

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

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## 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 ± 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

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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

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1 36 When confronted with student disengagement in the beginning of a lesson, teachers can react in many different  
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3 37 ways, so that some teachers remain patient and try to optimally motivate these students, while other teachers may start  
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5 38 to exert pressure in order to force students into participating. Patrick et al. (2003) suggested that the quality of the initial  
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7 39 social climate between teachers and students, which is characterized by mutual respect, teacher support, and mastery  
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9 40 goals, sets the tone for the subsequent social climate. Also Mainhard, Wubbels, and Brekelmans (2014) suggested that  
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11 41 maybe impressions of teacher affiliation and control in the first few minutes are important for how students perceive  
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13 42 their teacher later on. However, these suggestions have not been investigated within one lesson. The present study  
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15 43 builds on these suggestions by investigating reciprocal relationships between student engagement and disengagement  
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17 44 and teaching behavior at a micro-level by looking into the teacher-student dynamics within the first fifteen minutes of a  
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19 45 physical education (PE) lesson. To do so, this study uses the lens of self-determination theory (SDT; Deci and Ryan  
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21 46 1985, 2000), a widely used, accepted and scientifically supported theory on human motivational dynamics that has been  
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23 47 the theoretical framework for numerous studies on motivation in physical education (Van den Berghe, Vansteenkiste, et  
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25 48 al. 2014). The interesting feature of SDT is that it not only provides a good framework to conceptualize students'  
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27 49 motivation and related outcomes, but also in detail and very practically outlines how the social context, in case of the  
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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  
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32 52 2008; Skinner and Belmont 1993; Koka 2013). In the present study, this work was further extended by objectively  
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34 53 assessing teacher and student behavior by means of observations as was already done in previous studies (Haerens et al.  
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36 54 2013; Van den Berghe et al. 2013; Tessier, Sarrazin, and Ntoumanis 2010; Jang, Reeve, and Deci 2010; Reeve et al.  
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38 55 2004; Perlman 2013). In the latter observational studies, positive associations were found between supportive teaching  
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40 56 practices and adaptive outcomes, such as optimal student motivation. There are a few advantages of measuring behavior  
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42 57 through observations (Haerens et al. 2013). First, the use of observations can overcome some methodological  
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44 58 limitations related to the exclusive reliance on student reports which can cause problems of shared method variance,  
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46 59 such that associations get artificially inflated. Also, observations rule out students' personal interpretations of the  
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48 60 situation which could be colored by previous experiences with the teacher. Second, because of the real-life setting of the  
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50 61 videotaped PE lesson, the ecological validity is high, and observational measures provide insight in the frequency of  
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52 62 certain behaviors during a specific period of the lesson. Moreover, and in relation to the present study, such measures  
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54 63 allow investigating how teaching behavior and student engagement perhaps fluctuate during the course of one lesson  
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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  
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58 65 current study, observational measures were used to assess teaching behavior and student (dis)engagement in five-minute  
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60 66 intervals. The first fifteen minutes of a PE lesson were observed, this to capture both the introduction of the lesson as  
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62 67 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  
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5 102 SDT (Deci and Ryan 1985, 2000), because it encompasses a practical theory that conceptually frames teaching  
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7 103 behaviors many teachers regularly engage in from a motivational perspective. Central in SDT is the idea that, in  
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9 104 motivating learning environments, students' three basic psychological needs for autonomy (i.e., a sense of volitional  
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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.,  
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17 108 feelings of pressure), competence frustration (i.e., experiencing a sense of inferiority or failure), and relatedness  
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19 109 frustration (i.e., feelings of loneliness and alienation). To state differently, positive student outcomes, such as  
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21 110 engagement, are more likely to arise in a need-supportive teaching environment (Mouratidis et al. 2008; Standage,  
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23 111 Duda, and Ntoumanis 2005; Shen et al. 2009; Perlman 2013; Ward and Parker 2012), while maladaptive student  
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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  
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32 116 2009). Teachers can nurture students' need for competence by providing adequate structure through clear instructions  
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34 117 and positive feedback, (Farkas and Grolnick 2010; Haerens et al. 2013; Jang, Reeve, and Deci 2010; Mouratidis et al.  
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36 118 2008). The need for relatedness can be nourished by creating a warm class environment in which the teacher is  
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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  
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41 121 student engagement. In a general education context, Skinner and Belmont (1993), Reeve et al. (2004), and Jang et al.  
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43 122 (2010) found that teachers' autonomy support and structure related positively to student engagement. In PE, Ntoumanis  
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45 123 (2005) found that need support from teachers indirectly and positively related to indicators of student engagement (i.e.,  
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47 124 effort, concentration, affect, and intentions to participate in optional PE) through need satisfaction and self-determined  
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49 125 motivation. In an experimental study of García-Calvo et al. (2015), effort and cooperation in students was positively  
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51 126 influenced when teachers were more need-supportive towards their students in physical education. Whether the analyses  
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53 127 were based on hierarchical regression analyses (Reeve et al. 2004), structural equation modeling (Ntoumanis 2005) or  
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55 128 hierarchical linear modeling (Jang, Reeve, and Deci 2010), all studies positioned need-supportive teaching behavior as  
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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  
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60 131 bring students to become more disengaged. Need-thwarting teaching is characterized by exertion of control, a chaotic

1  
2 132 style, and having cold interactions, hereby frustrating students' needs for autonomy, competence and relatedness  
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4 133 respectively (Van den Berghe et al. 2013; Bartholomew et al. 2011). Controlling teachers thwart the need for autonomy,  
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6 134 because they pressure students to behave and think in prescribed ways (Grolnick 2003; Soenens et al. 2012).  
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8 135 Additionally, teachers may thwart the students' need for competence by creating a chaotic class climate in which  
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10 136 objectives, expectations and rules are unclear (Van den Berghe et al. 2013). Being unfriendly or even rejecting and  
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12 137 excluding students are typical behaviors depicting an emotionally cold environment (Skinner and Belmont 1993), which  
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14 138 may thwart the students' need for relatedness. Until now, less attention has been paid to this 'dark side' of motivational  
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16 139 teaching practices, even though it is recognized that the presence of need-thwarting teaching behavior is more than  
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18 140 merely the absence of need support (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; De Meyer  
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20 141 et al., 2013).

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22 142 Most of the studies that have addressed need-thwarting behaviors in an educational context have focused on  
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24 143 the exertion of control, while chaotic and cold interactions have received less attention. In a study among elementary  
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26 144 school children, controlling teaching related to less intensive student engagement as measured by student and teacher  
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28 145 questionnaires (Assor et al. 2005). Soenens et al. (2012) found that student reports of psychologically controlling  
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30 146 teaching (e.g., guilt induction) related negatively to deep-level learning strategies and academic performance in  
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32 147 secondary school students. In the study of De Meyer et al. (2014), observations of controlling teaching behavior related  
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34 148 positively to students' need frustration, controlled motivation, and amotivation in PE. The present study builds on this  
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36 149 research by not only focusing on controlling teaching behavior (e.g., Soenens et al. 2012; De Meyer et al. 2014), but by  
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38 150 also including observations of chaotic and cold teaching behaviors. It simultaneously investigates bidirectional  
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40 151 relationships between student (dis)engagement and teachers' need-thwarting behaviors, as well as between student  
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42 152 (dis)engagement and teachers' need-supportive behaviors.

### 43 44 153 **The present study**

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46 154 Whereas previous studies have investigated how teaching behavior predicts student engagement cross-  
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48 155 sectionally (Cox and Williams 2008), experimentally (Tessier, Sarrazin, and Ntoumanis 2010), or longitudinally across  
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50 156 lessons (Skinner and Belmont 1993; Koka 2013), no studies have investigated how teaching behaviors and student  
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52 157 engagement fluctuate and relate to each other within the first moments of a lesson. As Skinner, Kindermann, and Furrer  
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54 158 (2009) suggested that engagement can change over time and between different situations, the aim of the present  
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56 159 observational study was to investigate how observed student (dis)engagement and need-supportive or need-thwarting  
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58 160 teaching behavior are related to each other across and within the first fifteen minutes of a PE lesson.

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60 161 Based on the results of previous studies (Koka 2013; Skinner and Belmont 1993), it was hypothesized that  
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163 162 student engagement would be positively related to need support, while negative relationships with need-thwarting  
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165 163 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  
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3 165 (dis)engagement, need support, and need-thwarting in the first fifteen minutes of the lesson. Further, we investigated the  
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5 166 relationships between student (dis)engagement and teaching behavior across and between specific five-minute intervals.  
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7 167 We hypothesized that when students are more engaged during the first five minutes of the lesson, teachers probably  
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9 168 notice this, and, therefore, they might feel encouraged to act in a more need-supportive manner in the following five or  
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11 169 ten minutes. Further, it was hypothesized that teachers might feel discouraged to be need-supportive and even become  
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13 170 (more) need-thwarting when students show disengagement during the first five minutes of the lesson because they feel  
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15 171 pressured (e.g., Van den Berghe, Soenens, et al. 2014; Pelletier, Seguin-Levesque, and Legault 2002). Additionally,  
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17 172 negative relationships between need-thwarting teaching behaviors at the beginning of the lesson and student  
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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](#)  
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1  
2 196 external raters coded 19 need-supportive and 16 need-thwarting teaching behaviors through a valid and reliable  
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4 197 observation tool with an acceptable to good intra- and interrater reliability (Haerens et al. 2013; Van den Berghe et al.  
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6 198 2013). More information on the development and use of the observation tool can be found in the studies of Haerens et  
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8 199 al. (2013) and Van den Berghe et al. (2013). For the present study, the first 15 minutes (corresponding to three five-  
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10 200 minute intervals) of each lesson were re-coded by one out of the six external raters in terms of students' engagement  
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12 201 and disengagement. This observer was trained as part of a larger research project (Haerens et al. 2013; Van den Berghe  
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14 202 et al. 2013). Training included coding videotapes, discussing the observations and come to a consensus between the  
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16 203 observers. Each of the teaching behaviors was coded on a 4-point scale ranging from 0 (never observed) to 1 (observed  
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18 204 sometimes), to 2 (observed often), to 3 (observed all the time). In total, three intervals were coded and the coding took  
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20 205 approximately 30 to 60 minutes for each lesson (75 hours total coding). The observation tool had adequate intra- and  
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22 206 interrater reliability (Haerens et al. 2013; Van den Berghe et al. 2013). The need-supportive teaching behaviors ( $\alpha =$   
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24 207 .81) reflected the four need-supportive teaching dimensions of autonomy support (e.g., "The teacher offers choice to all  
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26 208 students."), structure before the activity (e.g., "The teacher gives an overview of the content and structure of the  
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28 209 lesson."), structure during the activity (e.g., "The teacher offers the students a rationale for tasks and exercises."), and  
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30 210 relatedness support (e.g., "The teacher takes the perspective of students into account, is empathic."). To tap into need-  
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32 211 thwarting teacher behaviors ( $\alpha = .67$ ), the dimensions of controlling (e.g., "The teacher exercises power over the  
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34 212 students by interfering and demanding respect"), cold (e.g., "The teacher is acting unfriendly and cold"), and chaotic  
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36 213 teaching (e.g., "uses an illogical and inconsistent structure during the warming up and activity or in the transitions  
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38 214 between exercises") were assessed.

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38 215 **Observed student engagement.** Student engagement and student disengagement were also assessed by means  
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40 216 of observations by one external rater. Student engagement ( $\alpha = .68$ ) incorporated five items: students listening, being  
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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  
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46 219 selected from the Engagement versus Disaffection with Learning Scale (Skinner, Kindermann, and Furrer 2009)  
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48 220 reflecting the same dimensions as in the items of student engagement to observe student disengagement: not listening,  
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50 221 not making an effort, giving up easily, and being bored.

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51 222 We acknowledge that the scales with an alpha of less than .70 (i.e., need-thwarting teaching behavior and  
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53 223 student engagement) might need further refinement and/or additional items to increase the reliability (see also Van den  
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55 224 Berghe et al. 2013). Despite of the rather mediocre alpha ( $<.70$ ) in some dimensions, we still found it interesting to take  
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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 ( $\chi^2$ ), 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  
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4 260 engagement ( $F(1,69) = 3.11, ns$ ), or disengagement ( $F(1,99) = 3.11, ns$ ). Need-supportive teaching behavior increased  
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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  
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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  
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21 269 student (dis)engagement related to teaching behaviors within and across five minute intervals. In the next four models,  
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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  
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34 276 more need support in the next five minutes. When predicting student engagement and disengagement, only one across-  
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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.

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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	
<b>Need support</b>	<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>X<sup>2</sup> 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	
			<b>Need-thwarting</b>	<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>X<sup>2</sup> 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	
			<b>Engagement</b>	<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>X<sup>2</sup> 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	
			<b>Disengagement</b>	<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>X<sup>2</sup> 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.

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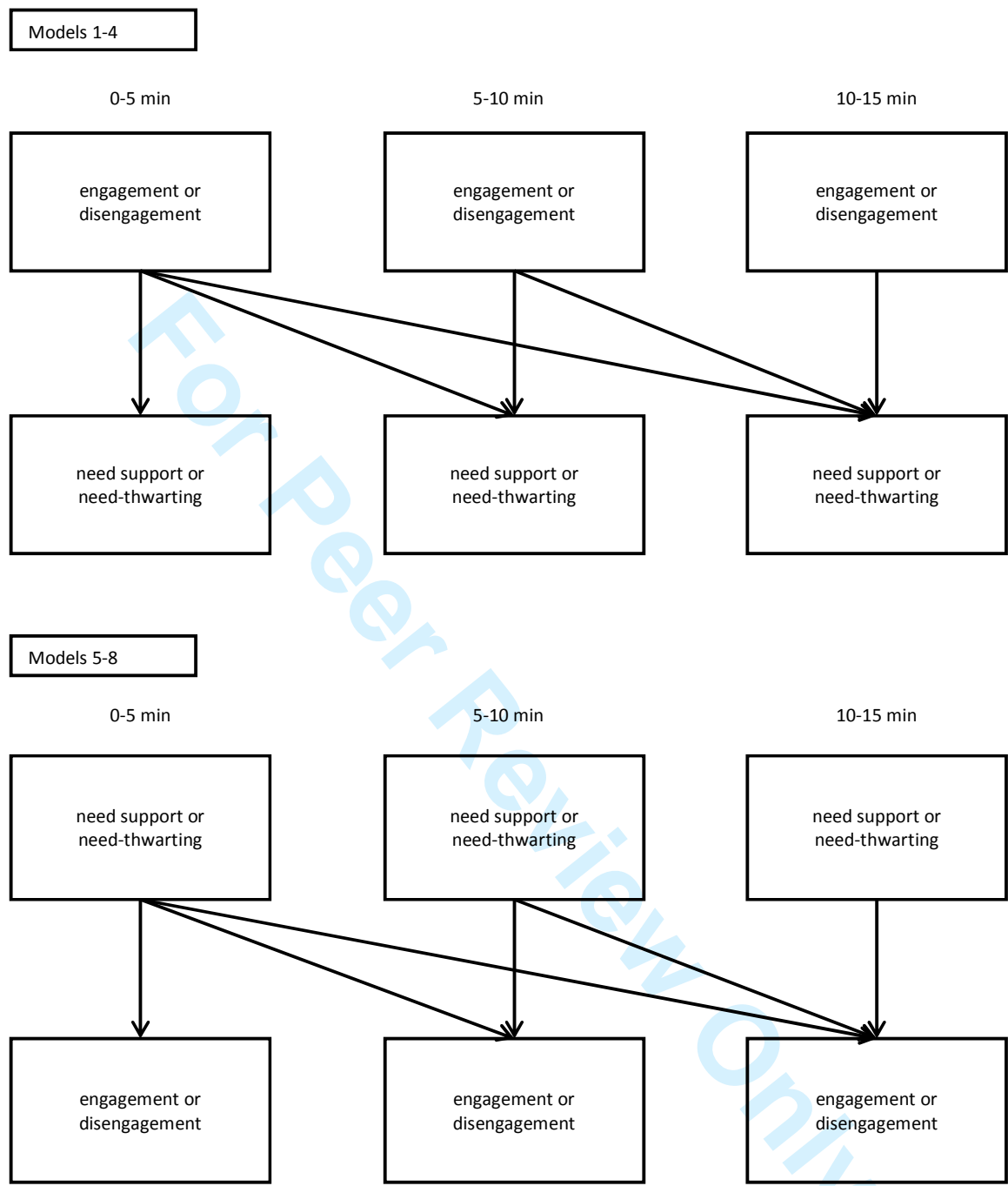


Figure 1. Eight hypothesized path models relating student (dis)engagement to teacher need support and need-thwarting (models 1-4) and the other way around (models 5-8).

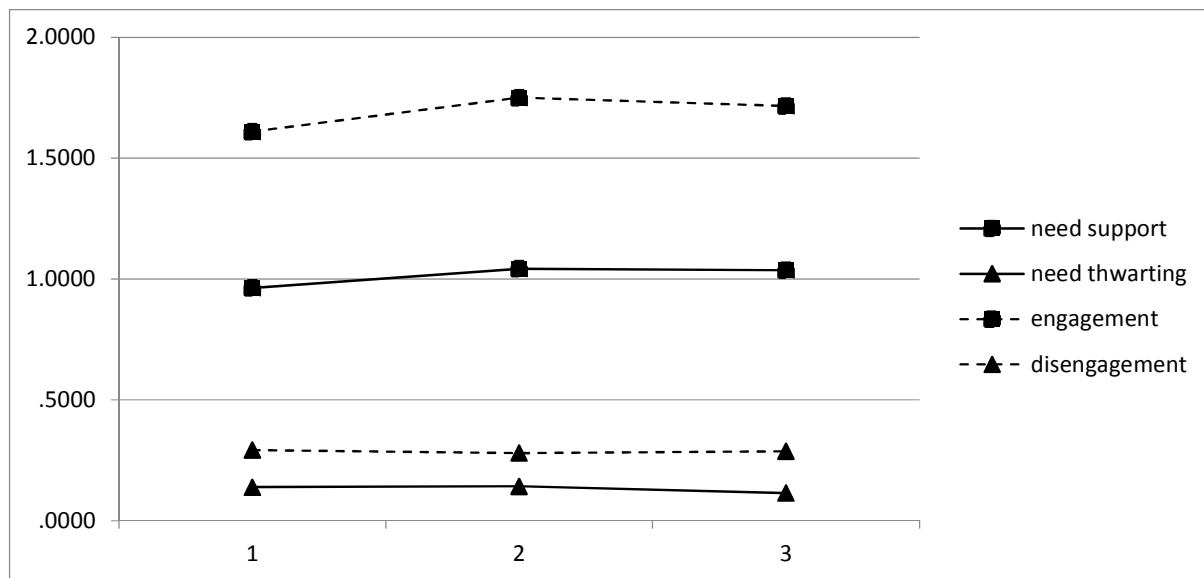


Figure 2. Fluctuations in need support, need-thwarting, engagement, and disengagement in the three first five-minute intervals of a PE lesson.