

Dynamics of need-supportive and need-thwarting teaching behavior: the bidirectional relationship with student engagement and disengagement in the beginning of a lesson

Lynn Van den Berghe, Greet Cardon, Isabel Tallir, David Kirk & Leen Haerens

To cite this article: Lynn Van den Berghe, Greet Cardon, Isabel Tallir, David Kirk & Leen Haerens (2016) Dynamics of need-supportive and need-thwarting teaching behavior: the bidirectional relationship with student engagement and disengagement in the beginning of a lesson, *Physical Education and Sport Pedagogy*, 21:6, 653-670, DOI: [10.1080/17408989.2015.1115008](https://doi.org/10.1080/17408989.2015.1115008)

To link to this article: <https://doi.org/10.1080/17408989.2015.1115008>



Published online: 06 Jan 2016.



Submit your article to this journal [↗](#)



Article views: 706



View Crossmark data [↗](#)



Citing articles: 12 View citing articles [↗](#)

Dynamics of need-supportive and need-thwarting teaching behavior: the bidirectional relationship with student engagement and disengagement in the beginning of a lesson

Lynn Van den Berghe^{a*}, Greet Cardon^a, Isabel Tallir^a, David Kirk^b and Leen Haerens^a

^aFaculty of Medicine and Health Sciences, Department of Movement and Sports Sciences, Ghent University, Gent, Belgium; ^bSchool of Education, University of Strathclyde, Glasgow, UK

(Received 12 December 2014; accepted 27 October 2015)

Background: According to the classroom ecology paradigm, teachers and students interpret, predict, and respond to each other repeatedly in a reciprocal way. Such a reciprocal relationship is reflected in bidirectional interactions between a teacher's behavior and student (dis)engagement, an issue that has been confirmed in longitudinal studies including measures at different moments in a school year.

Aims: Starting from the perspective of self-determination theory, the aim of the present study was to investigate bidirectional relationships between student (dis)engagement and need-supportive and need-thwarting teaching behavior during the first 15 min of a lesson.

Sample & method: The first three 5-minute intervals of 100 videotaped physical education lessons taught by 100 different teachers (51.9% male, M age = 37.5 ± 10.9 years) were observed and coded for need-supportive and need-thwarting teaching behavior, student engagement, and student disengagement. Correlations were calculated to explore relationships between student (dis)engagement and teaching behavior over the first 15 minutes of a PE lesson. Next, path analyses were conducted to analyze 5-to-5 minute interactions between teaching behavior and student (dis)engagement.

Results: Student engagement correlated positively and disengagement correlated negatively with need support, while engagement correlated negatively and disengagement correlated positively with need-thwarting over the first 15 minutes of the lesson. There were few significant relationships between student engagement and teachers' behavior across and between each of the three 5-minute intervals. Only when teachers provided more need support during the first 5 minutes of the lesson, students were more engaged in the third 5 minutes of the lesson. When students were more disengaged during the first 5 minutes of the lesson, teachers displayed less need support in the following 10 minutes of the lesson. In contrast, student disengagement in the second 5 minutes of the lesson related to more need support in the next 5 minutes. Most of the within-interval relationships between student engagement and teachers' behaviors were inconsistent, but we did find positive relationships between student disengagement and need-thwarting teaching behaviors in the first and third interval, suggesting a rather direct and momentary within 5-minute intervals interaction between teachers and students.

Conclusions: Findings of the present observational study suggest that, although overall relationships between student (dis)engagement and teachers' behavior were in the expected directions, the picture might become more complicated when relationships are investigated according to the timing of the lesson, an issue that has remained uncovered in self-reported studies. While student disengagement was related to less need support and more need-thwarting teaching behaviors, more detailed analyses showed that it was particularly student disengagement in the beginning of a lesson that elicited less positive

*Corresponding author. Email: l.vandenberghe@ugent.be

teaching behaviors. When students display disengagement further along in the first 15 minutes of the lesson, teachers seemed to respond in a more need-supportive way to student disengagement. Such findings provide interesting insights to build interventions for teachers around certain critical moments during the lesson, for example when dealing with student disengagement at a specific moment in the lesson.

Keywords: student engagement; student disengagement; need support; need-thwarting

When confronted with student disengagement in the beginning of a lesson, teachers can react in many different ways, so that some teachers remain patient and try to optimally motivate these students, while other teachers may start to exert pressure in order to force students into participating. Patrick et al. (2003) suggested that the quality of the initial social climate between teachers and students, which is characterized by mutual respect, teacher support, and mastery goals, sets the tone for the subsequent social climate. Also Mainhard, Wubbels, and Brekelmans (2014) suggested that maybe impressions of teacher affiliation and control in the first few minutes are important for how students perceive their teacher later on. However, these suggestions have not been investigated within one lesson. The present study builds on these suggestions by investigating reciprocal relationships between student engagement and disengagement and teaching behavior at a micro-level by looking into the teacher–student dynamics within the first 15 minutes of a physical education (PE) lesson. To do so, this study uses the lens of self-determination theory (SDT; Deci and Ryan 1985, 2000), a widely used, accepted and scientifically supported theory on human motivational dynamics that has been the theoretical framework for numerous studies on motivation in PE (Van den Berghe, Vansteenkiste, et al. 2014). The interesting feature of SDT is that it not only provides a good framework to conceptualize students' motivation and related outcomes, but also in detail and very practically outlines how the social context, in case of the present study the teacher, can elicit positive motivational outcomes among students.

Most previous SDT-based studies typically relied on student reports of teaching behaviors (Skinner and Belmont 1993; Cox and Williams 2008; Koka 2013). In the present study, this work was further extended by objectively assessing teacher and student behavior by means of observations as was already done in previous studies (Reeve et al. 2004; Jang, Reeve, and Deci 2010; Tessier, Sarrazin, and Ntoumanis 2010; Haerens et al. 2013; Perlman 2013; Van den Berghe et al. 2013). In the latter observational studies, positive associations were found between supportive teaching practices and adaptive outcomes, such as optimal student motivation. There are a few advantages of measuring behavior through observations (Haerens et al. 2013). First, the use of observations can overcome some methodological limitations related to the exclusive reliance on student reports which can cause problems of shared method variance, such that associations get artificially inflated. Also, observations rule out students' personal interpretations of the situation which could be colored by previous experiences with the teacher. Second, because of the real-life setting of the videotaped PE lesson, the ecological validity is high, and observational measures provide insight in the frequency of certain behaviors during a specific period of the lesson. Moreover, and in relation to the present study, such measures allow investigating how teaching behavior and student engagement perhaps fluctuate during the course of one lesson depending on whether it is the beginning of the lesson or a time period further along the lesson. For the purpose of the current study, observational measures were used to assess teaching behavior and student (dis)engagement in 5-minute intervals. The first 15 minutes of a PE lesson were observed; this is to capture both the introduction of the lesson as well as part of the main part of the lesson.

Student engagement and disengagement

Student engagement is a multifaceted concept, reflecting behavioral, emotional, and cognitive aspects (Fredricks, Blumenfeld, and Paris 2004). Students are engaged in a lesson when they listen to the teacher, enjoy doing the exercises, show effort and persistence, or answer the teacher's questions (Furrer and Skinner 2003; Reeve et al. 2004). Student disengagement (sometimes also called disaffection) is characterized by the absence of effort or persistence and includes behaviors such as not listening, not making an effort, giving up easily, or being bored (Skinner, Kindermann, and Furrer 2009). The importance of student engagement in the academic context is reflected in its relationship with students' grades and achievement (e.g. Skinner, Wellborn, and Connell 1990; Skinner, Kindermann, and Furrer 2009). Various studies have investigated student engagement as a positive consequence (e.g. Skinner and Belmont 1993; Assor, Kaplan, and Roth 2002; Mouratidis et al. 2008) and disengagement as a negative consequence of teachers' way of interacting with students (Skinner et al. 2008; Stephan et al. 2011). The process-product paradigm, which suggests a one-way route from teaching behavior (process) to student learning (product), has been criticized for oversimplifying the complexity of interactions between teachers and students (Doyle 1977; Solmon 2003). According to the classroom ecology paradigm (Hastie and Siedentop 2006), teachers and students interpret, predict, and respond to each other repeatedly in a reciprocal way, so that not only teachers affect students, but that students also influence teachers. In that respect, Skinner et al. (2009) argued that student engagement can act as an energetic resource for teachers.

Also longitudinal studies showed that, just as teachers can affect students, teachers' perceptions of student engagement can also affect teachers' behaviors. In the Skinner and Belmont (1993) study, it was illustrated that students' behavioral engagement at one point in time predicted motivating teaching behavior a few months later. In a different and more recent study, Koka (2013) looked at longitudinal relationships between students' motivation, as a proxy of engagement, and motivating teaching behavior. In this one-year longitudinal study, it was indicated that students' optimal motivation to engage in PE positively predicted their teachers' democratic (e.g. asking students for permission) and negatively predicted autocratic behavior (e.g. refusing to compromise with students) after a period of 12 months. These studies provided insight in long-term motivational dynamics, highlighting that engaged students subsequently elicit more motivating behavior in teachers, hereby illustrating a positive chain reaction across a number of lessons starting with the students' behaviors. Then, the question arose as to whether the same patterns would also emerge in shorter-term dynamics, such that these interactions would be found across and within 5-to-5 minute intervals. As Skinner et al. (2009) suggested that student engagement can change across situations and time, students might show different levels of engagement within one lesson based on certain interactions with the teacher, but also teachers could react differently to students' engagement according to the specific context of the lesson.

Need-supportive and need-thwarting teaching behavior

Studies examining relationships between teaching behaviors and student engagement from a motivational perspective (e.g. Skinner and Belmont 1993; Ntoumanis 2005; Jang, Reeve, and Deci 2010) often find their roots in SDT (Deci and Ryan 1985, 2000) because it encompasses a practical theory that conceptually frames teaching behaviors many teachers regularly engage in from a motivational perspective. Central in SDT is the idea that, in motivating learning environments, students' three basic psychological needs for autonomy

(i.e. a sense of volitional and psychological freedom), competence (i.e. a sense of personal effectiveness), and relatedness (i.e. interpersonal closeness and mutuality) are nurtured and developed (Ryan and Deci 2002; Vansteenkiste, Niemiec, and Soenens 2010). In demotivating learning environments, the same needs get actively frustrated that results in autonomy frustration (i.e. feelings of pressure), competence frustration (i.e. experiencing a sense of inferiority or failure), and relatedness frustration (i.e. feelings of loneliness and alienation). To state differently, positive student outcomes, such as engagement, are more likely to arise in a need-supportive teaching environment (Standage, Duda, and Ntoumanis 2005; Mouratidis et al. 2008; Shen et al. 2009; Ward and Parker 2012; Perlman 2013), while maladaptive student outcomes, such as disengagement, might arise in a need-thwarting environment (De Meyer et al. 2014; Haerens et al. 2015).

Need support involves the provision of autonomy support, structure, and involvement (Connell and Wellborn 1991). Autonomy-supportive teachers typically identify, nurture, and develop students' goals and interests (Reeve 2009). Teachers can nurture students' need for competence by providing adequate structure through clear instructions and positive feedback (Mouratidis et al. 2008; Farkas and Grolnick 2010; Jang, Reeve, and Deci 2010; Haerens et al. 2013). The need for relatedness can be nourished by creating a warm class environment in which the teacher is empathic, caring, and understanding (Skinner and Belmont 1993; Cox and Williams 2008; Haerens et al. 2013).

Several studies have revealed a positive association between need support and positive student behaviors and student engagement. In a general education context, Skinner and Belmont (1993), Reeve et al. (2004), and Jang, Reeve, and Deci (2010) found that teachers' autonomy support and structure related positively to student engagement. In PE, Ntoumanis (2005) found that need support from teachers indirectly and positively related to indicators of student engagement (i.e. effort, concentration, affect, and intentions to participate in optional PE) through need satisfaction and self-determined motivation. In an experimental study of García-Calvo et al. (2015), effort and cooperation in students was positively influenced when teachers were more need-supportive toward their students in PE. Whether the analyses were based on hierarchical regression analyses (Reeve et al. 2004), structural equation modeling (Ntoumanis 2005), or hierarchical linear modeling (Jang, Reeve, and Deci 2010), all studies positioned need-supportive teaching behavior as an antecedent of student engagement in the motivational sequence.

While need support is known to encourage engagement in students, need-thwarting teaching behaviors might bring students to become more disengaged. Need-thwarting teaching is characterized by exertion of control, a chaotic style, and having cold interactions, hereby frustrating students' needs for autonomy, competence, and relatedness, respectively (Bartholomew et al. 2011; Van den Berghe et al. 2013). Controlling teachers thwart the need for autonomy, because they pressure students to behave and think in prescribed ways (Grolnick 2003; Soenens et al. 2012). Additionally, teachers may thwart the students' need for competence by creating a chaotic class climate in which objectives, expectations, and rules are unclear (Van den Berghe et al. 2013). Being unfriendly or even rejecting and excluding students are typical behaviors depicting an emotionally cold environment (Skinner and Belmont 1993), which may thwart the students' need for relatedness. Until now, less attention has been paid to this 'dark side' of motivational teaching practices, even though it is recognized that the presence of need-thwarting teaching behavior is more than merely the absence of need support (Bartholomew et al. 2011; De Meyer et al. 2014).

Most of the studies that have addressed need-thwarting behaviors in an educational context have focused on the exertion of control, while chaotic and cold interactions have

received less attention. In a study among elementary school children, controlling teaching related to less-intensive student engagement as measured by student and teacher questionnaires (Assor et al. 2005). Soenens et al. (2012) found that student reports of psychologically controlling teaching (e.g. guilt induction) related negatively to deep-level learning strategies and academic performance in secondary school students. In the study of De Meyer et al. (2014), observations of controlling teaching behavior related positively to students' need frustration, controlled motivation, and amotivation in PE. The present study builds on this research by not only focusing on controlling teaching behavior (e.g. Soenens et al. 2012; De Meyer et al. 2014), but by also including observations of chaotic and cold teaching behaviors. It simultaneously investigates bidirectional relationships between student (dis)engagement and teachers' need-thwarting behaviors, as well as between student (dis)engagement and teachers' need-supportive behaviors.

The present study

Whereas previous studies have investigated how teaching behavior predicts student engagement cross-sectionally (Cox and Williams 2008), experimentally (Tessier, Sarrazin, and Ntoumanis 2010), or longitudinally across lessons (Skinner and Belmont 1993; Koka 2013), no studies have investigated how teaching behaviors and student engagement fluctuate and relate to each other within the first moments of a lesson. As Skinner, Kindermann, and Furrer (2009) suggested that engagement can change over time and between different situations, the aim of the present observational study was to investigate how observed student (dis)engagement and need-supportive or need-thwarting teaching behavior are related to each other across and within the first 15 minutes of a PE lesson.

Based on the results of previous studies (Skinner and Belmont 1993; Koka 2013), it was hypothesized that student engagement would be positively related to need support, while negative relationships with need-thwarting teaching behaviors were expected. Negative relationships with need support and positive relationships with need-thwarting teaching behavior were predicted for student disengagement. Next, we explored the fluctuations of student (dis)engagement, need support, and need-thwarting in the first 15 minutes of the lesson. Further, we investigated the relationships between student (dis)engagement and teaching behavior across and between specific 5-minute intervals. We hypothesized that when students are more engaged during the first 5 minutes of the lesson, teachers probably notice this, and, therefore, they might feel encouraged to act in a more need-supportive manner in the following 5 or 10 minutes. Further, it was hypothesized that teachers might feel discouraged to be need-supportive and even become (more) need-thwarting when students show disengagement during the first 5 minutes of the lesson because they feel pressured (e.g. Pelletier, Seguin-Levesque, and Legault 2002; Van den Berghe, Soenens et al. 2014). Additionally, negative relationships between need-thwarting teaching behaviors at the beginning of the lesson and student engagement, and between need support at the beginning of the lesson and student disengagement were expected.

Method

Procedure

One hundred videotaped PE lessons randomly chosen out of an existing dataset (Haerens et al. 2013; Van den Berghe et al. 2013; De Meyer et al. 2014) that was already coded in terms of teachers' need-supportive and need-thwarting teaching behaviors were re-analyzed

in terms of students' engagement and disengagement for the purposes of the current study. The Ethical Committee of Ghent University approved the larger research project, of which the present study was part of (Van den Berghe et al. 2013; Haerens et al. 2015). For this larger research project, the teachers all gave approval for being videotaped by means of an informed consent form. Also the students' parents or legal guardians signed an informed consent form. At the measurement day (i.e. one randomly chosen PE lesson), a digital camcorder was positioned in a corner of the gymnasium, enabling us to capture the widest possible angle of the lesson. Teachers wore a microphone to capture their verbal communication.

Participants

A sample of 100 different PE teachers from Flanders (51.9% male, M age = 37.5 ± 10.9 years, range = 21–61 years) had on average 14.3 (± 11.1) years of teaching experience and had on average 15 students (± 10.9) in class. Students' age ranged from 12 to 18. Of the participating classes, 58.8% came from an academic track, 19.6% from a technical track, 14.4% from a vocational track, and 7.2% from an artistic track. Fifty-one percent of the enrolled classes were co-educational classes and 49% single sex classes (31% boys-only and 18% girls-only). The topics of the lessons consisted of 43% ball games (e.g. soccer), 34% artistic sports (e.g. gymnastics), 13% fitness related activities (e.g. running), and 8% other sports such as racket games.

Measures

Observed need-supportive and need-thwarting teaching behavior

Teachers' need-supportive and need-thwarting behaviors were assessed as part of two different studies (Haerens et al. 2013; Van den Berghe et al. 2013). Six external raters coded 19 need-supportive and 16 need-thwarting teaching behaviors through a valid and reliable observation tool with an acceptable to good intra- and interrater reliability (Haerens et al. 2013; Van den Berghe et al. 2013). More information on the development and use of the observation tool can be found in the studies of Haerens et al. (2013) and Van den Berghe et al. (2013). For the present study, the first 15 minutes (corresponding to three 5-minute intervals) of each lesson were re-coded by one out of the six external raters in terms of students' engagement and disengagement. This observer was trained as part of a larger research project (Haerens et al. 2013; Van den Berghe et al. 2013). Training included coding videotapes, discussing the observations and come to a consensus between the observers. Each of the teaching behaviors was coded on a 4-point scale ranging from 0 (never observed) to 1 (observed sometimes), to 2 (observed often), and to 3 (observed all the time). In total, three intervals were coded and the coding took approximately 30–60 minutes for each lesson (75 hours total coding). The observation tool had adequate intra- and interrater reliability (Haerens et al. 2013; Van den Berghe et al. 2013). The need-supportive teaching behaviors ($\alpha = .81$) reflected the four need-supportive teaching dimensions of autonomy support (e.g. 'The teacher offers choice to all students. '), structure before the activity (e.g. 'The teacher gives an overview of the content and structure of the lesson. '), structure during the activity (e.g. 'The teacher offers the students a rationale for tasks and exercises. '), and relatedness support (e.g. 'The teacher takes the perspective of students into account, is empathic. '). To tap into need-thwarting teacher behaviors ($\alpha = .67$), the dimensions of controlling (e.g. 'The teacher exercises power over the students

by interfering and demanding respect'), cold (e.g. 'The teacher is acting unfriendly and cold'), and chaotic teaching (e.g. 'uses an illogical and inconsistent structure during the warming up and activity or in the transitions between exercises') were assessed.

Observed student engagement

Student engagement and student disengagement were also assessed by means of observations by one external rater. Student engagement ($\alpha = .68$) incorporated five items: students listening, being energetic, persistent, having fun, and asking questions (Furrer and Skinner 2003; Reeve et al. 2004; Aelterman et al. 2012). Aelterman et al. (2012) illustrated a good intra- and interrater reliability for this scale. Four items ($\alpha = .72$) were selected from the Engagement versus Disaffection with Learning Scale (Skinner, Kindermann, and Furrer 2009) reflecting the same dimensions as in the items of student engagement to observe student disengagement: not listening, not making an effort, giving up easily, and being bored.

We acknowledge that the scales with an alpha of less than .70 (i.e. need-thwarting teaching behavior and student engagement) might need further refinement and/or additional items to increase the reliability (see also Van den Berghe et al. 2013). Despite the rather mediocre alpha ($<.70$) in some dimensions, we still found it interesting to take into account these dimensions for the purpose of investigating the relationship of the different dimensions of teaching behavior with student engagement.

Plan of analysis

Pearson correlation coefficients were calculated to explore the relationships between observed student (dis)engagement and need-supportive and need-thwarting teaching behavior over the first 15 minutes of a PE lesson. To examine fluctuations in need-supportive and need-thwarting dimensions and student engagement and disengagement in the beginning of the PE lesson, interval-specific scores of need support, need-thwarting, engagement and disengagement were simultaneously entered as within-subjects variables in a repeated-measures multivariate analysis of variance (MANOVA) with teaching behavior and student (dis)engagement as dependent variables and the 5-minute time interval as a within-subjects factor. Before conducting path analyses, the data were checked for missing values and normality assumptions. Path analyses were conducted in Mplus (Version 7, Muthén and Muthén 1998–2012).

First, the relationships between observed student engagement or disengagement and need-supportive or need-thwarting teaching behavior within three 5-minute intervals were tested. It is recommended to have at least 10 cases per free parameter in the model (Westland 2010); so this would mean that over 300 videotaped PE lessons should be available and coded to compose a model with all measured dimensions. Therefore, four different path models were tested to explore how student (dis)engagement in the first 5 minutes of the lesson accounts for need support and need-thwarting in the first, second, and third 5-minute interval (see Figure 1).

Next, four different path models were tested to explore how need support and need-thwarting in the first 5 minutes of the lesson account for student (dis)engagement in the first, second, and third 5-minute interval. In these models, within-time relationships were allowed. The chi-square (χ^2), the Root Mean Square Error (RMSEA), the Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI), and the Tucker Lewis Index (TLI) were used to assess the model fit. A good model fit is indicated by an

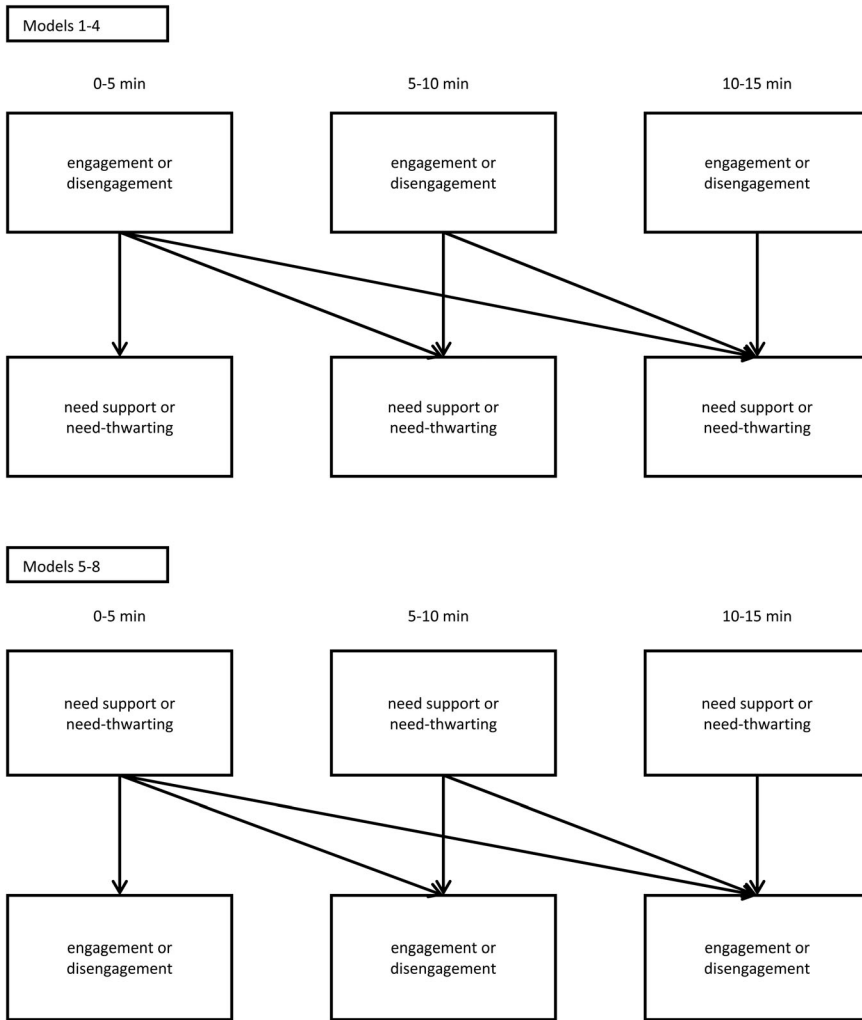


Figure 1. Eight hypothesized path models relating student (dis)engagement to teacher need support and need-thwarting (models 1–4) and the other way around (models 5–8).

RMSEA equal to or smaller than .06, an SRMR equal to or smaller than .08, and a CFI and TLI greater than .95 (Hu and Bentler 1999).

Results

The overall score of need support in the first 15 minutes of the lesson correlated negatively to need-thwarting ($r = -.42, p \leq .001$) and positively to student engagement ($r = .25, p \leq .05$), but it did not significantly correlate to student disengagement ($r = -.15, ns$). The overall score of need-thwarting correlated negatively to student engagement ($r = -.35, p \leq .001$) and positively to student disengagement ($r = .24, p \leq .05$).

The occurrence of observations ranged between 0.96 and 1.04 for need support ($M = 1.01 \pm .23$), between 0.13 and 0.17 for need-thwarting ($M = 0.13 \pm .14$), between 1.61 and 1.75 for engagement ($M = 1.69 \pm .38$), and between 0.28 and 0.29 for disengagement

($M = 0.29 \pm .26$) on a scale from 0 to 3. When exploring fluctuations in observations between time intervals (see Figure 2), the repeated-measures MANOVA with need support, need-thwarting, student engagement, and disengagement provided evidence for a significant multivariate within-subject effect of 5-minute time intervals ($F(1,98) = 5.85, p \leq .01, \eta_p^2 = .11$). Univariate repeated-measures analyses revealed a significant linear time effect for need support ($F(1,99) = 7.22, p \leq .01, \eta_p^2 = .07$), but not for need-thwarting ($F(1,99) = 3.11, ns$), student engagement ($F(1,69) = 3.11, ns$), or disengagement ($F(1,99) = 3.11, ns$). Need-supportive teaching behavior increased from the first 5 minutes to the second 5 minutes of the lesson and remained stable the third 5 minutes of the lesson. Also the quadratic trend for need support was significant ($F(1,99) = 5.13, p \leq .05, \eta_p^2 = .05$), with an increase from the first to second 5-minute interval, remaining stable in the third interval.

The nonparametric Kolmogorov–Smirnov test ($N < 200$) indicated that the data were not normally distributed. Therefore, path analyses were conducted with a maximum likelihood estimation with robust standard errors to adjust the chi-square statistics and standard errors in order to prevent Type I errors (Satorra and Bentler 2011). In Table 1, standardized XY estimates, significance levels, and fit indices of the eight models relating student (dis)engagement and need-supportive and need-thwarting teaching behavior are presented. In the first four models, we investigated how student (dis)engagement related to teaching behaviors within and across 5-minute intervals. In the next four models, relationships were investigated in the opposite direction, with teachers' behavior predicting student (dis)engagement across intervals.

When looking across each of the 5-minute intervals, there were few significant relationships between student (dis)engagement and teachers' behavior. Only in model 3, in which student disengagement was related to teachers' need support, it was found that student disengagement in the first 5 minutes of the lesson related to less need support in the second and third interval. On the contrary, student disengagement in the second 5 minutes of the lesson related to more need support in the next 5 minutes. When predicting student engagement and disengagement, only one across-interval relationship was found. When teachers displayed more need support in the first 5 minutes of the lesson, students were more engaged in the third 5-minute interval.

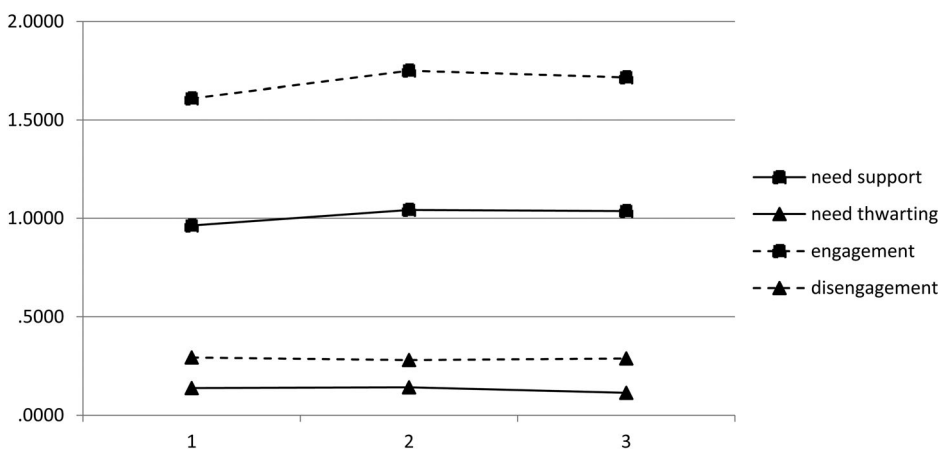


Figure 2. Fluctuations in need support, need-thwarting, engagement, and disengagement in the three first 5-minute intervals of a PE lesson.

Table 1. Standardized XY-estimates and fit indices for the models including 5-to-5 minute relationships between student engagement, student disengagement, teacher need support, and teacher need-thwarting.

Dependent variables			Independent variables							
			Engagement			Disengagement				
			Model 1			Model 3				
			0-5	5-10	10-15	0-5	5-10	10-15		
Need support	STXY (SE)	0-5	.06 (.10)				-.11 (.09)			
		5-10	-.03 (.11)	.07 (.10)			-.33 (.11)**	.25 (.10)		
		10-15	.03 (.12)	.05 (.10)	-.02 (.08)		-.37 (.11)***	.31 (.12)**	-.12 (.09)	
		χ^2 model fit		16.46 ($p < .001$)				1.86 ($p > .05$)		
		RMSEA		.21				.00		
		SRMR		.11				.03		
		CFI/TLI		.87/.47				1.00/1.05		
			Engagement			Disengagement				
			Model 2			Model 4				
			0-5	5-10	10-15	0-5	5-10	10-15		
Need-thwarting	STXY (SE)	0-5	-.29 (.08)***			.19 (.09)*				
		5-10	-.13 (.10)	-.18 (.07)*		.20 (.11)	.03 (.08)			
		10-15	-.12 (.13)	-.01 (.13)	-.14 (.07)	.13 (.13)	-.07 (.10)	.20 (.09)*		
		χ^2 model fit		2.99 ($p > .05$)				55 ($p > .05$)		
		RMSEA		.00				.00		
		SRMR		.05				.03		
		CFI/TLI		1.00/1.00				1.00/1.05		

			Need support			Need-thwarting			
			Model 5			Model 7			
			0–5	5–10	10–15	0–5	5–10	10–15	
Engagement	STXY (SE)	0–5	.06 (.10)			–.11 (.09)			
		5–10	.16 (.10)	.08 (.11)		–.20 (.11)	.25 (.09)**		
		10–15	.28 (.13)*	.18 (.13)	–.03 (.10)	–.14 (.10)	.11 (.15)	–.17 (.13)	
		χ^2 model fit		.38 ($p > .05$)			6.49 ($p > .05$)		
		RMSEA		.00			.11		
		SRMR		.01			.04		
		CFI/TLI		1.00/1.20			.95/.79		
			Need support			Need-thwarting			
			Model 6			Model 8			
			0–5	5–10	10–15	0–5	5–10	10–15	
Disengagement	STXY (SE)	0–5	–.29 (.09)**			.19 (.08)*			
		5–10	–.03 (.14)	–.35 (.16)*		.10 (.15)	.05 (.15)		
		10–15	–.09 (.16)	.06 (.20)	–.26 (.12)*	.15 (.13)	–.29 (.19)	.40 (.15)**	
		χ^2 model fit		1.50 ($p > .05$)			1.53 ($p > .05$)		
		RMSEA		.00			.00		
		SRMR		.02			.02		
		CFI/TLI		1.00/1.12			1.00/1.11		

Note. $N = 100$. STXY – standardized XY estimates.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

The within-interval relationships were also inconsistent across models. While student engagement and teacher need support did not show any significant within-time associations, student engagement and need-thwarting did relate negatively to each other within the three time intervals. Student disengagement showed a positive association with teacher need support in the second time interval, but it also showed a positive relationship with need-thwarting in the first and third time interval.

Discussion

Ideally, all PE teachers want their students to actively engage in their lessons in order to optimally facilitate the learning process. Students can react in different ways to motivating or demotivating teaching behavior by either being engaged or disengaged for the subject. No previous studies have investigated fluctuations in teaching behaviors and student engagement within the first moments of a PE lesson. The purpose of this study was to investigate how student (dis)engagement and need-supportive and need-thwarting teaching behavior are related to each other in three sequential 5-minute intervals of the beginning of the PE lesson.

A first purpose of the present study was to investigate whether relationships between student (dis)engagement and need-supportive and need-thwarting teaching behavior that were found based on student and teacher reports, could be replicated when making use of observations. As proposed by Skinner et al. (2009), and as was seen in the studies of Koka (2013) and Skinner and Belmont (1993) across a school year, we found that when students are engaged, teachers are also stimulated to act in a more need-supportive fashion. More specifically, when looking at overall relationships between student engagement and teaching behavior across all three 5-minute intervals, positive correlations between student engagement and need support and negative correlations between student engagement and need-thwarting teaching behavior were found. Student disengagement did not relate to need support, but it was positively associated with need-thwarting teaching behavior. This is in line with the suggestion for the existence of a dark motivational pathway (Haerens et al. 2015), in which experiences of need frustration (as opposed to need satisfaction) might have a unique predictive validity for maladaptive outcomes such as student disengagement (as opposed to student engagement).

However, these results were not confirmed between or within 5-minute intervals. First, when looking into changes over the three 5-minute intervals, no significant fluctuations were found in need-thwarting teaching behaviors, student engagement, or disengagement, suggesting that these variables are relatively stable during the course of a lesson. Only need support increased over time; so no strong interactions between student (dis)engagement and teaching behavior were expected, as most of the investigated behaviors remained relatively stable across the three intervals. Accordingly, no significant relationships were found between student engagement and need support between and within the 5-minute intervals. This indicates that when students are engaged at one moment in time, teachers might be pleased with how things go along in class and they might not see a need for change in their behavior. However, student engagement was negatively related to need-thwarting within the same time interval, which could mean that when students are engaged, teachers immediately feel less inclined to act in a need-thwarting way.

For the relationships between student disengagement and teacher need support and need-thwarting behavior, inconsistent results were found. Disengagement in the first 5 minutes of the lesson related to less need support in the next 5-minute intervals, but disengagement in the second 5 minutes of the lesson was associated with more instead of less

need support. In the study of Haerens et al. (2013), some need-supportive behaviors, such as providing clear guidelines and instructions, were more prevalent before the learning process, while other behaviors, such as offering help and guidelines to students were more frequently observed in the middle of the lesson. The start of the lesson often involves instructions from the teachers; so when students are disruptive or not listening, teachers might have a tendency to immediately react in a less need-supportive way because of their own agenda. In the second interval of the lesson, students are often already exercising or playing. In that context, teachers might be more inclined to act in a more need-supportive manner with their students when confronted with disengagement. Possible explanations for this phenomenon are yet to be explored in future research, but one avenue is to examine which need-supportive behaviors mainly occur at the beginning of the lesson and which behaviors especially occur during the course of the lesson, and how these behaviors might differentially influence students throughout the lesson.

Even though it is advised based on the principles of SDT, teachers did not have the automatic response to become more need-supportive when students were disengaged, as would be a recommended strategy according to SDT. On the other hand, teachers were more need-thwarting when students were observed to be disengaged. There was an immediate within-interval interaction between teachers and students when situated in a negative class atmosphere. As was illustrated by Baumeister et al. (2001), negative experiences have a stronger impact on an individual than positive experiences, which in our study might be reflected in an immediate display of teachers being more need-thwarting when confronted with student disengagement. This might also be the case when looking at it the other way around, with students becoming more disengaged when confronted with need-thwarting teachers. So next to other external pressures for teachers, such as imposing performance levels for students (Flink, Boggiano, and Barrett 1990), also student disengagement could be seen as a challenging or pressuring antecedent, possibly evoking an immediate reaction in teachers.

Due to the rather limited fluctuations in behavior over the 5-minute intervals, few cross-interval associations were found. One unexpected positive association between teachers' need support and student disengagement was found in the second 5 minutes of the lesson. This association suggested that teachers do react in a more need-supportive way toward disengaged students by for instance providing help and feedback. However, this positive correlation was found in only one model and in one interval, and, additionally, even a negative correlation was found within the first and third interval. It is possible that the relationship between teacher need support and student (dis)engagement is a relatively slow process, with the possible effects of need support on student engagement and disengagement only becoming apparent after a while, as was found in the studies of Koka (2013) and Skinner and Belmont (1993). Also here, critical incident analyses could show stronger associations between specific positive events and the teacher–student interactions following these specific events. However, this is merely speculation on our part and further research on this matter is needed.

It was expected that relationships between the positive constructs of student engagement and need support would be strong and that the associations between the negative constructs of student disengagement and need-thwarting would also be stronger than when looking into 'mixed' associations. The notion of a 'bright' and 'dark' pathway (Haerens et al. 2015) suggests that motivating teaching behavior relates to good-quality motivation in students, while need-thwarting teaching behavior relates to poor-quality motivation. However, in the current study, also 'mixed' relationships were revealed, with student

disengagement and need support and student engagement and need-thwarting showing associations within or between time intervals.

The results of the current study could be of added value for the practice of PE teachers by raising awareness of the two-way interactions between students and teachers. In future studies, intervention studies and workshops might be developed in the context of continuous professional development programs, for example targeting certain critical moments during the lesson. To illustrate, critical moments in which teachers have to deal with student disengagement and how they might differentially react to this according to the specific moment of the lesson. PE teachers can be explained which student behaviors might cause them to be more or less need-supportive or need-thwarting at which moment in the lesson and how they could optimally react to these student behaviors.

Shortcomings, strengths, and suggestions for future research

One shortcoming of this study is that, even with a number of 100 videotapes with the first 15 minutes analyzed down to a 5-minute level, there was not sufficient power to analyze cross-lagged models with all need-supportive and need-thwarting teaching dimensions in one model. In order to include all dimensions of teaching behavior and student (dis)engagement in one model, at least 300 videotaped and analyzed PE lessons should be available. In future studies, the number of observations could be increased, but one could also choose to focus on more detailed interactions or behaviors, without including all dimensions of teaching behavior and student (dis)engagement. Another consideration for future research is the analysis of the contextual motivational climate established before the data collection phase; so that one can take into account how this affects relationships between variables in the first 15 minutes of a lesson. It might also be interesting to assess teachers' motivational orientations, as these might affect how teachers react to students' engagement and disengagement.

Another way to analyze these student–teacher interactions from a more qualitative point of view, to gain insight into what happens during class is using a technique called critical incident analyses (Flanagan 1954). When applying the method of critical incident analyses, observers focus on incidents that have a special significance in that context (e.g. a teacher is having an argument with a student) and from there, they make sound inferences about its effects on people and make predictions for future incidents (e.g. the realization that the rationale for some disciplinary rules is not clear for the students or that (consequences of) disciplinary rules are not clearly communicated at the beginning of the school year). Such analyses can result in insights and reflections particularly useful for preservice and inservice teachers, for example, to be discussed in teacher education programs or professional development sessions on a specific topic. To take a more qualitative point of view, observation studies can also be combined with (post-observation recall) interviews with teachers and students to gain additional information on their interactions, and the differences in perceptions between both.

We chose to specify models with a specific temporal ordering of the first 15 minutes of student (dis)engagement and need support or need-thwarting. However, there is an array of other possibilities to analyze these data, such as focusing on other parts of the lesson, on identifying single teacher or student behaviors to identifying specific teaching dimensions or including all dimensions of student engagement, and on coding 5-minute intervals to examining specific parts of the lesson (such as the warm up, main part, and the ending). Additionally, the reliabilities of student engagement in the cited study (Aelterman et al. 2012) were calculated based on the total impression of a lesson, while in the current

study, the tool was used to code 5-minute intervals of student engagement. Another shortcoming of this study is that potentially important contextual factors (such as the diversity in teachers' age and experience, in the students' grade, or in the topic of the lesson) were not addressed in the analyses. Possibly, the strength of the associations between student (dis)engagement and need-supportive and need-thwarting teaching behavior depends on the unique characteristics of the setting of the videotaped lesson, so that for example lesson requiring a lot of feedback and interactions between teachers and students might show stronger associations between teacher and student behavior.

One of the strengths of the current study is the use of an elaborate measure of teachers' need-supportive and need-thwarting behaviors, including four need-supportive and three need-thwarting teaching dimensions (Haerens et al. 2013; Van den Berghe et al. 2013). Further, both measures of student (dis)engagement and need-supportive and need-thwarting teaching behavior were not biased by previous experiences with teachers and students. We acknowledge that observing student (dis)engagement as a class measure has the disadvantage of not capturing the possible impact of individual student (dis)engagement on (de)motivating teaching behaviour, which might reveal more associations. An alternative for this method could be observing and rating (dis)engagement of individual students together with specific and personal teacher–student interactions, as was done in the study of Skinner, Kindermann, and Furrer (2009). To use a similar observation method in a PE lesson asks for another methodological and practical approach, because students are constantly moving around in PE, because of the noise in a gymnasium, and because students frequently talk to and yell at each other during the lesson.

The advantage of studying student and teacher behavior in the context of PE is reflected in the greater visibility of student engagement through movements and bodily efforts during class. Nevertheless, the question rises whether the results of the current study are transferable to a more general academic context or to other curricula.

Conclusion

The study provided partial support for the classroom ecology paradigm (Doyle 1977; Hastie and Siedentop 2006), indicating that teachers and students interact in a reciprocal way. The findings suggest that student disengagement might elicit less positive teaching behaviors both momentary (more need-thwarting teaching behavior) and during the course of a lesson (less need-supportive teaching behavior over time). This knowledge might provide insights for teachers on how (not to) react when trying to elicit student engagement or other optimal outcomes and could be used to build interventions for teachers around certain critical moments during the lesson, for example when dealing with student disengagement at a specific moment in the lesson.

Disclosure statement

No potential conflict of interest was reported by the authors.

References

- Aelterman, Nathalie, Maarten Vansteenkiste, Hilde Van Keer, Lynn Van den Berghe, Jotie De Meyer, and Leen Haerens. 2012. "Students' Objectively Measured Physical Activity Levels and Engagement as a Function of Between-class and Between-student Differences in Motivation Toward Physical Education." *Journal of Sport & Exercise Psychology* 34 (4): 457–480.

- Assor, A., H. Kaplan, Y. Kanat-Maymon, and G. Roth. 2005. "Directly Controlling Teacher Behaviors as Predictors of Poor Motivation and Engagement in Girls and Boys: The Role of Anger and Anxiety." *Learning and Instruction* 15 (5): 397–413. doi:10.1016/j.learninstruc.2005.07.008.
- Assor, A., H. Kaplan, and G. Roth. 2002. "Choice is Good, but Relevance is Excellent: Autonomy-enhancing and Suppressing Teacher Behaviours Predicting Students' Engagement in Schoolwork." *British Journal of Educational Psychology* 72: 261–278. doi:10.1348/000709902158883.
- Bartholomew, Kimberley Jane, Nikos Ntoumanis, Richard M. Ryan, J. A. Bosch, and Cecilie Thøgersen-Ntoumani. 2011. "Self-determination Theory and Diminished Functioning: The Role of Interpersonal Control and Psychological Need Thwarting." *Personality and Social Psychology Bulletin* 37 (11): 1459–1473. doi:10.1177/0146167211413125.
- Baumeister, R. F., Ellen Bratslavsky, Catrin Finkenauer, and Kathleen D. Vohs. 2001. "Bad is Stronger than Good." *Review of General Psychology* 5 (4): 323–370. doi:10.1037/1089-2680.5.4.323.
- Connell, J. P., and J. G. Wellborn. 1991. "Competence, Autonomy, and Relatedness: A Motivational Analysis of Self-system Processes." In *Self Processes and Development*. Vol. 23, edited by M. R. Gunnar and L. A. Sroufe, 43–77. Hillsdale: Lawrence Erlbaum Assoc Publ.
- Cox, A. E., and L. Williams. 2008. "The Roles of Perceived Teacher Support, Motivational Climate, and Psychological Need Satisfaction in Students' Physical Education Motivation." *Journal of Sport & Exercise Psychology* 30 (2): 222–239.
- De Meyer, Jotie, Isabel B. Tallir, Bart Soenens, Maarten Vansteenkiste, Nathalie Aelterman, Lynn Van den Berghe, Lise Speleers, and Leen Haerens. 2014. "Does Observed Controlling Teaching Behavior Relate to Students' Motivation in Physical Education?" *Journal of Educational Psychology* 106 (2): 541–554. doi:10.1037/a0034399.
- Deci, E. L., and R. M. Ryan. 1985. *Intrinsic Motivation and Self-determination in Human Behavior*. New York.
- Deci, E. L., and R. M. Ryan. 2000. "The "What" and "why" of Goal Pursuits: Human Needs and the Self-determination of Behavior." *Psychological Inquiry* 11 (4): 227–268. doi: 10.1207/s15327965plii1104_01.
- Doyle, Walter. 1977. "4: Paradigms for Research on Teacher Effectiveness." *Review of Research in Education* 5 (1): 163–198. doi:10.3102/0091732x005001163.
- Farkas, M. S., and W. S. Grolnick. 2010. "Examining the Components and Concomitants of Parental Structure in the Academic Domain." *Motivation and Emotion* 34 (3): 266–279. doi:10.1007/s11031-010-9176-7.
- Flanagan, John C. 1954. "The Critical Incident Technique." *Psychological Bulletin* 51 (4): 327–358. doi:10.1037/h0061470.
- Flink, C., A. K. Boggiano, and M. Barrett. 1990. "Controlling Teaching Strategies: Undermining Children's Self-determination and Performance." *Journal of Personality and Social Psychology* 59 (5): 916–924. doi:10.1037//0022-3514.59.5.916.
- Fredricks, Jennifer A., Phyllis C. Blumenfeld, and Alison H. Paris. 2004. "School Engagement: Potential of the Concept, State of the Evidence." *Review of Educational Research* 74 (1): 59–109. doi:10.3102/00346543074001059.
- Furrer, C., and E. Skinner. 2003. "Sense of Relatedness as a Factor in Children's Academic Engagement and Performance." *Journal of Educational Psychology* 95 (1): 148–162. doi:10.1037/0022-0663.95.1.148.
- García-Calvo, Tomás, David Sánchez-Oliva, Francisco Miguel Leo, Diana Amado, and Juan José Pulido. 2015. "Effects of an Intervention Programme with Teachers on the Development of Positive Behaviours in Spanish Physical Education Classes." *Physical Education and Sport Pedagogy*, 1–17. doi:10.1080/17408989.2015.1043256.
- Grolnick, W. S. 2003. *The Psychology of Parental Control: How Well-meant Parenting Backfires*. Mahwah, NJ: L. Erlbaum Associates.
- Haerens, Leen, Nathalie Aelterman, Lynn Van den Berghe, Jotie De Meyer, Bart Soenens, and Maarten Vansteenkiste. 2013. "Observing Physical Education Teachers' Need-Supportive Interactions in Classroom Settings." *Journal of Sport & Exercise Psychology* 35 (1): 3–17.
- Haerens, Leen, Nathalie Aelterman, Maarten Vansteenkiste, Bart Soenens, and Stijn Van Petegem. 2015. "Do Perceived Autonomy-supportive and Controlling Teaching Relate to Physical Education Students' Motivational Experiences Through Unique Pathways? Distinguishing Between the Bright and Dark Side of Motivation." *Psychology of Sport and Exercise* 16, Part 3: 26–36. doi:http://dx.doi.org/10.1016/j.psychsport.2014.08.013.

- Hastie, P. A., and D. Siedentop. 2006. "The Classroom Ecology Paradigm." In *The Handbook of Physical Education*, edited by D. Kirk, D. Macdonald, and M. O'Sullivan, 214–225. London: SAGE Publications.
- Hu, Li-tze, and Peter M. Bentler. 1999. "Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus new Alternatives." *Structural Equation Modeling: A Multidisciplinary Journal* 6 (1): 1–55. doi:10.1080/10705519909540118.
- Jang, H., J. Reeve, and E. L. Deci. 2010. "Engaging Students in Learning Activities: It is not Autonomy Support or Structure but Autonomy Support and Structure." *Journal of Educational Psychology* 102 (3): 588–600. doi:10.1037/a0019682.
- Koka, A. 2013. "The Relationships Between Perceived Teaching Behaviors and Motivation in Physical Education: A One-year Longitudinal Study." *Scandinavian Journal of Educational Research* 57 (1): 33–53. doi:10.1080/00313831.2011.621213.
- Mainhard, T., T. Wubbels, and M. Brekelmans. 2014. "The Role of the Degree of Acquaintance with Teachers on Students' Interpersonal Perceptions of Their Teacher." *Social Psychology of Education* 17 (1): 127–140. doi:10.1007/s11218-013-9234-6.
- Mouratidis, A., M. Vansteenkiste, W. Lens, and G. Sideridis. 2008. "The Motivating Role of Positive Feedback in Sport and Physical Education: Evidence for a Motivational Model." *Journal of Sport & Exercise Psychology* 30 (2): 240–268.
- Muthén, L. K., and B. O. Muthén. 1998–2012. *Mplus User's Guide*. 7th ed. Los Angeles, CA: Muthén & Muthén.
- Ntoumanis, N. 2005. "A Prospective Study of Participation in Optional School Physical Education using a Self-determination Theory Framework." *Journal of Educational Psychology* 97 (3): 444–453. doi:10.1037/0022-0663.97.3.444.
- Patrick, H., J. C. Turner, D. K. Meyer, and C. Midgley. 2003. "How Teachers Establish Psychological Environments During the First Days of School: Associations with Avoidance in Mathematics." *Teachers College Record* 105 (8): 1521–1558. doi:10.1111/1467-9620.00299.
- Pelletier, L. G., C. Seguin-Levesque, and L. Legault. 2002. "Pressure from Above and Pressure from Below as Determinants of Teachers' Motivation and Teaching Behaviors." *Journal of Educational Psychology* 94 (1): 186–196. doi:10.1037//0022-0663.94.1.186.
- Perlman, Dana J. 2013. "Help Motivate the Amotivated by being a Supportive Teacher." *Physical Education and Sport Pedagogy* 20 (2): 204–214. doi:10.1080/17408989.2013.868876.
- Reeve, J. 2009. "Why Teachers Adopt a Controlling Motivating Style Toward Students and how They can Become More Autonomy Supportive." *Educational Psychologist* 44 (3): 159–175. doi:10.1080/00461520903028990.
- Reeve, J., H. Jang, D. Carrell, S. Jeon, and J. Barch. 2004. "Enhancing Students' Engagement by Increasing Teachers' Autonomy Support." *Motivation and Emotion* 28 (2): 147–169. doi:10.1023/B:MOEM.0000032312.95499.6f.
- Ryan, R. M., and E. L. Deci. 2002. "An Overview of Self-determination Theory." In *Handbook of Self-determination Research*, edited by E. L. Deci and R. M. Ryan, 3–33. Rochester, NY: University of Rochester Press.
- Satorra, Albert, and Peter Bentler. 2011. "Scaling Corrections for Statistics in Covariance Structure Analysis." Department of Statistics Papers. Los Angeles: Department of Statistics, UCLA. Accessed November 17, 2015. <http://escholarship.org/uc/item/8dv7p2hr>.
- Shen, Bo, Nate McCaughy, Jeffrey Martin, and Mariane Fahlman. 2009. "Effects of Teacher Autonomy Support and Students' Autonomous Motivation on Learning in Physical Education." *Research Quarterly for Exercise and Sport* 80 (1): 44–53.
- Skinner, E. A., and M. J. Belmont. 1993. "Motivation in the Classroom: Reciprocal Effects of Teacher Behavior and Student Engagement Across the School Year." *Journal of Educational Psychology* 85 (4): 571–581. doi:10.1037/0022-0663.85.4.571.
- Skinner, E. A., T. A. Kindermann, J. P. Connell, and J. G. Wellborn. 2009. "Engagement and Disaffection as Organizational Constructs in the Dynamics of Motivational Development." In *Handbook of Motivation at School*, edited by K. R. Wentzel and A. Wigfield, 223–246. New York: Routledge.
- Skinner, E. A., T. A. Kindermann, and C. J. Furrer. 2009. "A Motivational Perspective on Engagement and Disaffection." *Educational and Psychological Measurement* 69 (3): 493–525. doi:10.1177/0013164408323233.

- Skinner, E. A., G. Marchand, C. Furrer, and T. Kindermann. 2008. "Engagement and Disaffection in the Classroom: Part of a Larger Motivational Dynamic?" *Journal of Educational Psychology* 100 (4): 765–781. doi:10.1037/a0012840.
- Skinner, E. A., J. G. Wellborn, and J. P. Connell. 1990. "What it Takes to do Well in School and Whether I've got It: A Process Model of Perceived Control and Children's Engagement and Achievement in School." *Journal of Educational Psychology* 82 (1): 22–32. doi:10.1037/0022-0663.82.1.22.
- Soenens, B., E. Sierens, M. Vansteenkiste, F. Dochy, and L. Goossens. 2012. "Psychologically Controlling Teaching: Examining Outcomes, Antecedents, and Mediators." *Journal of Educational Psychology* 104 (1): 108–120. doi:10.1037/a0025742.
- Solmon, M. A. 2003. "Student Issues in Physical Education Classes: Attitudes, Cognition, and Motivation." In *Student Learning in Physical Education: Applying Research to Enhance Instruction*, edited by S. J. Silverman and C. D. Ennis, 147–164. Champaign, IL: Human Kinetics.
- Standage, M., J. L. Duda, and N. Ntoumanis. 2005. "A Test of Self-determination Theory in School Physical Education." *British Journal of Educational Psychology* 75: 411–433. doi:10.1348/000709904x22359.
- Stephan, Y., J. Caudroit, J. Boiche, and P. Sarrazin. 2011. "Predictors of Situational Disengagement in the Academic Setting: The Contribution of Grades, Perceived Competence, and Academic Motivation." *British Journal of Educational Psychology* 81 (3): 441–455. doi:10.1348/000709910x522285.
- Tessier, D., P. Sarrazin, and N. Ntoumanis. 2010. "The Effect of an Intervention to Improve Newly Qualified Teachers' Interpersonal Style, Students Motivation and Psychological Need Satisfaction in Sport-based Physical Education." *Contemporary Educational Psychology* 35 (4): 242–253. doi:10.1016/j.cedpsych.2010.05.005.
- Van den Berghe, Lynn, Bart Soenens, Nathalie Aelterman, Greet Cardon, Isabel B. Tallir, and Leen Haerens. 2014. "Within-person Profiles of Teachers' Motivation to Teach: Associations with Need Satisfaction at Work, Need-supportive Teaching, and Burnout." *Psychology of Sport and Exercise* 15 (4): 407–417. doi:10.1016/j.psychsport.2014.04.001.
- Van den Berghe, Lynn, Bart Soenens, Maarten Vansteenkiste, Nathalie Aelterman, Greet Cardon, Isabel B. Tallir, and Leen Haerens. 2013. "Observed Need-supportive and Need-thwarting Teaching Behavior in Physical Education: Do Teachers' Motivational Orientations Matter?" *Psychology of Sport and Exercise* 14 (5): 650–661. doi:10.1016/j.psychsport.2013.04.006.
- Van den Berghe, Lynn, Maarten Vansteenkiste, Greet Cardon, David Kirk, and Leen Haerens. 2014. "Research on Self-Determination in Physical Education: Key Findings and Proposals for Future Research." *Physical Education and Sport Pedagogy* 19 (1): 97–121. doi:10.1080/17408989.2012.732563.
- Vansteenkiste, M., C. Niemiec, and Bart Soenens. 2010. "The Development of the Five Mini-theories of Self-determination Theory: An Historical Overview, Emerging Trends, and Future Directions." In *The Decade Ahead: Theoretical Perspectives on Motivation and Achievement*, Vol. 16, edited by Timothy C. Urdan and Stuart A. Karabenick, 105–166. Bingley: Emerald Publishing.
- Ward, Stefan, and Melissa Parker. 2012. "The Voice of Youth: Atmosphere in Positive Youth Development Program." *Physical Education and Sport Pedagogy* 18 (5): 534–548. doi:10.1080/17408989.2012.726974.
- Westland, C. J. 2010. "Lower Bounds on Sample Size in Structural Equation Modeling." *Electronic Commerce Research and Applications* 9 (6): 476–487. doi:dx.doi.org/10.1016/j.elerap.2010.07.003.