

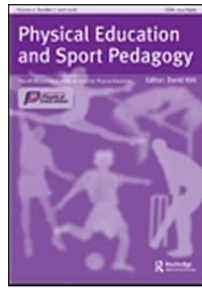


Van den Berghe, Lynn and Cardon, Greet and Tallir, Isabel and Kirk, David and Haerens, Leen (2016) Dynamics of need-supportive and need-thwarting teaching behavior : the bidirectional relationship with student engagement and disengagement in the beginning of a lesson. Physical Education and Sport Pedagogy, 21 (6). pp. 653-670. ISSN 1740-8989 , <http://dx.doi.org/10.1080/17408989.2015.1115008>

This version is available at <https://strathprints.strath.ac.uk/57065/>

Strathprints is designed to allow users to access the research output of the University of Strathclyde. Unless otherwise explicitly stated on the manuscript, Copyright © and Moral Rights for the papers on this site are retained by the individual authors and/or other copyright owners. Please check the manuscript for details of any other licences that may have been applied. You may not engage in further distribution of the material for any profitmaking activities or any commercial gain. You may freely distribute both the url (<https://strathprints.strath.ac.uk/>) and the content of this paper for research or private study, educational, or not-for-profit purposes without prior permission or charge.

Any correspondence concerning this service should be sent to the Strathprints administrator: strathprints@strath.ac.uk



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

Journal:	<i>Physical Education and Sport Pedagogy</i>
Manuscript ID	CPES-2014-0155.R1
Manuscript Type:	Original Article
Keywords:	student engagement, student disengagement, need support, need thwarting

SCHOLARONE™
Manuscripts

Abstract

Background. According to the classroom ecology paradigm (Hastie and Siedentop 2006; Doyle 1977), 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 fifteen minutes of a lesson.

Sample & Method. The first three five-minute intervals of 100 videotaped PE lessons taught by 100 different teachers (51.9% male, $M\ age = 37.5 \pm 10.9$ 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 fifteen minutes of a PE lesson. Next, path analyses were conducted to analyze five-to-five 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 fifteen minutes of the lesson. There were few significant relationships between student engagement and teachers' behavior across and between each of the three five-minute intervals. Only when teachers provided more need support during the first five minutes of the lesson, students were more engaged in the third five minutes of the lesson. When students were more disengaged during the first five minutes of the lesson, teachers displayed less need support in the following ten minutes of the lesson. **In contrast**, student disengagement in the second five minutes of the lesson related to more need support in the next five 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 five-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 teaching behaviors. When students display disengagement further along **in the first fifteen minutes of** the lesson, teachers seemed to respond in a more need-supportive way to student

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33 disengagement. Such findings provide interesting insights to build interventions for teachers around certain critical
34 moments during the lesson, for example when dealing with student disengagement at a specific moment in the lesson.

35 Key words: student engagement, student disengagement, need support, need-thwarting

For Peer Review Only

1 36 When confronted with student disengagement in the beginning of a lesson, teachers can react in many different
2
3 37 ways, so that some teachers remain patient and try to optimally motivate these students, while other teachers may start
4
5 38 to exert pressure in order to force students into participating. Patrick et al. (2003) suggested that the quality of the initial
6
7 39 social climate between teachers and students, which is characterized by mutual respect, teacher support, and mastery
8
9 40 goals, sets the tone for the subsequent social climate. Also Mainhard, Wubbels, and Brekelmans (2014) suggested that
10
11 41 maybe impressions of teacher affiliation and control in the first few minutes are important for how students perceive
12
13 42 their teacher later on. However, these suggestions have not been investigated within one lesson. The present study
14
15 43 builds on these suggestions by investigating reciprocal relationships between student engagement and disengagement
16
17 44 and teaching behavior at a micro-level by looking into the teacher-student dynamics within the first fifteen minutes of a
18
19 45 physical education (PE) lesson. To do so, this study uses the lens of self-determination theory (SDT; Deci and Ryan
20
21 46 1985, 2000), a widely used, accepted and scientifically supported theory on human motivational dynamics that has been
22
23 47 the theoretical framework for numerous studies on motivation in physical education (Van den Berghe, Vansteenkiste, et
24
25 48 al. 2014). The interesting feature of SDT is that it not only provides a good framework to conceptualize students'
26
27 49 motivation and related outcomes, but also in detail and very practically outlines how the social context, in case of the
28
29 50 present study the teacher, can elicit positive motivational outcomes among students.

30 51 Most previous SDT based studies typically relied on student-reports of teaching behaviors (Cox and Williams
31
32 52 2008; Skinner and Belmont 1993; Koka 2013). In the present study, this work was further extended by objectively
33
34 53 assessing teacher and student behavior by means of observations as was already done in previous studies (Haerens et al.
35
36 54 2013; Van den Berghe et al. 2013; Tessier, Sarrazin, and Ntoumanis 2010; Jang, Reeve, and Deci 2010; Reeve et al.
37
38 55 2004; Perlman 2013). In the latter observational studies, positive associations were found between supportive teaching
39
40 56 practices and adaptive outcomes, such as optimal student motivation. There are a few advantages of measuring behavior
41
42 57 through observations (Haerens et al. 2013). First, the use of observations can overcome some methodological
43
44 58 limitations related to the exclusive reliance on student reports which can cause problems of shared method variance,
45
46 59 such that associations get artificially inflated. Also, observations rule out students' personal interpretations of the
47
48 60 situation which could be colored by previous experiences with the teacher. Second, because of the real-life setting of the
49
50 61 videotaped PE lesson, the ecological validity is high, and observational measures provide insight in the frequency of
51
52 62 certain behaviors during a specific period of the lesson. Moreover, and in relation to the present study, such measures
53
54 63 allow investigating how teaching behavior and student engagement perhaps fluctuate during the course of one lesson
55
56 64 depending on whether it is the beginning of the lesson or a time period further along the lesson. For the purpose of the
57
58 65 current study, observational measures were used to assess teaching behavior and student (dis)engagement in five-minute
59
60 66 intervals. The first fifteen minutes of a PE lesson were observed, this to capture both the introduction of the lesson as
67
68 well as part of the main part of the lesson.

68 Student engagement and disengagement

69 Student engagement is a multifaceted concept, reflecting behavioral, emotional, and cognitive aspects
70 (Fredricks, Blumenfeld, and Paris 2004). Students are engaged in a lesson when they listen to the teacher, enjoy doing
71 the exercises, show effort and persistence, or answer the teacher's questions (Reeve et al. 2004; Furrer and Skinner
72 2003). Student disengagement (sometimes also called disaffection) is characterized by the absence of effort or
73 persistence and includes behaviors such as not listening, not making an effort, giving up easily, or being bored (Skinner,
74 Kindermann, and Furrer 2009). The importance of student engagement in the academic context is reflected in its
75 relationship with students' grades and achievement (e.g., Skinner, Kindermann, and Furrer 2009; Skinner, Wellborn,
76 and Connell 1990). Various studies have investigated student engagement as a positive consequence (e.g., Skinner and
77 Belmont 1993; Mouratidis et al. 2008; Assor, Kaplan, and Roth 2002) and disengagement as a negative consequence of
78 teachers' way of interacting with students (Stephan et al. 2011; Skinner et al. 2008). The process-product paradigm,
79 which suggests a one-way route from teaching behavior (process) to student learning (product), has been criticized for
80 oversimplifying the complexity of interactions between teachers and students (Doyle 1977; Solmon 2003). According to
81 the classroom ecology paradigm (Hastie and Siedentop 2006), teachers and students interpret, predict and respond to
82 each other repeatedly in a reciprocal way, so that not only teachers affect students, but that students also influence
83 teachers. In that respect, Skinner, Kindermann, Connell, and Wellborn (2009) argued that student engagement can act as
84 an energetic resource for teachers.

85 Also longitudinal studies showed that, just as teachers can affect students, teachers' perceptions of student
86 engagement can also affect teachers' behaviors. In the Skinner and Belmont (1993) study, it was illustrated that
87 students' behavioral engagement at one point in time predicted motivating teaching behavior a few months later. In a
88 different and more recent study, Koka (2013) looked at longitudinal relationships between students' motivation, as a
89 proxy of engagement, and motivating teaching behavior. In this one-year longitudinal study, it was indicated that
90 students' optimal motivation to engage in PE positively predicted their teachers' democratic (e.g., asking students for
91 permission) and negatively predicted autocratic behavior (e.g., refusing to compromise with students) after a period of
92 12 months. These studies provided insight in long-term motivational dynamics, highlighting that engaged students
93 subsequently elicit more motivating behavior in teachers, hereby illustrating a positive chain reaction across a number
94 of lessons starting with the students' behaviors. Then, the question arose as to whether the same patterns would also
95 emerge in shorter-term dynamics, such that these interactions would be found across and within five-to-five minute
96 intervals. As Skinner et al. (2009) suggested that student engagement can change across situations and time, students
97 might show different levels of engagement within one lesson based on certain interactions with the teacher, but also
98 teachers could react differently to students' engagement according to the specific context of the lesson.

99 Need-supportive and need-thwarting teaching behavior

1 100 Studies examining relationships between teaching behaviors and student engagement from a motivational
2
3 101 perspective (e.g., Skinner and Belmont 1993; Jang, Reeve, and Deci 2010; Ntoumanis 2005) often find their roots in
4
5 102 SDT (Deci and Ryan 1985, 2000), because it encompasses a practical theory that conceptually frames teaching
6
7 103 behaviors many teachers regularly engage in from a motivational perspective. Central in SDT is the idea that, in
8
9 104 motivating learning environments, students' three basic psychological needs for autonomy (i.e., a sense of volitional
10
11 105 and psychological freedom), competence (i.e., a sense of personal effectiveness), and relatedness (i.e., interpersonal
12
13 106 closeness and mutuality) are nurtured and developed (Ryan & Deci, 2002; Vansteenkiste, Niemiec, & Soenens, 2010).
14
15 107 In demotivating learning environments, the same needs get actively frustrated that results in autonomy frustration (i.e.,
16
17 108 feelings of pressure), competence frustration (i.e., experiencing a sense of inferiority or failure), and relatedness
18
19 109 frustration (i.e., feelings of loneliness and alienation). To state differently, positive student outcomes, such as
20
21 110 engagement, are more likely to arise in a need-supportive teaching environment (Mouratidis et al. 2008; Standage,
22
23 111 Duda, and Ntoumanis 2005; Shen et al. 2009; Perlman 2013; Ward and Parker 2012), while maladaptive student
24
25 112 outcomes, such as disengagement, might arise in a need-thwarting environment (De Meyer et al. 2014; Haerens et al.
26
27 113 2015).

28 114 Need support involves the provision of autonomy support, structure, and involvement (Connell and Wellborn
29
30 115 1991). Autonomy-supportive teachers typically identify, nurture, and develop students' goals and interests (Reeve
31
32 116 2009). Teachers can nurture students' need for competence by providing adequate structure through clear instructions
33
34 117 and positive feedback, (Farkas and Grolnick 2010; Haerens et al. 2013; Jang, Reeve, and Deci 2010; Mouratidis et al.
35
36 118 2008). The need for relatedness can be nourished by creating a warm class environment in which the teacher is
37
38 119 empathic, caring, and understanding (Cox and Williams 2008; Haerens et al. 2013; Skinner and Belmont 1993).

39 120 Several studies have revealed a positive association between need support and positive student behaviors and
40
41 121 student engagement. In a general education context, Skinner and Belmont (1993), Reeve et al. (2004), and Jang et al.
42
43 122 (2010) found that teachers' autonomy support and structure related positively to student engagement. In PE, Ntoumanis
44
45 123 (2005) found that need support from teachers indirectly and positively related to indicators of student engagement (i.e.,
46
47 124 effort, concentration, affect, and intentions to participate in optional PE) through need satisfaction and self-determined
48
49 125 motivation. In an experimental study of García-Calvo et al. (2015), effort and cooperation in students was positively
50
51 126 influenced when teachers were more need-supportive towards their students in physical education. Whether the analyses
52
53 127 were based on hierarchical regression analyses (Reeve et al. 2004), structural equation modeling (Ntoumanis 2005) or
54
55 128 hierarchical linear modeling (Jang, Reeve, and Deci 2010), all studies positioned need-supportive teaching behavior as
56
57 129 an antecedent of student engagement in the motivational sequence.

58 130 While need support is known to encourage engagement in students, need-thwarting teaching behaviors might
59
60 131 bring students to become more disengaged. Need-thwarting teaching is characterized by exertion of control, a chaotic

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
132 style, and having cold interactions, hereby frustrating students' needs for autonomy, competence and relatedness
133 respectively (Van den Berghe et al. 2013; Bartholomew et al. 2011). Controlling teachers thwart the need for autonomy,
134 because they pressure students to behave and think in prescribed ways (Grolnick 2003; Soenens et al. 2012).
135 Additionally, teachers may thwart the students' need for competence by creating a chaotic class climate in which
136 objectives, expectations and rules are unclear (Van den Berghe et al. 2013). Being unfriendly or even rejecting and
137 excluding students are typical behaviors depicting an emotionally cold environment (Skinner and Belmont 1993), which
138 may thwart the students' need for relatedness. Until now, less attention has been paid to this 'dark side' of motivational
139 teaching practices, even though it is recognized that the presence of need-thwarting teaching behavior is more than
140 merely the absence of need support (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; De Meyer
141 et al., 2013).

20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
142 Most of the studies that have addressed need-thwarting behaviors in an educational context have focused on
143 the exertion of control, while chaotic and cold interactions have received less attention. In a study among elementary
144 school children, controlling teaching related to less intensive student engagement as measured by student and teacher
145 questionnaires (Assor et al. 2005). Soenens et al. (2012) found that student reports of psychologically controlling
146 teaching (e.g., guilt induction) related negatively to deep-level learning strategies and academic performance in
147 secondary school students. In the study of De Meyer et al. (2014), observations of controlling teaching behavior related
148 positively to students' need frustration, controlled motivation, and amotivation in PE. The present study builds on this
149 research by not only focusing on controlling teaching behavior (e.g., Soenens et al. 2012; De Meyer et al. 2014), but by
150 also including observations of chaotic and cold teaching behaviors. It simultaneously investigates bidirectional
151 relationships between student (dis)engagement and teachers' need-thwarting behaviors, as well as between student
152 (dis)engagement and teachers' need-supportive behaviors.

40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 153 **The present study**

154 Whereas previous studies have investigated how teaching behavior predicts student engagement cross-
155 sectionally (Cox and Williams 2008), experimentally (Tessier, Sarrazin, and Ntoumanis 2010), or longitudinally across
156 lessons (Skinner and Belmont 1993; Koka 2013), no studies have investigated how teaching behaviors and student
157 engagement fluctuate and relate to each other within the first moments of a lesson. As Skinner, Kindermann, and Furrer
158 (2009) suggested that engagement can change over time and between different situations, the aim of the present
159 observational study was to investigate how observed student (dis)engagement and need-supportive or need-thwarting
160 teaching behavior are related to each other across and within the first fifteen minutes of a PE lesson.

161 Based on the results of previous studies (Koka 2013; Skinner and Belmont 1993), it was hypothesized that
162 student engagement would be positively related to need support, while negative relationships with need-thwarting
163 teaching behaviors were expected. Negative relationships with need support and positive relationships with need-

1 164 thwarting teaching behavior were predicted for student disengagement. Next, we explored the fluctuations of student
2
3 165 (dis)engagement, need support, and need-thwarting in the first fifteen minutes of the lesson. Further, we investigated the
4
5 166 relationships between student (dis)engagement and teaching behavior across and between specific five-minute intervals.
6
7 167 We hypothesized that when students are more engaged during the first five minutes of the lesson, teachers probably
8
9 168 notice this, and, therefore, they might feel encouraged to act in a more need-supportive manner in the following five or
10
11 169 ten minutes. Further, it was hypothesized that teachers might feel discouraged to be need-supportive and even become
12
13 170 (more) need-thwarting when students show disengagement during the first five minutes of the lesson because they feel
14
15 171 pressured (e.g., Van den Berghe, Soenens, et al. 2014; Pelletier, Seguin-Levesque, and Legault 2002). Additionally,
16
17 172 negative relationships between need-thwarting teaching behaviors at the beginning of the lesson and student
18
19 173 engagement, and between need support at the beginning of the lesson and student disengagement were expected.

174 **Method**

175 **Procedure**

176 One hundred videotaped PE lessons randomly chosen out of an existing dataset (Haerens et al. 2013; Van den
177 Berghe et al. 2013; De Meyer et al. 2014) that was already coded in terms of teachers' need supportive and need-
178 thwarting teaching behaviors, were re-analyzed in terms of students' engagement and disengagement for the purposes
179 of the current study. [The Ethical Committee of Ghent University approved the larger research project, of which the](#)
180 [present study was part of \(Haerens et al. 2015; Van den Berghe et al. 2013\).](#) For this larger research project, the teachers
181 all gave approval for being videotaped by means of an informed consent form. Also the students' parents of legal
182 guardians signed an informed consent form. At the measurement day (i.e., one randomly chosen PE lesson), a digital
183 camcorder was positioned in a corner of the gymnasium, enabling to capture the widest possible angle of the lesson.
184 Teachers wore a microphone to capture their verbal communication.

185 **Participants**

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

193 **Measures**

194 **Observed need-supportive and need-thwarting teaching behavior.** Teachers' need-supportive and need-
195 thwarting behaviors were assessed [as part of two different studies](#) (Haerens et al. 2013; Van den Berghe et al. 2013). [Six](#)
60

1
2 196 external raters coded 19 need-supportive and 16 need-thwarting teaching behaviors through a valid and reliable
3
4 197 observation tool with an acceptable to good intra- and interrater reliability (Haerens et al. 2013; Van den Berghe et al.
5
6 198 2013). More information on the development and use of the observation tool can be found in the studies of Haerens et
7
8 199 al. (2013) and Van den Berghe et al. (2013). For the present study, the first 15 minutes (corresponding to three five-
9
10 200 minute intervals) of each lesson were re-coded by one out of the six external raters in terms of students' engagement
11
12 201 and disengagement. This observer was trained as part of a larger research project (Haerens et al. 2013; Van den Berghe
13
14 202 et al. 2013). Training included coding videotapes, discussing the observations and come to a consensus between the
15
16 203 observers. Each of the teaching behaviors was coded on a 4-point scale ranging from 0 (never observed) to 1 (observed
17
18 204 sometimes), to 2 (observed often), to 3 (observed all the time). In total, three intervals were coded and the coding took
19
20 205 approximately 30 to 60 minutes for each lesson (75 hours total coding). The observation tool had adequate intra- and
21
22 206 interrater reliability (Haerens et al. 2013; Van den Berghe et al. 2013). The need-supportive teaching behaviors ($\alpha =$
23
24 207 .81) reflected the four need-supportive teaching dimensions of autonomy support (e.g., "The teacher offers choice to all
25
26 208 students."), structure before the activity (e.g., "The teacher gives an overview of the content and structure of the
27
28 209 lesson."), structure during the activity (e.g., "The teacher offers the students a rationale for tasks and exercises."), and
29
30 210 relatedness support (e.g., "The teacher takes the perspective of students into account, is empathic."). To tap into need-
31
32 211 thwarting teacher behaviors ($\alpha = .67$), the dimensions of controlling (e.g., "The teacher exercises power over the
33
34 212 students by interfering and demanding respect"), cold (e.g., "The teacher is acting unfriendly and cold"), and chaotic
35
36 213 teaching (e.g., "uses an illogical and inconsistent structure during the warming up and activity or in the transitions
37
38 214 between exercises") were assessed.

37
38 215 **Observed student engagement.** Student engagement and student disengagement were also assessed by means
39
40 216 of observations by one external rater. Student engagement ($\alpha = .68$) incorporated five items: students listening, being
41
42 217 energetic, persistent, having fun, and asking questions (Reeve et al. 2004; Furrer and Skinner 2003; Aelterman et al.
43
44 218 2012). Aelterman et al. (2012) illustrated a good intra- and interrater reliability for this scale. Four items ($\alpha = .72$) were
45
46 219 selected from the Engagement versus Disaffection with Learning Scale (Skinner, Kindermann, and Furrer 2009)
47
48 220 reflecting the same dimensions as in the items of student engagement to observe student disengagement: not listening,
49
50 221 not making an effort, giving up easily, and being bored.

50
51 222 We acknowledge that the scales with an alpha of less than .70 (i.e., need-thwarting teaching behavior and
52
53 223 student engagement) might need further refinement and/or additional items to increase the reliability (see also Van den
54
55 224 Berghe et al. 2013). Despite of the rather mediocre alpha ($<.70$) in some dimensions, we still found it interesting to take
56
57 225 into account these dimensions for the purpose of investigating the relationship of the different dimensions of teaching
58
59 226 behavior with student engagement.

227 Plan of Analysis

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

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

242 Next, four different path models were tested to explore how need support and need-thwarting in the first five
243 minutes of the lesson account for student (dis)engagement in the first, second, and third five-minute interval. In these
244 models, within-time relationships were allowed. The chi-square (χ^2), the Root Mean Square Error (RMSEA), the
245 Standardized Root Mean Square Residual (SRMR), the Comparative Fit Index (CFI), and the Tucker Lewis Index (TLI)
246 were used to assess the model fit. A good model fit is indicated by an RMSEA equal to or smaller than .06, an SRMR
247 equal to or smaller than .08, and a CFI and TLI greater than .95 (Hu and Bentler 1999).

248 Results

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

253 The occurrence of observations ranged between 0.96 and 1.04 for need support ($M = 1.01 \pm .23$), between 0.13
254 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
255 and 0.29 for disengagement ($M = 0.29 \pm .26$) on a scale from 0 to 3. When exploring fluctuations in observations
256 between time intervals (see Figure 2), the repeated-measures MANOVA with need support, need-thwarting, student
257 engagement, and disengagement provided evidence for a significant multivariate within-subject effect of five-minute
258 time intervals ($F(1,98) = 5.85, p \leq .01, \eta^2_p = .11$). Univariate repeated-measures analyses revealed a significant linear

1
2 259 time effect for need support ($F(1,99) = 7.22, p \leq .01, \eta^2_p = .07$), but not for need-thwarting ($F(1,99) = 3.11, ns$), student
3
4 260 engagement ($F(1,69) = 3.11, ns$), or disengagement ($F(1,99) = 3.11, ns$). Need-supportive teaching behavior increased
5
6 261 from the first five minutes to the second five minutes of the lesson and remained stable the third five minutes of the
7
8 262 lesson. Also the quadratic trend for need support was significant ($F(1,99) = 5.13, p \leq .05, \eta^2_p = .05$), with an increase
9
10 263 from the first to second five-minute interval, remaining stable in the third interval.

11 264 The nonparametric Kolmogorov-Smirnov-test ($N < 200$) indicated that the data were not normally distributed.
12
13 265 Therefore, path analyses were conducted with a maximum likelihood estimation with robust standard errors to adjust
14
15 266 the chi-square statistics and standard errors in order to prevent Type I errors (Satorra and Bentler 2011). In Table 1,
16
17 267 standardized XY estimates, significance levels, and fit indices of the eight models relating student (dis) engagement and
18
19 268 need-supportive and need-thwarting teaching behavior are presented. In the first four models we investigated how
20
21 269 student (dis)engagement related to teaching behaviors within and across five minute intervals. In the next four models,
22
23 270 relationships were investigated in the opposite direction, with teachers' behavior predicting student (dis)engagement
24
25 271 across intervals.

26 272 When looking across each of the five minute intervals, there were few significant relationships between student
27
28 273 (dis)engagement and teachers' behavior. Only in model 3, in which student disengagement was related to teachers' need
29
30 274 support, it was found that student disengagement in the first five minutes of the lesson related to less need support in the
31
32 275 second and third interval. On the contrary, student disengagement in the second five minutes of the lesson related to
33
34 276 more need support in the next five minutes. When predicting student engagement and disengagement, only one across-
35
36 277 interval relationship was found. When teachers displayed more need support in the first five minutes of the lesson,
37
38 278 students were more engaged in the third five-minute interval.

39 279 The within-interval relationships were also inconsistent across models. While student engagement and teacher
40
41 280 need support did not show any significant within-time associations, student engagement and need-thwarting did relate
42
43 281 negatively to each other within the three time intervals. Student disengagement showed a positive association with
44
45 282 teacher need support in the second time interval, but it also showed a positive relationship with need-thwarting in the
46
47 283 first and third time interval.

284 Discussion

49 285 Ideally, all PE teachers want their students to actively engage in their lessons in order to optimally facilitate the
50
51 286 learning process. Students can react in different ways to motivating or demotivating teaching behavior by either being
52
53 287 engaged or disengaged for the subject. *No previous studies have investigated fluctuations in teaching behaviors and*
54
55 288 *student engagement within the first moments of a physical education lesson.* The purpose of this study was to
56
57 289 investigate how student (dis)engagement and need-supportive and need-thwarting teaching behavior are related to each
58
59 290 other in three sequential five-minute intervals of the beginning of the PE lesson.
60

1 291 A first purpose of the present study was to investigate whether relationships between student (dis)engagement
2
3 292 and need-supportive and need-thwarting teaching behavior that were found based on student and teacher reports, could
4
5 293 be replicated when making use of observations. As proposed by Skinner, Kindermann, Connell, and Wellborn (2009),
6
7 294 and as was seen in the studies of Koka (2013) and Skinner and Belmont (1993) across a school year, we found that
8
9 295 when students are engaged, teachers are also stimulated to act in a more need-supportive fashion. More specifically,
10
11 296 when looking at overall relationships between student engagement and teaching behavior across all three five minute
12
13 297 intervals, positive correlations between student engagement and need support and negative correlations between student
14
15 298 engagement and need-thwarting teaching behavior were found. Student disengagement did not relate to need support,
16
17 299 but it was positively associated with need-thwarting teaching behavior. This is in line with the suggestion for the
18
19 300 existence of a dark motivational pathway (Haerens et al. 2015), in which experiences of need frustration (as opposed to
20
21 301 need satisfaction) might have a unique predictive validity for maladaptive outcomes such as student disengagement (as
22
23 302 opposed to student engagement).

24 303 However, these results were not confirmed between or within five-minute intervals. First, when looking into
25
26 304 changes over the three five-minute intervals, no significant fluctuations were found in need-thwarting teaching
27
28 305 behaviors, student engagement, or disengagement, suggesting that these variables are relatively stable during the course
29
30 306 of a lesson. Only need support increased over time, so no strong interactions between student (dis)engagement and
31
32 307 teaching behavior were expected, as most of the investigated behaviors remained relatively stable across the three
33
34 308 intervals. Accordingly, no significant relationships were found between student engagement and need support between
35
36 309 and within the five-minute intervals. This indicates that when students are engaged at one moment in time, teachers
37
38 310 might be pleased with how things go along in class and they might not see a need for change in their behavior.
39
40 311 However, student engagement was negatively related to need-thwarting within the same time interval, which could
41
42 312 mean that when students are engaged, teachers immediately feel less inclined to act in a need-thwarting way.

43 313 For the relationships between student disengagement and teacher need support and need-thwarting behavior,
44
45 314 inconsistent results were found. Disengagement in the first five minutes of the lesson related to less need support in the
46
47 315 next five-minute intervals, but disengagement in the second five minutes of the lesson was associated with more instead
48
49 316 of less need support. In the study of Haerens et al. (2013) some need-supportive behaviors, such as providing clear
50
51 317 guidelines and instructions, were more prevalent before the learning process, while other behaviors, such as offering
52
53 318 help and guidelines to students were more frequently observed in the middle of the lesson. The start of the lesson often
54
55 319 involves instructions from the teachers, so when students are disruptive or not listening, teachers might have a tendency
56
57 320 to immediately react in a less need-supportive way because of their own agenda. In the second interval of the lesson,
58
59 321 students are often already exercising or playing. In that context, teachers might be more inclined to act in a more need-
60
322 supportive manner with their students when confronted with disengagement. Possible explanations for this phenomenon

1
2 323 are yet to be explored in future research, but one avenue is to examine which need-supportive behaviors mainly occur at
3
4 324 the beginning of the lesson and which behaviors especially occur during the course of the lesson, and how these
5
6 325 behaviors might differentially influence students throughout the lesson.

7 326 Even though it is advised based on the principles of SDT, teachers did not have the automatic response to
8
9 327 become more need-supportive when students were disengaged, as would be a recommended strategy according to SDT.
10
11 328 On the other hand, teachers were more need-thwarting when students were observed to be disengaged. There was an
12
13 329 immediate within-interval interaction between teachers and students when situated in a negative class atmosphere. As
14
15 330 was illustrated by Baumeister, Bratslavsky, Finkenauer, and Vohs (2001), negative experiences have a stronger impact
16
17 331 on an individual than positive experiences, which in our study might be reflected in an immediate display of teachers
18
19 332 being more need-thwarting when confronted with student disengagement. This might also be the case when looking at it
20
21 333 the other way around, with students becoming more disengaged when confronted with need-thwarting teachers. So next
22
23 334 to other external pressures for teachers, such as imposing performance levels for students (Flink, Boggiano, and Barrett
24
25 335 1990), also student disengagement could be seen as a challenging or pressuring antecedent, possibly evoking an
26
27 336 immediate reaction in teachers.

28 337 Due to the rather limited fluctuations in behavior over the five-minute intervals, few cross-interval associations
29
30 338 were found. One unexpected positive association between teachers' need support and student disengagement was found
31
32 339 in the second five minutes of the lesson. This association suggested that teachers do react in a more need-supportive
33
34 340 way towards disengaged students by for instance providing help and feedback. However, this positive correlation was
35
36 341 only found in one model and in one interval, and, additionally, even a negative correlation was found within the first
37
38 342 and third interval. It is possible that the relationship between teacher need support and student (dis)engagement is a
39
40 343 relatively slow process, with the possible effects of need support on student engagement and disengagement only
41
42 344 becoming apparent after a while, as was found in the studies of Koka (2013) and Skinner and Belmont (1993). Also
43
44 345 here, critical incident analyses could show stronger associations between specific positive events and the teacher-
45
46 346 student interactions following these specific events. However, this is merely speculation on our part and further research
47
48 347 on this matter is needed.

49 348 It was expected that relationships between the positive constructs of student engagement and need support
50
51 349 would be strong and that the associations between the negative constructs of student disengagement and need-thwarting
52
53 350 would also be stronger than when looking into 'mixed' associations. The notion of a 'bright' and 'dark' pathway
54
55 351 (Haerens et al. 2015) suggests that motivating teaching behavior relates to good quality motivation in students, while
56
57 352 need-thwarting teaching behavior relates to poor quality motivation. However, in the current study, also 'mixed'
58
59 353 relationships were revealed, with student disengagement and need support and student engagement and need-thwarting
60
354 showing associations within or between time intervals.

1 355 The results of the current study could be of added value for the practice of PE teachers by raising awareness of
2
3 356 the two-way interactions between students and teachers. In future studies, intervention studies and workshops might be
4
5 357 developed in the context of continuous professional development programs, for example targeting certain critical
6
7 358 moments during the lesson. To illustrate, critical moments in which teachers have to deal with student disengagement
8
9 359 and how they might differentially react to this according to the specific moment of the lesson. PE teachers can be
10
11 360 explained which student behaviors might cause them to be more or less need-supportive or need-thwarting at which
12
13 361 moment in the lesson and how they could optimally react to these student behaviors.

14 362 **Shortcomings, strengths, and suggestions for future research**

16 363 One shortcoming of this study is that, even with a number of 100 videotapes with the first fifteen minutes
17
18 364 analyzed down to a five-minute level, there was not sufficient power to analyze cross-lagged models with all need-
19
20 365 supportive and need-thwarting teaching dimensions in one model. In order to include all dimensions of teaching
21
22 366 behavior and student (dis)engagement in one model, at least 300 videotaped and analyzed PE lessons should be
23
24 367 available. In future studies, the number of observations could be increased, but one could also choose to focus on more
25
26 368 detailed interactions or behaviors, without including all dimensions of teaching behavior and student (dis)engagement.
27
28 369 Another consideration for future research is the analysis of the contextual motivational climate established before the
29
30 370 data collection phase, so that one can take into account how this affects relationships between variables in the first
31
32 371 fifteen minutes of a lesson. It might also be interesting to assess teachers motivational orientations, as these might affect
33
34 372 how teachers react to students engagement and disengagement.

35 373 Another way to analyze these student-teacher interactions from a more qualitative point of view, to gain insight
36
37 374 into what happens during class, is a technique called critical incident analyses (Flanagan 1954). When applying the
38
39 375 method of critical incident analyses, observers focus on incidents that have a special significance in that context (e.g., a
40
41 376 teacher is having an argument with a student) and from there, they make sound inferences about its effects on people
42
43 377 and make predictions for future incidents (e.g., the realization that the rationale for some disciplinary rules is not clear
44
45 378 for the students or that (consequences of) disciplinary rules are not clearly communicated at the beginning of the school
46
47 379 year). Such analyses can result in insights and reflections particularly useful for preservice and inservice teachers, for
48
49 380 example, to be discussed in teacher education programs or professional development sessions on a specific topic. To
50
51 381 take a more qualitative point of view, observation studies can also be combined with (post-observation recall)
52
53 382 interviews with teachers and students to gain additional information on their interactions, and the differences in
54
55 383 perceptions between both.

56 384 We chose to specify models with a specific temporal ordering of the first fifteen minutes of student
57
58 385 (dis)engagement and need support or need-thwarting. However, there is an array of other possibilities to analyze these
59
60 386 data, such as focusing on other parts of the lesson, on identifying single teacher or student behaviors to identifying

1
2 387 specific teaching dimensions or including all dimensions of student engagement, and on coding five-minute intervals to
3
4 388 examining specific parts of the lesson (such as the warm up, main part, and the ending). Additionally, the reliabilities of
5
6 389 student engagement in the cited study (Aelterman et al. 2012) were calculated based on the total impression of a lesson,
7
8 390 while in the current study, the tool was used to code five-minute intervals of student engagement. Another shortcoming
9
10 391 of this study is that potentially important contextual factors (such as the diversity in teachers' age and experience, in the
11
12 392 students' grade, or in the topic of the lesson) were not addressed in the analyses. Possibly, the strength of the
13
14 393 associations between student (dis)engagement and need-supportive and need-thwarting teaching behavior depends on
15
16 394 the unique characteristics of the setting of the videotaped lesson, so that for example lesson requiring a lot of feedback
17
18 395 and interactions between teachers and students might show stronger associations between teacher and student behavior.

19 396 One of the strengths of the current study is the use of an elaborate measure of teachers' need-supportive and
20
21 397 need-thwarting behaviors, including four need-supportive and three need-thwarting teaching dimensions (Haerens et al.
22
23 398 2013; Van den Berghe et al. 2013). Further, both **measures of** student (dis)engagement and need-supportive and need-
24
25 399 thwarting teaching behavior were not biased by previous experiences teachers and students. We acknowledge that
26
27 400 observing student (dis)engagement as a class measure has the disadvantage of not capturing the possible impact of
28
29 401 individual student (dis)engagement on (de)motivating teaching behaviour, which might reveal more associations. An
30
31 402 alternative for this method could be observing and rating (dis)engagement of individual students together with specific
32
33 403 and personal teacher-student interactions, as was done in the study of Skinner, Kindermann, and Furrer (2009). To use a
34
35 404 similar observation method in a PE lesson asks for another methodological and practical approach, because students are
36
37 405 constantly moving around in PE, because of the noise in a gymnasium, and because students frequently talk to and yell
38
39 406 at each other during the lesson.

40
41 407 The advantage of studying student and teacher behavior in the context of PE is reflected in the greater visibility
42
43 408 of student engagement through movements and bodily efforts during class. Nevertheless, the question rises whether the
44
45 409 results of the current study are transferable to a more general academic context or to other curricula.

46 47 410 **Conclusion**

48
49 411 The study provided partial support for the classroom ecology paradigm (Doyle 1977; Hastie and Siedentop
50
51 412 2006), indicating that teachers and students interact in a reciprocal way. The findings suggest that student
52
53 413 disengagement might elicit less positive teaching behaviors both momentary (more need-thwarting teaching behavior)
54
55 414 and during the course of a lesson (less need-supportive teaching behavior over time). This knowledge might provide
56
57 415 insights for teachers on how (not to) react when trying to elicit student engagement or other optimal outcomes and could
58
59 416 be used to build interventions for teachers around certain critical moments during the lesson, for example when dealing
60
417 with student disengagement at a specific moment in the lesson.

References

- 1 418
2
3
4 419 Aelterman, Nathalie, Maarten Vansteenkiste, Hilde Van Keer, Lynn Van den Berghe, Jotie De Meyer, and Leen
5 420 Haerens. 2012. "Students' objectively measured physical activity levels and engagement as a function of
6 421 between-class and between-student differences in motivation toward physical education." Review of. *Journal*
7 422 *of Sport & Exercise Psychology* 34 (4):457-80.
- 8
9
10 423 Assor, A., H. Kaplan, Y. Kanat-Maymon, and G. Roth. 2005. "Directly controlling teacher behaviors as predictors of
11 424 poor motivation and engagement in girls and boys: The role of anger and anxiety." Review of. *Learning and*
12 425 *Instruction* 15 (5):397-413. doi: 10.1016/j.learninstruc.2005.07.008.
- 13
14
15 426 Assor, A., H. Kaplan, and G. Roth. 2002. "Choice is good, but relevance is excellent: Autonomy-enhancing and
16 427 suppressing teacher behaviours predicting students' engagement in schoolwork." Review of. *British Journal of*
17 428 *Educational Psychology* 72:261-78. doi: 10.1348/000709902158883.
- 18
19
20 429 Bartholomew, Kimberley Jane, Nikos Ntoumanis, Richard M. Ryan, J. A. Bosch, and Cecilie Thogersen-Ntoumani.
21 430 2011. "Self-Determination Theory and diminished functioning: The role of interpersonal control and
22 431 psychological need thwarting." Review of. *Personality and Social Psychology Bulletin* 37 (11):1459-73. doi:
23 432 10.1177/0146167211413125.
- 24
25
26
27 433 Baumeister, R. F., Ellen Bratslavsky, Cathrin Finkenauer, and Kathleen D. Vohs. 2001. "Bad is stronger than good."
28 434 Review of. *Review of General Psychology* 5 (4):323-70. doi: 10.1037/1089-2680.5.4.323.
- 29
30
31 435 Connell, J. P., and J. G. Wellborn. 1991. *Competence, autonomy, and relatedness: A motivational analysis of self-*
32 436 *system processes*. Edited by M. R. Gunnar and L. A. Sroufe. Vol. 23, *Self Processes and Development*.
33 437 Hillsdale: Lawrence Erlbaum Assoc Publ.
- 34
35
36 438 Cox, A. E., and L. Williams. 2008. "The roles of perceived teacher support, motivational climate, and psychological
37 439 need satisfaction in students' physical education motivation." Review of. *Journal of Sport & Exercise*
38 440 *Psychology* 30 (2):222-39.
- 39
40
41 441 De Meyer, Jotie, Isabel B. Tallir, Bart Soenens, Maarten Vansteenkiste, Nathalie Aelterman, Lynn Van den Berghe,
42 442 Lise Speleers, and Leen Haerens. 2014. "Does observed controlling teaching behavior relate to students'
43 443 motivation in physical education?" Review of. *Journal of Educational Psychology* 106 (2):541-54. doi:
44 444 10.1037/a0034399.
- 45
46
47 445 Deci, E. L., and R. M. Ryan. 1985. *Intrinsic Motivation and Self-Determination in Human Behavior*. New York:
48 446 Plenum Publishing Co.
- 49
50
51 447 ———. 2000. "The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior." Review
52 448 of. *Psychological Inquiry* 11 (4):227-68. doi: 10.1207/s15327965pli1104_01.
- 53
54
55 449 Doyle, Walter. 1977. "4: Paradigms for research on teacher effectiveness." Review of. *Review of Research in Education*
56 450 5 (1):163-98. doi: 10.3102/0091732x005001163.
- 57
58
59
60

- 1
2 451 Farkas, M. S., and W. S. Grolnick. 2010. "Examining the components and concomitants of parental structure in the
3 452 academic domain." Review of. *Motivation and Emotion* 34 (3):266-79. doi: 10.1007/s11031-010-9176-7.
4
5 453 Flanagan, John C. 1954. "The critical incident technique." Review of. *Psychological Bulletin* 51 (4):327-58. doi:
6 454 10.1037/h0061470.
7
8
9 455 Flink, C., A. K. Boggiano, and M. Barrett. 1990. "Controlling teaching strategies: Undermining children's self-
10 456 determination and performance." Review of. *Journal of Personality and Social Psychology* 59 (5):916-24. doi:
11 457 10.1037//0022-3514.59.5.916.
12
13
14 458 Fredricks, Jennifer A, Phyllis C Blumenfeld, and Alison H Paris. 2004. "School engagement: Potential of the concept,
15 459 state of the evidence." Review of. *Review of Educational Research* 74 (1):59-109. doi:
16 460 10.3102/00346543074001059.
17
18
19 461 Furrer, C., and E. Skinner. 2003. "Sense of relatedness as a factor in children's academic engagement and performance."
20 462 Review of. *Journal of Educational Psychology* 95 (1):148-62. doi: 10.1037/0022-0663.95.1.148.
21
22
23 463 García-Calvo, Tomás, David Sánchez-Oliva, Francisco Miguel Leo, Diana Amado, and Juan José Pulido. 2015.
24 464 "Effects of an intervention programme with teachers on the development of positive behaviours in Spanish
25 465 physical education classes." Review of. *Physical Education and Sport Pedagogy*:1-17. doi:
26 466 10.1080/17408989.2015.1043256.
27
28
29 467 Grolnick, W. S. 2003. *The psychology of parental control: how well-meant parenting backfires*. Mahwah, N.J.: L.
30 468 Erlbaum Associates.
31
32
33 469 Haerens, Leen, Nathalie Aelterman, Lynn Van den Berghe, Jotie De Meyer, Bart Soenens, and Maarten Vansteenkiste.
34 470 2013. "Observing physical education teachers' need-supportive interactions in classroom settings." Review of.
35 471 *Journal of Sport & Exercise Psychology* 35 (1):3-17.
36
37
38 472 Haerens, Leen, Nathalie Aelterman, Maarten Vansteenkiste, Bart Soenens, and Stijn Van Petegem. 2015. "Do perceived
39 473 autonomy-supportive and controlling teaching relate to physical education students' motivational experiences
40 474 through unique pathways? Distinguishing between the bright and dark side of motivation." Review of.
41 475 *Psychology of Sport and Exercise* 16, Part 3 (0):26-36. doi: <http://dx.doi.org/10.1016/j.psychsport.2014.08.013>.
42
43
44 476 Hastie, P. A., and D. Siedentop. 2006. "The classroom ecology paradigm." In *The Handbook of Physical Education*,
45 477 edited by D. Kirk, D. Macdonald and M. O'Sullivan, 214-25. London: SAGE Publications Ltd.
46
47
48 478 Hu, Li-tze, and Peter M. Bentler. 1999. "Cutoff criteria for fit indexes in covariance structure analysis: Conventional
49 479 criteria versus new alternatives." Review of. *Structural Equation Modeling: A Multidisciplinary Journal* 6
50 480 (1):1-55. doi: 10.1080/10705519909540118.
51
52
53 481 Jang, H., J. Reeve, and E. L. Deci. 2010. "Engaging students in learning activities: It is not autonomy support or
54 482 structure but autonomy support and structure." Review of. *Journal of Educational Psychology* 102 (3):588-600.
55 483 doi: 10.1037/a0019682.
56
57
58
59
60

- 1
2 484 Koka, A. 2013. "The relationships between perceived teaching behaviors and motivation in physical education: A one-
3 485 year longitudinal study." Review of. *Scandinavian Journal of Educational Research* 57 (1):33-53. doi:
4 486 10.1080/00313831.2011.621213.
5
6
7 487 Mainhard, T., T. Wubbels, and M. Brekelmans. 2014. "The role of the degree of acquaintance with teachers on students'
8 488 interpersonal perceptions of their teacher." Review of. *Social Psychology of Education* 17 (1):127-40. doi:
9 489 10.1007/s11218-013-9234-6.
10
11
12 490 Mouratidis, A., M. Vansteenkiste, W. Lens, and G. Sideridis. 2008. "The motivating role of positive feedback in sport
13 491 and physical education: Evidence for a motivational model." Review of. *Journal of Sport & Exercise*
14 492 *Psychology* 30 (2):240-68.
15
16
17 493 Muthén, L. K., and B. O. Muthén. 1998-2012. *Mplus User's Guide*. 7th ed. Los Angeles, CA: Muthén & Muthén.
18
19
20 494 Ntoumanis, N. 2005. "A prospective study of participation in optional school physical education using a self-
21 495 determination theory framework." Review of. *Journal of Educational Psychology* 97 (3):444-53. doi:
22 496 10.1037/0022-0663.97.3.444.
23
24
25 497 Patrick, H., J. C. Turner, D. K. Meyer, and C. Midgley. 2003. "How teachers establish psychological environments
26 498 during the first days of school: Associations with avoidance in mathematics." Review of. *Teachers College*
27 499 *Record* 105 (8):1521-58. doi: 10.1111/1467-9620.00299.
28
29
30 500 Pelletier, L. G., C. Seguin-Levesque, and L. Legault. 2002. "Pressure from above and pressure from below as
31 501 determinants of teachers' motivation and teaching behaviors." Review of. *Journal of Educational Psychology*
32 502 94 (1):186-96. doi: 10.1037//0022-0663.94.1.186.
33
34
35 503 Perlman, Dana J. 2013. "Help motivate the amotivated by being a supportive teacher." Review of. *Physical Education*
36 504 *and Sport Pedagogy* 20 (2):204-14. doi: 10.1080/17408989.2013.868876.
37
38
39 505 Reeve, J. 2009. "Why teachers adopt a controlling motivating style toward students and how they can become more
40 506 autonomy supportive." Review of. *Educational Psychologist* 44 (3):159-75. doi: 10.1080/00461520903028990.
41
42
43 507 Reeve, J., H. Jang, D. Carrell, S. Jeon, and J. Barch. 2004. "Enhancing students' engagement by increasing teachers'
44 508 autonomy support." Review of. *Motivation and Emotion* 28 (2):147-69. doi:
45 509 10.1023/B:MOEM.0000032312.95499.6f.
46
47
48 510 Satorra, Albert, and Peter Bentler. 2011. "Scaling corrections for statistics in covariance structure analysis." In.
49
50
51 511 Shen, Bo, Nate McCaughtry, Jeffrey Martin, and Mariane Fahlman. 2009. "Effects of Teacher Autonomy Support and
52 512 Students' Autonomous Motivation on Learning in Physical Education." Review of. *Research Quarterly for*
53 513 *Exercise and Sport* 80 (1):44-53.
54
55
56 514 Skinner, E. A., and M. J. Belmont. 1993. "Motivation in the classroom: Reciprocal effects of teacher behavior and
57 515 student engagement across the school year." Review of. *Journal of Educational Psychology* 85 (4):571-81. doi:
58 516 10.1037/0022-0663.85.4.571.
59
60

- 1
2 517 Skinner, E. A., T. A. Kindermann, J. P. Connell, and J. G. Wellborn. 2009. "Engagement and disaffection as
3 518 organizational constructs in the dynamics of motivational development." In *Handbook of motivation at school*,
4 519 edited by K. R. Wentzel and A. Wigfield, 223-46. New York & London: Routledge.
- 5
6
7 520 Skinner, E. A., T. A. Kindermann, and C. J. Furrer. 2009. "A motivational perspective on engagement and disaffection."
8 521 Review of. *Educational and Psychological Measurement* 69 (3):493-525. doi: 10.1177/0013164408323233.
- 9
10
11 522 Skinner, E. A., G. Marchand, C. Furrer, and T. Kindermann. 2008. "Engagement and disaffection in the classroom: Part
12 523 of a larger motivational dynamic?" Review of. *Journal of Educational Psychology* 100 (4):765-81. doi:
13 524 10.1037/a0012840.
- 14
15
16 525 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
17 526 process model of perceived control and children's engagement and achievement in school." Review of. *Journal*
18 527 *of Educational Psychology* 82 (1):22-32. doi: 10.1037/0022-0663.82.1.22.
- 19
20
21 528 Soenens, B., E. Sierens, M. Vansteenkiste, F. Dochy, and L. Goossens. 2012. "Psychologically controlling teaching:
22 529 Examining outcomes, antecedents, and mediators." Review of. *Journal of Educational Psychology* 104
23 530 (1):108-20. doi: 10.1037/a0025742.
- 24
25
26 531 Solmon, M. A. 2003. "Student issues in physical education classes: Attitudes, cognition, and motivation." In *Student*
27 532 *learning in physical education: Applying research to enhance instruction*, edited by S. J. Silverman and C. D.
28 533 Ennis, 147-64. Champaign, IL: Human Kinetics.
- 29
30
31 534 Standage, M., J. L. Duda, and N. Ntoumanis. 2005. "A test of self-determination theory in school physical education."
32 535 Review of. *British Journal of Educational Psychology* 75:411-33. doi: 10.1348/000709904x22359.
- 33
34
35 536 Stephan, Y., J. Caudroit, J. Boiche, and P. Sarrazin. 2011. "Predictors of situational disengagement in the academic
36 537 setting: The contribution of grades, perceived competence, and academic motivation." Review of. *British*
37 538 *Journal of Educational Psychology* 81 (3):441-55. doi: 10.1348/000709910x522285.
- 38
39
40 539 Tessier, D, P Sarrazin, and N Ntoumanis. 2010. "The effect of an intervention to improve newly qualified teachers'
41 540 interpersonal style, students motivation and psychological need satisfaction in sport-based physical education."
42 541 Review of. *Contemporary Educational Psychology* 35 (4):242-53. doi: 10.1016/j.cedpsych.2010.05.005.
- 43
44
45 542 Van den Berghe, Lynn, Bart Soenens, Nathalie Aelterman, Greet Cardon, Isabel B. Tallir, and Leen Haerens. 2014.
46 543 "Within-person profiles of teachers' motivation to teach: Associations with need satisfaction at work, need-
47 544 supportive teaching, and burnout." Review of. *Psychology of Sport and Exercise* 15 (4):407-17. doi:
48 545 10.1016/j.psychsport.2014.04.001.
- 49
50
51 546 Van den Berghe, Lynn, Bart Soenens, Maarten Vansteenkiste, Nathalie Aelterman, Greet Cardon, Isabel B. Tallir, and
52 547 Leen Haerens. 2013. "Observed need-supportive and need-thwarting teaching behavior in physical education:
53 548 Do teachers' motivational orientations matter?" Review of. *Psychology of Sport and Exercise* 14 (5):650-61.
54 549 doi: 10.1016/j.psychsport.2013.04.006.
- 55
56
57
58
59
60

- 1
2 550 Van den Berghe, Lynn, Maarten Vansteenkiste, Greet Cardon, David Kirk, and Leen Haerens. 2014. "Research on self-
3 551 determination in physical education: Key findings and proposals for future research." Review of. *Physical*
4 552 *Education and Sport Pedagogy* 19 (1):97-121. doi: 10.1080/17408989.2012.732563.
5
6
7 553 Ward, Stefan, and Melissa Parker. 2012. "The voice of youth: atmosphere in positive youth development program."
8 554 Review of. *Physical Education and Sport Pedagogy* 18 (5):534-48. doi: 10.1080/17408989.2012.726974.
9
10 555 Westland, C. J. 2010. "Lower bounds on sample size in structural equation modeling." Review of. *Electronic Commerce*
11 556 *Research and Applications* 9 (6):476-87. doi: dx.doi.org/10.1016/j.elerap.2010.07.003.
12
13
14 557

For Peer Review Only

Table 1. Standardized XY-estimates and Fit Indices for the Models including Five-to-five 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	<i>STXY (SE)</i>	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)	
	<i>X² model fit</i>			16.46 (<i>p</i> < .001)			1.86 (<i>p</i> > .05)		
	<i>RMSEA</i>			.21			.00		
	<i>SRMR</i>			.11			.03		
	<i>CFI/TLI</i>			.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	<i>STXY (SE)</i>	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)*	
<i>X² model fit</i>			2.99 (<i>p</i> > .05)			55 (<i>p</i> > .05)			
<i>RMSEA</i>			.00			.00			
<i>SRMR</i>			.05			.03			
<i>CFI/TLI</i>			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	<i>STXY (SE)</i>	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)	
<i>X² model fit</i>			.38 (<i>p</i> > .05)			6.49 (<i>p</i> > .05)			
<i>RMSEA</i>			.00			.11			
<i>SRMR</i>			.01			.04			
<i>CFI/TLI</i>			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	<i>STXY (SE)</i>	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)**	
<i>X² model fit</i>			1.50 (<i>p</i> > .05)			1.53 (<i>p</i> > .05)			
<i>RMSEA</i>			.00			.00			
<i>SRMR</i>			.02			.02			
<i>CFI/TLI</i>			1.00/1.12			1.00/1.11			

Note. N = 100. STXY = standardized XY estimates. * *p* < .05; ** *p* < .01; *** *p* < .001.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

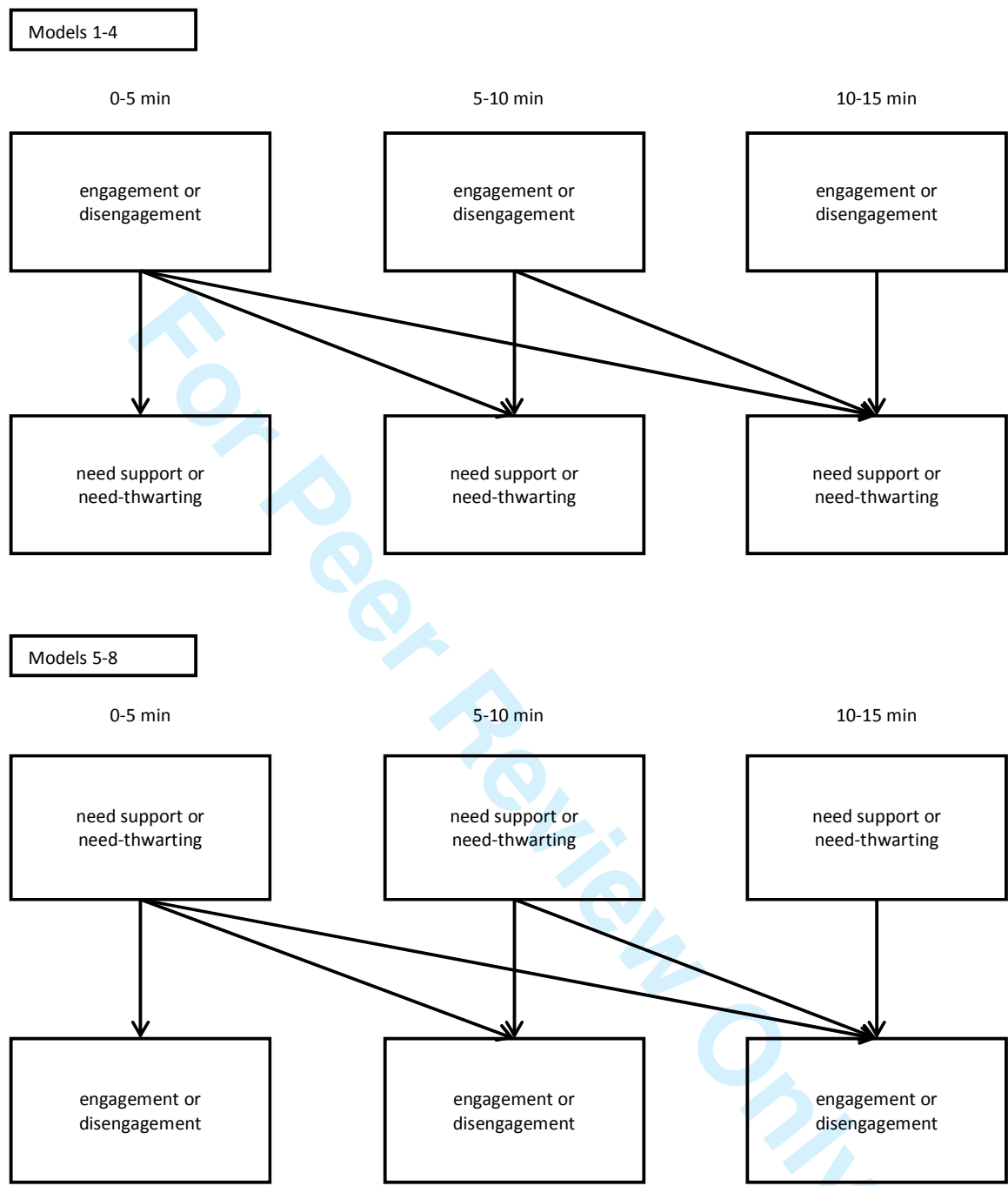


Figure 1. Eight hypothesized path models relating student (dis)engagement to teacher need support and need-thwarting (models 1-4) and the other way around (models 5-8).

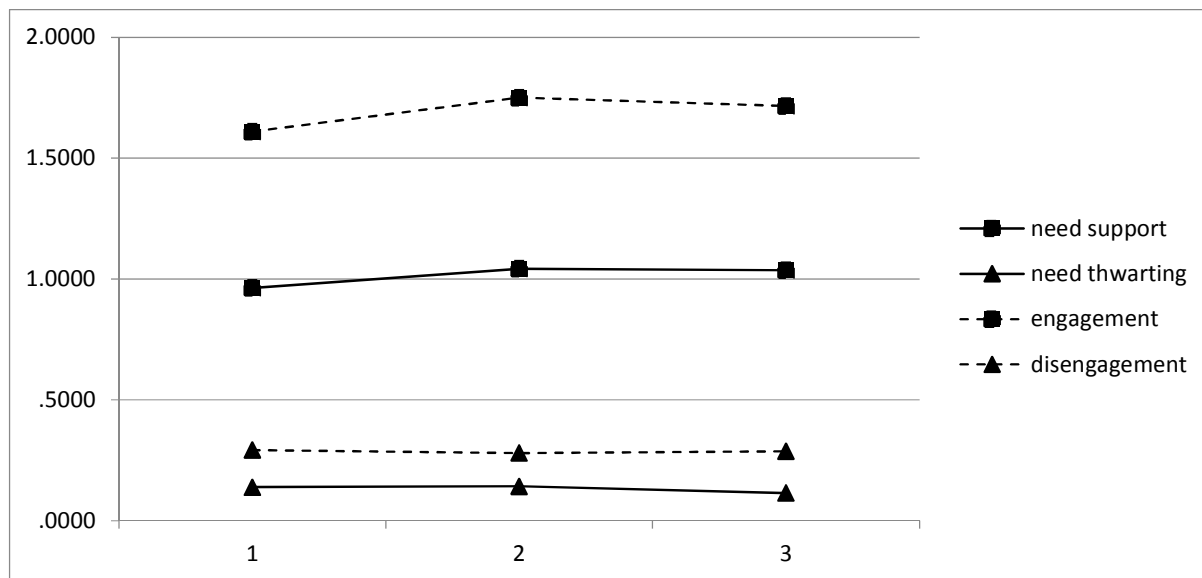


Figure 2. Fluctuations in need support, need-thwarting, engagement, and disengagement in the three first five-minute intervals of a PE lesson.