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The Temporal Relations of Adolescents' Basic Need Satisfaction in Physical Education and
Global Self-Worth

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Abstract

This study investigates the temporal relations of adolescents' basic need satisfaction in physical education (PE) and global self-worth in a sample of 3398 lower and upper secondary school students (49 % boys, 51 % girls, average age $T1 = 15.00$, $SD = 1.79$). Four models and competing hypotheses were tested, and the model with bidirectional paths specified showed the best fit to the data. The bidirectional effect estimates suggest that basic need satisfaction in PE predicts global self-worth development, but also that adolescents' perceptions of global self-worth predict the degree to which they experience basic need satisfaction in PE. Findings could suggest that students with low global self-worth are less sensitive to basic need support in PE. These students may need personally tailored need supportive initiatives in order to develop basic need satisfaction in PE and thus, global self-worth through PE.

Key words: self-determination theory, basic psychological needs, self-esteem, psychological wellbeing, PE, direction of effects

The Temporal Relations of Adolescents' Basic Need Satisfaction in Physical Education and Global Self-Worth

Global self-worth is described as an overall evaluation of one's worth or value as a person (Harter, 2006) and a general sense of happiness with the way one is as a human being (Harter, 2012). Besides commonly being referred to as global self-worth (Harter, 2006), this overall sense of personal worthiness is also often referred to as global self-esteem (Harter, 2006; Rosenberg, 1979) or general self-concept (Marsh & Jackson, 1986; Shavelson, Hubner, & Stanton, 1976) in the research literature, which often applies these terms interchangeably (Harter, 2006). Theoretically, perceptions of global self-worth are considered to be socially constructed, meaning that global self-worth may be either supported or undermined based on how individuals experience and interact with the social world around them (Harter, 2006). However, scholars also argue that global self-worth may affect how individuals experience and interact with the social contexts of their everyday lives (e.g., Bos, Huijding, Muris, Vogel, & Biesheuvel, 2010; Bum & Jeon, 2016; Singh & Pathak, 2017; Sowislo & Orth, 2013). As such, the literature does not only suggest that experiences of, and interactions with, social contexts may influence peoples' development of global self-worth (Lerner, Lewin-Bizan, & Warren, 2011), but also that global self-worth may influence how people experience and interact with the social contexts in which they participate.

Previous research has suggested that participation in contexts involving bodily expression and interaction predicts positive global self-worth among adolescents (Haugen, Säfvenbom, & Ommundsen, 2011; Slutzky & Simpkins, 2009; Taliaferro, Rienzo, Miller, Pigg, & Dodd, 2010). Participation in movement contexts is typically theorised to relate to global self-worth through domain specific self-perceptions, (e.g., physical, social, and academic self-concept; Crocker, Kowalski, & Hadd, 2008; Fox, 1997, 2000b; Harter, 2006), which are considered more closely related to motivation for specific types of behavior

(Crocker et al., 2008). Such a link has also been empirically supported in a large body of research (e.g., Fox, 2000a; Garn, McCaughy, Martin, Shen, & Fahlman, 2012; Haugen et al., 2011; Slutzky & Simpkins, 2009). Among the domain specific self-perceptions, physical self-concept has been identified as particularly important to the global self (Crocker et al., 2008). Thus, the abovementioned literature suggests that movement contexts central to adolescents' daily lives, including school physical education (PE), may be arenas for the promotion of positive global self-worth development.

However, the link between participation in PE and positive global self-worth cannot be understood without consideration of adolescents' experiences as they take part in the PE subject (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019) and thus, this link should not be taken for granted (Agans, Säfvenbom, Davis, Bowers, & Lerner, 2013; Faulkner & Tamminen, 2016). From the perspective of Self-Determination Theory (SDT; Ryan & Deci, 2017), a potential relationship between participation in PE and indicators of wellbeing – such as global self-worth – requires consideration of adolescents' experience of basic psychological need satisfaction in PE class. SDT maintains that experiences of basic need satisfaction promote intrinsic motivation, internalization and integration of behavioural regulations, and ultimately, feelings of vitality and wellbeing (Ryan & Deci, 2017). Theoretically, the study of basic psychological need satisfaction may therefore be key to our understanding of adolescents' global self-worth development in movement contexts like PE.

Nonetheless, while SDT researchers typically have hypothesized that basic psychological need satisfaction in the context of PE promotes students' sense of global self-worth (e.g., Erdvik, Haugen, Ivarsson & Säfvenbom, 2019; Garn et al., 2012; Standage & Gillison, 2007), there is also theory (e.g., Harter, 2006; Lerner et al., 2011) to support arguments that students' sense of global self-worth may influence how they relate to the PE context, and thus their perceptions of basic psychological need satisfaction in class. Drawing

on Competence Motivation Theory (Harter, 2006; Harter, Fischer, Harter, & Serwator, 1999) and SDT's sub-theory on basic psychological needs (Ryan & Deci, 2017), this study aims to extend our knowledge of the relationship between students' basic psychological need satisfaction in PE and global self-worth through the examination of temporal relations. More specifically, this study investigates global self-worth as both a consequence and an antecedent of adolescents' basic need satisfaction in PE.

Self-Determination Theory

Several theories have been developed to aid the understanding of how experiences in various facets of life may influence human development and thriving, and one such theory is SDT. SDT describes interpersonal and contextual influences on human cognition and behaviour (Ryan & Deci, 2017). A central aspect of this theory is the existence of three basic psychological human needs for autonomy, competence, and relatedness, which apply across cultures, contexts, demographics, and developmental epochs (Ryan & Deci, 2017). These basic psychological needs include the need to experience a sense of volition and psychological freedom (need for autonomy), the need to experience mastery through interaction with the social environment (need for competence), and the need to belong and feel connected with others (need for relatedness; Ryan & Deci, 2017). Because social contexts have different characteristics they will also vary in their ability to support these three basic psychological needs. Early experience with social contexts that consistently support or undermine basic need satisfaction is theorized to manifest in different forms of causality orientations reflecting individual differences in how people relate to their social environments (Ryan & Deci, 2017). Together, contextual characteristics and individual differences are considered to explain variation in basic psychological need satisfaction, which again produces differences in peoples' prerequisites for psychological growth and wellbeing (Ryan & Deci, 2017) and thus, global self-worth development (Fox, 1997, 2000a, 2000b; Harter et al., 1999).

Researchers have investigated basic psychological need satisfaction at various levels of generality (episodic, context specific, and global level; Milyavskaya, Philippe, & Koestner, 2013) in relation to several indicators of wellbeing (e.g., subjective vitality, life satisfaction, global self-worth; Adie, Duda, & Ntoumanis, 2012; Garn et al., 2012; Leversen, Danielsen, Birkeland, & Samdal, 2012). The importance of the physical self to perceptions of global self-worth has led researchers to develop interest in the ability of movement contexts to support global self-worth and the potential role of basic need satisfaction in such a relationship. However, the vast majority of this research generally aligns with the logic that global self-worth is a consequence of basic psychological need satisfaction experienced by adolescents as they participate in these movement contexts.

The Global Self-Worth Consequence Model

In line with the tenets of SDT, researchers have identified general basic psychological need satisfaction as positively related to global self-worth among adults (Deci et al., 2001), young adults (León & Núñez, 2013), and adolescents (Demirtaş, Yıldız, & Baytemir, 2017). However, general and contextual basic need satisfaction have been identified as independent contributors to adolescents' general well-being (Milyavskaya et al., 2013), and the specific relations between basic need satisfaction in PE and adolescents' global self-worth has not received much attention in the research literature. Nevertheless, three studies have identified a positive cross-sectional relationship between secondary school students' basic need satisfaction in PE and perceptions of global self-worth (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019; Garn et al., 2012; Standage & Gillison, 2007). These studies suggest that basic need satisfaction in PE may, in line with the logic of the global self-worth consequence model, affect adolescents' global self-worth. Given that PE typically constitutes a mandatory school subject and a movement context central to adolescents' daily lives, researchers have argued that PE has a unique potential in terms of promoting positive global self-worth among

all adolescents. In fact, a cross sectional study from the current project identified a stronger association between basic need satisfaction in PE and global self-worth than basic need satisfaction in leisure-time movement contexts and global self-worth (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019). Such findings could serve to suggest that PE holds a special place in supporting positive global self-worth development among adolescents. However, as the direction of effects in this relationship has not yet been tested, this precludes any conclusions as to whether global self-worth is a consequence or an antecedent of changes in basic need satisfaction in PE.

The Global Self-Worth Antecedent Model

While global self-worth may be a consequence of adolescents' experience of basic psychological need satisfaction in PE, another possible explanation for the identification of a positive cross-sectional relationship between these variables is that adolescents who perceive themselves more positively (i.e., report higher levels of global self-worth) perceive and interact with their social environment in a way that secures more basic need satisfaction in PE. A vast body of research shows that low levels of global self-worth is associated with susceptibility to depression (Bos et al., 2010; Bum & Jeon, 2016; Sowislo & Orth, 2013; Steiger, Allemann, Robins, & Fend, 2014), risk of suicide (Sharaf, Thompson, & Walsh, 2009; Singh & Pathak, 2017), anxiety (Bos et al., 2010; Sowislo & Orth, 2013), and eating disorders (Bos et al., 2010) – mental states that are known to affect peoples' perceptions of themselves and their social environments, and subsequently how these people behave and interact with the social world. SDT theorizes that individual characteristics such as causality orientations may affect the effectiveness of peoples' interactions with their social environments, something which is considered to reflect on their experiences of basic psychological need satisfaction (Ryan & Deci, 2017). Research has indicated that autonomous causality orientations are positively associated with intrinsic motivation, self-esteem, vitality,

and life satisfaction (Deci & Ryan, 1985; Ryan & Deci, 2017; Solberg, Halvari, & Ommundsen, 2013), whereas impersonal causality orientations predict feelings of anxiety, incompetence, and lack of control. As such, it could be that adolescents with high global self-worth experience the PE context more favourably in terms of basic psychological need satisfaction because they relate to PE in a more autonomy-oriented way. This reasoning may support the global-self-worth antecedent model, in which global self-worth is hypothesized to affect the degree to which adolescents experience basic psychological need satisfaction in PE.

However, drawing on a process-relational understanding of adolescent development, it is possible that global self-worth should not be viewed as either a consequence or an antecedent of basic need satisfaction in PE: The relationship between these variables may also be understood as processual and bidirectional.

The Bidirectional Model of Basic Need Satisfaction in PE and Global Self-Worth

Drawing on a process-relational approach to human development, global self-worth may be considered to develop through bidirectional and mutually influential relationships between individuals' sense of global self-worth and individuals' perceptions of everyday social contexts (Overton & Lerner, 2014). A bidirectional model of global self-worth development acknowledges that basic need satisfaction in PE may support adolescents' global self-worth development (in line with the global self-worth consequence model) at the same time as adolescents' perceptions of global self-worth may lead them to perceive the PE environment more basic need satisfying (in line with the global self-worth antecedent model). While existing research has paid limited attention to the temporal ordering of basic psychological need satisfaction in PE and global self-worth (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019; Garn et al., 2012; Standage & Gillison, 2007), the longitudinal relations between general basic psychological need satisfaction and global self-worth has been investigated by León and Núñez (2013) using a sample of young adults. In their study, general

competence need-satisfaction and general relatedness need-satisfaction were identified as significant predictors of global self-worth, yet global self-worth was not identified as a significant predictor of general competence need-satisfaction or general relatedness need-satisfaction (León & Núñez, 2013). However, the measure of basic psychological need satisfaction applied in their study was not specific to PE, and the study was based on between-person analyses. The use of between-person analyses to investigate temporal effects can increase the risk of erroneous findings due to the inability to separate within- and between-person effects (Hamaker, Kuiper, & Grasman, 2015).

Research Questions

As shown above, prior research has identified a significant association between basic psychological need satisfaction in PE and global self-worth (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019; Garn et al., 2012; Standage & Gillison, 2007), yet the cross-sectional nature of former analyses prevents a determination of whether and how these variables relate across time. While Standage and Gillison (2007) studied the relationship between basic psychological need satisfaction in PE and global self-worth across two time points, they did not address the issue of temporality and have called for longitudinal studies that may provide more insight into this relationship. Such knowledge may not only make an important contribution to the field of exercise and health psychology (Standage & Gillison, 2007), it may also have important pedagogical implications.

Schools have an important role in preparing students for later life, and the educational authorities in many countries consider schools to be central in the promotion of students' mental health and wellbeing (e.g., Australian Department of Education, n.d.; British Department for Education, 2016; Skollag [the Swedish Education Act], 2010; Utdanningsdirektoratet [Norwegian Directorate for Education and Training], 2015). Knowledge about factors that may contribute to global self-worth

development in school is therefore necessary. Physical education is a subject included in the national curricula of many nations and represents a subject that is considered to contribute positively to adolescents' global self-worth development (e.g., Standage & Gillison, 2007; Whitehead & Corbin, 1997). While adolescents' basic need satisfaction in PE has been linked to their sense of global self-worth (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019; Garn et al., 2012; Standage & Gillison, 2007), the direction of effects in this relationship has gained limited attention in prior research. This study therefore aims to further investigate these proposed relations by applying a longitudinal design to test the temporal relations between adolescents' basic psychological need satisfaction in PE and global self-worth. Based on the recommendations for statistical testing of temporal effects (Hamaker et al., 2015) we will also apply an approach where these effects are specified on the within-person level. In line with this aim, four models and competing hypotheses were tested:

(H1) Autoregressive model: Basic need satisfaction in PE does not predict global self-worth, and global self-worth does not predict basic need satisfaction in PE.

(H2) Global self-worth consequence model: Basic psychological need satisfaction in PE predicts global self-worth, but global self-worth does not predict basic need satisfaction in PE.

(H3) Global self-worth antecedent model: Global self-worth predicts basic need satisfaction in PE, but basic need satisfaction in PE does not predict global self-worth.

(H4) Bidirectional model: There is a bidirectional relationship between basic need satisfaction in PE and global self-worth: Basic need satisfaction in PE predicts global self-worth and global self-worth predicts basic need satisfaction in PE.

Methods

Participants

The original sample comprised two birth cohorts of altogether 3496 adolescents who

participated in annual data collections during the months from March to May across three consecutive school years (2013-2015). Among these adolescents, 2854 also provided cross-sectional (T1) data for a previously published study (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019). Among the participants in this longitudinal study, 98 adolescents did not provide information on basic need satisfaction in PE or global self-worth and the final sample therefore comprised 3398 adolescents: 50 % born in 2000 (first year of lower secondary school at T1), 50 % born in 1997 (first year of upper secondary school at T1), 51 % girls, and 49 % boys. Participants were students from 44 different schools located in four different counties of Norway. The sample was drawn according to a cluster sampling procedure, with schools as the basic unit, and schools were stratified according to region, study program, number of students and centrality.

Data Collection

Data was collected in the schools during regular school hours by means of electronic questionnaires. Adolescents used approximately 60-90 minutes to complete the survey and a project researcher was present to answer potential questions. Permissions to conduct the study were received from the school principals and the Norwegian Centre for Research Data (NSD; further ethics approval was not required as per applicable institutional and national guidelines and regulations). Participation was voluntary and adolescents were free to withdraw from the study at any time. In agreement with the recommendation of NSD, written informed parental consent was ensured for all adolescents under the age of 15, while older adolescents were included based on independent written informed consent.

Instruments

Global self-worth. Adolescents' sense of global self-worth was assessed using a subscale from the Norwegian revised version (Wichstrøm, 1995) of Harter's Self-Perception Scale for Adolescents (SPPA; Harter, 1988). In keeping with Wichstrøm's (1995) revised

version, the global self-worth subscale was based on five different statements designed to tap into participants' sense of global self-worth (e.g., "I am often disappointed about myself"), and responses were anchored on a Likert scale from 1 (*describes me very poorly*) to 4 (*describes me very well*; Wichstrøm, 1995). Two contra-indicative items were reversed before mean scores for each of the three time points were computed. The global self-worth subscale showed high levels of internal consistency at each time point (α T1 = .84, α T2 = .81, α T3 = .82).

Basic need satisfaction in PE. Basic psychological need satisfaction in PE was measured using the 12-item Basic Psychological Needs in Exercise Scale (BPNES; Vlachopoulos & Michailidou, 2006) adapted for use in a PE context. Participants' sense of autonomy (e.g., "Physical Education classes are in agreement with my choices and interests"), competence (e.g., "I feel that I have made a lot of progress in relation to the objective of physical education") and relatedness (e.g., "I feel very comfortable with the students in PE") was assessed across three time points, rated on a Likert scale ranging from 1 (*totally disagree*) to 7 (*very strongly agree*). Theoretically, the three basic psychological needs are considered interdependent, and they were thus expected to operate convergently (Ryan & Deci, 2017). Former research on adolescents has shown that people in this age group do not distinguish between the different needs and tend to perceive need satisfaction globally (Katz, Kaplan, & Buzukashvily, 2011). Thus, in line with other researchers (e.g., Akkerman, Kef, & Meininger, 2017; Gagne, Ryan, & Bargmann, 2003), analyses for this study were based on measures of overall basic need satisfaction, and data were not forced to provide psychometric independence. BPNES showed high levels of internal consistency at each time point (α T1 = .95, α T2 = .95, α T3 = .95).

Statistical Analyses

Descriptive statistics were computed using IBM SPSS 24 (version 24, Armonk, NY: IBM Corp), while bivariate unconditional latent curve models with structured residuals (LCM-SR; P. J. Curran, Howard, Bainter, Lane, & McGinley, 2014) were performed using the MLR estimator in Mplus (version 7.0, Muthén & Muthén, 1998-2015, Los Angeles, CA; see figure 1). This structural equation (SEM) model allows for the simultaneous assessment of within-person relations between basic need satisfaction and global self-worth over time (P. J. Curran et al., 2014). More specifically, the between-subject variance is captured in the specified latent curve model, leaving the specified temporal relationship between the two variables on the within-subject level. In line with the aim of this study, four temporal models and competing hypotheses were assessed. According to P. J. Curran et al. (2014, p. 890), “this allows for the unambiguous evaluations of each side of the reciprocal effects by considering them one at a time”. In all of the four models the intercept and slope factors of basic need satisfaction in PE and global self-worth were estimated and allowed to covary. In the autoregressive model (H1), only autoregressive effects for the residuals of basic need satisfaction in PE and global self-worth were modelled. In the global self-worth consequence model (H2), the autoregressive effects were supplemented with within-subject cross-lagged effects, modelled by means of phantom variables, with the residual of global self-worth being regressed on the residual of basic need satisfaction in PE. With respect to the global-self-worth antecedent model (H3), the autoregressive effects were supplemented with within-subject cross-lagged effects modelled in the opposite direction, with the residual of basic need satisfaction in PE regressed on the residual of global self-worth. In the bidirectional model (H4, as illustrated in figure 1), the autoregressive effects were supplemented with within-subject cross-lagged effects modelled in both directions, regressing the residual of basic need satisfaction in PE on the residual of global self-worth while at the same time regressing the

residual of global self-worth on the residual of basic need satisfaction in PE. Model selection indices and model fit indices were compared to evaluate model fit across the four models, and the model that showed the best fit to the data was retained. The model selection indices used were the Akaike information criterion (AIC), and the Bayesian information criterion (BIC). The model fit indices used for the purpose of this study were the Root Mean Square Error of Approximation (RMSEA), the Comparative-fit index (CFI), the Tucker-Lewis index (TLI), and the Standardized Root Mean Square Residual (SRMR). In terms of AIC and BIC, lower values indicate improved model fit (Byrne, 2013). In terms of the model fit indices, RMSEA below .05 (Browne & Cudeck, 1993, in Byrne, 2013), CFI above .95 (Hu and Bentler, 1999, in Byrne, 2013), TLI above .95 and SRMR below .05 (Byrne, 2013) were considered indicative of good model fit. For all analyses, a p -value $< .05$ was considered to indicate a statistically significant result.

FIGURE 1 IN ABOUT HERE

Results

Descriptive statistics from the study sample are shown in table 1. In terms of basic need satisfaction in PE at different measurement points, Pearson's bivariate correlations ranged from .48 - .60 ($ps < .01$). Correlations between the measures of average global self-worth at different time points ranged from .56 - .64 ($ps < .01$). Correlations between the measures of average basic need satisfaction in PE and global self-worth at different time points ranged from .28 - .41 ($ps < .01$).

TABLE 1 IN ABOUT HERE

With respect to the temporal relationships between the two constructs, the bidirectional model provided the best fit to the data in terms of both model selection indices (AIC = 28876.985, BIC = 28975.080, see table 2). The bidirectional model also yielded the best model fit indices, with $\chi^2 95.38$, $df = 11$, $p = < .001$, RMSEA = .048 (90 % CI = [.039,

.057]), CFI = .967, TLI = .995, and SRMR = .040, indicating good model fit to the data (Byrne, 2013). Thus, the autoregressive model (H1), the global self-worth consequence model (H2) and the global self-worth antecedent model (H3) were rejected, while the bidirectional model of basic need satisfaction in PE and global self-worth (H4) was retained.

TABLE 2 IN ABOUT HERE

In the bidirectional model, small statistically non-significant negative between-subject slopes for basic psychological need satisfaction in PE and global self-worth were identified (BPN: $\Delta = -.013$, $SE = .017$, $p = .431$; GSW: $\Delta = -.012$, $SE = .008$, $p = .116$; see table 3). Intercepts for basic need satisfaction in PE and global self-worth were both significantly different from zero (BPNi: $M = 4.767$, $SE = 0.025$, $p < .001$; GSWi: $M = 2.968$, $SE = .013$, $p < .001$). On the within-person level, statistically significant cross-sectional correlations between basic need satisfaction in PE and global self-worth were identified at each of the three time points (T1: $r = .410$, $SE = .020$, $p < .001$; T2: $r = .216$, $SE = .020$, $p < .001$; T3: $r = .228$, $SE = .022$, $p < .001$). We also identified statistically significant autoregressive effects for basic psychological need satisfaction in PE (BPN_{T1-T2}: $\beta = .572$, $SE = .021$, $p < .001$; BPN_{T2-T3}: $\beta = .602$, $SE = .021$, $p < .001$) and global self-worth (GSW_{T1-T2}: $\beta = .618$, $SE = .015$, $p < .001$; GSW_{T2-T3}: $\beta = .615$, $SE = .016$, $p < .001$). Last, all cross-lagged effects were statistically significant, showing that basic psychological need satisfaction in PE at T1 predicted global self-worth at T2 ($\beta = .079$, $SE = .016$, $p < .001$), that basic psychological need satisfaction in PE at T2 predicted global self-worth at T3 ($\beta = .085$, $SE = .017$, $p < .001$), that global self-worth at T1 predicted basic psychological need satisfaction in PE at T2 ($\beta = .093$, $SE = .018$, $p < .001$), and that global self-worth at T2 predicted basic psychological need satisfaction in PE at T3 ($\beta = .090$, $SE = .017$, $p < .001$, see table 3).

TABLE 3 IN ABOUT HERE

Discussion

This longitudinal study aimed to investigate the temporal relations of adolescents' basic need satisfaction in PE and global self-worth. The bidirectional model showed the best fit to data, indicating that adolescents' experience of basic need satisfaction in PE was related to positive global self-worth development, while at the same time, adolescents' level of global self-worth was related to their sense of basic psychological need satisfaction in PE.

The identification that basic need satisfaction in PE may promote global self-worth supports the tenets of SDT (Ryan & Deci, 2017) and illustrates the importance of adolescents experiencing autonomy, competence, and relatedness in PE as this may foster positive global self-worth development. Findings also provide longitudinal support to previous research in that the PE subject may promote students' positive global self-worth development provided that students experience the PE context to be basic need satisfying (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019; Garn et al., 2012; Standage & Gillison, 2007). However, the current study also expands our understanding of the relationship between basic need satisfaction in PE and global self-worth as it indicates that global self-worth affects adolescents' sense of basic need satisfaction in the PE environment. The identification that global self-worth predicts experiences of basic need satisfaction in PE could suggest that adolescents with low global self-worth are less effective in their interactions with the PE environment compared to adolescents with high global self-worth. Although not specifically tested in the current study, this direction of effects could possibly be explained by individual differences in adolescents' causality orientations. Such differences may explain why some adolescents appear less likely to perceive and benefit from a basic need supportive PE environment and risk developing negative behavioural patterns as a result of a desire to protect their self from harm (e.g., Lyngstad, Hagen, & Aune, 2016).

Basic need satisfaction is considered to be determined on the basis of both individual

characteristics (e.g., causality orientations) and contextual specificities (e.g., need support). While it may be difficult to effectively change individual student characteristics, schools are obliged to adapt the educational environment to ensure optimal learning in their students. Basic need supportive teaching has both theoretically (e.g., Ryan & Deci, 2017) and empirically (e.g., Franco & Coterón, 2017; Sánchez-Oliva, Pulido-González, Leo, González-Ponce, & García-Calvo, 2017; Su & Reeve, 2011) been linked to students' sense of basic need satisfaction in PE. Based on the extensive research literature on this relationship as well as findings from this and previous (Garn et al., 2012; Standage & Gillison, 2007) studies, there is much to suggest that basic need supportive PE teaching promotes students' global self-worth development through feelings of basic psychological need satisfaction in PE. As such, high quality teaching (e.g., T. Curran & Standage, 2017) could bring students into a positive spiral of increased basic need satisfaction in PE and thus, increased global self-worth. Based on a backdrop of theories such as SDT (Ryan & Deci, 2017) and Competence Motivation Theory (Harter, 2006; Harter et al., 1999), there is reason to assume that joint effort to promote such experiences across several social contexts could increase the likelihood that adolescents develop more autonomy-oriented causality orientations, which again could foster more basic need satisfaction and a more positive sense of global self-worth.

On the other hand, the herein identified bidirectional relationship between basic need satisfaction in PE and global self-worth also suggests that adolescents who experience low levels of basic need satisfaction in PE over time may not have the same prerequisites for the development of positive global self-worth in PE as other students. This indicates that PE may have the effect of a double-edged sword, either supporting students' global self-worth development and thus, their learning and thriving in PE, or quite the opposite; constraining students' opportunities for global self-worth development and learning as they take part in the subject. This provides PE teachers with a major responsibility to ensure that their teaching

supports students' basic psychological need satisfaction and thus, students' global self-worth development in PE.

The finding that adolescents experience different levels of basic need satisfaction in PE depending on their levels of global self-worth carries important implications. This bidirectional relationship alerts us to the importance of recognizing that every PE student is inherently unique and that all students enter the PE context with different prerequisites for experiencing basic need satisfaction in PE, and thus, develop global self-worth through PE. However, regardless of their differences in global self-worth and prerequisites to experience basic need satisfaction in PE, students (at least in Scandinavia; e.g., *Opplæringslova* [the Norwegian Education Act], 1998; *Skollag* [the Swedish Education Act], 2010) are legally entitled to equal opportunities for learning through equal education. It is therefore important for PE teachers to acknowledge that students' perceptions of global self-worth may influence whether PE contributes to healthy growth or whether it challenges students' basic psychological need satisfaction in PE as well as their opportunities to develop a more positive sense of personal worthiness.

Limitations and Future Directions

Some limitations should be given consideration when interpreting the results of the present study. This study did not distinguish between contingent and true global self-worth. From the perspective of SDT, these types of global self-worth have different qualities and consequences (Ryan & Deci, 2017) and thus, we encourage researchers to differentiate between contingent and true global self-worth in future research. This study was also based on self-reported measures and may be vulnerable to common method bias (Podsakoff, MacKenzie, & Podsakoff, 2012). More specifically, common method bias (e.g., the effect of uncontrolled method factors) can influence both the reliability and validity of different constructs as well as the relationship between different constructs (Podsakoff et al., 2012).

However, research has shown that temporal separation between variables, as the lagged effect in the current study, decreases the risk of common method bias. Although temporal separation decreases the risk for common method bias there are still several limitations with this approach. In previous studies, concerns such as increased model complexity, increased risk for non-methodological factors influencing the outcomes, and uncertainty about the length between the measurement occasions have been highlighted (for a summary see, Podsakoff et al. 2012). Given the uncertainty about how these potential concerns might influence the risk of common method bias, more research focusing on evaluating these effects in longitudinal studies is needed.

Further, like any real world non-experimental study, this study may be influenced by third-variable explanations for the observed effects (Field, 2013). It should be noted that researchers have not yet studied the effects of need supportive strategies on students with high versus low levels of global self-worth. While findings from this study suggest that not all students may be equally sensitive to need supportive education, more research is necessary to determine how students with low global self-worth respond to basic need supportive interventions in PE. Such research would also do well to assess how individual causality orientations relate to the relationship between basic need satisfaction and global self-worth. In light of prior research findings, future studies should also apply longitudinal designs to investigate how basic need satisfaction in PE and global self-worth relate to adolescent leisure-time sport participation. Such research is necessary to understand who benefits from contemporary PE, and what changes are necessary to achieve equal opportunities for learning through equal education (Erdvik, Haugen, Ivarsson & Säfvenbom, 2019).

Conclusion

The present study suggests that the relationship between basic need satisfaction in PE and global self-worth is bidirectional. As such, this study adds support to previous research

arguing that basic need satisfaction in PE may promote global self-worth in accordance with the PE curriculum. However, students' perceptions of global self-worth also predict the degree to which they experience basic need satisfaction in PE. This suggests that adolescents with low global self-worth are less sensitive to basic need support in PE, and thus, that these students may have different prerequisites for the development of global self-worth through PE. Consequently, students with low global self-worth may require increased teacher attention and personally tailored basic need supportive initiatives in order to experience basic need satisfaction and learning in PE, and to develop global self-worth through PE.

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Figure and figure caption

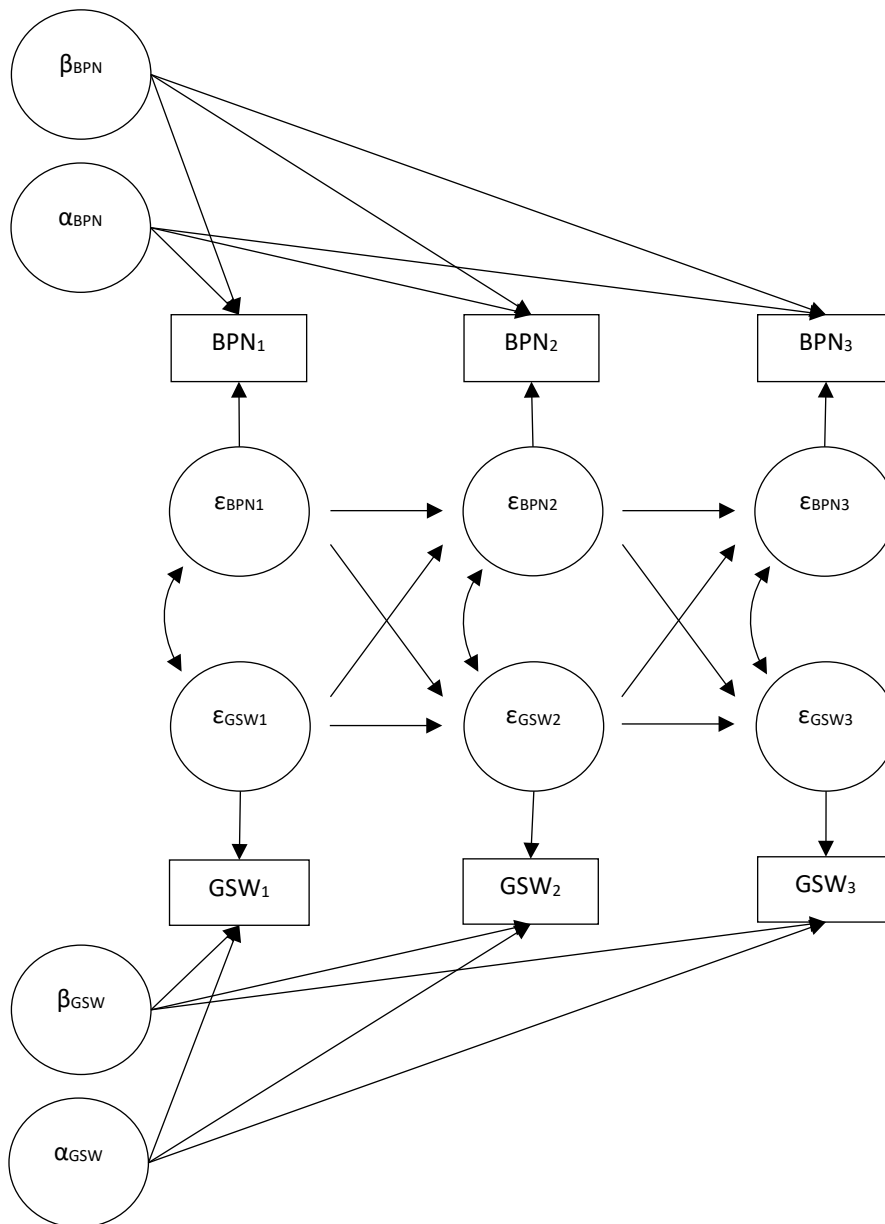


Figure 1. The bidirectional model of basic psychological need satisfaction in PE and global self-worth, assessed by means of a bivariate unconditional LCM-SR model.

Tables

Table 1

Descriptive statistics

	BPN T1	BPN T2	BPN T3	GSW T1	GSW T2	GSW T3
Bivariate correlations (two-tailed)						
BPN T1	-	.615*	.485*	.398*	.306*	.294*
BPN T2		-	.615*	.303*	.313*	.306*
BPN T3			-	.276*	.274*	.392*
GSW T1				-	.619*	.549*
GSW T2					-	.629*
GSW T3						-

Note. Pearson's bivariate correlations among study variables estimated with 2000 bootstraps. BPN = Basic psychological need satisfaction; GSW = Global self-worth; * $p < .01$ (two-tailed).

Table 2

Model selection and model fit indices

	Model 1: Autoregressive model	Model 2: BPN → GSW	Model 3: GSW → BPN	Model 4: BPN ↔ GSW
<i>Model selection indices</i>				
AIC	28942.984	28907.589	28902.165	28876.985
BIC	29028.818	28999.553	28994.129	28975.080
<i>Model fit indices</i>				
χ^2	154.609	123.393	118.396	95.383
<i>df</i>	13	12	12	11
<i>p</i>	<.001	<.001	<.001	<.001
RMSEA	.057	.052	.051	.048
(90 % CI)	(.049-.065)	(.044-.061)	(.043-.060)	(.039-.057)
CFI	.944	.956	.958	.967
TLI	.936	.945	.948	.955
SRMR	.075	.057	.053	.040

Note. BPN = Basic psychological need satisfaction in PE; GSW = Global self-worth.

Table 3

Within-person relations between basic need satisfaction in PE and global self-worth, and between-person slopes and intercepts

	T1 – T2			T2 – T3		
	Estimate	SE	<i>p</i>	Estimate	SE	<i>p</i>
Model 1: Autoregressive model						
<i>Within-person</i>						
BPN → BPN	.600	.019	<.001	.625	.019	<.001
GSW → GSW	.640	.014	<.001	.632	.015	<.001
<i>Between-person</i>						
Slope BPN	-.009	.017	.590			
Slope GSW	-.011	.008	.176			
Intercept BPN	4.767	.025	<.001			
Intercept GSW	2.968	.013	<.001			
Model 2: Consequence model						
<i>Within-person</i>						
BPN → GSW	.092	.016	<.001	.099	.017	<.001
BPN → BPN	.612	.018	<.001	.640	.019	<.001
GSW → GSW	.602	.016	<.001	.599	.017	<.001
<i>Between-person</i>						
Slope BPN	-.010	.017	.532			
Slope GSW	-.012	.008	.121			
Intercept BPN	4.767	.025	<.001			
Intercept GSW	2.969	.013	<.001			
Model 3: Antecedent model						
<i>Within-person</i>						
GSW → BPN	.105	.018	<.001	.103	.018	<.001
BPN → BPN	.557	.021	<.001	.585	.021	<.001
GSW → GSW	.651	.014	<.001	.647	.015	<.001
<i>Between-person</i>						
Slope BPN	-.012	.017	.467			
Slope GSW	-.011	.008	.160			
Intercept BPN	4.767	.025	<.001			
Intercept GSW	2.967	.013	<.001			
Model 4: Bidirectional model						
<i>Within-person</i>						
BPN → GSW	.079	.016	<.001	.085	.017	<.001
GSW → BPN	.093	.018	<.001	.090	.017	<.001
BPN → BPN	.572	.021	<.001	.602	.021	<.001
GSW → GSW	.618	.015	<.001	.615	.016	<.001
<i>Between-person</i>						
Slope BPN	-.013	.017	.431			
Slope GSW	-.012	.008	.116			
Intercept BPN	4.767	.025	<.001			
Intercept GSW	2.968	.013	<.001			

Note. BPN = Basic psychological need satisfaction in PE; GSW = Global self-worth.