

Note. This article will be published in a forthcoming issue of the *Journal of Sport & Exercise Psychology*. The article appears here in its accepted, peer-reviewed form, as it was provided by the submitting author. It has not been copyedited, proofread, or formatted by the publisher.

Section: Article

Article Title: A Teacher-Focused Intervention to Decrease PE Students’ Amotivation by Increasing Need Satisfaction and Decreasing Need Frustration

Authors: Sung Hyeon Cheon¹, Johnmarshall Reeve², and Yong-Gwan Song³

Affiliations: ¹Division of Sport Science, Kangwon National University, Chuncheon, Republic of Korea. ²Department of Education; ³Department of Physical Education; Korea University, Seoul, Republic of Korea.

Running Head: Decreasing Amotivation

Journal: *Journal of Sport & Exercise Psychology*

Acceptance Date: March 12, 2016

©2016 Human Kinetics, Inc.

DOI: <http://dx.doi.org/10.1123/jsep.2015-0236>

Running head: DECREASING AMOTIVATION

A Teacher-Focused Intervention to Decrease PE Students’ Amotivation
by Increasing Need Satisfaction and Decreasing Need Frustration

Sung Hyeon Cheon

Kangwon National University

Johnmarshall Reeve

Korea University

and

Yong-Gwan Song

Korea University

Authors’ Note. Address all correspondence concerning this manuscript to Sung Hyeon Cheon, Division of Sport Science, Kangwon National University, 1 Kangwondaehak-gil, Chuncheon-si, Kangwon-do 200-701, Korea or to Johnmarshall Reeve, 633 Uncho-Useon Hall, Department of Education, Korea University, Seoul, Korea.
Email is either kucheon@kangwon.ac.kr or reeve@korea.ac.kr.

This research was supported by the National Research Foundation of Korea funded by the Korean Government (Grant no. NRF-2014S1A5A8017649) and by a 2015 Grant funded by Kangwon National University.

Abstract

Intervention-induced gains in need satisfaction decrease PE students’ amotivation. The present study adopted a dual-process model to test whether an intervention could also decrease need frustration and hence provide a second supplemental source to further decrease students’ PE amotivation. Using an experimental, longitudinal research design, 19 experienced PE teachers (9 experimental, 10 control) and their 1,017 students participated in an intervention program to help teachers become both more autonomy supportive and less controlling. Multilevel repeated measures analyses showed that students of teachers in the experimental group reported greater T2, T3, and T4 perceived autonomy support, need satisfaction, and engagement and lesser T2, T3, and T4 perceived teacher control, need frustration, and amotivation than did students of teachers in the control group. Multilevel structural equation modeling analyses confirmed the hypothesized dual-process model in which both intervention-induced increases in need satisfaction and intervention-induced decreases need frustration decreased students’ end-of-semester amotivation. We discuss the theoretical and practical implications of this new finding on the dual antecedents of diminished amotivation.

Keywords: amotivation; autonomy support; dual-process model; intervention; need satisfaction; need frustration.

In the PE classroom, amotivation is the student’s lack of **intention** to engage in the day’s exercise or sport activity (Legault, Green-Demers, & Pelletier, 2006). What amotivated PE students lack is an intention to act. Seeing little or no reason to invest energy and effort, the amotivated student tends to display non-participation and, when induced to participate, merely “goes through the motions” of doing so.

To conceptualize, understand, and assess PE students’ amotivation, researchers tend to adopt one of two approaches. Some researchers focus on a general lack of intentionality (e.g., “I don’t see the point in exercising”; Goudas, Biddle, & Fox, 1994; Markland & Tobin, 2004; Vallerand et al., 1992). Other researchers focus on five specific intentionality deficits that stem particularly from a lack of PE-related competence, autonomy, or relatedness, including pessimistic capacity beliefs and a learned helplessness-like diminished desire to exert effort (two competence-related intentionality deficits), low value placed on PE activities and a perception that PE activities are simply unappealing things to do (two autonomy-related intentionality deficits), and estranged relationships during group-based PE activities (relatedness-related intentionality deficit) (Cheon & Jang, 2012; Green-Demer, Legault, Pelletier, & Pelletier, 2008; Ntoumanis, Pensgaard, Martin, & Pipe, 2004; Shen, Li, Sun, & Rukavina, 2010; Shen, Wingert, Li, Sun, & Rukavina, 2010). While researchers differ in their one-dimensional vs. multidimensional conceptualization, they share a common underlying self-determination theory explanatory framework.

Self-Determination Theory Perspective on Student Amotivation

According to self-determination theory (SDT: Ryan & Deci, 2000), all students possess three inherent psychological needs (autonomy, competence, and relatedness) that, when supported during instruction, enhance students’ functioning in the classroom. Autonomy is the need for self-direction and personal endorsement in one’s behavior;

competence is the need to be effective in one’s interactions with the environment; and relatedness is the need to have warm, caring relationships with close others. Much of the satisfaction of these three needs depends on the quality of the teacher-student relationship, as teachers may appreciate and support these needs and hence create the classroom conditions that lead to positive student functioning or teachers may neglect and frustrate these needs and hence create alternative classroom conditions that lead to poor student functioning. More specifically, need satisfaction depends mostly on teacher-provided autonomy support, which is the interpersonal sentiment and behavior teachers provide during instruction to nurture and support students’ perspective, initiatives, and psychological needs (e.g., “I am your ally; I am here to support you”), while need frustration depends mostly on teacher control, which is the interpersonal sentiment and behavior teachers provide to pressure students to think, feel, and act in teacher-prescribed ways (e.g., “I am your boss; I am here to change you.”) (Reeve, 2015).

The primary reason students experience amotivation, according to SDT, is because they first experience psychological need frustration during PE instruction (Ntoumanis, 2001; Standage, Duda, & Ntoumanis, 2003; Shen, Li, Sun, & Rukavina, 2010). Autonomy need frustration refers to an experience of pressure and “have to” in the initiation and regulation of classroom activity (e.g., feeling forced to exercise while not wanting to do so). Competence need frustration refers to an experience of ineffectiveness or inadequacy in interacting with exercise and sport challenges (e.g., feeling incompetent while rope skipping). Relatedness need frustration refers to an experience of rejection or social exclusion by one’s peers or teachers (e.g., being teased by one’s teammates to the point of rejection during a basketball game). One reason PE students experience need frustration is because their PE teachers adopt a controlling motivating style toward them, as they yell, communicate through commands, criticize, and react negatively to their students’ input and perspective (De Meyer

et al., 2014; Standage, Duda, & Ntoumanis, 2005; Tessier, Sarrazin, & Ntoumanis, 2010). If this reasoning is correct, then the problem of student amotivation during PE instruction may be somewhat under the teacher’s intentional control, at least to the extent that he or she has the will and skill to be less controlling toward students.

Preventing and reversing amotivation is only half of the instructional goal, however, as PE teachers also seek to engage their students fully in classroom learning activities. That is, PE teachers would like to see their students display effort, enthusiasm, strategic thinking, and proactivity when offered a sport or exercise activity. One reason that students show such robust classroom engagement, again according to SDT, is because they first experience psychological need satisfaction (Cheon, Reeve, & Moon, 2012; Jang, Kim, & Reeve, 2012), and the primary reason PE students experience need satisfaction is because their PE teachers adopt an autonomy-supportive motivating style toward them, as they listen, take their students’ perspective, provide interesting activities, and explain the personal relevance of exercise and sport activities (Assor, Kaplan, & Roth, 2002; Cheon et al., 2012).

Dual-Process Model within Self-Determination Theory

SDT highlights two parallel processes that generally guide people’s motivation and functioning (Vansteenkiste & Ryan, 2013), including PE students’ classroom motivation and functioning in particular (Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013; Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015). On the one hand, autonomy-supportive teaching vitalizes the “brighter side” of students’ motivation and functioning: Autonomy-support → increased need satisfaction → increased engagement. On the other hand, teacher control galvanizes the “darker side” of students’ motivation and functioning: Teacher control → increased need frustration → increased amotivation. SDT researchers therefore propose a dual-process model in which different aspects of a teacher’s motivating

style (autonomy supportive *vs.* controlling) set in motion two somewhat parallel classroom trajectories in which students experience some degree of adaptive motivation and functioning as well as some additional degree of maladaptive motivation and functioning (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; Vansteenkiste & Ryan, 2013).

Such a dual-process model has been empirically supported in cross-sectional, correlational research (Bartholomew, Ntoumanis, Ryan, & Thogersen-Ntoumani, 2011; Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; Gunnell et al., 2013; Haerens et al., 2015; Ng, Ntoumanis, Thogersen-Ntoumani, Stott, & Hindle, 2013; Shen, Li, Sun, & Rukavina, 2010), as well as in a real-time diary study (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; Study 3). In the present study, we sought to extend the empirical test of the dual-process model by employing a research design that was both experimental and longitudinal.

Intervention Program to Help Teachers Become Both More Autonomy Supportive and Less Controlling

Many SDT-informed, teacher-focused, experimentally-based, and longitudinally-designed intervention studies have shown that (1) teachers who participate in a carefully designed autonomy-supportive intervention program (ASIP) can learn how to become significantly more autonomy supportive and significantly less controlling toward their students during instruction and, when they do, (2) their students benefit in a multitude of educationally important ways, including greater need satisfaction, engagement, learning, performance, and well-being and lesser need frustration and amotivation (Aelterman, Vansteenkiste, Van den Berghe, De Meyer, & Haerens, 2014; Chatzisarantis & Hagger, 2009; Cheon & Reeve, 2013, 2015; Cheon et al., 2012; deCharms, 1976; Reeve, Jang, Carrell, Jeon, & Barch, 2004; Tessier, Sarrazin, & Ntoumanis, 2010).

These ASIPs introduce PE teachers to autonomy-supportive teaching and to students’ psychological needs, highlight the benefits of autonomy support and the costs of interpersonal control, and invite teachers to learn about, observe, practice, and receive coaching on concrete and empirically validated autonomy-supportive instructional strategies (e.g., see Cheon et al., 2012). The typical result is that, by mid-semester, teachers who participate in ASIP display a more autonomy-supportive and a less controlling motivating style toward their students. In the present study, we offered an upgraded intervention program (more explicit, more in-depth) that emphasized not only how to be more autonomy supportive but also how to be less controlling.

Two propositions guided the present study: (1) if we could help teachers adopt a more autonomy-supportive style during instruction, then they would acquire the means to increase their students’ need satisfaction, increase their students’ engagement, and decrease their students’ amotivation, and (2) if we could help teachers adopt a less controlling style during instruction, then they would acquire the means to decrease their students’ need frustration, increase their students’ engagement, and decrease their students’ amotivation.

Helping Teachers Decrease PE Students’ Amotivation

To help teachers solve the particularly difficult classroom challenge of student amotivation, past research implemented a SDT-based, PE-centric intervention program to help teachers adopt a more autonomy-supportive motivating style that could nurture and satisfy students’ psychological needs during PE instruction (Cheon & Reeve, 2015). In this study, PE teachers who were randomly assigned into the intervention-based experimental group did learn how to better support their students’ autonomy and their students did experience greater need satisfaction during PE. Importantly, students’ increased need satisfaction in turn decreased their classroom amotivation as the semester progressed. The

study concluded that “psychological need satisfaction was the antidote to amotivation” (Cheon & Reeve, 2015, p. 109).

The limitation of that investigation, however, was that it focused its explanatory power only on the brighter side processes. In the present study, we sought to extend that previous investigation by including the darker-side processes from SDT’s dual-process model by testing the hypothesis that decreased need frustration might also explain decreased amotivation. This is an important question because changes in need frustration (controlling for changes in need satisfaction) might fully explain changes in amotivation—a finding that would highlight the darker side processes in understanding the etiology of amotivation and hence invalidate our earlier conclusion statement. Or, we might find that changes in need frustration explain merely additional changes in amotivation—that is, perhaps increased need satisfaction and decreased need frustration together explain decreased amotivation. Such a finding, if supported, would validate but also extend our earlier conclusion statement: Need satisfaction diminishes amotivation while need frustration exacerbates it.

Hypotheses and Hypothesized Model

Hypotheses. We predicted that teacher participation in the ASIP (experimental group), relative to teacher non-participation in the ASIP (control group), would significantly increase students’ post-intervention (T2, T3, and T4) perceived autonomy-supportive teaching, need satisfaction, and engagement and significantly decrease students’ post-intervention perceived controlling teaching, need frustration, and amotivation. That is, we hypothesized that teacher participation in the ASIP intervention would enhance the full array of brighter side process and also lessen the full array of darker side processes.

Hypothesized model. The study’s independent variable was teacher participation (or not) in the ASIP. Because we delivered the ASIP over time (in three parts over a 10-week

period), we expected ASIP participation to increase not only mid-semester (T2) need satisfaction but also increase further end-of-semester (T3) need satisfaction, just as we expected ASIP participation to decrease not only mid-semester (T2) need frustration but also end-of-semester (T3) need frustration. These ASIP-induced increases in need satisfaction were then predicted to produce corresponding longitudinal increases in students’ end-of-semester (spring, T3; fall, T4) engagement, just as these ASIP-induced decreases in need frustration were predicted to produce corresponding longitudinal decreases in students’ end-of-semester (spring, T3; fall, T4) amotivation. In addition to these hypothesized “brighter side” and “darker side” effects, we followed previous empirical tests of the dual-process model (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011; Haerens et al., 2015) to predict “cross-over effects” such that ASIP-induced increases in need satisfaction would not only increase T3 and T4 engagement but would also decrease T3 and T4 amotivation (even after controlling for changes in need frustration), and also that ASIP-induced decreases in need frustration would not only decrease T3 and T4 amotivation but would also increase T3 and T4 engagement (even after controlling for changes in need satisfaction).

Method

Participants

Teacher-participants included 19 ethnic Korean certified PE teachers, 4 women and 15 men. Teachers taught in 19 different schools (16 middle, 3 high) in the Seoul metropolitan area. Teachers averaged 36.5 years of age and 7.9 years of teaching experience. Each participating teacher received the equivalent of \$50 in appreciation of their participation. No teacher dropped out over the course of the study, so the teacher retention rate was 100%.

Student-participants were those students who completed the study questionnaire over all four waves of data collection. At T1, 1,178 ethnic Korean students completed the questionnaire. By the fourth and final wave of data collection, 1,017 of the original 1,178 students had completed all four waves of data collection. So the overall student retention rate was 86.3%. As shown in Table 1, the loss of these 161 student-participants over the multiple waves of data collection did not bias the final sample in terms of representation of the experimental condition, school levels, or genders, as these sample percentages were essentially unchanged from T1 to T4 (see columns 4-9). Group differences between study persisters *vs.* study dropouts at T3 and T4 showed that the analyzed sample was somewhat biased *vs.* the initial sample by the loss of participants reporting relatively high need frustration.

Procedure and Implementation of the ASIP

One month prior to the beginning of the school year, we contacted 24 PE teachers who worked in Seoul to invite them to participate in our year-long study. Nineteen teachers agreed to participate. These 19 PE teachers were then randomly assigned into either the experimental ($n = 9$) or control ($n = 10$) condition. The full procedural timeline for the intervention program and the four waves of data collection appear in Figure 1. In interpreting the figure, it is important to note that the Korean school year begins in early March and ends in late December (with a one month summer break during July-August).

For teachers in the experimental condition, we delivered the ASIP in three parts. Part 1 was a 2 ½ hour workshop to introduce autonomy-supportive teaching, to contrast it against controlling teaching, and to offer empirical evidence on the benefits of autonomy support and the costs of control. Part 2 was a 2 ½ hour workshop that centered on developing the teaching skill to deliver the six specific autonomy-supportive instructional behaviors more

and on delivering the six specific controlling instructional behaviors less. For a PE-specific example of these instructional behaviors, see Reeve and Cheon (2016), Table 3. During the workshop, each autonomy-supportive instructional behavior was described, modeled, explained, practiced, and discussed. Part 3 of ASIP was a 2 hour peer-based group discussion in which teachers shared their classroom experiences with autonomy-supportive teaching, reported on instances of being able to transform controlling instructional strategies into autonomy-supportive strategies, reported on how their students reacted to instances of both autonomy-supportive and controlling teaching, and shared tips and strategies from the field (classroom).

As to the data collection, it was conducted in four waves in which students completed the same four-page questionnaire at the beginning (T1), middle (T2), and end (T3) of the [spring](#) semester and at the end (T4) of the [fall](#) semester. We assessed the dependent measures during weeks 1, 9, and 17 of the [spring](#) semester and week 17 of the [fall](#) semester. The survey was administered at the beginning of the class period, and students were asked to complete the questionnaire in response to their experiences associated with that particular class. Students were assured that their responses would be confidential.

In addition, a pair of trained raters visited each classroom halfway through the [spring](#) semester (during weeks 9-10) to score each teacher’s post-intervention objective autonomy-supportive *vs.* controlling instructional behaviors.

Measures

Each questionnaire used the same 1-7 response scale (1, *strongly disagree*; 7, *strongly agree*). We used previously-validated Korean-translated versions of each English-language questionnaire (see Cheon & Reeve, 2013, 2015; Cheon, Reeve, Yu, & Jang, 2014).

Perceived Autonomy Supportive and Controlling Teaching. We assessed perceived autonomy-supportive teaching with the 6-item version of Learning Climate Questionnaire (LCQ; Williams & Deci, 1996). The LCQ includes items such as, “My PE teacher listens to how I would like to do things.” Scores on the LCQ have been shown to be able to predict extent of need satisfaction (Jang et al., 2012). Students’ reports of autonomy-supportive teaching were internally consistent across the four waves of data collection (α ’s at T1, T2, T3, and T4 were .94, .96, .97, and .97, respectively).

We assessed perceived controlling teaching with a teacher-adapted version of the 15-item Coach Controlling Behaviors Scale (CCBS; Bartholomew, Ntoumanis, & Thogersen-Ntoumani, 2010). The CCBS (Korean version, Song & Cheon, 2012) includes the following four subscales: use of controlling rewards (4 items; e.g., “My PE teacher tries to motivate me by promising to reward me if I do well.”; α ’s at T1, T2, T3, and T4 were .79, .84, .86, and .86); negative conditional regard (4 items; e.g., “My PE teacher is less friendly with me if I don’t make the effort to see things his/her way.”; α ’s were .89, .92, .94, and .95); intimidation (4 items; e.g., “My PE teacher shouts at me in front of others to make me do certain things.”; α ’s were .86, .87, .90, and .91); and excessive personal control (3 items; e.g., “My PE teacher tries to interfere in aspects of my life outside of PE class.”; α ’s were .85, .92, .90, and .92). Because the four scales were highly positively intercorrelated (4-scale α s at T1, T2, T3, and T4 were .82, .86, .89, and .90), we aggregated them into one overall score. These total scores on the CCBS have been shown to predict extent of need frustration (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011), including in the PE context (Hein, Koka, & Hagger, 2015).

Psychological Need Satisfaction and Frustration. We assessed students’ autonomy, competence, and relatedness satisfaction with three separate scales. We assessed autonomy need satisfaction with the 5-item Perceived Autonomy scale (Standage, Duda, &

Ntoumanis, 2006). A sample item is, “In this PE class, I feel that I do PE activities because I want to.” (α 's at T1, T2, T3, and T4 were .86, .90, .92, and .93). We assessed competence need satisfaction with the 4-item Perceived Competence scale from the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989). A sample item is, “I think I am pretty good at physical education.” (α 's were .91, .92, .93, and .94). We assessed relatedness need satisfaction with the 5-item Perceived Relatedness scale from the Basic Needs Satisfaction Scale (Ng, Lonsdale, & Hodge, 2011). A sample item is, “I have close relationships with others in my PE class.” (α 's were .88, .92, .94, and .95).

We assessed students’ autonomy, competence, and relatedness frustration with the 12-item Psychological Need Thwarting Scale (PNTS; Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). The PNTS includes three 4-item subscales to assess autonomy need frustration (“In PE class, I feel pushed to behave in certain ways.”; α 's were .86, .92, .93, and .93), competence need frustration (“In PE class, there are situations where I am made to feel inadequate.”; α 's were .77, .85, .83, and .82), and relatedness need frustration (“I feel rejected by my PE teachers.”; α 's were .83, .88, .86, and .86). The PNTS has been used successfully in the PE context (Hein, Koka, & Hagger, 2015; Liu & Chung, 2015).

Classroom engagement and amotivation. We assessed the behavioral, emotional, agentic, and cognitive aspects of engagement with four separate scales (Reeve, 2013). To assess behavioral and emotional engagement, we used the Engagement versus Disaffection with Learning measure (Skinner, Kindermann, & Furrer, 2009): behavioral engagement (5 items; e.g., “In this PE class, I work as hard as I can.”; α 's at T1, T2, T3, and T4 were .92, .93, .96, and .96); and emotional engagement (5 items; e.g., “When I’m in this PE class, I feel good.”; α 's were .94, .94, .96, and .96). To assess agentic engagement, we used the Agentic Engagement Scale (Reeve, 2013; 5 items; e.g., “During PE class, I express my preferences and opinions.”; α 's were .92, .93, .94, and .95). To assess cognitive engagement,

we used the Metacognitive Strategies Questionnaire (Wolters, 2004; 4 items; e.g., “When doing work for this PE class, I try to relate what I’m learning to what I already know.”; α ’s were .89, .92, .92, and .95).

To assess students’ amotivation, we used the 16-item Amotivation Inventory-Physical Education (AI-PE; Shen, Wingert, Li, Sun, & Rukavina, 2010). The AI-PE features four 4-item subscales to assess *amotivation—low ability* (e.g., “I don’t have what it takes to do well in PE.”; α ’s at T1, T2, T3, and T4 were .90, .93, .94, and .93); *amotivation—low effort* (e.g., “I don’t like to invest the effort that is required for PE.”; α ’s were .90, .92, .93, and .93); *amotivation—low value* (e.g., “I have no good reason to participate in PE.”; α ’s were .92, .95, .96, and .96); and *amotivation—unappealing task* (e.g., “I find that the activities being played are boring.”; α ’s were .92, .95, .95, and .95). In addition, we included a fifth scale—namely, the 4-item Problematic Relationships Scale (i.e., *estranged relationships*; Cheon & Jang, 2012; 4 items, “I feel uncomfortable getting along with others in PE.”; α ’s were .88, .93, .94, and .94). This scale correlates highly with the other four amotivation scales (Cheon & Kim, 2015), and its inclusion allowed us to assess amotivation in a more comprehensive way, as this scale is sensitive to relatedness need frustration experiences in a way that the other four scales are not (see Cheon & Jang, 2012).

Raters’ Scoring of Teachers’ Motivating Style

Before the data collection, a team of six students (4 undergraduates, 2 graduates) with an understanding of both self-determination theory and PE instruction in Korean secondary schools received extensive (a) instruction on autonomy-supportive and controlling PE instructional behaviors and (b) training and practice with a previously-validated rating sheet (see Cheon et al., 2012, p. 372). During the data collection (weeks 9 and 10, as per Fig. 1), raters worked in pairs, came to the class unannounced 5–10 min before its start time, did not

know into which group (experimental or control) the observed teacher had been randomly assigned, and made independent ratings. The rating sheet listed the following 5 instructional behaviors with the controlling behavior on the left side of the rating sheet (scored as “1”) and the autonomy-supportive behavior on the right side (scored as “7”): relies on extrinsic incentives *vs.* nurtures inner motivational resources; uses pressuring language *vs.* uses informational language; neglects explanatory rationales *vs.* provides explanatory rationales; displays impatience *vs.* displays patience; and counters and tries to change negative affect *vs.* acknowledges and accepts negative affect. The two observers’ ratings were positively correlated on each instructional behavior: nurtures inner motivational resources, $r(19) = .82$, $p < .001$; uses informational language, $r(19) = .74$, $p < .001$; provides explanatory rationales, $r(19) = .79$, $p < .001$; displays patience, $r(19) = .79$, $p < .001$; and acknowledges and accepts negative affect, $r(19) = .85$, $p < .001$. Given these acceptable reliabilities, we averaged the two ratings into a single score for each instructional behavior. Subsequent analyses showed that the five instructional behaviors were rated in an internally consistent way ($\alpha = .96$), so we combined the five instructional behaviors into one overall score.

Multilevel Data Analyses

To determine whether meaningful between-teacher differences might have affected the student-reported dependent measures, we used hierarchical linear modeling to calculate ICCs from unconditional models. The intra-class correlation coefficients (ICCs) for the 6 baseline measures were as follows: perceived autonomy-supportive teaching, 13.1%; perceived controlling teaching, 12.9%; need satisfaction, 3.2%; need frustration, 3.5%; engagement, 4.8%; and amotivation, 7.6%. Because ICCs exceeded 10% for two measures, we decided to test our hypotheses and hypothesized model using multilevel modeling. Doing

so allowed us to analyze the student-reported dependent measures as statistically independent of these “controlled for” teacher-level effects.

The longitudinal design had a 3-level hierarchical structure with repeated measures (Level 1) nested within students (Level 2) nested within teachers (Level 3). At level 1 (within student), the longitudinal data allowed us to measure students’ increase or decrease on each dependent measure over four time points—the beginning, middle, and end of the spring semester and the end of the fall semester. We entered “time” as an un-centered independent variable (scored as 0, 1, 2, 3) so that we could use participants’ T1 beginning-of-spring-semester score as an initial status measurement so that the T2, T3, and T4 scores could then function as change scores from that initial score. At level 2 (between students), we entered the student-level individual differences of gender and grade level as group mean centered covariates to function as a pair of statistical controls in each analysis. At level 3 (between teachers), we entered experimental condition as an un-centered independent variable so that we could retain its raw metric form of control group = -1 and experimental group = 1. Finally, we entered the condition \times time interaction as a cross-level predictor (experimental condition was a level 3 predictor, time was a level 1 predictor) to test the extent to which the changes in the T2, T3, and T4 scores depended on experimental condition.

In the test of the hypothesized model, we used multilevel latent variable structural equation modeling (LISREL 8.80; Joreskog & Sorbom, 2006) to evaluate both the measurement model and the hypothesized (structural) model.

Results

Preliminary Analyses

Missing values and normal distribution of scores. Missing data were rare (< 0.1%), so we used the expectation-maximization (EM) algorithm for imputing missing values.

Values for skewness and kurtosis for the 302 individual questionnaire items (82 items \times 3 or 4 waves) and for the 62 aggregate scores (17 measures \times 3 or 4 waves; see Table 2) were all less than |2.4|, indicating little deviation from normality.

Students’ demographic characteristics. We tested for possible associations between gender and grade level with the dependent measures. Gender was associated with 12 of the 24 dependent measures, as males scored higher than females on T1, T2, T3, and T4 need satisfaction and engagement and lower on T1, T2, T3, and T4 amotivation. Grade level was associated with 7 of the 24 dependent measures, as high school students scored higher than middle school students on T1, T2, T3, and T4 perceived autonomy support and lower on T1 perceived teacher control and T1 and T3 amotivation. Given these associations, we included student gender (females = 0; males = 1) and grade level (middle = 0; high = 1) as covariates (i.e., as statistical controls) in all subsequent analyses.

Five aspects of amotivation. To evaluate the validity of our 5-aspect measure of amotivation, we entered all 20 amotivation questionnaire items assessed at baseline into a series of four multilevel confirmatory factor analyses to discover a best-fitting factor structure. A single-factor model in which all 20 items loaded onto a single latent variable produced mixed results, $X^2(380) = 4,274.75$, $p < .01$, $RMSEA = .15$ (90% $CI = .15 - .16$), $CFI = .95$; $NNFI = .95$. A five-factor model in which the 20 items loaded on their respective five latent factors fit the data reasonably well, $X^2(370) = 2,480.18$, $p < .01$, $RMSEA = .09$ (90% $CI = .09 - .10$), $CFI = .97$; $NNFI = .97$. A 20-item five-factor model that added one higher-order (super) latent factor also fit the data reasonably well, $X^2(375) = 2,647.49$, $p < .01$, $RMSEA = .10$ (90% $CI = .09 - .10$), $CFI = .97$; $NNFI = .97$. Finally, a 20-item five-factor model that added three higher order (super) latent factors—one each for an autonomy, competence, and relatedness deficit, also fit the data reasonably well, $X^2(372) = 2,542.49$, $p < .01$, $RMSEA = .10$ (90% $CI = .09 - .10$), $CFI = .97$; $NNFI = .97$. In the end, the best-fitting model (as

determined by a series of X^2 difference tests) was the five-factor model in which the 20 items loaded on their respective five latent factors. These 20 factor loadings were all significant (λ s $\geq .77$; $ts > 28$, $p < .01$), as can be seen in Figure 2.

Effectiveness of the ASIP Manipulation

Our first test of the effectiveness of the ASIP manipulation (i.e., the experimental condition) used a t -test to compare observers’ ratings of experimental vs. control group teachers’ actual in-class autonomy-supportive vs. controlling instructional behaviors. Raters scored teachers in the experimental group as enacting more autonomy-supportive instructional behaviors than did teachers in the control group, $t(17) = 3.88$, $p < .01$, $d = 1.88$ (M s, 5.81 vs. 4.48).

Our second test of the effectiveness of the ASIP manipulation used students’ perceptions of autonomy-supportive teaching and controlling teaching. For these two analyses, we used a multilevel repeated measures analysis with follow-up post hoc pairwise mean comparisons (Bonferroni corrected t -test procedure in which the critical $\alpha = .005$, based on .05/10 possible pairwise mean comparisons).

For *perceptions of autonomy-supportive teaching*, fixed effects results showed that the condition main effect was not significant, $t(17) = 1.87$, $p = .08$, the time main effect was significant, $t(3,030) = 7.43$, $p < .01$, and the critical condition \times time interaction was significant, $t(3,030) = 5.96$, $p < .01$. Random effects results showed that there was significant teacher-level variance among students’ perceptions of autonomy-supportive teaching, $\tau = .13$, $X^2 (17 df) = 174.68$, $p < .01$. As illustrated in the left panel of Figure 3, perceived autonomy-supportive teaching increased significantly for students of the teachers in the experimental group from T1 to T2 ($\Delta = +0.49$, $t = 8.43$, $p < .01$) but then leveled off from T2 to T3 ($\Delta = +0.03$, $t = 0.52$, $p = .60$) and from T3 to T4 ($\Delta = +0.10$, $t = 1.61$, $p = .11$), while it decreased

significantly for students of the teachers in the control group from T1 to T2 ($\Delta = -0.24, t = 4.61, p < .01$) before leveling off from T2 to T3 ($\Delta = +0.11, t = 2.04, p = .04$) and from T3 to T4 ($\Delta = +0.12, t = 2.24, p = .03$). The two conditions unexpectedly differed at baseline ($\Delta = +0.25, t = 4.77, p < .01$). Nevertheless, perceived autonomy-supportive teaching was greater for students of the teachers in the experimental group than it was for students of teachers in the control group at T2 ($\Delta = +0.98, t = 17.03, p < .01$), T3 ($\Delta = +0.90, t = 15.38, p < .01$), and T4 ($\Delta = +0.88, t = 14.99, p < .01$).

For *perceptions of controlling teaching*, fixed effects results showed that neither the condition main effect, $t(17) = 0.57, p = .58$, nor the time main effect, $t(3,030) = 0.20, p = .84$, was significant, while the critical condition \times time interaction was significant, $t(3,030) = 9.98, p < .01$. Random effects results showed that there was significant teacher-level variance among students’ perceptions of controlling teaching, $\tau = .10, X^2(17 df) = 188.24, p < .01$. As illustrated in the right panel of Figure 3, perceived controlling teaching decreased significantly for students of the teachers in the experimental group from T1 to T2 ($\Delta = -0.45, t = 9.78, p < .01$) but then leveled off from T2 to T3 ($\Delta = -0.02, t = 0.32, p = .75$) and from T3 to T4 ($\Delta = +0.11, t = 2.14, p = .03$), while it increased significantly for students of the teachers in the control group from T1 to T2 ($\Delta = +0.32, t = 7.75, p < .01$) before leveling off from T2 to T3 ($\Delta = -0.03, t = 0.67, p = .50$) and from T3 to T4 ($\Delta = +0.09, t = 1.93, p = .05$). While the two conditions did not differ at baseline ($\Delta = +0.08, t = 1.88, p = .06$), perceived controlling teaching was lesser for students of the teachers in the experimental group than it was for students of teachers in the control group at T2 ($\Delta = -0.68, t = 15.30, p < .01$), T3 ($\Delta = -0.67, t = 14.84, p < .01$), and T4 ($\Delta = -0.65, t = 13.74, p < .01$).

Both the trained raters and the students in each teacher’s classroom made independent ratings of the teachers’ autonomy-supportive teaching and controlling teaching during weeks 9 and 10 (T2). The extent of agreement between the raters and the classroom average of the

students was significant: observers’ ratings with students’ perceived autonomy-supportive teaching, $r(19) = .48, p = .04$; and observers’ raters with students’ perceived controlling teaching, $r(19) = -.47, p = .05$.

Effects of ASIP on Students’ Motivation and Functioning

For *need satisfaction*, fixed effects results showed that the condition main effect was not significant, $t(17) = 0.54, p = .60$, the time main effect was significant, $t(3,030) = 15.01, p < .01$, and the critical condition \times time interaction was significant, $t(3,030) = 6.14, p < .01$. Random effects results showed that there was significant teacher-level variance among students’ need satisfaction, $\tau = .05, X^2(17 df) = 79.39, p < .01$. As illustrated in the upper left panel of Figure 4, need satisfaction increased significantly for students of the teachers in the experimental group from T1 to T2 ($\Delta = +0.41, t = 8.10, p < .01$) but then leveled off from T2 to T3 ($\Delta = +0.08, t = 1.47, p = .14$) before again increasing significantly from T3 to T4 ($\Delta = +0.23, t = 4.15, p < .01$), while it unexpectedly increased significantly for students of the teachers in the control group from T1 to T2 ($\Delta = +0.13, t = 3.07, p < .01$) before leveling off from T2 to T3 ($\Delta = +0.07, t = 1.33, p = .18$) and from T3 to T4 ($\Delta = +0.08, t = 1.67, p = .10$). While the two conditions did not differ at baseline ($\Delta = -0.07, t = 1.64, p = .10$), need satisfaction was greater for students of the teachers in the experimental group than it was for students of teachers in the control group at T2 ($\Delta = +0.35, t = 6.84, p < .01$), T3 ($\Delta = +0.36, t = 6.89, p < .01$), and T4 ($\Delta = +0.51, t = 10.02, p < .01$).

For *need frustration*, fixed effects results showed that the condition main effect was not significant, $t(17) = 0.57, p = .58$, the time main effect was significant, $t(3,030) = 4.55, p < .01$, and the critical condition \times time interaction was significant, $t(3,030) = 7.39, p < .01$. Random effects results showed that there was significant teacher-level variance among students’ need frustration, $\tau = .03, X^2(17 df) = 77.93, p < .01$. As illustrated in the upper right

panel of Figure 4, need frustration decreased significantly for students of the teachers in the experimental group from T1 to T2 ($\Delta = -0.23, t = 4.98, p < .01$) but then leveled off from T2 to T3 ($\Delta = +0.02, t = 0.37, p = .71$) and from T3 to T4 ($\Delta = +0.09, t = 1.94, p = .05$), while it increased significantly for students of the teachers in the control group from T1 to T2 ($\Delta = +0.20, t = 4.77, p < .01$), increased significantly again from T2 to T3 ($\Delta = +0.13, t = 2.87, p < .01$), before leveling off from T3 to T4 ($\Delta = +0.07, t = 1.59, p = .11$). While the two conditions did not differ at baseline ($\Delta = +0.05, t = 1.07, p = .29$), need frustration was lesser for students of the teachers in the experimental group than it was for students of teachers in the control group at T2 ($\Delta = -0.38, t = 8.13, p < .01$), T3 ($\Delta = -0.49, t = 10.43, p < .01$), and T4 ($\Delta = -0.47, t = 9.68, p < .01$).

For *classroom engagement*, fixed effects results showed that the condition main effect was not significant, $t(17) = 1.51, p = .15$, the time main effect was significant, $t(3,030) = 9.81, p < .01$, and the critical condition \times time interaction was significant, $t(3,030) = 7.63, p < .01$. Random effects results showed that there was significant teacher-level variance among students’ classroom engagement, $\tau = .05, X^2 (17 df) = 88.21, p < .01$. As illustrated in the lower left panel of Figure 4, engagement increased significantly for students of the teachers in the experimental group from T1 to T2 ($\Delta = +0.50, t = 9.41, p < .01$) but then leveled off from T2 to T3 ($\Delta = +0.03, t = 0.59, p = .56$) and from T3 to T4 ($\Delta = +0.08, t = 1.52, p = .13$), while it remained unchanged for students of the teachers in the control group from T1 to T2 ($\Delta = +0.01, t = 0.22, p = .83$), from T2 to T3 ($\Delta = -0.02, t = 0.41, p = .68$) and from T3 to T4 ($\Delta = +0.09, t = 1.96, p = .05$). While the two conditions did not differ at baseline ($\Delta = +0.10, t = 2.23, p = .03$), engagement was significantly greater for students of the teachers in the experimental group than it was for students of teachers in the control group at T2 ($\Delta = +0.59, t = 11.33, p < .01$), T3 ($\Delta = +0.64, t = 12.57, p < .01$), and T4 ($\Delta = +0.63, t = 12.10, p < .01$).

For *classroom amotivation*, fixed effects results showed that the condition main effect was not significant, $t(17) = 0.80, p = .44$, the time main effect was significant, $t(3,030) = 3.11, p < .01$, and the critical condition \times time interaction was significant, $t(3,030) = 6.50, p < .01$. Random effects results showed that there was significant teacher-level variance among students’ amotivation, $\tau = .08, X^2(17 df) = 121.83, p < .01$. As illustrated in the lower right panel of Figure 4, amotivation decreased significantly for students of the teachers in the experimental group from T1 to T2 ($\Delta = -0.19, t = 3.49, p < .01$) but then leveled off from T2 to T3 ($\Delta = -0.02, t = 0.41, p = .68$) and from T3 to T4 ($\Delta = +0.09, t = 1.52, p = .13$), while it increased significantly for students of the teachers in the control group from T1 to T2 ($\Delta = +0.20, t = 4.31, p < .01$) but then leveled off from T2 to T3 ($\Delta = +0.08, t = 1.56, p = .12$) and from T3 to T4 ($\Delta = +0.06, t = 1.25, p = .21$). While the two conditions did not differ at baseline ($\Delta = -0.08, t = 1.51, p = .13$), amotivation was significantly lesser for students of the teachers in the experimental group than it was for students of teachers in the control group at T2 ($\Delta = -0.47, t = 8.80, p < .01$), T3 ($\Delta = -0.57, t = 10.79, p < .01$), and T4 ($\Delta = -0.54, t = 10.36, p < .01$).

Test of the Hypothesized Model

We first tested the measurement model, which featured 14 latent variables, including 3 indicators for need satisfaction (autonomy, competence, relatedness) at T1, T2, and T3, 3 indicators for need frustration (autonomy, competence, relatedness) at T1, T2, and T3, 4 indicators for engagement (behavioral, emotional, agentic, and cognitive) at T1, T2, T3, and T4, and 5 indicators for amotivation (value, task, capacity, effort, relationships) at T1, T2, T3, and T4. The measurement model fit the data very well, $X^2(2,888) = 1,444.65, p = .99, RMSEA = .00 (.00 - .00), CFI = 1.00, NNFI = 1.00$. Table 2 shows the descriptive statistics

and factor loadings for all 54 individual indicators, while Table 3 shows the intercorrelations among experimental condition and the 14 latent variables.

We next tested the hypothesized model, and it fit the data well overall, $X^2(2,977) = 2,812.15$, $p = .98$, $RMSEA = .01$ (.00 - .01), $CFI = 1.00$, $NNFI = 1.00$. Most of the variance occurred at the student ($X^2 = 2,662.57$; 94.7%) rather than at the teacher ($X^2 = 149.58$, 5.3%) level. Eleven of the 12 hypothesized paths were individually significant.

As shown in Figure 5, experimental condition increased T2 need satisfaction ($B = .09$, $SE B = .02$, $\beta = .16$, $t = 3.97$, $p < .01$), even after controlling for T1 need satisfaction ($\beta = .51$, $p < .01$), but it did not increase T3 need satisfaction ($B = .01$, $SE B = .02$, $\beta = .02$, $t = 0.42$, $p = .68$), at least not after controlling for T2 need satisfaction ($\beta = .71$, $p < .01$). Experimental condition also decreased T2 need frustration ($B = -.09$, $SE B = .02$, $\beta = -.15$, $t = 4.00$, $p < .01$), even after controlling for T1 need frustration ($\beta = .34$, $p < .01$), and it further decreased T3 need frustration ($B = -.07$, $SE B = .02$, $\beta = -.12$, $t = 3.23$, $p < .01$), even after controlling for T2 need frustration ($\beta = .50$, $p < .01$).

The ASIP-induced increase in T2 need satisfaction increased T3 engagement ($B = .47$, $SE B = .05$, $\beta = .43$, $t = 8.87$, $p < .01$), even after controlling for T2 engagement ($\beta = .52$, $p < .01$), and it also decreased T3 amotivation ($B = -.39$, $SE B = .05$, $\beta = -.35$, $t = 8.10$, $p < .01$), even after controlling for T2 amotivation ($\beta = .51$, $p < .01$). The increase in T3 need satisfaction increased T4 engagement ($B = .35$, $SE B = .07$, $\beta = .25$, $t = 4.83$, $p < .01$), even after controlling for T3 engagement ($\beta = .53$, $p < .01$), and it also decreased T4 amotivation ($B = -.27$, $SE B = .06$, $\beta = -.19$, $t = 4.17$, $p < .01$), even after controlling for T3 amotivation ($\beta = .53$, $p < .01$).

The ASIP-induced decrease in T2 need frustration decreased T3 amotivation ($B = .18$, $SE B = .04$, $\beta = .17$, $t = 4.33$, $p < .01$), even after controlling for T2 amotivation ($\beta = .50$, $p < .01$), and it also increased T3 engagement ($B = -.15$, $SE B = .04$, $\beta = -.14$, $t = 3.68$, $p < .01$),

even after controlling for T2 engagement ($\beta = .52, p < .01$). Further, the ASIP-induced decrease in T3 need frustration decreased T4 amotivation ($B = .12, SE B = .05, \beta = .10, t = 2.63, p < .01$), even after controlling for T3 amotivation ($\beta = .53, p < .01$), and it also increased T4 engagement ($B = -.12, SE B = .05, \beta = -.10, t = 2.60, p < .01$), even after controlling for T3 engagement ($\beta = .53, p < .01$).

Supplemental Analysis

Given that experimental condition predicted changes in amotivation, we wondered whether teacher participation in ASIP decreased students’ amotivation, whether teacher non-participation in ASIP increased amotivation, or whether both of these effects occurred. Borrowing from Ntoumanis’ (2002) normative data with secondary-school PE students in the United Kingdom, we used the following pre-analysis coding scheme to classify all 1,017 students’ beginning-of-the-semester baseline (T1) amotivation level as follows (using each student’s mean score on the 20-item amotivation measure; 1-7 Likert scale): No amotivation at T1 = 1.00 ($n = 170, 16.7\%$); low amotivation at T1 = 1.01 to 2.00 ($n = 313, 30.8\%$); medium amotivation at T1 = 2.01 to 3.00 ($n = 258, 25.4\%$); and high amotivation at T1 = 3.01 to 7.00 ($n = 276, 27.1\%$). We analyzed changes in these group classifications over the course of the semester as a function of experimental condition. In the experimental group, the number of “no amotivation” students increased at T2, T3, and T4; in the control group, the number of “high amotivation” students increased at T2, T3, and T4: at T2, $X^2 (df = 3, N = 1017) = 37.62, p < .01$, at T3, $X^2 (df = 3, N = 1017) = 42.81, p < .01$, and at T4, $X^2 (df = 3, N = 1017) = 50.84, p < .01$. In other words, both effects were in the data (see Supplemental Figure 1).

Discussion

When amotivated, PE students are unable to generate the motivation they need to participate in and benefit from the exercise and sport activities their teachers provide. Amotivation is not a rare phenomenon in PE classrooms (Ntoumanis, 2002), and its common trajectory over the course of an academic year is gradually to rise (Cheon & Reeve, 2015; see Fig. 4). Recognizing this, our goal in the present study was to implement a teacher-focused SDT-based intervention to help PE teachers learn how to offer a classroom motivating style that could (1) grow their students’ autonomy, competence, and relatedness need satisfaction and (2) reverse their students’ autonomy, competence, and relatedness need frustration.

Teachers who participated in the ASIP did become more autonomy supportive and less controlling in the classroom, and this change was confirmed both by classroom observers and by the students of these teachers. Because the intervention produced these effects, students of teachers in the experimental group experienced increased need satisfaction and decreased need frustration. As shown in Figure 5, these ASIP-induced gains in need satisfaction and losses in need frustration produced two important student benefits—namely increased classroom engagement and decreased classroom amotivation.

These findings are important because they expand our current understanding of what teachers can do to decrease and even reverse their students’ PE-related amotivation. Previous intervention-based research had already established that ASIP-induced increases in students’ need satisfaction could explain students’ lesser amotivation (Cheon & Reeve, 2015). The conclusion was that elevated need satisfaction was the antidote to amotivation. The present study found these same results, but it also found the additional result that decreased need frustration similarly decreased amotivation, even after controlling for increases in need satisfaction. This new finding provides rather compelling support for the SDT-based dual-process model that emphasizes both brighter side and darker side explanatory processes.

Before we conclude that the twin antidotes to amotivation are boosts in need satisfaction and reductions in need frustration, it may be profitable in future research to test the utility of expanding the dual-process model to incorporate a three-process model, one that features not only need satisfaction and need frustration but also the newly-studied construct of need dissatisfaction (Costa, Ntoumanis, & Bartholomew, 2015). From this perspective, autonomy-supportive teaching enriches the brighter side of students’ functioning (via need satisfaction); teacher control exacerbates the darker side of students’ functioning (via need frustration); while teacher neglect or indifference mutes some of the brighter side processes and creates a new additional darker side process, because it deprives the person from need satisfaction. Thus, perhaps, psychological needs can be (a) satisfied to catalyze the brighter side, (b) frustrated to catalyze the darker side and/or (c) dissatisfied to mute the brighter side while also catalyzing the darker side of students’ functioning.

Adding Estranged Relationships to Amotivation

The general consensus in the SDT literature is to conceptualize amotivation as the lack of an intention sourced in moribund autonomy (low value, unappealing options) and competence (low capacity beliefs, apathetic effort) (Green-Demer et al., 2008; Ntoumanis et al., 2004; Shen, Wingert, Li, Sun, & Rukavina, 2010). This view does not recognize a lack of intentionality sourced in moribund relatedness. In a typical PE class, students participate in group-structured activities, such as team sports. Even individual-oriented activities (e.g., stretching, rope jumping) are routinely embedded in a group context. When Cheon and Jang (2012) interviewed PE students, they often traced their PE amotivation to estranged, or problematic, peer interactions and relationships. Adding “estranged relationships” as a fifth aspect of amotivation makes sense in terms of the three needs within SDT, and its addition allows for a more comprehensive understanding of amotivation.

Limitations

Four methodological features limit the strength of the conclusions that can be drawn from our findings. First, one baseline difference emerged between the experimental and control groups (i.e., perceived autonomy-supportive teaching), and this unexpected difference makes the interpretation of the repeated measures results more difficult than it otherwise would have been. Still, the emergence of this one baseline difference reaffirmed our methodological decision to collect baseline measures and therefore focus on change scores. Second, scores on the student-rated dependent measures likely varied with the specific sport activity of the day. We did measure the activity students engaged in during each wave of data collection, but “PE activity” proved to be a very difficult variable to analyze. We originally planned to treat “PE activity” in the same way we treated the demographic characteristics (i.e., a statistical control), but this proved quite difficult to do in a satisfying way. Third, our study did not include a measure of performance, skill development, learning, achievement, physical activity, or intentions to adopt a more physically active lifestyle that might be linked to engagement and amotivation. Fourth, our classroom observers used a bipolar rating scale that assumes that autonomy support and teacher control represent opposite ends of a single continuum. We recognize, however, that there would be very little cost and some meaningful gain if future research—especially that inspired by the dual-process model—scored autonomy support and teacher control with two separate unipolar rating scales. This is a methodological advance that we would encourage.

Future Research and Practical Implications

Future research might expand students’ need status beyond satisfaction and frustration to include dissatisfaction as well. Future research might also expand our exclusive focus on the autonomy-supportive dimension of teaching to include structure and involvement as well

(e.g., Tessier et al., 2010). It is possible that structure *vs.* chaos may uniquely explain the brighter and darker sides of competence need status, while involvement *vs.* neglect may uniquely explain the brighter and darker sides of relatedness need status. Perhaps not only teacher control but also teacher chaos and teacher neglect contribute to darker side processes. On a practical point, our finding that teachers contribute to changes in students’ amotivation is not the same thing as saying that teachers are responsible for their students’ high *vs.* low amotivation. Students bring wide individual differences in baseline amotivation with them into the PE classroom, and what teachers contribute to is the week-by-week changes in students’ baseline levels of amotivation.

Conclusion

We adopted the SDT-based dual-process model to design a teacher-focused intervention to supply teachers with the means they needed to increase students’ need satisfaction and to decrease students’ need frustration. By doing so, teachers acquired the means they needed to decrease students’ maladaptive classroom amotivation.

References

- Aelterman, N., Vansteenkiste, M., Van den Berghe, L., De Meyer, J., & Haerens, L. (2014). Fostering a need-supportive teaching style: intervention effects on physical education teachers’ beliefs and teaching behaviors. *Journal of Sport and Exercise Psychology*, *36*, 595–609.
- Assor, A., Kaplan, H., & Roth, G. (2002). Choice is good, but relevance is excellent: Autonomy-enhancing and suppressing teaching behaviors predicting students’ engagement in schoolwork. *British Journal of Educational Psychology*, *27*, 261-278.
- Bartholomew, K. J., Ntoumanis, N., & Thøgersen-Ntoumani, C. (2010). The controlling interpersonal style in a coaching context: development and validation of a psychometric scale. *Journal of Sport and Exercise Psychology*, *32*, 193-216.
- Bartholomew, K. J., Ntoumanis, N., Ryan, R., Bosch, J. A., & Thøgersen-Ntoumani, C. (2011). Self-determination theory and diminished functioning: The role of interpersonal control and psychological need thwarting. *Personality and Social Psychology*, *37*, 1459-1473.
- Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., & Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: assessing the darker side of athletic experience. *Journal of Sport & Exercise Psychology*, *33*, 75-102.
- Chatzisarantis, N. L., & Hagger, M. S. (2009). Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology and Health*, *24*, 29-48.
- Cheon, S. H., & Jang, H. (2012). Development and validation of student amotivation scale in high school physical education. *The Korean Journal of Physical Education*, *51*, 473-485.
- Cheon, S. H., & Kim, S. J. (2015). Experimental test of motivational strategies to prevent student amotivation to learn in physical education. *Korean Journal of Sport Psychology*, *26*, 99-120.
- Cheon, S. H., & Reeve, J. (2013). Do the benefits from autonomy-supportive PE teacher training programs endure? A one-year follow-up investigation. *Psychology of Sport and Exercise*, *14*, 508-518.
- Cheon, S. H., & Reeve, J. (2015). A classroom-based intervention to help teachers decrease students’ amotivation. *Contemporary Educational Psychology*, *40*, 99-111.
- Cheon, S. H., Reeve, J., & Moon, I. S. (2012). Experimentally based, longitudinally designed, teacher-focused intervention to help physical education teachers be more autonomy supportive toward their students. *Journal of Sport & Exercise Psychology*, *34*, 365-396.
- Cheon, S. H., Reeve, J., Yu, T. H., & Jang, H.-R. (2014). The teacher benefits from giving autonomy support during physical education instruction. *Journal of Sport and Exercise Psychology*, *36*, 331-346.

- Costa, S., Ntoumanis, N., & Bartholomew, K. J. (2015). Predicting the brighter and darker sides of interpersonal relationships: Does psychological need thwarting matter? *Motivation and Emotion, 39*, 11-24.
- deCharms, R. (1976). *Enhancing motivation: Change in the classroom*. New York: Irvington.
- De Meyer, J., Tallir, I., Soenens, B., Vansteenkiste, M., Aelterman, N., Van den Berghe, L., Speleers, L., & Haerens, L. (2014). Does observed controlling teaching behavior relate to students’ motivation in physical education? *Journal of Educational Psychology, 106*, 541-554.
- Goudas, M., Biddle, S., & Fox, K. (1994). Perceived locus of causality, goal orientations, and perceived competence in school physical education classes. *The British Journal of Educational Psychology, 64*, 453–463.
- Green-Demer, I., Legault, L., Pelletier, D., & Pelletier, L. G. (2008). Factorial invariance of the academic amotivation inventory across gender and grade in a sample of Canadian high school students. *Educational and Psychological Measurement, 68*, 862-880.
- Gunnell, K., Crocker, P. R. E., Wilson, P. M., Mack, D. E., & Zumbo, B. D. (2013). Psychological need satisfaction and thwarting: A test of basic psychological needs theory in physical activity contexts. *Psychology of Sport & Exercise, 14*, 599-607.
- Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., & Van Petegem, S. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students’ motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise, 16*, 26–36.
- Hein, V., Koka, A., & Hagger, M. S. (2015). Relationships between perceived teachers’controlling behavior, Psychological need thwarting, anger and bullying behavior in high-school students. *Journal of Adolescence, 42*, 103-114.
- Jang, H., Kim, E. J., & Reeve, J. (2012). Longitudinal test of self-determination theory’s motivation mediation model in a naturally-occurring classroom context. *Journal of Educational Psychology, 104*, 1175-1188.
- Joreskog, K. G., & Sorbom, D. (2006). *LISREL 8.80 for Windows* [Computer software]. Lincolnwood, IL: Scientific Software International.
- Legault, L., Green-Demers, I., & Pelletier, L. G. (2006). Why do high school students lack motivation in the classroom? Toward an understanding of academic amotivation and social support. *Journal of Educational Psychology, 98*, 567-582.
- Liu, J. D., & Chung, P. K. (2015). Development and initial validation of the Chinese version of psychological needs thwarting scale in physical education. *Journal of Teaching in Physical Education, 34*, 402-423.
- Markkand, D. & Tobin, V. (2004). A modification of the Behavioral Regulation in Exercise *Psychology, 26*, 191-196.

- McAuley, E., Duncan, T., & Tammen, V. V. (1989). Psychometric properties of the intrinsic motivation inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport*, 60, 48-58.
- Ng, J. Y. Y., Lonsdale, C., & Hodge, K. (2011). The Basic Needs Satisfaction in Sport Scale (BNSSS): Instrument development and initial validity evidence. *Psychology of Sport and Exercise*, 12, 257-264.
- Ng, J. Y. Y., Ntoumanis, N., Thogersen-Ntoumani, C., Stott, K., & Hindle, L. (2013). Predicting psychological needs and well-being of individuals engaging in weight management: The role of important others. *Applied Psychology: Health and Well-being*, 5, 291-310.
- Ntoumanis, N. (2001). A self-determination approach to the understanding of motivation in physical education. *British Journal of Educational Psychology*, 71, 225-242.
- Ntoumanis, N. (2002). Motivational clusters in a sample of British physical education classes. *Psychology of Sport and Exercise*, 3, 177-194.
- Ntoumanis, N., Pensgaard, A., Martin, C., & Pipe, K. (2004). An idiographic analysis of amotivation in compulsory school physical education. *Journal of Sport & Exercise Psychology*, 26, 197-214.
- Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology*, 105, 579-595.
- Reeve, J. (2015). Autonomy-supportive teaching: What it is, how to do it. In J. C. K. Wang, W. C. Liu, and R. M. Ryan’s (Eds.), *Motivation in educational research: Translating theory into classroom practice* (Chpt 5). New York: Springer.
- Reeve, J., & Cheon, S. H. (2016). Teachers become more autonomy supportive after they believe it is easy to do. *Psychology of Sport and Exercise*, 22, 178-189.
- Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students’ engagement by increasing teachers’ autonomy support. *Motivation and Emotion*, 28, 147-169.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55, 68-78.
- Shen, B., Li, W., Sun, H., & Rukavina, P. B. (2010). The influence of inadequate teacher-to-student social support on amotivation of physical education students. *Journal of Teaching in Physical Education*, 29, 417-432.
- Shen, B., Wingert, R. K., Li, W., Sun, H., & Rukavina, P. B. (2010). An amotivation model in physical education. *Journal of Teaching in Physical Education*, 29, 72-84.
- Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement and disaffection: Conceptualization and assessment of children’s behavioral and emotional participation in academic activities in the classroom. *Educational and Psychological Measurement*, 69, 493-525.

- Song, Y. G., & Cheon, S. H. (2012). Development and validation of controlling coach behaviors scale. *Korean Journal of Sport Psychology, 23*, 111-123.
- Standage, M., Duda, J. L., & Ntoumanis, N. (2003). A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions. *Journal of Educational Psychology, 95*, 97-110.
- Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology, 75*, 411-433.
- Standage, M., Duda, J. L., & Ntoumanis, N. (2006). Students’ motivational processes and their relationship to teacher ratings in school physical education: A self-determination theory approach. *Research Quarterly for Exercise and Sport, 77*, 100-110.
- Tessier, D., Sarrazin, P., & Ntoumanis, N. (2010). The effect of an intervention to improve newly qualified teachers’ interpersonal style, students’ motivation and psychological need satisfaction in sport-based physical education. *Contemporary Educational Psychology, 35*, 242-253.
- Vallerand, R. J., Pelletier, L. G., Blais, M. R., Briere, N. M., Senecal, C., & Vallières, E. F. (1992). The Academic Motivation Scale: A measure of intrinsic, extrinsic, and amotivation in education. *Educational and Psychological Measurement, 52*, 1003-1017.
- Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: Basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration, 23*, 263–280.
- Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and Social Psychology, 70*, 767-779.
- Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students’ motivation, cognition, and achievement. *Journal of Educational Psychology, 96*, 236-250.

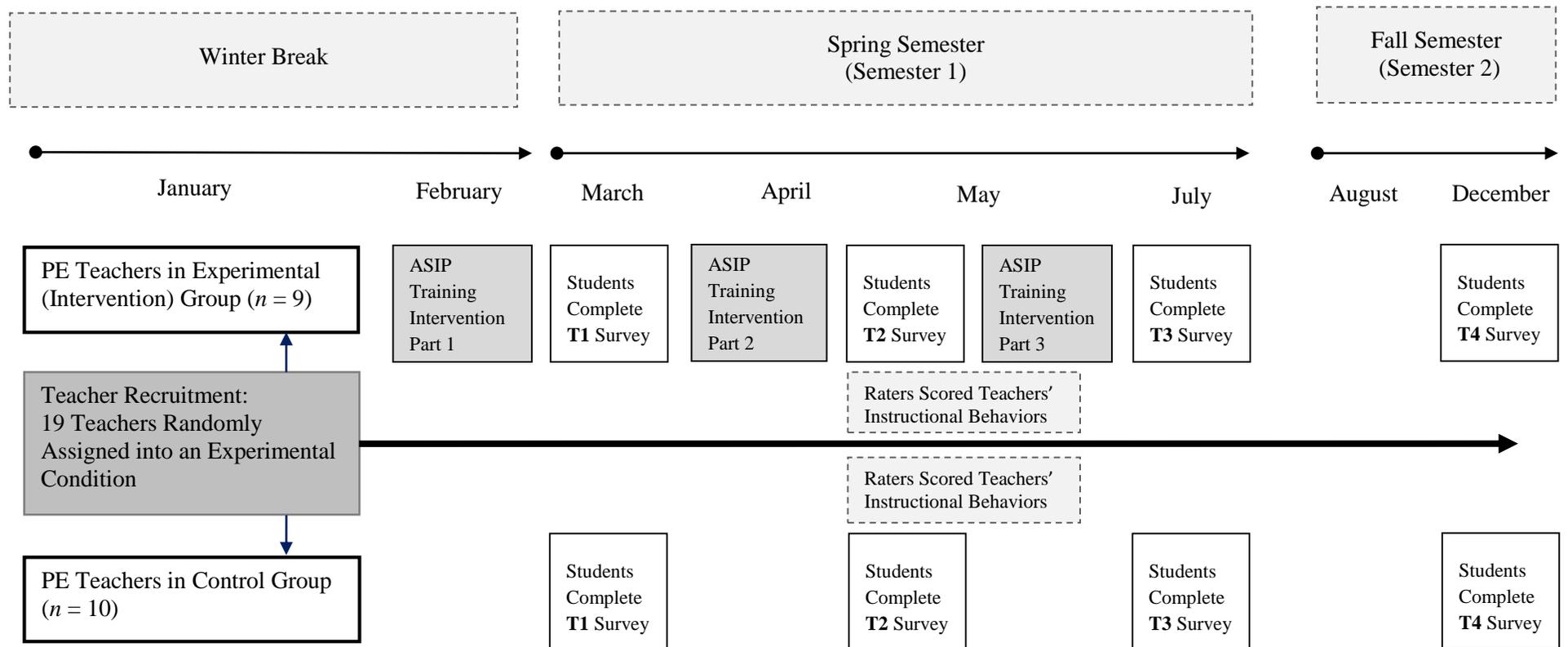


Figure 1. Procedural timeline for the 3-part autonomy-supportive teacher training program and the 4 waves of data collection.

Value Perceptions Items

Participating in PE is not important for me. .90
 I have no good reason to participate in PE. .88
 Participating in PE is not valuable to me. .87
 For me, PE holds no interest. .84

Unappealing Task Characteristics

The activities in PE are not stimulating. .89
 I find that the activities being played are boring. .88
 I don’t like activities being played in PE. .88
 I have the impression that it’s always the same thing in PE. .81

Capability Beliefs Items

I’m not good at PE. .91
 I don’t have what it takes to do well in PE. .86
 I don’t have the knowledge/skill required to succeed in PE. .81
 The tasks demanded of me in PE surpass my ability. .79

Effort Beliefs Items

I don’t like to invest the effort that is required for PE. .86
 I don’t have the energy to participate in PE. .83
 I’m not energetic enough for PE. .82
 I’m a bit lazy. .81

Estranged Relationship Items

I dislike playing with others in PE. .84
 I feel uncomfortable getting along with others in PE. .83
 My PE classmates make fun of me if I make a mistake. .82
 I feel nervous when I am with others in PE. .77

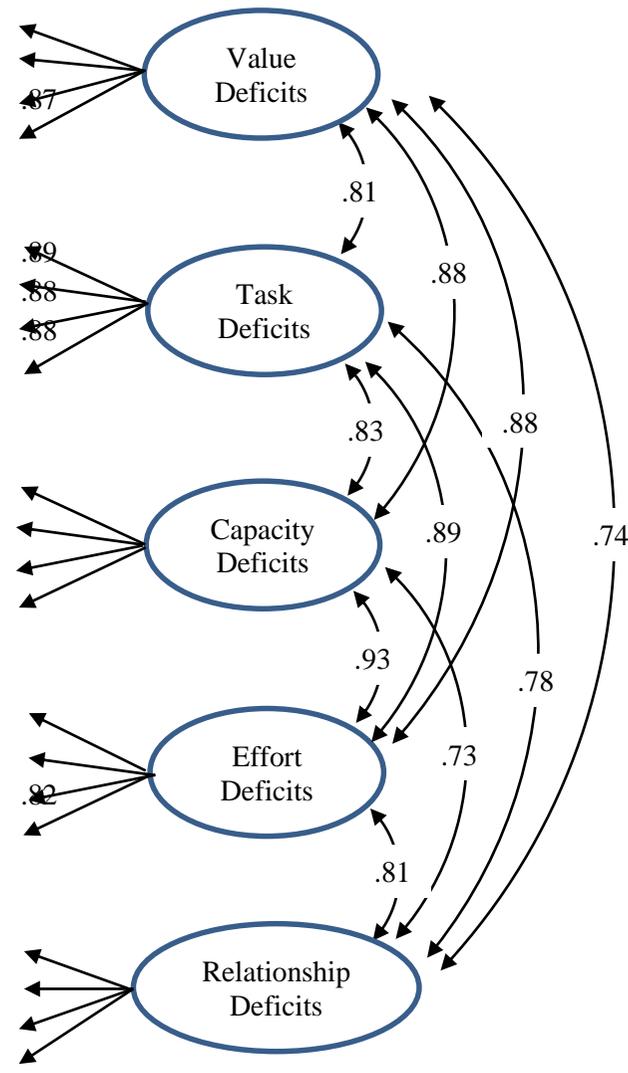


Figure 2. Standardized factor loadings from a five latent-factor multilevel CFA for the 20 items assessing the 5 aspects of student amotivation.

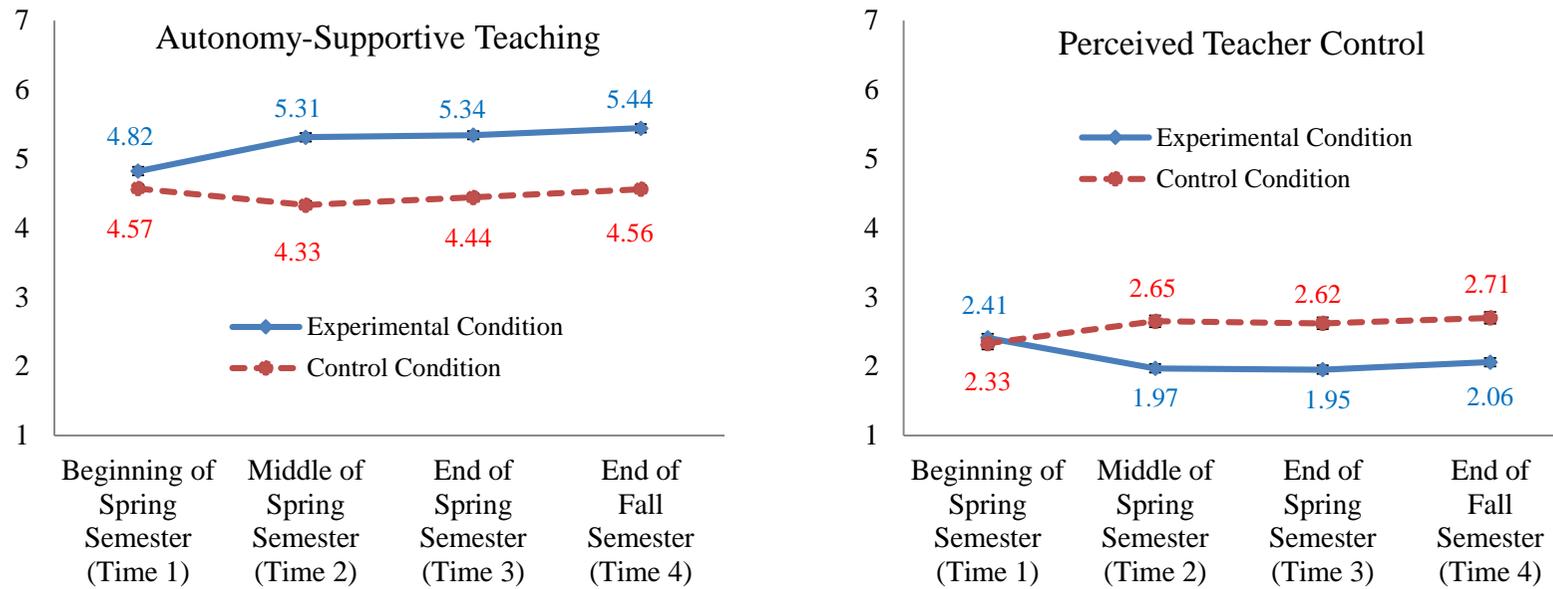


Figure 3. Means and standard errors for students’ perceptions of their teachers’ autonomy support and control broken down by experimental condition and time of assessment. *Note.* Numbers are mean scores, while vertical bars are standard errors. Solid blue lines represent the experimental group, while dashed red lines represent the control group.

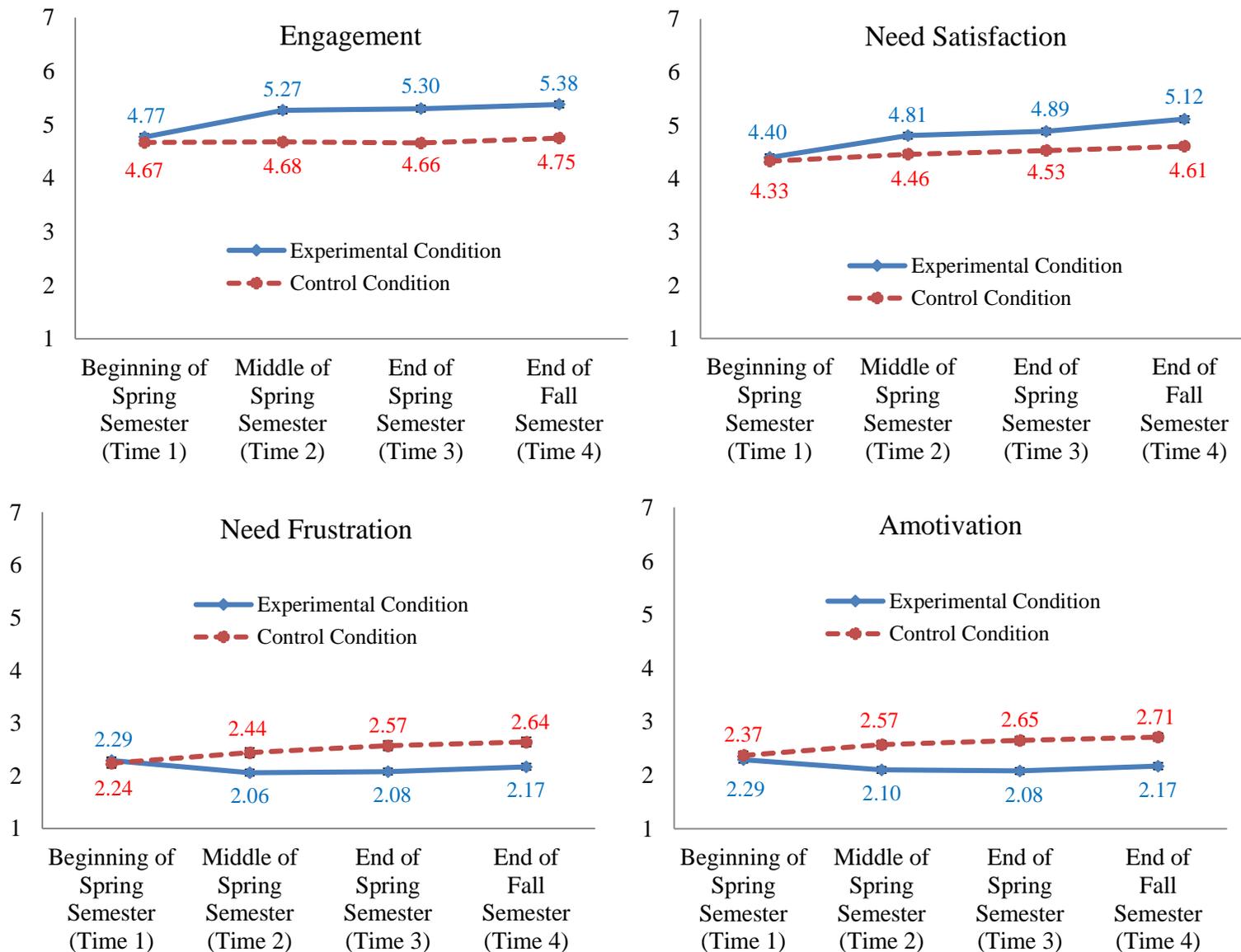


Figure 4. Means and standard errors for students’ need satisfaction (upper left), need frustration (upper right), engagement (lower left), and amotivation (lower right) broken down by experimental condition and time of assessment. *Note.* Numbers are mean scores, while vertical bars are standard errors. Solid blue lines represent the experimental group, while dashed red lines represent the control group.

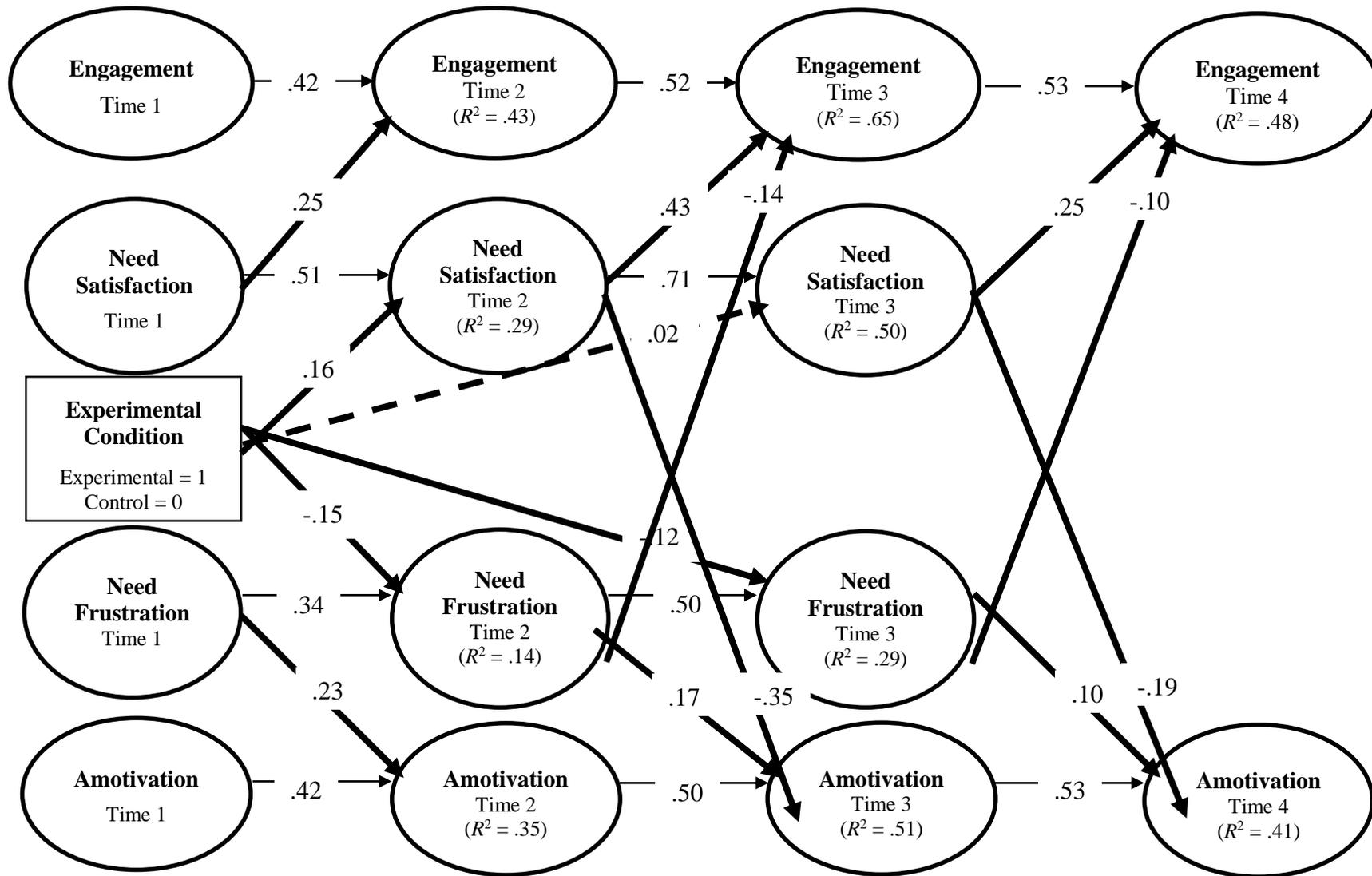


Figure 5. Standardized parameter estimates for the test of the overall supplemental to the hypothesized model.

Table 1 Sample Characteristics of the PE Students across the Four Waves of Data Collection

Wave of Data Collection	Persisters vs. Dropouts		Experimental Condition		Grade Level		Gender		Group Differences (persisters vs. dropouts) on T1 dependent measures	Group Differences (persisters vs. dropouts) on T2 dependent measures	Group Differences (persisters vs. dropouts) on T3 dependent measures
	Persisting Students	Dropout Students	Experimental	Control	Middle school	High school	Females	Males			
Time 1	1,178 (100%)	n/a	519 (44.1%)	659 (55.9%)	947 (80.4%)	231 (19.6%)	672 (57.0%)	506 (43.0%)	n/a	n/a	n/a
Time 2	1,136 (96.4%)	42 (3.6%)	502 (44.2%)	634 (55.8%)	918 (80.8%)	218 (19.2%)	646 (56.9%)	490 (43.1%)	1 significant difference among the 6 T1 measures (↓ need satisfaction)	n/a	n/a
Time 3	1,090 (96.0%)	46 (4.0%)	486 (44.6%)	604 (55.4%)	888 (81.5%)	202 (18.5%)	622 (57.1%)	468 (42.9%)	No significant differences among the 6 T1 measures.	1 significant difference among the 6 T2 measures. (↓ need frustration)	n/a
Time 4	1,017 (93.3%)	73 (6.7%)	448 (44.1%)	569 (55.9%)	828 (81.4%)	189 (18.6%)	584 (57.4%)	433 (42.6%)	1 significant difference among the 6 T1 measures. (↓ need frustration)	1 significant difference among the 6 T2 measures. (↓ need frustration)	No significant differences among the 6 T3 measures.

Table 2 Descriptive Statistics, Unstandardized, and Standardized Beta Weights Associated with the Dependent Measures in the Measurement Model

Dependent Measure	<i>M</i>	(<i>SD</i>)	<i>B</i>	<i>SE</i>	β	<i>M</i>	(<i>SD</i>)	<i>B</i>	<i>SE</i>	β	<i>M</i>	(<i>SD</i>)	<i>B</i>	<i>SE</i>	β	<i>M</i>	(<i>SD</i>)	<i>B</i>	<i>SE</i>	
<i>Need Satisfaction Indicators</i>																				
1. Autonomy	4.52	(1.13)	1.00	-	.64	4.73	(1.27)	1.00	-	.69	4.79	(1.29)	1.00	-	.68					
2. Competence	3.89	(1.37)	.82	.06	.52	4.13	(1.47)	.82	.06	.56	4.27	(1.46)	.86	.06	.59					
3. Relatedness	4.66	(1.09)	.72	.06	.45	4.99	(1.24)	.73	.06	.50	5.01	(1.26)	.82	.06	.56					
<i>Need Frustration Indicators</i>																				
1. Autonomy	2.28	(1.10)	1.00	-	.63	2.24	(1.20)	1.00	-	.64	2.33	(1.21)	1.00	-	.65					
2. Competence	2.41	(1.06)	1.02	.08	.64	2.40	(1.15)	.99	.07	.63	2.45	(1.11)	.97	.06	.63					
3. Relatedness	2.10	(0.92)	.82	.07	.51	2.19	(1.07)	.91	.07	.58	2.28	(1.06)	.94	.06	.61					
<i>Engagement Indicators</i>																				
1. Behavior	5.10	(1.11)	.93	.06	.60	5.18	(1.20)	.97	.06	.62	5.12	(1.20)	.95	.06	.63	5.17	(1.24)	.98	.06	.67
2. Emotion		4.99	(1.28)	1.00	-	.65	5.12	(1.39)	1.00	-	.65	5.07	(1.34)	1.00	-	.67	5.13	(1.32)	1.00	-
3. Agency		4.24	(1.29)	.80	.06	.52	4.64	(1.38)	.89	.06	.58	4.73	(1.36)	.88	.06	.59	4.91			
(1.33)	.89	.06	.61																	
4. Cognition	4.52	(1.17)	.87	.06	.56	4.80	(1.33)	.98	.06	.63	4.84	(1.31)	.97	.06	.64	4.91	(1.34)	.97	.06	.66
<i>Amotivation Indicators</i>																				
1. Low ability	2.57	(1.35)	.93	.06	.61	2.57	(1.43)	.97	.06	.64	2.56	(1.41)	.97	.05	.66	2.63	(1.39)	.95	.05	.64
2. Low effort	2.42	(1.30)	.95	.06	.63	2.46	(1.39)	.98	.06	.64	2.49	(1.36)	.99	.05	.68	2.58	(1.39)	.99	.06	.68
3. Low value	2.36	(1.23)	1.00	-	.66	2.38	(1.35)	1.00	-	.65	2.43	(1.33)	1.00	-	.68	2.48	(1.35)	1.00	-	.68
4. Unappealing Tasks	2.32	(1.23)	.97	.06	.64	2.35	(1.34)	1.00	.06	.65	2.40	(1.33)	1.00	.05	.67	2.48	(1.36)	.98	.06	.67
5. Estranged Relationships		2.00	(1.03)	.86	.06	.56	2.07	(1.18)	.90	.06	.59	2.11	(1.16)	.87	.05	.59	2.20			
(1.22)	.85	.05	.58																	

Possible range for each variable, 1—7. *M* = mean; (*SD*) = standard deviation; *B* = unstandardized beta weight; *SE* = standard error; β = standardized beta weight.

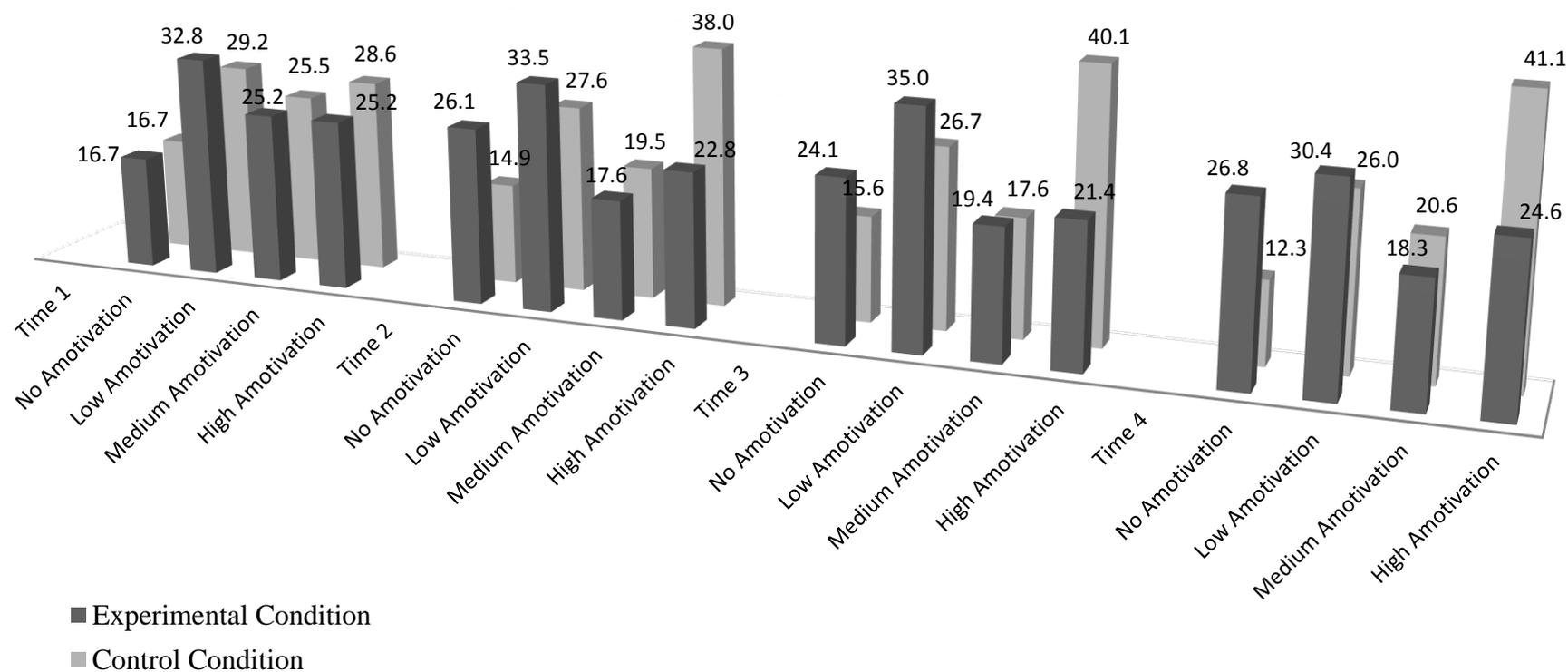
Table 3 Intercorrelation Matrix among Experimental Condition and the 14 Latent Variables Included in the Test of the Structural Model

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Experimental Condition	-														
2. Need Satisfaction, T1	.04	-													
3. Need Frustration, T1	.00	-.46	-												
4. Engagement, T1	.03	.86	-.45	-											
5. Amotivation, T1	-.04	-.60	.62	-.63	-										
6. Need Satisfaction, T2	.13	.55	-.35	.55	-.42	-									
7. Need Frustration, T2	-.14	-.33	.43	-.29	.36	-.50	-								
8. Engagement, T2	.17	.54	-.28	.54	-.41	.83	-.47	-							
9. Amotivation, T2	-.15	-.44	.39	-.40	.53	-.57	.70	-.63	-						
10. Need Satisfaction, T3	.12	.62	-.34	.55	-.46	.69	-.45	.63	-.54	-					
11. Need Frustration, T3	-.19	-.30	.38	-.32	.34	-.44	.60	-.45	.54	-.52	-				
12. Engagement, T3	.20	.54	-.30	.55	-.45	.66	-.45	.70	-.57	.84	-.54	-			
13. Amotivation, T3	-.17	-.39	.37	-.45	.52	-.53	.48	-.60	.66	-.59	.72	-.65	-		
14. Engagement, T4	.20	.48	-.26	.50	-.38	.56	-.35	.62	-.51	.63	-.45	.70	-.50	-	
15. Amotivation, T4	-.16	-.36	.33	-.39	.45	-.44	.40	-.50	.57	-.48	.49	-.51	.65	-.63	-

$N = 1,017$. All r 's $> .12$, $p < .01$. T1 = Time (wave) 1; T2 = Time 2; T3 = Time 3; T4 = Time 4.

Note. For clarity, gender and grade level correlations are not included in the table because all of these correlations were $r < .10$

Amotivation Categories



Supplemental Figure 1. Percentages of the four categories of amotivation across the four waves of data collection broken down by experimental condition. Numbers above each vertical bar are percentages of participants in that amotivation category for that experimental condition.