The Relative Roles of Teachers and Peers on Students' Motivation in Physical Education and its Relationship to Self-Esteem and Health-Related Quality of Life

Andre Koka

Faculty of Exercise and Sport Sciences, University of Tartu

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Author Note

Andre Koka is now at the Faculty of Exercise and Sport Sciences, University of Tartu, Estonia.

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Correspondence concerning this article should be addressed to Andre Koka, Institute of Sport and Coaching Sciences, Faculty of Exercise and Sport Sciences, University of Tartu, 5 Jakobi Street, EE 51014 Tartu, Estonia, Email: andre.koka@ut.ee; Tel: +372 7 375382; Fax: +372 7 375362.

Abstract

This study examined the relative influence of perceived autonomy support from the teacher and peers on students' global self-esteem and health-related quality of life (HRQoL) through the motivational processes within physical education (PE) in line with self-determination theory. Secondary school students (N = 395) ages 12-16 years completed a multi-section inventory assessing their motivational processes towards PE as well as global physical self-esteem. They also completed measures of global self-esteem and HRQoL on three occasions: baseline, 3-month, and 6-month follow-ups. A well-fitting path-analytic model revealed a larger positive, significant indirect effect of perceived autonomy support from the teacher, relative to perceived autonomy support from peers, on students' overall well-being variables. Results further revealed that physical global self-esteem partially mediated the effect of autonomous motivation towards PE on students' global self-esteem and HRQoL, and that global self-esteem and HRQoL were reciprocally related over time. Results suggest that perceived autonomy support from both the teacher and peers in PE are essential antecedents to students' overall well-being.

Keywords: adolescents, overall well-being, perceived autonomy support, self-determination theory, significant others

The Relative Roles of Teachers and Peers on Students' Motivation in Physical Education and its Relationship to Self-Esteem and Health-Related Quality of Life

The need to develop the essential markers of adolescent's overall well-being such as self-esteem (i.e., "a person's appraisal of his or her value", Leary & Baumeister, 2000, p. 2) and health-related quality of life (HRQoL) (i.e., "a person's subjective evaluations of the influences of their current health status, health care, and health promoting activities on their ability to achieve and maintain a level of overall functioning that allows them to pursue valued life goals and that is reflected in their general well-being", Shumaker & Naughton, 1995, p. 7) is impossible to overestimate. Research has shown that low self-esteem during adolescence is related to poorer mental and physical health, worse economic well-being, and higher levels of antisocial behaviour and criminal activity as well as higher levels of depression and suicidal ideation in adulthood (Donnellan, Trzesniewski, Robins, Moffitt, & Caspi, 2005; McGee & Williams, 2000; Orth, Robins, & Roberts, 2008; Trzesniewski et al., 2006). The HRQoL of children and adolescents is directly related to their HRQoL in adulthood (Bisegger et al., 2005). To take advantage of the link between the periods of adolescent and adulthood, research has focused on variables that support adolescents' self-esteem and HRQoL. For example, Standage and Gillison (2007) and Standage, Gillison, Ntoumanis and Treasure (2012) have found students' perceptions of autonomy support, as provided by their teacher in physical education (PE) classes, to positively predict global self-esteem and HRQoL through the motivational processes within PE. The present investigation aims to extend the previous studies by incorporating perceived autonomy support from both the teacher and peers in PE as influences on overall well-being such as global physical self-esteem, global self-esteem, and HRQoL through the motivational processes within PE.

Motivational processes within PE in line with central tenets of self-determination theory

Self-determination theory (SDT; Deci & Ryan, 2000) as a theoretical framework has been used to study motivational processes in many contexts including PE. It distinguishes between autonomous motivation, controlled motivation, and amotivation. In line with SDT, a student holds an autonomous motivation towards PE when s/he participates in classes because of the enjoyment derived from the

activities performed there (i.e., intrinsic motivation) or because s/he realizes the importance of these activities (i.e., identified regulation). On the other hand, a student holds a controlled motivation towards PE when s/he participates in classes in order to avoid the negative feelings of guilt and gain the positive feelings of a sense of self (i.e., introjected regulation) or because this is what s/he must do (i.e., external regulation). Finally, a student is amotivated towards PE when s/he feels a lack of competence in PE classes, believes that activities performed in classes are unimportant, and does not perceive the link between his or her effort and outcome in PE.

The SDT assumes that the type of motivation guiding the behaviour in an activity is dependent on the extent to which individual's basic psychological needs for competence (i.e., to be effective in his or her environment), autonomy (i.e., to be the origin of his or her behavior), and relatedness (i.e., to be socially connected to others) are satisfied (Deci & Ryan, 2000). A central tenet of SDT is that social-contextual factors (e.g., perceived teacher behaviour and learning environment) which fulfil the perceptions of basic psychological needs will be nutrients of autonomous forms of motivation (i.e., intrinsic motivation and identified regulation), whereas social-contextual factors which undermine such perceptions will result in controlled forms of motivation (i.e., introjected and external regulation) or amotivation (Ryan & Deci, 2008). A growing body of research in PE have supported this by demonstrating the positive effect of perceived autonomy support from the teacher (i.e., valuing students' perspectives, acknowledging his or her feelings, providing students with pertinent information, and opportunities for choice) on students' basic psychological needs satisfaction which, in turn, positively predicted autonomous motivation (Barkoukis, Hagger, Lambropoulos, & Tsorbatzoudis, 2010; Ntoumanis, 2005; Standage, Duda, & Ntoumanis, 2005, 2006; Standage & Gillison, 2007; Standage et al., 2012).

Based on the results of classroom-based studies (e.g., Sage & Kindermann, 1999) as well as studies conducted in the leisure-time physical activity context (Hagger et al., 2009), one may argue that perceived autonomy support from teachers should not be considered as the sole source of perceived autonomy support in PE influencing students' autonomous motivation. The recent research shows that, in

addition to teachers, the quality of each student's relationship with his/her closest friend as well as the extent to which students feel accepted by their peers in PE classes, also affected positively students' autonomous motivation through the satisfaction of the need for relatedness (Cox, Duncheon, & McDavid, 2009). Although the latter research did not examine the effect of perceived autonomy support from peers *per se* on students' autonomous motivation, this confirms that both teacher and peers comprise the social context of PE and they have independent roles in motivational processes (Cox & Ullrich-French, 2010).

Although outside of PE context, the effect of perceived autonomy support from peers, in addition to parents, on autonomous motivation towards physical activity in a leisure-time context was examined by Hagger and colleagues (Hagger et al., 2009). Their research revealed that perceived autonomy support from both peers and parents had significant positive effects on leisure-time autonomous motivation. Furthermore, these effects were independent from the effect of perceived autonomy support from the PE teacher on leisure-time autonomous motivation mediated by the autonomous motivation in PE (Hagger et al., 2009). Transferring these results into the PE context, one may argue that when students perceive their peers' behaviour in PE as autonomy-supportive, this will likely lead to the formation of autonomous motivation. Peers who are expressing confidence in their classmates' abilities, listening and valuing perspectives of them, acknowledging their feelings and supporting self-initiation of others in PE are considered to be as autonomy-supportive (Hagger et al., 2007). According to SDT (Deci & Ryan, 2000), the effect of perceived autonomy support from peers on autonomous motivation should be exerted through the satisfaction of one or more of the psychological needs for competence, autonomy, and relatedness. In line with the claiming expressed by Hagger et al. (2009), if the effect of perceived autonomy support from the teacher on autonomous motivation remains after controlling for perceived autonomy support from peers, then it will provide further evidence for the unique effect of autonomy-supportive behaviours from the teacher on students' autonomous motivation in PE.

The role of autonomous motivation towards PE on globally-assessed outcomes such as self-esteem and health-related quality of life

Studies investigated the link between autonomous motivation towards PE and students' overall well-being such as general self-esteem and HRQoL have been based on the hypotheses from the SDT (Deci & Ryan, 2000; Ryan & Deci, 2008) and Vallerand's (1997) hierarchical model of motivation. According to SDT, autonomous motivation is considered to be positively linked with overall well-being variables, because behavioural regulation behind the autonomous motivation involves having a more integrated perception of the self, supportive of one's aspirations toward psychological growth and development (Ryan & Deci, 2008). Vallerand's (1997) hierarchical model of motivation posits that individual's autonomous motivation as well as its antecedents, mediators, and consequences operates at three levels of generality, namely global (i.e., a generalised disposition to be autonomously motivated), contextual (i.e., autonomous motivation to engage in behaviours in a given context such as PE) and specific (i.e., autonomous motivation towards specific bouts of a given behaviour). Furthermore, the model proposes the existence of a dynamic interplay between adjacent motivations in the hierarchy. Vallerand (1997) theorized that both top-down and bottom-up relationships exist. In other words, motivation at a lower level of generality (i.e., contextual motivation) affects motivation at the next higher level of generality (i.e., global motivation) and vice versa (Vallerand, 1997).

In their study with secondary school students, Standage and Gillison (2007) found positive association between autonomous motivation towards PE and self-reported general self-esteem and HRQoL. Similarly, in addition to students' dispositional goal orientation, Hein and Hagger (2007) found autonomous motivation towards PE to have a direct and positive effect on secondary school students' self-reported global self-esteem. Standage and Gillison argued that, according to the hierarchical model of motivation, repeated experiences of autonomous motivation in a PE context should have a bottom-up effect on global autonomous motivation which also nurture motivational outcomes assessed at the more global level of generality such as general self-esteem and HRQoL. Moreover, Standage and Gillison reported significant indirect effect of perceived autonomy support from the teacher on students' general self-esteem and HRQoL via the satisfaction of the need for autonomy and competence, and autonomous motivation towards PE.

The present study

The present study aimed to examine the effects of perceived autonomy support from the teacher and peers on students' perceptions of basic psychological needs satisfaction and autonomous motivation towards PE, as well as self-reported global physical self-esteem, global self-esteem, and HRQoL.

Based on the hypotheses from SDT (Deci & Ryan, 2000; Ryan & Deci, 2008), Vallerand's (1997) hierarchical model of motivation and results of the previous research, a total of 10 hypotheses were formulated. Hypotheses 1-3 relate to the basic tenets of SDT proposing the mediating role of basic psychological needs satisfaction between perceived autonomy support and autonomous motivation. Specifically, as illustrated in the left-hand side of Figure 1, it was hypothesized that perceived autonomy support from both the teacher and peers will have significant direct and positive effects on the basic psychological need satisfaction variables (Hypothesis 1). The need satisfaction variables will have significant direct and positive effects on autonomous motivation towards PE (Hypothesis 2). The expected significant association of perceived autonomy support from both the teacher and peers with autonomous motivation towards PE will be mediated by the need satisfaction variables (Hypothesis 3).

Hypotheses 4-6 relate to the relationship between autonomous motivation towards PE and globally-assessed outcomes such as global physical self-esteem, global self-esteem, and HRQoL. It was expected that autonomous motivation towards PE have positive effect on global self-esteem and HRQoL. However, according to Fox's (1997) hierarchical nature of self-esteem models, Standage and Gillison (2007) have argued that the domain specific perceptions of the self (i.e., physical self-esteem) should have stronger influence on assessments taken within and/or towards the context such as PE. Standage and Gillison, therefore, suggested exploring in the future studies the role of perceptions of physical self-esteem as a possible mediator in explaining the relationship between autonomous motivation towards PE and globally-assessed outcomes such as global self-esteem and HRQoL. Accordingly, it was hypothesized that autonomous motivation towards PE will have significant direct and positive effect on global physical self-esteem (Hypothesis 4). The global physical self-esteem will have significant direct and positive effect on global self-esteem and HRQoL (Hypothesis 5). The expected significant correlation

between autonomous motivation towards PE and (i) global self-esteem and (ii) HRQoL will be mediated by the global physical self-esteem (Hypothesis 6). The hypotheses are shown in Figure 1 by arrows from autonomous motivation towards PE to global physical self-esteem and from global physical self-esteem to global self-esteem at Time 1 and HRQoL at Time 1.

According to previous studies (Standage & Gillison, 2007; Standage et al., 2012), hypotheses 7-9 relate to the unique direct effects that perceived psychological needs satisfaction for competence and relatedness in PE have on global physical self-esteem and HRQoL. Specifically, students' self-reported global physical self-esteem has been found to be directly and positively predicted by the perceived competence (Standage et al., 2012), whereas HRQoL by the perceived relatedness in PE (Standage & Gillison, 2007; Standage et al., 2012). Moreover, Standage et al. (2012) found the effect of perceived competence on global physical self-esteem to be both direct and indirect via the mediation of autonomous motivation towards PE. In the present study, therefore, as depicted in Figure 1, the direct effect of perceived competence need satisfaction on global physical self-esteem was specified (Hypothesis 7). However, it was expected that the effect of perceived competence on global physical self-esteem would be both direct and indirect via the mediation of autonomous motivation towards PE (Hypothesis 8). Furthermore, the direct effect of perceived relatedness need satisfaction on HRQoL at Time 1 was also specified (Hypothesis 9).

The last hypothesis relate to the relationship between global self-esteem and HRQoL. The association between global self-esteem and HRQoL, with latter domains of physical health and the emotional, social, and school-related functioning of children and adolescents, has been well documented (Baumeister, Campbell, Krueger, & Vohs, 2003). Past empirical research has shown that global self-esteem positively predicts school academic performance (i.e., school-related functioning; Hansford & Hattie, 1982), emotions such as happiness (i.e., emotional functioning; Diener & Diener, 1995), better relationships with peers (i.e., social functioning; Keefe & Berndt, 1996), and perceptions of physical self-worth (i.e., physical health; Kowalski, Crocker, Kowalski, Chad, & Humbert, 2003). Research thus supports the perspective that global self-esteem should be considered as a cause of higher scores on

physical, social, emotional, and school-related aspects of HRQoL. However, some studies suggest that global self-esteem should be considered as a result of higher scores on various aspects of HRQoL. Skaalvik and Hagtvek (1990), for example, have found in their longitudinal study that doing well in school led to a higher score on self-esteem measured the subsequent year. In relation to the social domain of HRQoL, Leary and colleagues' (Leary, Tambor, Terdal, & Downs, 1995) sociometric model suggests that being able to be more successful in one's interpersonal relationships should result in increased self-esteem. In the context of the association of the physical and emotional domains of HRQoL with global self-esteem, physical self-esteem (Fox, 1997) and emotional responses (Ebbeck & Weiss, 1998) have been shown to positively predict global self-esteem in previous research with adolescents. Finally, comparing a series of structural equation models in their cross-sectional study with secondary school students, Standage and Gillison (2007) have found global self-esteem to influence the HRQoL to a slightly stronger degree ($\beta = .39$, $p < .05$) than the reverse case of HRQoL influencing global self-esteem ($\beta = .31$, $p < .05$). Studies that have been conducted so far thus point toward a reciprocal relation between the global self-esteem of children and adolescents and their HRQoL; however, no study has directly tested this relation. Using a cross-lagged reciprocal effect model involving three waves of data, it was investigated how global self-esteem and HRQoL are interrelated over a six-month period among study participants. Based on the findings of previous research, a bidirectional relationship between global self-esteem and HRQoL was expected (Hypothesis 10). The hypothesis is shown, as illustrated in the right-hand side of Figure 1, by arrows from the global self-esteem at Time 1 and Time 2 to the HRQoL at Time 2 and Time 3, respectively, and from the HRQoL at Time 1 and Time 2 to the global self-esteem at Time 2 and Time 3, respectively.

*** Insert Figure 1 about here ***

To recapitulate, the present study contributes to the extant literature in a number of unique ways. First, this study will examine the relative roles of perceived autonomy support from the teacher and peers in PE in explaining perceptions of global self-esteem and HRQoL via the motivational processes in PE. As pointed out by Hagger et al. (2009), it would provide further information about the extent of the

influence to which perceived autonomy support from peers in PE, in addition to the well-established influence of perceived autonomy support from the teacher, will have on overall well-being variables, especially given peers' central role in social development of young people. Second, this study will test whether the global physical self-esteem mediate the relationship between PE motivation and overall well-being variables such as global self-esteem and HRQoL. According to Standage and Gillison (2007), it would provide further information about the underpinning mechanisms of the self-system within the context of PE. Third, this study will examine the direction of relationship between global self-esteem and HRQoL over time. It would provide further information about the mechanism by which these variables are interrelated, as well as recommendations for the refinement of intervention programs. Specifically, if the bidirectional cross-lagged relationship between global self-esteem and HRQoL will be supported, as expected, programs that combine intervention to nurture the both self-esteem and HRQoL should be the most effective. On the other hand, if the unidirectional cross-lagged relationship will be evident, for example with the flow from global self-esteem to HRQoL, the program focusing on to nurture students' global self-esteem should produce the most pronounced effects and vice versa.

Method

Participants and Procedures

The participants were 656 secondary school students (310 boys and 346 girls) ages 12-16 years (*M* age = 13.58 years, *SD* = .63) from a city of 100,000 inhabitants located on southeast of Estonia, who took part in the first data collection (Time 1—October 2009). The second and third data collections were conducted approximately three and six months later, respectively (Time 2—January 2010 and Time 3—April 2010, respectively). A total of 568 and 489 students participated at Time 2 and 3, respectively. The complete data across the three data collection waves were available from 395 students (173 boys and 222 girls, *M* age = 13.60 years, *SD* = .62).[1] Attrition was attributed mainly to absences of students on testing day at Time 2 and/or Time 3. The independent samples *t*-test was used to evaluate whether there were mean differences on all Time 1 study variables between participants who completed the questionnaires at

all three points in time and those who did not. No significant differences emerged on the mean scores of any of the study variables, suggesting that attrition did not affect the results reported in this study.

Permission to carry out the study was obtained from the Head Teachers of all schools. The informed consent was obtained from the participants and their parents via a letter sent home with each child that briefly outlined the study. Parents' permission was considered approved if they did not send the letter back to the school. No letters were returned. The questionnaires at all three points in time were administered to students at school during the regular school day in their homerooms. In the first wave of data collection (Time 1), students responded to the questionnaires assessing their motivational processes towards PE (i.e., perceived autonomy support from both the teacher and peers, perceived satisfaction of the needs for autonomy, competence, relatedness, and motivation towards PE) as well as perceptions of global physical self-esteem, global self-esteem and HRQoL. In the second and third waves of data collections (Time 2 and 3), only perceptions of global self-esteem and HRQoL were assessed. Students responded to the questionnaires anonymously to preserve confidentiality and responses were matched using dates of birth and gender. The procedures and protocol for the present study were approved by the local ethical committee.

Measures

Perceived autonomy support from the teacher and peers in PE. To assess the degree to which the students perceived the teacher and peers to support their autonomy in PE, the 6-item scale, adapted from the Sport Climate Questionnaire by Hagger et al. (2003), was used. All items were preceded by the stem, "In this PE class...", and participants responded on 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Example items from the scale are: "...I feel that my [salient referent(s)] listen(s) to how I would like to do things", and "...I feel that my [salient referent(s)] show(s) confidence in my abilities to do well in PE" with 'PE teacher' or 'peers' as the salient referent in each of the two scale, respectively. Reliable scores using this scale have been reported in previous PE-based research with Estonian school students (Viira & Koka, 2012).

Autonomy need satisfaction. Students' perceived satisfaction of autonomy in PE was measured using a 3-item scale (Koka & Hagger, 2010), derived from previous research assessing autonomy need satisfaction in sport settings (Hollembeak & Amorose, 2005). Students were asked to indicate how they feel about the amount of choice they have when participating in PE. A sample item included "I feel that I have a say in what I do when participating in PE". Responses were made on 7-point scales with response options ranging from 1 (strongly disagree) to 7 (strongly agree). Previous work with Estonian school students of similar age to the present sample supported the reliability of item scores using Cronbach alpha (Koka & Hagger, 2010, Viira & Koka, 2012).

Competence need satisfaction. Students' perceived satisfaction of competence in PE was assessed using a 5-item perceived competence subscale of the Intrinsic Motivation Invetory (IMI; McAuley, Duncan, & Tammen, 1989). An example item is: "I think I am pretty good at PE." Responses were indicated on 7-point scale anchored by 1 (strongly disagree) to 7 (strongly agree). Support for reliability of scores provided with this scale has been supported previously with Estonian school students (Koka & Hagger, 2010; Koka & Hein, 2003; Viira & Koka, 2012).

Relatedness need satisfaction. A modified version of the Need for Relatedness Scale (Richer & Vallerand, 1998) was used to measure students' perceived satisfaction of relatedness in PE. Specifically, a measure previously used by several researchers (e.g., Cox et al., 2009; Standage et al., 2006; Viira & Koka, 2012) was employed in which the items were adapted to target the PE context. Students responded to the common stem, "In my PE class, I feel...", followed by five descriptors (e.g., "...understood" and "...listened to"), on 7-point scale anchored by 1 (strongly disagree) to 7 (strongly agree). In line with the work of Cox et al. (2009) and Viira and Koka (2012), in the current study, the stem of the items did not refer to any specific significant others (e.g., teacher or peers), thereby enabling to assess students' general feelings of relatedness without defining the source of these feelings. The internal reliability of this scale has been reported in previous PE work with similar-aged Estonian school students (Viira & Koka, 2012).

Motivational regulations. Different types of motivational regulations toward PE were assessed using the Perceived Locus of Causality (PLOC) scale devised by Goudas, Biddle, and Fox (1994).

Participants responded to the items using the stem: "I take part in PE...", followed by different reasons. All subscales included four items and example items are: "...because PE is fun" (intrinsic motivation), "...because it is important for me to do well in PE" (identified regulation), "...because I will feel bad about myself if I did not" (introjected regulation), "...because I will get into trouble if I do not" (external regulation), and "...but I really do not know why" (amotivation). Responses were made on 7-point scale anchored by 1 (strongly disagree) to 7 (strongly agree). Previous research with Estonian school students of similar age have supported the reliability of scores using Cronbach 's alphas and factorial structure using confirmatory factor analysis (CFA) of the PLOC (Viira & Koka, 2012).

For the purpose of examining relations among the hypothesized path model, consistent with previous studies in PE (e.g., Koka & Hagger, 2010; Standage et al., 2006), four types of motivation and amotivation were integrated into single index by calculating a self-determination index (SDI) reflecting "autonomous motivation". Accordingly, each subscale average score was weighted as follows: intrinsic motivation (+3), identified regulation (+2), introjected regulation (–1), extrinsic regulation (–2), and amotivation (-3), and a single SDI was calculated based on the weighted composite of these scores.

Global physical self-esteem and global self-esteem. Students' perceptions of global physical self-esteem and global self-esteem were measured using respective subscales from the Physical Self-Description Questionnaire (PSDQ; Marsh, Richards, Johnson, Roche, & Tremayne, 1994). Sample items from the global physical self-esteem (6 items) and global self-esteem (8 items) subscale are "Physically, I am happy with myself", and "Overall, I have a lot to be proud of", respectively. Participants responded on 6-point scale with answers ranging from 1 (false) to 6 (true). The standardized back-translation techniques, suggested by Brislin (1986), were used to produce an Estonian version of the subscales of global physical self-esteem and global self-esteem from the PSDQ. Results of the CFA confirmed the existence of two empirically distinct constructs of global physical self-esteem and global self-esteem. Specifically, after setting error covariance to be free between some of the items within both subscale, the two-factor model approached the criteria of acceptable fit suggested by Hu and Bentler (1999) [χ^2 (69) =

216.57, $p < .001$, CFI = .92, IFI = .93, RMSEA = .071, 90% confidence interval (CI_{90}) for RMSEA range = .061–.082].

HRQoL. The Pediatric Quality of Life Inventory™ 4.0 (PedsQL™ 4.0) Generic Core Scales (Varni, Seid, & Kurtin, 2001), adapted into Estonian by Viira and Koka (2011), was used to assess participants' perceptions of HRQoL with dimensions of physical health (8 items, e.g., "It is hard for me to run"), social functioning (5 items, e.g., "I have trouble getting along with other kids"), emotional functioning (5 items, e.g., "I feel afraid or scared"), school-related functioning (3 items, e.g., "It is hard to pay attention in class"), and days missed from school due to illness (2 items, e.g., "I miss school to go to the doctor or hospital"). Students were asked to indicate how much of a problem has this been during the past one month on 5-point scale ranging from 0 (never a problem) to 4 (almost always a problem). Prior to data analysis items were reversed-scored and linearly transformed to a 0 to 100 scale (i.e., 0 = 100, 1 = 75, 2 = 50, 3 = 25, and 4 = 0). For estimating relations among the hypothesized path model, a total composite score of HRQoL was calculated with higher scores indicating better HRQoL. Previous research with Estonian school students of similar age have supported the factorial structure of the PedsQL™ 4.0 using CFA as well as reliability of total score of HRQoL using Cronbach's alpha (Viira & Koka, 2011).

Results

Descriptive Statistics

Table 1 presents the descriptive statistics, correlations, and Cronbach alpha (α) coefficients for all study variables.

*** Insert Table 1 about here ***

Path Analyses

A path analysis with averaged manifest scales for each construct was conducted to test the adequacy of the proposed model outlined in Figure 1, using IBM SPSS Amos 22 software. The Mardia's coefficient value (51.39, critical ratio = 25.86) indicated multivariate non-normality within the data. Therefore, in line with the recommendation by Preacher and Hayes (2008), to ensure the robustness of the

path analytic model and that it was not adversely affected by the artifact such as non-normality, the path analysis was conducted using bootstrapping procedure. As has been suggested by Preacher and Hayes and used previously in studies analysing the data departing from multivariate normality (e.g., Standage et al., 2012), 5000 bootstrap replication samples based on the original sample were requested.

Several recommended goodness of fit indices were used to assess the adequacy of data fit for path models (Hu & Bentler, 1999): the chi-square test (χ^2), Incremental Fit Index (IFI), Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI), and Root Mean Square Error of Approximation (RMSEA). According to Hu and Bentler (1999), values ≥ .95 for IFI, CFI, and NNFI, and values ≤ .06 for RMSEA are taken to reflect an acceptable fit.

Relationships in the model

The hypothesized model exhibited acceptable fit with the data [χ^2 (45) = 94.73, $p < .001$, CFI = .98, IFI = .98, NNFI = .96, RMSEA = .053, CI_{90} for RMSEA range = .038-.068].[2] The standardized path coefficients for the free parameters are shown in Figure 2. The standardized parameter estimates of indirect effects along with their 95% lower and upper limits of bootstrapped-generated bias-corrected confidence intervals are presented in Table 2. The model accounted for 32%, 40%, and 45% of the variance in HRQoL and 44%, 51%, and 47% of the variance in global self-esteem at Time 1, 2, and 3, respectively.

*** Insert Figure 2 and Table 2 about here ***

Hypothesis 1. As expected, results indicated that perceived autonomy support from the PE teacher and peers had direct and positive effects on the need satisfaction variables of autonomy (β = .51, $p < .001$ and β = .16, $p < .001$, respectively), competence (β = .29, $p < .001$ and β = .14, $p < .01$, respectively), and relatedness (β = .15, $p < .001$ and β = .56, $p < .001$, respectively).

Hypothesis 2. Perceived satisfaction of autonomy (β = .21, $p < .001$) and competence (β = .33, $p < .001$), but not relatedness (β = -.02, $p > .05$), significantly predicted autonomous motivation towards PE, thus only partially supported the hypothesis.

Hypothesis 3. Perceived autonomy support from the teacher and peers were expected to have significant indirect effects on autonomous motivation towards PE mediated by the need satisfaction variables. The indirect effect of perceived autonomy support from the teacher ($\beta = .20$, $p < .001$), but not from peers ($\beta = .07$, $p > .05$), on autonomous motivation was significant. Separate tests revealed the larger indirect effect of perceived autonomy support from the teacher [$\beta = .17$, bias-corrected 95% confidence intervals (BC CI_{95}) = .12–.24, $p < .001$] on autonomous motivation via perceived autonomy after removing (i.e., fixed to zero) perceived competence as a mediator, relative to the indirect effect of perceived autonomy support from the teacher on autonomous motivation ($\beta = .11$, BC CI_{95} = .07–.16, $p <$ .001) via perceived competence after removing perceived autonomy as a mediator. The role of perceived relatedness as a mediator was not tested as it did not significantly predict autonomous motivation. However, significant direct effect of perceived autonomy support from the teacher on autonomous motivation also emerged ($\beta = .25$, $p < .001$). This indicated that any mediation of the effect of perceived autonomy support from the PE teacher on autonomous motivation would be partial, supported thus the Hypothesis 3 only partially. Therefore, the total effect of perceived autonomy support from the PE teacher on autonomous motivation (total effect, $\beta = .44$, $p < .001$) was both direct and indirect via perceived satisfaction of the needs for autonomy and competence.

Hypotheses 4. As expected, autonomous motivation towards PE ($\beta = .12$, $p < .01$) had significant direct effect on physical global self-esteem.

Hypothesis 5. Physical global self-esteem significantly predicted HRQoL ($\beta = .39$, $p < .001$) and global self-esteem ($\beta = .61$, $p < .001$) at Time 1, as hypothesized.

Hypothesis 6. It was expected that physical global self-esteem would mediate the effect of autonomous motivation towards PE on HRQoL and global self-esteem at Time 1. Results indicated that the indirect effects of autonomous motivation towards PE on HRQoL ($\beta = .05$, $p < .01$) and global self-esteem ($\beta = .08$, $p < .01$) at Time 1 were significant. However, there were also significant direct effects of autonomous motivation towards PE on HRQoL ($\beta = .22$, $p < .001$) and global self-esteem ($\beta = .11$, $p <$

.01) at Time 1. This resulted in total effects of autonomous motivation towards PE on HRQoL (total effect, β = .27, $p < .001$) and global self-esteem (total effect, β = .18, $p < .001$) at Time 1, indicated that any mediation of the effect of autonomous motivation towards PE on HRQoL and global self-esteem at Time 1 would be partial. The Hypothesis 6 was thus supported only partially.

Hypotheses 7. As hypothesized, perceived satisfaction of the need for competence (β = .54, $p <$ .001) had direct effect on global physical self-esteem.

Hypothesis 8. Accordance with the hypothesis, a significant indirect effect of perceived competence satisfaction on global physical self-esteem (β = .04, $p < .01$) was also followed, indicated that the total effect of perceived competence on global physical self-esteem (total effect, β = .58, $p < .001$) was both direct and indirect via autonomous motivation towards PE.

Hypothesis 9. As expected, the perceived satisfaction of the need for relatedness in PE had direct effect (β = .13, $p < .001$) on HRQoL at Time 1. Since the expected direct effect of perceived relatedness in PE on HRQoL at Time 1 was supported, separate tests were conducted in order to specify the route most responsible for the significant indirect effects of perceived autonomy support from the teacher (β = .20, $p < .001$) and peers (β = .11, $p < .01$) on HRQoL at Time 1. Specifically, first the effect of perceived relatedness on HRQoL at Time 1 was fixed to zero to examine the indirect effect of perceived autonomy support from the teacher and peers via the route of perceived autonomy and competence, autonomous motivation, and global physical self-esteem. Then the effects of global physical self-esteem and autonomous motivation on HRQoL at Time 1 were fixed to zero, removing thus the indirect effects of perceived autonomy support from the teacher and peers on HRQoL at Time 1 via the route of perceived autonomy and competence, autonomous motivation, and global physical self-esteem, to examine the indirect effects of perceived autonomy support from the teacher and peers on HRQoL at Time 1 via the perceived relatedness in PE.

In terms of the indirect effect of perceived autonomy support from the PE teacher on HRQoL at Time 1, separate tests revealed the larger indirect effect (β = .19, BC CI_{95} = .14–.26, $p < .001$) via the

route of perceived autonomy and competence, autonomous motivation, and global physical self-esteem, relative to the indirect effect (β = .04, BC CI_{95} = .02–.08, $p < .001$) via the perceived relatedness. In terms of the indirect effect of perceived autonomy support from peers on HRQoL at Time 1, separate tests revealed significant indirect effect (β = .15, BC CI_{95} = .09–.23, $p < .001$) via the perceived relatedness, relative to the nonsignificant indirect effect (β = .04, BC CI_{95} = -.01–.09, $p > .05$) via the route of perceived competence and global physical self-esteem.

Hypothesis 10. In accordance with the hypothesis, there were significant bidirectional cross-lagged relationships among HRQoL and global self-esteem between three points in time over a six-month period. As shown in Figure 2, the cross-lagged effects among HRQoL and global self-esteem between Time 1 and Time 2 were relatively equal in terms of effect sizes (β = .13, $p < .001$ and β = .12, $p < .01$ for the effect from HRQoL at Time 1 to global self-esteem at Time 2 and the effect from global self-esteem at Time 1 to HRQoL at Time 2, respectively), whereas the cross-lagged effect of HRQoL at Time 2 on global self-esteem at Time 3 (β = .11, $p < .01$) was weaker than the reverse case of global self-esteem at Time 2 influencing HRQoL at Time 3 (β = .20, $p < .001$).

Discussion

The present study tested the model aimed to explain the relative roles of perceived autonomy support from the teacher and peers on students' overall well-being such as global physical self-esteem, global self-esteem and HRQoL through the motivational processes within PE.

Accordance with the hypothesis (Hypothesis 1), perceived autonomy support from both the teacher and peers positively predicted perceptions of the basic psychological needs satisfaction in PE. As regards to the effect of perceived autonomy support from the teacher, this is consistent with past work conducted in school PE (Barkoukis et al., 2010; Ntoumanis, 2005; Standage et al., 2005, 2006; Standage & Gillison, 2007; Standage et al., 2012). It should be noted, however, that the magnitude of the effects of perceived autonomy support from the teacher and peers on need satisfaction variables were different. Specifically, perceived autonomy support from the teacher had stronger effect on perceived satisfaction of the needs for competence and autonomy, whereas perceived autonomy support from peers had stronger

effect on perceived satisfaction of the need for relatedness. These findings are not surprising as children in this age rely more heavily on teacher's feedback as a source of their perceived competence in PE (Weiss, Ebbeck, & Horn, 1997). Furthermore, the teacher is the authority who is able to facilitate students' feelings of autonomy by including them into the decision-making processes. As pointed out by Koka (2013), the possible explanation for the weaker effect of perceived autonomy support from the teacher on perceived satisfaction of the need for relatedness, compared with peers, could be that it is rather rare to have really close relationships between teachers and students at this age.

Deviation from the hypothesis (Hypothesis 2), results indicated that perceived satisfaction of the need for relatedness did not contribute significantly to the formation of autonomous motivation, while perceived satisfaction of the need for autonomy and competence did, as expected. This finding, however, is not surprising as several past studies conducted in school PE have also demonstrated nonsignificant influence of perceived relatedness need satisfaction on autonomous motivation (Barkoukis, et al., 2010; Standage & Gillison, 2007; Standage et al., 2012). According to Standage et al. (2012), several factors may contribute to this nonsignificant relationship (e.g., a lack of measure assessing the relevant support for perceived relatedness in a PE context); the main reason for this, however, could be probably the more distal role of the need for relatedness in enhancing the autonomous motivation in PE compared with the needs for autonomy and competence (Deci & Ryan, 2000).

Results showed, however not entirely consistent with the hypothesis (Hypothesis 3), that perceived autonomy support from the teacher, but not from peers, had significant indirect effect on students' autonomous motivation through the satisfaction of the needs for autonomy and competence. This is consistent with previous studies showing that perceived autonomy support from the PE teacher increases need satisfaction of students which, in turn, facilitate formation of autonomous motivation towards activity (Barkoukis, et al., 2010; Ntoumanis, 2005; Standage, et al., 2005, 2006; Standage & Gillison, 2007; Standage et al., 2012). Similarly with previous work conducted in school PE (Cox et al., 2009), this study also demonstrated that in terms of motivational experiences in PE, students' relationships with their teachers are more important than relationships with their peers.

In addition to the significant indirect effect, perceived autonomy support from the teacher showed also a significant direct effect on autonomous motivation. The emergence of such a direct effect is not consistence with previous research (e.g., Barkoukis, et al., 2010; Ntoumanis, 2005; Standage, et al., 2005, 2006; Standage & Gillison, 2007; Standage et al., 2012) that have examined the influence of perceived autonomy support from the teacher on autonomous motivation in PE according to the tenets of SDT (Deci & Ryan, 2000). This finding suggests, however, that for the current sample, perceived autonomy support from the teacher influences autonomous motivation towards PE via two processes: direct, impulsive route and an indirect, reflective route via the mediation of satisfaction of the needs for autonomy and competence, as illustrated in recent research in a PE context (Koka & Hagger, 2010). One interpretation of these two routes may be that some students perceiving high degree of autonomy support from their teacher may subsequently form autonomous motives towards PE because of a high degree of satisfaction of the needs for autonomy and competence as indicated by the indirect, reflective route in the path model. Other students with high degree of perceived autonomy support from the teacher may form autonomous motivation towards PE without the conscious necessity of feeling a high degree of psychological need satisfaction as indicated by the direct, impulsive route in the path model.

In line with previous studies (e.g., Hein & Hagger, 2007; Standage & Gillison, 2007), autonomous motivation towards PE influenced global self-esteem and HRQoL directly. This provides further support for the notion that stable self-esteem and HRQoL will only be enhanced if individual's actions have been driven by autonomous or self-regulated reasons (Ryan & Deci, 2008; Standage et al., 2012). This study extends past work by demonstrating that global physical self-esteem acted as a mediator, although partial, of the relationship between autonomous motivation towards PE and (i) global self-esteem and (ii) HRQoL (Hypothesis 6). Accordingly, when interpreting the influence of autonomous motivation towards PE on students' global self-esteem and HRQoL, the effect of global physical self-esteem as a possible mediator should also be considered. This finding suggests that students who participate in PE with autonomous motivation will develop a higher global physical self-esteem which, in turn, will contribute to increased global self-esteem and HRQoL. The latter interpretation was based on the results of recent study by

Martín-Albo and colleagues (Martín-Albo, Núñez, Domínguez, León, & Tomás, 2012) who demonstrated in their longitudinal study that individuals who were intrinsically motivated towards leisure-time physical exercise tend to have a better physical self-perception, and consequently reported higher psychological well-being.

Consistent with results of the study by Standage et al. (2012), results of the present study also indicated that perceived satisfaction of the need for competence had both direct (Hypothesis 7) and indirect (Hypothesis 8) effects on global physical self-esteem via the autonomous motivation towards PE. These findings support the important role perceived competence need satisfaction plays in determining motivation towards PE as well as high level of global physical self-esteem. In other words, students who perform well in PE and have their need for competence to be satisfied, are more likely to form autonomous motives towards PE and have higher global physical self-esteem. Therefore, providing opportunities to satisfy the need for competence in PE could result in autonomous motives for participation in lessons, but more importantly, high level of global physical self-esteem.

According to the hypothesis (Hypothesis 9) and previous studies conducted in school PE (Standage & Gillison, 2007; Standage et al., 2012), perceived satisfaction of the need for relatedness had direct effect on students' HRQoL. Results further specified the mechanism or process by which perceived autonomy support from the teacher and peers in PE affect students' HRQoL. Results indicated that satisfaction of the need for relatedness alone was responsible for the mediation of the relationship between perceived autonomy support from peers and students' HRQoL, whereas the motivational sequence in PE including perceived satisfaction of the needs for autonomy and competence, autonomous motivation as well as global physical self-esteem was most responsible for the mediation of the relationship between perceived autonomy support from the teacher and HRQoL. The indirect effect of perceived autonomy support from the PE teacher on students' HRQoL via the proposed motivational sequence, but also via the perceived satisfaction of the need for relatedness, albeit marginal, is consistent with previous studies (Standage & Gillison, 2007; Standage et al., 2012). A reason why perceived autonomy support from peers in PE had an effect on students' HRQoL via the satisfaction of the need for

relatedness alone may be that autonomy support from significant others such as peers is more closely related to relatedness reasons or motives for engaging in PE (Hagger et al., 2009). Therefore, creating opportunities for students to interact and form relationships with many different students could result in enhanced feelings of relatedness in PE and, in turn, high level of HRQoL. The indirect effects of perceived autonomy support from the teacher and peers in PE on students' global self-esteem via the proposed motivational sequence are in line with previous studies conducted in school PE (e.g., Standage & Gillison, 2007).

Consistent with the final hypothesis (Hypothesis 10), results demonstrated that relationship between global self-esteem and HRQoL over time were reciprocal: higher levels of prior global self-esteem led to higher subsequent levels of HRQoL, and higher levels of prior HRQoL led to higher subsequent levels of global self-esteem. These results suggest that if intervention programs are design to enhance students' global self-esteem without promoting their HRQoL simultaneously, then the possible gains in global self-esteem are likely to be smaller. Further, if interventions are designed to enhance students' HRQoL without fostering their global self-esteem, then gains in HRQoL are also likely to be smaller.

Although results of the present study provided interesting and unique information about the relative influence of perceived autonomy support from the teacher and peers in PE on students' overall well-being, some caution should be exercised when interpreting the results. First, although the sample size was good at the beginning of the study, high attrition across the three data collection should be considered as a major limitation of the study. Second, perceived autonomy support from peers was assessed by simply rewording the items contained in adult-focused autonomy support questionnaire. Such an approach, however, may not tap the unique aspects of peer influence experienced by students (Chan, Lonsdale, & Fung, 2012; Vazou, Ntoumanis, & Duda, 2006). Although reliability of the 6-item scale of perceived autonomy support from peers has been supported (Viira & Koka, 2012) and, as suggested by Duda and Whitehead (1998), a common core of items should be developed to measure the relative influence of significant others in order to avoid interpretational difficulties, future studies would do well

to explore more thoroughly the specific aspects of autonomy-supportive behaviours from peers by conducting qualitative study. Third, results from this study are based entirely on data obtained from students' self-reports. Although caution should indeed be exercised when interpreting students' subjective ratings, researchers (e.g., Scriven, 1988) have argued that subjective ratings by students about learning environments and teachers' behaviours as well as themselves are comparatively valid. Fourth, because of the sophisticated path model and relatively small final sample size, composite rather than latent variables were used to analyse the data. This may have reduced the effect size of the paths. Future studies, therefore, should attempt to replicate the present findings with a larger sample to allow for the use of latent variables. Fifth, data of the present study, principally, are correlational in nature, which preclude the inference of causality. It is possible that students' motivation may affect the way teachers and their peers behave (Pelletier, Séguin-Lévesque, & Legault, 2002). Also, physical self-esteem may affect motivation as suggested by Amorose (2001). Furthermore, although the multiwave cross-lagged reciprocal effect model was used to examine interrelationship between students' global self-esteem and HRQoL over time, this still does not allow claiming that one is the cause of the other. Therefore, additional experimental tests are needed to better infer the causal nature of the proposed relationships. Sixth, the present study focused on explaining exclusively the influence of adaptive behaviours (i.e., autonomy support) from the teacher and peers on students' overall well-being through the motivational processes within PE. Recently, however, in order to obtain a more comprehensive insight into the psychological experiences of individuals in different social environments, researchers (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011) have examined the impact of adaptive and maladaptive (i.e., controlling) behaviours form supervisors on their subordinates' experiences of both need satisfaction and need thwarting and explored the differentiated effect of latter variables on well-being and ill-being outcomes. Future studies, striving to examine the relative influence of teacher and peers on students' health-related outcomes through the motivational processes within PE, would do well by including assessments of perceived autonomy-supportive and controlling behaviours as well as perceived need satisfaction and need thwarting. Finally, since this study was based on secondary school

students only from one Estonian city, the findings may not be generalizable to all secondary school students.

In conclusion, findings of the present study provided support to the previous PE studies indicated that perceived autonomy support from the teacher affects students' overall well-being such as global physical self-esteem, global self-esteem, and HRQoL through the proposed motivational sequence or processes within PE. Furthermore, results indicated that the significant indirect effect of perceived autonomy support from the PE teacher on students' overall well-being variables remained after controlling for the effect of perceived autonomy support from peers in PE. All in all, results showed that the indirect effect of perceived autonomy support from the teacher on students' overall well-being variables was stronger relative to the indirect effect of perceived autonomy support from peers.

From an applied perspective, PE teachers aiming to foster students' overall well-being including global physical self-esteem, global self-esteem, and HRQoL should adopt an autonomy-supportive teaching style. Teachers, thus, are encouraged to provide students with choices and options, acknowledge their feelings, provide the rationale for exercises, to include students into decision making, and provide quality feedback, all behaviours that are characterized as autonomy supportive (Reeve & Jang, 2006). Teachers are also encouraged to guide interaction between students so that this would facilitate their basic psychological need satisfaction, especially the need for relatedness which, in turn, would result in increased overall well-being. Students may benefit from teachers setting up cooperative tasks in small groups (Morgan & Carpenter, 2002). It is important to note that the present study indicated that perceptions of the physical global self-esteem partially mediated the "PE motivational processes–global self-esteem/ HRQoL" relationship. Practitioners, therefore, should consider facilitating first the domain specific perceptions of the self in order to enhance overall well-being of adolescents. Finally, cross-lagged bidirectional relationships between global self-esteem and HRQoL suggest researchers and healthcare professionals, when designing intervention programs, to strive improving simultaneously both global self-esteem and HRQoL to achieve the most effective results.

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Footnotes

[1] Preliminary data screening indicated that from those participants who had completed questionnaires at all three data collection waves, four had missing values in one or two variables. The Little's (1988) missing completely at random (MCAR) test indicated that the data were missing completely at random ($\chi^2 = 62.51$, df = 50, $p = .11$). The Expectation Maximization (EM) algorithm was implemented to impute the missing data.

[2] In line with the recommendation of Martens and Haase (2006), when analyzing a path model including cross-lagged reciprocal effects, alternative path models should be tested and compared against the baseline model (i.e., the hypothesized model depicted in Figure 1). In the first alternative model, the cross-lagged paths from HRQoL at Time 1 and 2 to global self-esteem at Time 2 and 3, respectively, were fixed to zero. Although this model provided an acceptable fit to the data [χ^2 (47) = 110.00, $p < .001$, CFI = .97, IFI = .97, NNFI = .96, RMSEA = .058, CI_{90} for RMSEA range = .044-.073], it did provide significantly worse fit to the data compared with the hypothesized model [χ^2_{diff} (2) = 15.27, $p < .001$]. In the second alternative model, the cross-lagged paths from global self-esteem at Time 1 and 2 to HRQoL at Time 2 and 3, respectively, were fixed to zero. Again, although this model also provided an acceptable fit to the data [χ^2 (47) = 122.24, $p < .001$, CFI = .97, IFI = .97, NNFI = .95, RMSEA = .064, CI_{90} for RMSEA range = .050-.078], it did provide significantly worse fit to the data compared with the hypothesized model [χ^2_{diff} (2) = 27.51, $p < .001$]. Finally, in the third alternative model, all the cross-lagged paths among global self-esteem and HRQoL between three points in time were fixed to zero, leaving only stability or horizontal effects (i.e., the regressions of the global self-esteem and HRQoL on themselves over time). This model provided also an acceptable fit to the data [χ^2 (49) = 144.39, $p < .001$, CFI = .96, IFI = .96, NNFI = .94, RMSEA = .070, CI_{90} for RMSEA range = .057-.084], but again significantly worse compared with the hypothesized model [χ^2_{diff} (4) = 49.66, $p < .001$]. Based on these results, the hypothesized model depicted in Figure 1 was deemed to be the best fitted model.

Table 1

Descriptive Statistics and Bivariate Correlations Among the Study Variables (N = 395)

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Autonomy support from teacher	(.86)												
2. Autonomy support from peers	.32	(.87)											
3. Autonomy need satisfaction	.56	.32	(.80)										
4. Competence need satisfaction	.34	.23	.48	(.89)									
5. Relatedness need satisfaction	.33	.61	.39	.39	(.93)								
6. Autonomous motivation	.45	.15	.47	.49	.24	-							
7. Global physical self-esteem	.23	.18	.33	.60	.27	.39	(.90)						
8. Health-related quality of life T1	.23	.24	.29	.41	.34	.40	.51	(.87)					
9. Global self-esteem T1	.22	.20	.28	.46	.34	.34	.66	.57	(.85)				
10. Health-related quality of life T2	.14	.14	.17	.29	.23	.33	.41	.63	.44	(.89)			
11. Global self-esteem T2	.19	.14	.23	.40	.28	.33	.57	.49	.71	.51	(.87)		
12. Health-related quality of life T3	.07	.12	.12	.26	.21	.29	.39	.50	.38	.65	.48	(.93)	
13. Global self-esteem T3	.17	.14	.21	.33	.27	.35	.49	.45	.62	.43	.68	.53	(.88)
Mean	4.11	4.55	3.91	5.17	4.90	5.07	4.64	72.50	4.64	73.05	4.69	71.03	4.63
Standard deviation	1.22	1.28	1.44	1.38	1.37	9.41	.96	12.55	.85	13.07	.83	15.90	.93
Skewness	-.03	-.30	-.03	-.72	-.60	-.59	-.72	-.43	-.79	-.34	-.80	-.88	-.72
Kurtosis	-.41	-.48	-.74	-.04	-.04	.20	.62	.44	.67	-.04	.49	1.76	.22

Note. Bivariate correlations of .12 and above are significant at the $p < .05$; bivariate correlations of .14 and above are significant at the $p < .01$; Cronbach alphas for each subscale are presented on the diagonal in parentheses; T1 = first data collection (Time 1); T2 = second data collection (Time 2); T3 = third data collection (Time 3).

Table 2

Standardized Parameter Estimates of Indirect Effects (N = 395)

Parameter	β (CI_{95} lower, upper)	Parameter	β (CI_{95} lower, upper)	Parameter	β (CI_{95} lower, upper)
PAS-Teacher→Motivation	.20*** (.14, .27)	Autonomy→HRQoL T1	.06*** (.03, .10)	Relatedness→GSE T2	.01 (-.01, .04)
PAS-Teacher→GPSE	.21*** (.14, .28)	Autonomy→GSE T1	.04*** (.01, .08)	Relatedness→HRQoL T3	.04* (.01, .08)
PAS-Teacher→HRQoL T1	.20*** (.15, .27)	Autonomy→HRQoL T2	.04*** (.02, .06)	Relatedness→GSE T3	.02 (-.00, .04)
PAS-Teacher→GSE T1	.18*** (.12, .24)	Autonomy→GSE T2	.03*** (.01, .06)	Motivation→HRQoL T1	.05** (.01, .09)
PAS-Teacher→HRQoL T2	.13*** (.09, .18)	Autonomy→HRQoL T3	.03*** (.01, .05)	Motivation→GSE T1	.08** (.02, .14)
PAS-Teacher→GSE T2	.14*** (.09, .19)	Autonomy→GSE T3	.02*** (.01, .04)	Motivation→HRQoL T2	.18*** (.12, .24)
PAS-Teacher→HRQoL T3	.10*** (.07, .14)	Competence→GPSE	.04** (.01, .08)	Motivation→GSE T2	.15*** (.08, .22)
PAS-Teacher→GSE T3	.10*** (.07, .14)	Competence→HRQoL T1	.30*** (.24, .37)	Motivation→HRQoL T3	.13*** (.08, .18)
PAS-Peer→Motivation	.07 (-.01, .15)	Competence→GSE T1	.39*** (.32, .46)	Motivation→GSE T3	.11*** (.06, .17)
PAS-Peer→GPSE	.08* (.01, .15)	Competence→HRQoL T2	.22*** (.16, .27)	GPSE→HRQoL T2	.29*** (.22, .37)
PAS-Peer→HRQoL T1	.11** (.03, .18)	Competence→GSE T2	.29*** (.23, .34)	GPSE→GSE T2	.44*** (.36, .52)
PAS-Peer→GSE T1	.05 (-.00, .10)	Competence→HRQoL T3	.17*** (.13, .22)	GPSE→HRQoL (T3)	.25*** (.19, .31)
PAS-Peer→HRQoL T2	.07** (.02, .11)	Competence→GSE T3	.20*** (.15, .26)	GPSE→GSE T3	.31*** (.24, .38)
PAS-Peer→GSE T2	.04* (.01, .08)	Relatedness→GPSE	-.00 (-.02, .01)	HRQoL T1→HRQoL T3	.33*** (.24, .42)
PAS-Peer→HRQoL T3	.05** (.01, .08)	Relatedness→HRQoL T1	-.01 (-.04, .02)	HRQoL T1→GSE T3	.14*** (.05, .23)
PAS-Peer→GSE T3	.04* (.01, .07)	Relatedness→GSE T1	-.00 (-.03, .02)	GSE T1→HRQoL T3	.19*** (.11, .28)
Autonomy→GPSE	.03** (.01, .06)	Relatedness→HRQoL T2	.07* (.01, .13)	GSE T1→GSE T3	.41*** (.33, .50)

Note. Standardized beta coefficients are presented with bootstrap-generated bias-corrected 95% confidence intervals. PAS-Teacher = perceived autonomy support from teacher; PAS-Peer = perceived autonomy support from peers; Autonomy = autonomy need satisfaction; Competence = competence need satisfaction; Relatedness = relatedness need satisfaction; Motivation = autonomous motivation; GPSE = global physical self-esteem; GSE = global self-esteem; HRQoL = health-related quality of life; T1 = first data collection (Time 1); T2 = second data collection (Time 2); T3 = third data collection (Time 3); *$p < .05$; **$p < .01$, ***$p < .001$.

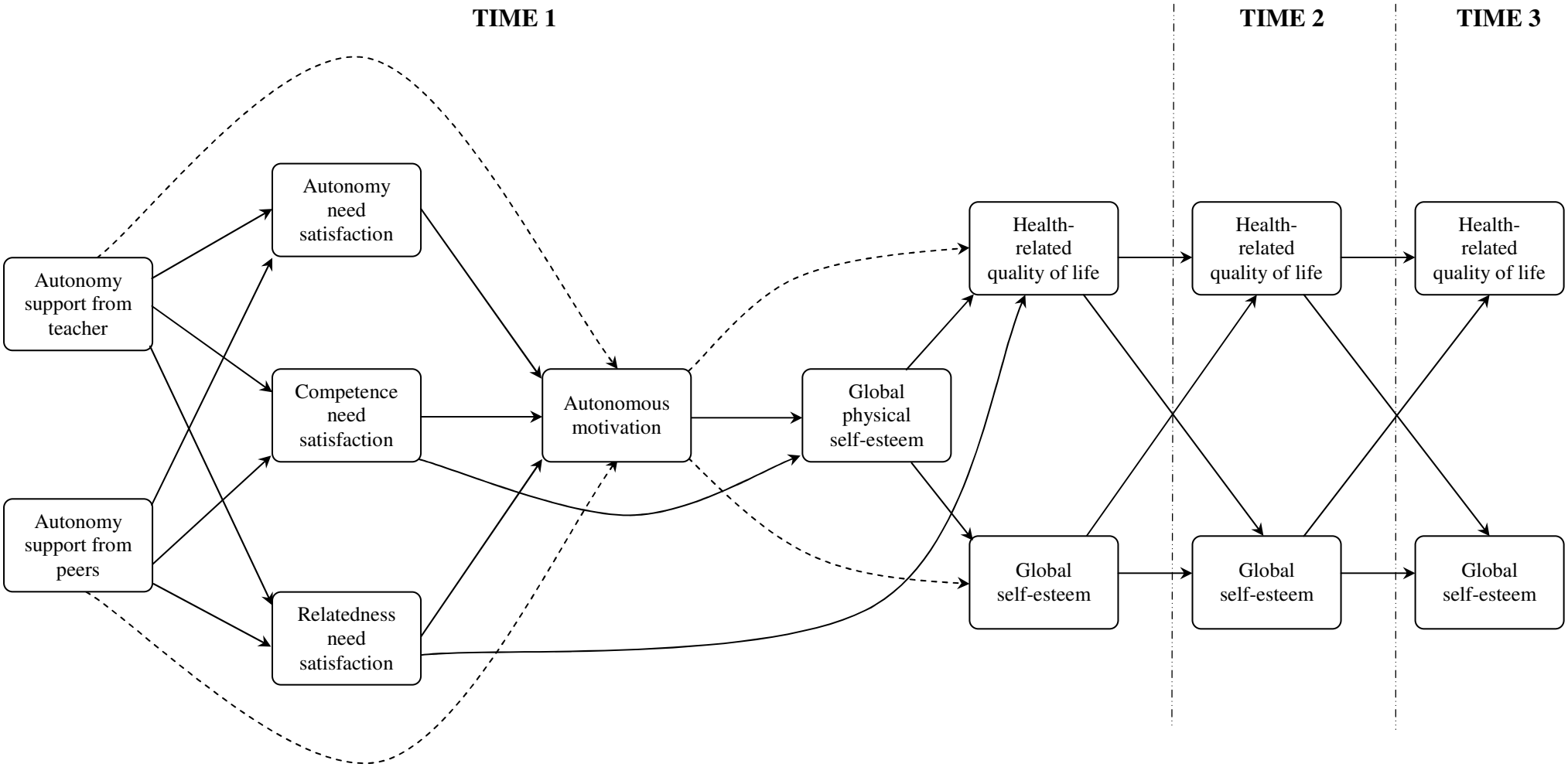

Figure 1. Hypothesized path-analytic model. For clarity, error covariances among perceived competence, autonomy, and relatedness need satisfaction variables as well as health-related quality of life and global self-esteem at all three points in time are omitted. Broken lines indicate paths set to be free in order to test indirect and mediation effects.

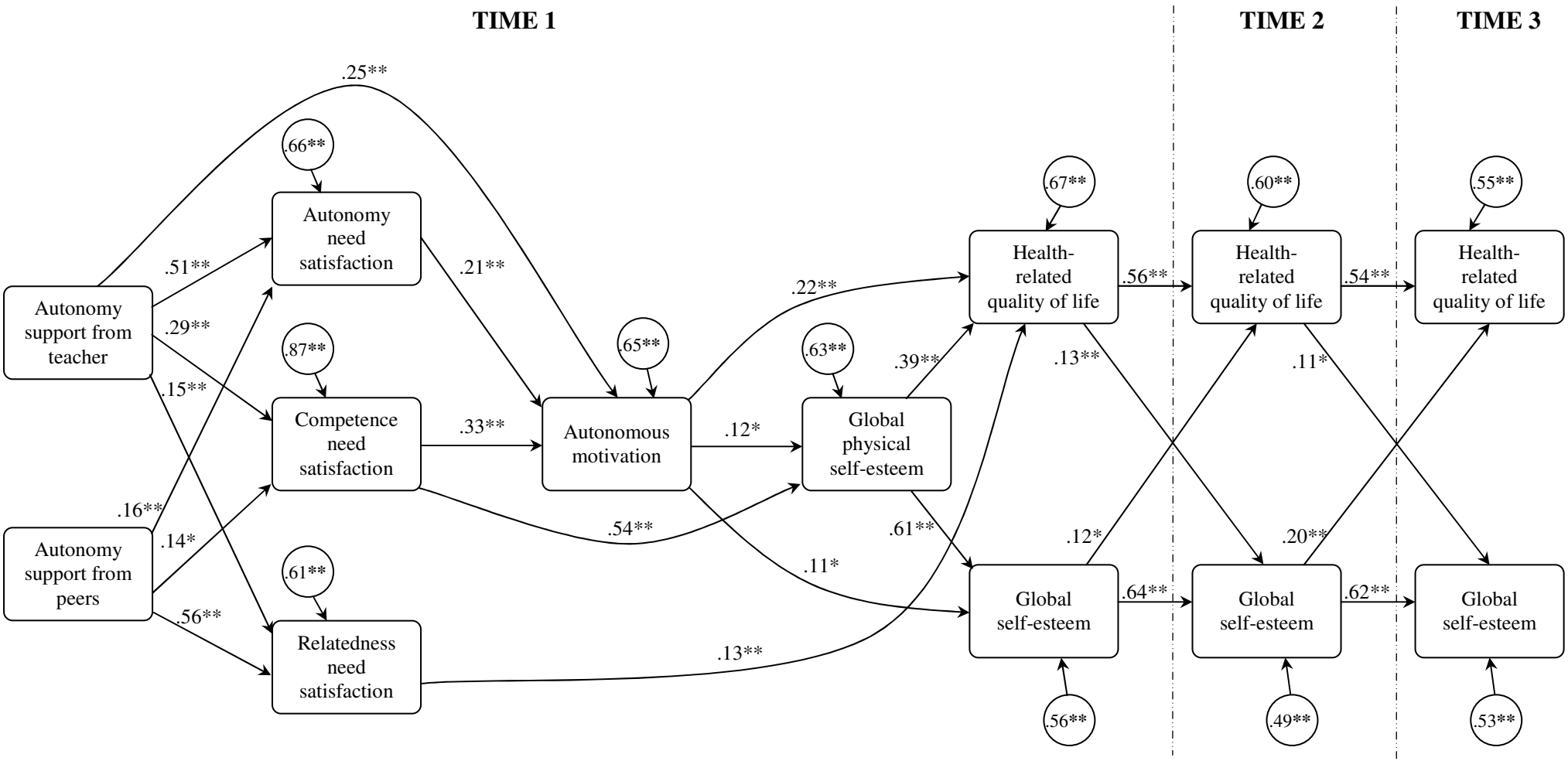

Figure 2. Standardized parameter estimates for the path-analytic model ($N = 395$). Nonsignificant paths as well as error covariances among perceived competence, autonomy, and relatedness need satisfaction variables as well as health-related quality of life and global self-esteem at all three points in time are omitted. Covariances of the error terms were as follows: $r_{\text{competence - autonomy}} = .35^{**}$, $r_{\text{autonomy - relatedness}} = .20^{**}$, $r_{\text{competence - relatedness}} = .29^{**}$, $r_{\text{health-related quality of life at Time 1 - global self-esteem at Time 1}} = .32^{**}$, $r_{\text{health-related quality of life at Time 2 - global self-esteem at Time 2}} = .29^{**}$, $r_{\text{health-related quality of life at Time 3 - global self-esteem at Time 3}} = .28^{**}$. $^{*}p < .01$, $^{**}p < .001$.