as indicated by a change of .01 or less in the fit indexes (Cheung & Rensfold 2002). Thus, multi-group comparison indicated that the measurement model was equivalent across the Latvian and Estonian samples. Pending the adequacy of the measurement model, a structural model was estimated together with both samples.

Main analyses

The main purpose of the structural equation model (Figure 1) was to examine the influence of the perceived autonomy support from teachers on physical self-esteem and effort in physical education context. It was proposed that students' perceptions of autonomy support from a teacher would affect self-determined motivation through the perceived need satisfaction for autonomy and self-determined motivation would predict effort via physical self-esteem. Also, it was suggested that there would be a significant overall effect of the perceived autonomy support from a teacher on perceived effort through the motivational sequence model.

Examination of the fit indexes revealed that the structural model reproduced the observed covariance matrix satisfactorily (Model 3, Table 2). In general, 27% of the variance in perceived effort was explained. The correlations between all the study variables were statistically significant (Table 1).

Table 1. Descriptive statistics, reliability and correlations among the variables

	Mean	SD	α	1	2	3	4
Perceived autonomy support from teacher	4.36	1.19	.85				
Need satisfaction for autonomy	3.99	1.23	.81	.81			
Physical self-esteem	4.18	1.16	.96	.09	.11		
Perceived effort	4.92	1.24	.81	.42	.34	.24	
Self-determination index (SDI)	3,33	5,74	.88	.55	.55	.45	.24

Note. All correlations are statistically significant at $p < .05$. Self-determination index (SDI) reflects autonomous motivation.

Table 2. Fit indexes of confirmatory factor analysis (CFA) of study subscales and structural equation models

Models	χ^2	df	CFI	RMSEA	CI ₉₀ RMSEA	NNFI
Model 1.	1068.85	265	.97	.065	.061-.069	.96
Model 2A	1472.18	530	.96	.070	.061-.069	.97
Model 2B	1580.04	555	.96	.071	.067-.076	.96
Model 2C	1614.06	565	.96	.072	.061-.069	.96
Model 2D	1576.80	590	.96	.068	.061-.069	.96
Model 3	1086.46	268	.97	.065	.061-.069	.96
Model 4	1163.92	269	.96	.068	.064-.072	.95
Model 5	1190.52	269	.97	.065	.061-.069	.96
Model 6.	807.35	268	.96	.077	.071-.083	.96
Model 7	670.04	268	.96	.063	.057-.069	.96
Model 8	1586.45	593	.96	.096	.064-.072	.96

Note. Model 1=measurement model with all study variables for both samples together (perceived autonomy support from a teacher, need satisfaction for autonomy, autonomous motivation, physical self-esteem, effort important); Model 2A=unconstrained model; Model 2B=constrained factor loadings; Model 2C=constrained factor covariances; Model 2D=constrained error of items; Model 3=hypothesized structural model with both samples; Model 4=reduced structural equation model in which the path from autonomous motivation to effort importance is fixed to 0; Model 5=reduced structural equation model in which the path from autonomy support to effort importance is fixed to 0; Model 6=SEM for Estonian sample; Model 7=SEM for Lithuanian sample; Model 8=all parameters of SEM were assumed to be the same in both groups; Model 9=the paths representing the relationships of the hypothesized model were assumed to be different in both groups.

To confirm the hypothesis that physical self-esteem mediated the effect of self-determination motivation on effort, the direct path from self-determined motivation to perceived effort was fixed to zero. In this alternative model the direct effect of physical self-esteem on effort significantly increased (from $\beta=0.16$ to 0.20 , $p < .01$), indicating the existence of partial mediation. This restricted model accounted for 4% of variance in effort, which is the amount of variance that can be attributed to the perceived physical self-esteem. There was a significant difference in the model goodness-of-fit chi-square

($\chi^2=77.46$, $p < .01$) for the model that included this path as a free parameter (Table 2, Model 3) and the model that did not. The parameters of the structural equation model indicated that perceived autonomy support from a teacher exerted a direct influence on perceived effort of students ($\beta=0.24$, $p < .01$), need satisfaction for autonomy ($\beta=0.81$, $p < .01$), and self-determined motivation ($\beta=0.30$, $p < .01$). The total and indirect effects of perceived autonomy support from a teacher on self-determined motivation, physical self-esteem and perceived effort are presented in Table 3.

One reviewer has suggested to test the alternative models. The model in which autonomous motivation was directly related to perceived effort and that in turn effected physical self-esteem, as well as the model where both constructs were placed at the same line were tested and compared with the hypothesized model. The results of models showed that the goodness of fit indexes of the models were on acceptable levels and quite similar to each other. However, Akaike information criterion (AIC) for the model presented in the paper (the model in which autonomous motivation was directly related to effort and indirectly via physical self-esteem) was lower (1200.46) than that for the alternative models. For the alternative model in which autonomous motivation was directly related to perceived effort which in turn effected physical self-esteem, the AIC value was 1209.86, and for the second alternative model the AIC value was 1220.95. According to Rigdon (1999), lower values indicate a better fit and so the model with the lowest AIC was regarded as the best fitting model.

Table 3. Total and indirect effects of autonomy support from teachers on dependent variables

	Total effects	Indirect effects
Autonomous motivation	.55	.25
Effort important	.41	.17
Physical self-esteem	.11	.11

Note. All effects are statistically significant at $p < .05$.

All effects were statistically significant. The indirect effect of perceived autonomy support from a teacher on effort was higher than on self-esteem. The total effect of perceived autonomy support from a teacher on self-esteem was the same as the indirect effect. Consequently, self-esteem was not directly affected by perceived autonomy support from a teacher.

We also tested whether the structural parameters representing the relationships of the hypothesized model were invariant over two groups (Models 6-9 in Table 2). At first, the adequacy of the models for both groups we tested separately (Model 6 and 7). Next, the model where all parameters were assumed to be the same in both groups (Model 8) was compared with the model where the path representing the relationships of the hypothesized model was assumed to be different (Model 9). The results showed that the change in the S-B χ^2 statistic (4.81 per 1 df) was not significant ($p < .01$) indicating the invariability of the model. Also, adopting the previously noted recommendation of Cheung and Rensvold (2002) with regard to the change in CFI, the model was invariant across the observed samples.

Discussion and conclusions

The main purpose of the study was to investigate whether the physical self-esteem and effort, and their relationships may be explained by the motivational sequence model. This hypothesized model of motivational sequences was designed to test whether students' perceived autonomy support from teachers affects self-determined motivation through the perceived need satisfaction for autonomy and self-determined motivation in turn affects perceived effort via self-esteem. The results from structural equation modelling revealed a good fit of the data to the hypothesized model separately for the sample of Estonian and Latvian subjects and also for both samples together. In terms of measurement, the present study provides support for the generalizability of the constructs used in this study. Also, the invariances between the patterns of structural relationships among the constructs in the proposed model were confirmed across the observed nation groups.

The perceived autonomy support from a teacher was directly and indirectly related, via need satisfaction for autonomy, to self-determined motivation. The perceived autonomy support from a teacher was strongly related with need satisfaction for autonomy. This result corroborates the finding obtained by Standage and Gillson (2007) in which the highest relation between perceived autonomy support from a teacher and the need satisfaction for autonomy in comparison with other need satisfactions (need for competence and relatedness) was found. Additionally, the direct effect from perceived autonomy support from a teacher on self-determined motivation was followed. In this study it was hypothesized that self-determined motivation in PE influences perceived effort both directly and indirectly via perceived self-esteem. In general, the results of the model provided support for the proposed relations between the observed variables which were guided by SDT. To some extent this model is similar with models presented previously by Hein and Hagger (2007) and Standage and Gillson (2007) in which, instead of physical self-esteem, the global self-esteem was observed. The direct effect of self-determined motivation on physical self-esteem in this study was larger than it was in the model with global self-esteem (Standage & Gillson, 2007). An explanation for that may be that physical self-esteem is more specific than global self-esteem with regard to the PE context.

To test the hypothesis that physical self-esteem mediates the effect of self-determined motivation on perceived effort, we tested an alternative model, in which the path from self-determination motivation on effort was fixed to zero. The findings provided support for the partial mediation of the physical self-esteem between self-determined motivation and perceived effort. The amount of the variance explained by this restricted model decreased from 27% to 23% indicating that 4% of the variance can be attributed to the perceived physical self-esteem. The mediation role of physical self-esteem between self-determined motivation and perceived effort is consistent with the finding obtained in previous study in which the physical self-esteem mediated the effect of intrinsic motivation on satisfaction with life (Martin-Albo, et al., 2012). Also, the effect from self-determination motivation on effort presented in this model corroborates the statement reported by Martin-Albo et al., (2012) that self-determined motivation is an antecedent for self-esteem, and not *vice versa*. However, Amorose (2001), who investigated the relationships between intra-individual variability of self-evaluation and motivation measured by scales of challenge and curiosity/interest, provided support for the positive impact of physical self-concept on exercise motivation among children in a physical education context. Baumeister, Campbell, Krueger, and Vohs (2003) have widely

discussed whether self-esteem is caused by successful activity or whether self-esteem influences the result of activity. In one case, it was supposed that working hard or putting a lot of effort into performance depends on self-esteem. In another case, the rise in self-esteem could operate as an important reinforcement for hard work that leads to success. Research also suggests that much of the influence on individual's self-esteem comes from early positive experiences with other significant individuals. The interpretation of these experiences can have a substantial influence on how adolescents come to view their physical self-concept (Marsh, 1996). Teacher behaviour perceived by their students as their autonomy support can facilitate their need satisfaction for autonomy. Autonomy supportive teacher behaviour allows the students to feel more involved in decision-making processes that could consequently potentially increase the students' need satisfaction for autonomy and via autonomous motivation promote physical self-concept. The indirect effect from autonomy supportive behaviour on physical self-esteem presented in this study provides some support to the study by Garn, McCaughtry, Martin, Shen, and Fahlman (2012), in which need satisfaction mediated the relationships between autonomy support and physical self-concept.

As for the direct effect of self-determined motivation on effort, the results of this study provide some support to the early study by Chatzisarantis, Hagger, Biddle, and Karageorghis, (2002) and Ntoumanis (2001) who reported that intrinsic motivation was a strong predictor of effort. Students with high self-determined motivation experience PE as exciting and fun and are therefore willing to exert high effort to learn new skills. In addition, Chatzisarantis et al. (2002) highlighted effort to be an important factor of physical activity.

The results of the present study are unique, because they focus on the mediation role of physical self-esteem on learning outcome like effort. An important finding in the model was also that the students' perceived autonomy support from a teacher has a direct effect on effort beyond the indirect effects in the motivational sequences. The stronger direct effect of perceived autonomy support from the teacher on perceived effort compared to the indirect

effect was followed. It allows to assume that when students perceive that their teacher provides them the opportunity to choose tasks consistent with their goals or to be involved in decision-making processes, may react immediately to put more effort into exercise. The effect of autonomy support on effort via other components of the model may not be so immediate.

The results of the proposed motivational sequence model allows to assume that more self-determined motivation facilitates the students to feel physically well which in turn subsequently contributes to putting more effort into exercising. The students, recognizing the effort importance as an inseparable component of physical activities, do not have to force themselves to be physically active. Consequently, these students can easily be involved in physical exercise during their free time, which is the main objective of PE.

In conclusion, these results suggest that teachers' autonomy supportive behaviour will help foster self-determined motivation which, via self-esteem, enhances the feeling of effort importance for physical activity. The provided information can help teachers to understand how the students' perceived effort is related to self-determined motivation and physical self-esteem.

There are also some limitations of this study. Firstly, gender variations of the measures were not controlled. However, according to previous studies based on the self-determination theory in a PE context, there are no gender variations in the structure of the study measures (Standage, Duda, & Ntoumanis, 2005). Secondly, from three psychological need satisfactions only need satisfaction for autonomy was observed. A justification for it is that for self-determined motivation in a similar model the need satisfaction for autonomy was a stronger predictor than need satisfaction for competence and relatedness (Standage & Gillson, 2007). The third limitation is that this study involves a cross-sectional design which precludes the inference of causality. Future studies should consider taking into account these limitations to test a more extensive model. Also, to have a more general educational application of the proposed model, the evidence of the validity in different contexts beyond PE is needed.

References

- Amorose, A.J. (2001). Intra-individual variability of self-evaluations in the physical domain: Prevalence, consequences, and antecedents. *Journal of Sport and Exercise Psychology*, 23, 222-244.
- Bailey, R. (2006). Physical education and sport in schools: A review of benefits and outcomes. *Journal of School Health*, 76, 397-40.
- Baumeister, R.F., Campbell, J.D., Krueger, J.I., & Vohs, K.D. (2003). Does high self-esteem cause better performance, interpersonal success, or healthier lifestyles? *Psychological Science in the Public Interest*, 4, 1-44.
- 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., & Muthen, 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., Hagger, M.S., Biddle, S.J.H., & Karageorghis, C. (2002). The cognitive processes by which perceived locus of causality predicts participation in physical activity. *Journal of Health Psychology*, 7, 685-699.
- Cheung, G.W., & Rensvold, R.B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, 9, 233-255.
- Cox, A.E., Smith, A.L., & Williams, L. (2008). Change in physical education motivation and physical activity behavior during middle school. *The Journal of Adolescent Health*, 43, 506-513.
- Deci, E.L., & Ryan, R.M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of Research in Personality*, 19, 109-134.
- Deci, E.L., & Ryan, R.M. (1995). Human autonomy: The basis for true self-esteem. In M. Kernis (Ed.), *Efficacy, agency, and self-esteem* (pp. 31-49). New York: Plenum.
- 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.
- Garn, A.C., McCaughtry, N., Martin, J., Shen, B., & Fahlman, M. (2012). A basic needs theory investigation of adolescents' physical self-concept and global self-esteem. *International Journal of Sport and Exercise Psychology*, 10, 314-328.
- Gillison, F.B., Standage, M., & Skevington, S.M. (2013). The effects of manipulating goal content and autonomy support climate on outcomes of a PE fitness class. *Psychology of Sport and Exercise*, 14, 342-352.
- Guay, F., Mageau, G.A., & Vallerand, R.J. (2003). On the hierarchical structure of self-determined motivation: A test of top-down, bottom-up, reciprocal, and horizontal effects. *Personality and Social Psychology Bulletin*, 29, 992-1004.
- Hagger, M.S., Biddle, S.J.H., Chow, E.W., Stambulova, N., & Kavussanu, M. (2003). Physical self-perceptions in adolescence: Generalizability of a hierarchical multidimensional model across three cultures. *Journal of Cross-Cultural Psychology*, 34, 611-628.
- Hein, V., & Hagger, M. (2007). Global self-esteem, goal achievement orientations and self-determined behavioural regulations in physical education setting. *Journal of Sports Sciences*, 25(2), 149-159.
- 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.
- Jöreskog, K. G., Sörbom, D., du Toit, S.H.C., & du Toit, M. (2001). *LISREL 8: New statistical features*. Lincolnwood, IL: Scientific Software International.
- Martín-Albo, J., Núñez, J.L., Domínguez, E, León, J., & Tomás, J.M. (2012). Relationships between intrinsic motivation, physical self-concept and satisfaction with life: A longitudinal study. *Journal of Sports Sciences*, 30, 337-347.
- Marsh, H.W. (1996). Construct validity of Physical Self-Description Questionnaire responses. Relations to external criteria. *Journal of Sport and Exercise Psychology*, 18, 111-131.
- Marsh, H.W., Marco, I.T., & Ascí, F.H. (2002). Cross-cultural validity of the Physical Self-Description Questionnaire: Comparison of factor structures in Australia, Spain and Turkey. *Research Quarterly for Exercise and Sport*, 73, 257-270.
- Marsh, H.W., Richards, G.E., Johnson, S., Roche, L., & Tremayne, P. (1994). Physical Self-Description Questionnaire: Psychometric properties and a multitrait-multimethod analysis of relations to existing instruments. *Journal of Sport and Exercise Psychology*, 16, 270-305.
- McAuley, E., Duncan, T., & Tammen, V.V. (1989). Psychometric properties of the Intrinsic Motivation Inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport*, 60, 48-58.
- Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology*, 71, 225-242.
- Ntoumanis, N., & Standage, M. (2009). Motivation in physical education classes: A self-determination theory perspective. *Theory and Research in Education*, 7, 194-202.
- Ommundsen, Y., & Kvaló, S.E. (2007). Autonomy-mastery supportive or performance focused? Different teacher behaviours and pupils' outcomes in physical education. *Scandinavian Journal of Educational Research*, 4, 385-413.

- Pelletier, L.G., Fortier, M.S., Vallerand, R.J., Tuson, K.M., Briere, N.M., & Blais, M.R. (1995). Toward a new measure of intrinsic motivation, extrinsic motivation, and amotivation in sports: The Sports Motivation Scale (SMS). *Journal of Sport and Exercise Psychology, 17*, 35-53.
- Quested, E., & Duda, J.L. (2011). Perceived autonomy support, motivation regulations and the self-evaluative tendencies of student dancers. *Journal of Dance Medicine & Science, 15*, 3-14.
- Reeve J., & Halusic, M. (2009). How K-12 teachers can put self-determination theory principles into practice. *Theory and Research in Education, 7*, 145-154.
- Reeve, J., Jang, H., Hardre, P., & Omura, M. (2002). Providing a rationale in an autonomy-supportive way as a strategy to motivate others during an uninteresting activity. *Motivation and Emotion, 26*, 183-207.
- Rigdon, E.E. (1999). Using the Friedman method of ranks for model comparison in structural equation modelling. *Structural Equation Modelling: A Multidisciplinary Journal, 3*, 219-232.
- 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, 5*, 749-761.
- Standage, M., Duda, J.L., & Ntoumanis, N. (2003). 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. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology, 75*, 411-433.
- Standage, M., Duda, J. L., & Ntoumanis, N. (2006). Students' motivational processes and their relationship to teacher ratings in school physical education: A self-determination theory approach. *Research Quarterly for Exercise and Sport, 77*, 100-110.
- Standage, M., & Gillison, F. (2007). Students' motivational responses toward school physical education and their relationship to general self-esteem and health-related quality of life. *Psychology of Sport and Exercise, 8*, 704-721.
- Standage, M., Gillison, F., Ntoumanis, N., & Treasure, D. C (2012). Predicting students' physical activity and health-related well-being: A prospective cross-domain investigation of motivation across school physical education and exercise settings. *Journal of Sport & Exercise Psychology, 34*, 37-60.
- Taylor, I.M., Ntoumanis, N., & Standage, M. (2008). A self-determination theory approach to understanding antecedents of teachers' motivational strategies in physical education. *Journal of Sport & Exercise Psychology, 30*, 75-94.
- Taylor, I.M., Ntoumanis, N., Standage, M., & Spray, C.M. (2010). Motivational predictors of physical education students' effort, exercise intentions, and leisure-time physical activity: A multilevel linear growth analysis. *Journal of Sport & Exercise Psychology, 32*, 99-120.
- Thøgersen-Ntoumani, C., & Ntoumanis, N. (2006). The role of self-determined motivation to the understanding of exercise related behaviours, cognitions and physical self-evaluations. *Journal of Sports Sciences, 24*, 393-404.
- Thøgersen-Ntoumani, C., & Ntoumanis, N. (2007). A self-determination theory approach to the study of body image concerns, self-presentation and self-perceptions in a sample of aerobic instructors. *Journal of Health Psychology, 12*, 301-315.
- Vallerand, R.J. (1997). Towards a hierarchical model of intrinsic and extrinsic motivation. In M.P. Zanna (Ed.), *Advances in experimental social psychology* (pp. 271-359). New York: Academic Press.
- Vallerand, R.J., & Ratelle, C.F. (2002). Intrinsic and extrinsic motivation: A hierarchical model. In E.L. Deci & R.M. Ryan (Eds.), *Handbook of self-determination research* (pp. 37-63). Rochester, NY: University of Rochester Press.
- Wang, C.K., Koh, K.T., & Chatzisarantis, N.L. (2009). An intra-individual analysis of players' perceived coaching behaviours, psychological needs, and achievement goals. *International Journal of Sports Science and Coaching, 4*, 177-192.
- Wilson, P.M., & Rodgers, W.M. (2002). The relationship between exercise motives and physical self-esteem in female exercise participants: An application of self-determination theory. *Journal of Applied Biobehavioral Research, 7*, 30-43.
- Zhang, T. (2009) Relations among school students' self-determined motivation perceived enjoyment, effort, and physical activity behaviors. *Perceptual and Motor Skills, 109*, 783-790.

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Correspondence to:

Prof. Vello Hein, Ph.D.

Faculty of Exercise and Sports Sciences University of Tartu

5 Jakobi Street, 51014 Tartu, Estonia

Phone: +372 737 5382

Fax: +372 737 5362

E-mail: vello.hein@ut.ee