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Why students become more engaged or more disengaged during the semester: A self-determination theory dual-process model

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ABSTRACT

We adopted a dual-process model within a self-determination theory framework to investigate why students sometimes veer toward a longitudinal trajectory of rising classroom engagement during the semester and why they other times tend toward a trajectory of rising disengagement. Measures of perceived autonomy support, perceived teacher control, need satisfaction, need frustration, engagement, and disengagement were collected from 366 (174 females, 192 males) Korean high-school students using a three-wave longitudinal research design. Multi-level structural equation modeling analyses found that perceived autonomy support predicted longitudinal changes need satisfaction which predicted changes in engagement and also that perceived teacher control predicted longitudinal changes need frustration which predicted changes disengagement. Reciprocal effects also emerged in that extent of disengagement predicted both longitudinal increases in students' perceptions of teacher control and decreases in perceptions of teacher autonomy support. We conclude that students tend toward a semester-long trajectory of rising engagement when they perceive their teachers to be autonomy supportive and need satisfying while they tend toward a trajectory of rising disengagement when they perceive their teachers to be controlling and need frustrating.

Over the course of a semester, students' classroom experience can veer toward a productive trajectory of rising perceived teacher support, motivational satisfaction, and classroom engagement, or it can veer off on a counter-productive trajectory of rising perceived teacher control, motivational frustration, and classroom disengagement. The direction such a trajectory takes depends a good deal on how supportive *vs.* conflictual students perceive the classroom teacher to be toward them (Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015), but this perception of teacher support *vs.* conflict itself depends on how engaged *vs.* disengaged students are during classroom instruction (Sarrazin, Tessier, Pelletier, Trouilloud, & Chanal, 2006). In the present paper, our goal was to utilize a self-determination theory framework to understand the complex and potentially reciprocal classroom dynamics that explain why students might veer either toward a longitudinal trajectory of rising engagement and greater teacher support or toward a trajectory of rising disengagement and greater teacher control.

1. Self-determination theory

Self-determination theory (SDT) is an approach to motivation that highlights people's psychological needs (autonomy, competence, and relatedness) as inherent motivational assets that, when supported, facilitate optimal functioning and psychological well-being (Ryan & Deci, 2000a). When applied to the classroom context, the source of students' need support is often the teacher's motivating style (Reeve, 2009). When need supportive, the teacher acts as a social-contextual facilitator of students' need satisfaction and optimal functioning; but when controlling, the teacher acts as a social-contextual thwart of these same processes. Within such a theoretical framework, a teacher's motivating style is understood in terms of autonomy support *vs.* teacher control; student motivation is understood in terms of need satisfaction *vs.* need frustration; and student functioning is often understood in terms of engagement *vs.*

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disengagement (Reeve, Deci, & Ryan, 2004; Ryan & Deci, 2000a, 2000b; Skinner, Kindermann, & Furrer, 2009).

As evidenced by both experimental manipulations (Cheon, Reeve, & Moon, 2012) and longitudinal surveys (Jang, Kim, & Reeve, 2012), autonomy-supportive teaching (the delivery of instruction through an interpersonal tone of support and understanding; e.g., perspective taking, creating opportunities for initiative) enhances students' positive classroom functioning (e.g., engagement, conceptual learning, well-being), and it does so because it nurtures and supports students' autonomy, competence, and relatedness need satisfaction during instruction. Hence, the primary reason students show robust classroom engagement is because they first experience engagement-energizing psychological need satisfaction (Cheon et al., 2012; Jang et al., 2012), and the primary reason why students experience need satisfaction in the first place is because their teachers adopt an autonomy-supportive style toward them (Cheon & Reeve, 2013; Reeve & Jang, 2006). These processes are represented by SDT's motivation mediation model: Teachers' motivating style → students' need satisfaction → students' positive outcomes (Cheon et al., 2012; Deci et al., 2001; Jang, 2008; Jang et al., 2012; Jang, Reeve, Ryan, & Kim, 2009).

One shortcoming of the motivation mediation model is that it features only unilateral and not reciprocal effects. This is a shortcoming because teachers do tend to respond to displays of students' engagement–disengagement with changes in their motivating style. For instance, one investigation showed that teachers become more controlling when students show behavioral disengagement (e.g., minimal or no effort; Sarrazin et al., 2006), a second investigation showed that students perceived their teachers as becoming increasingly autonomy supportive following student displays of agentic engagement (e.g., show initiative, ask questions; Reeve, 2013), and a third investigation showed how these reciprocal teacher-student relations unfold longitudinally in naturally-occurring classrooms over the course of a semester (Jang et al., 2012).

SDT's motivation mediation model explains students' positive classroom functioning rather well. As researchers turned their attention to understanding students' non-optimal and even maladaptive classroom functioning, however, they found that the primary reason students experienced disengagement, amotivation, negative affect, intentional non-participation, exhaustion-burnout, bullying, anti-social behavior, adverse physical symptoms, and various dysfunctional behaviors (e.g., disordered eating, depression) was not so much because of low need satisfaction during instruction but rather because of high need frustration (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011a; Gunnell, Crocker, Wilson, Mack, & Zumbo, 2013; Hein, Koka, & Hagger, 2015; Unanue, Dittmar, Vignoles, & Vansteenkiste, 2014). An experience of need frustration tends to thwart autonomous motivation and task-involvement (i.e., intrinsic goals, immersed attention in the activity) and to replace them with compensatory controlled motivation and ego-involvement (extrinsic goals, redirected attention toward outperforming others; Vansteenkiste, Matos, Lens, & Soenens, 2007). And, the primary reason why students experience need frustration is because their teachers adopt a controlling motivating style toward them (De Meyer et al., 2014; Standage, Duda, & Ntoumanis, 2005).

To explain both optimal and non-optimal functioning, self-determination theorists now highlight two differentiated explanatory processes (Haerens et al., 2015; Ryan & Deci, 2000b; Vansteenkiste & Ryan, 2013). 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 rouses the "darker" side of students' motivation and functioning: Teacher control → increased need frustration → increased disengagement. This distinction has led SDT researchers to propose a dual-process model, and empirical research on this model has shown that autonomy support is one distinct pathway to facilitate students' need satisfaction and optimal functioning while teacher control is a second distinct pathway to promote students' need frustration and non-optimal functioning (Bartholomew, Ntoumanis, Ryan, & Thogersen-Ntoumani, 2011a; Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011b; Gunnell et al., 2013; Haerens et al., 2015; Ng, Ntoumanis, Thogersen-Ntoumani, Stott, & Hindle, 2013; Unanue et al., 2014).

2. Dual-process model

The dual-process model within a self-determination theory framework is built on a differentiated view of the social-contextual environment, of student motivation, and of student outcomes. That is, teachers' perceived motivating style is differentiated into the distinct processes of perceived autonomy support and perceived teacher control, student motivation is differentiated into the distinct processes of need satisfaction and need frustration, and student outcomes are differentiated into those that are adaptive and optimal (e.g., engagement) and those that are maladaptive and non-optimal (e.g., disengagement). Further, these differentiated processes are not only conceptually distinct, but each has its own unique set of antecedents and outcomes. The aim of the dual-process model, at least relative to the traditional motivational mediation model, is to better explain students' experience of need frustration and non-optimal functioning. The dual-process model acknowledges the bright side aspects that explain the conditions under which students tend toward a semester-long trajectory of greater support, motivational satisfaction, and engagement, but is ads a new emphasis on the dark side aspects that further explain the conditions under which students tend toward a semester-long trajectory of greater control, motivational frustration, and disengagement.

As to the distinction within students' perceptions of their teacher's motivating style, several classroom-based studies find that autonomy-supportive and controlling teaching are negatively correlated but only mildly so ($r = -.15$ in Haerens et al., 2015) or only moderately so ($r = -.38$ in Cheon & Reeve, 2013; $r = -.49$ in Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011b). SDT researchers now make the distinction between these two aspects of motivating style because the absence of autonomy support is not necessarily the presence of teacher control, just as the absence of teacher control is not necessarily the presence of autonomy support.

As to the distinction within students' psychological needs, newly developed questionnaire measures now assess not only need satisfaction (e.g., "I feel free.") but also need frustration (e.g., "I have to do things against my will."), and these investigations find that need frustration is not just the opposite of need satisfaction but instead is a separate motivational experience (Chen et al., 2015; Sheldon & Hilpert, 2012). The opposite of need satisfaction is not need frustration (e.g., "I feel rejected by those around me") but, rather, is need dissatisfaction (e.g., "I don't have opportunities to interact with others"), which is an experience of need neglect or a lacking of opportunities for need satisfaction (Costa, Ntoumanis, & Bartholomew, 2015). Need frustration, in contrast, is closely linked to active need thwarting. When need satisfaction and need frustration are assessed together, researchers find that they are only moderately negatively correlated ($r = -.39$ in Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011b; $r = -.40$ in Cheon & Reeve, 2015; $r = -.47$ in Unanue et al., 2014). Further, these investigations find that need satisfaction tends to predict one class of

student outcomes (e.g., optimal functioning), while need frustration tends to predict a different class of student outcomes (e.g., non-optimal functioning).

Research on the distinction between engagement *vs*. disengagement as two distinct processes is sparse and largely not yet undertaken (but see Skinner et al., 2009). We conceptualize engagement and disengagement as two distinct constructs based on the findings (e.g., from factor analyses) that (1) positive emotion and negative emotion are more independent than opposite (Diener & Emmons, 1984), (2) agentic engagement (initiating action to render one's environment more supportive and need-satisfying) and agentic disengagement (accepting one's environment as it is, even if it is non-supportive or need-neglecting) are more independent than opposite (Reeve, 2013), and cognitive engagement (deep processing, elaboration, critical thinking) and cognitive disengagement (using no or only disorganized study strategies) are more independent than opposite (Elliot, McGregor, & Gable, 1999). Behavioral engagement and behavioral disengagement may be opposites (based on high *vs*. low on-task attention, effort, persistence), though some researchers conceptualize behavioral disengagement as positive conduct such as following rules *vs*. getting into trouble (Finn, Pannozzo, & Voelkl, 1995). In the present study, we hoped to make new progress on testing our assumption that engagement and disengagement represent two distinct processes such that engagement aligns with the brighter side aspects while disengagement aligns with the darker side aspects.

Overall, empirical research on the dual-process model shows that (1) autonomy support and teacher control are only moderately negatively correlated, (2) autonomy support strongly predicts need satisfaction but only mildly predicts (low) need frustration, (3) teacher control strongly predicts need frustration but only mildly predicts (low) need satisfaction, (4) need satisfaction and need frustration are only moderately negatively correlated, (5) need satisfaction strongly predicts optimal functioning but only mildly predicts (low) non-optimal functioning, and (6) need frustration strongly predicts non-optimal functioning but only mildly predicts (low) optimal functioning. The overall theoretical direction that has emerged from this line of research has been to expand the basic motivational mediation model into the more comprehensive dual-process motivational mediation model.

3. Hypothesized model

The purpose of the paper was to integrate and then to test the validity of two recent trends in self-determination theory-based research: (1) reciprocal effects and (2) the dual-process model. The integration of these two trends can be seen in our hypothesized "dual-process motivation mediation model" in Fig. 1.[1]

Perceptions of motivating style longitudinally affect engagement–disengagement. The upper half of Fig. 1 depicts how, according to the hypothesized model, perceptions of motivating style longitudinally affect changes in students' engagement–disengagement. These hypothesized paths appear in Fig. 1 as the four boldfaced downwardly-slopped lines. Specifically, perceptions of teachers' beginning of-semester (T1) autonomy support predict longitudinal changes in mid-semester (T2) need satisfaction, controlling for T1 need satisfaction (and for T1 teacher control, which is not shown in Fig. 1 for purposes of clarity), and perceptions of beginning-of-semester (T1) teacher control predict longitudinal changes in mid-semester (T2) need frustration, controlling for T1 need frustration (and for T1 autonomy support). Similarly, mid-semester (T2) changes in perceived autonomy support predict end-of-semester (T3) changes in need satisfaction, controlling for T2 need satisfaction (and for T1 autonomy support and T2 teacher control, which are not shown in Fig. 1 for purposes of clarity), and mid-semester (T2) changes in perceived teacher control predict end-of-semester (T3) changes in need frustration, controlling for T2 need frustration (and for T1 teacher control and T2 autonomy support).

To fully characterize predictions based on SDT's dual-process motivation mediation model, we added four supplemental downwardly sloped lines in the lower half of Fig. 1. As shown in the figure's lower left quadrant, beginning-of-semester (T1) need satisfaction predicts changes in mid-semester (T2) engagement, controlling for T1 engagement (and for T1 need frustration, which is not shown in Fig. 1 for purposes of clarity), and beginning-of-semester (T1) need frustration predicts mid-semester (T2) changes in disengagement, controlling for T1 disengagement (and for T1 need satisfaction). As shown in the figure's lower right quadrant, mid-semester (T2) changes in need satisfaction predict end-of-semester (T3) changes in engagement, controlling for T2 engagement (and for T1 need satisfaction and T2 need frustration, which are not shown in Fig. 1 for purposes of clarity), and mid-semester (T2) changes in need frustration predict end-of-semester (T3) changes in disengagement, controlling for T2 disengagement (and for T1 need frustration and T2 need satisfaction).

To communicate the dual-process motivation mediation model more clearly, we shaded the six ovals representing the six variables featured in the model. As shown in Fig. 1, both aspects of perceived motivating style predict their corresponding changes in students' motivation (need satisfaction—need frustration) which, in turn, predict their corresponding changes in students' classroom functioning (engagement—disengagement).

Engagement–disengagement temporally affects perceived motivating style. The upper half of Fig. 1 depicts how, according to the hypothesized model, students' engagement–disengagement longitudinally affects changes in perceived motivating style. These hypothesized paths appear in Fig. 1 as the four boldfaced upwardly-slopped lines. Specifically, beginning-of-semester (T1) engagement predicts mid-semester (T2) longitudinal changes in perceived autonomy support, controlling for T1 autonomy support (and for T1 disengagement), and beginning-of-semester (T1) disengagement predicts mid-semester (T2) longitudinal changes in perceived teacher control, controlling for T1 teacher control (and for T1 engagement). Similarly, changes in mid-semester (T2) engagement predict end-of-semester (T3) changes in perceived autonomy support, controlling for T2 autonomy support (and for T1 engagement and T2 disengagement), and changes in mid-semester (T2) disengagement predict end-of-semester (T3) changes in perceived teacher control, controlling for T2 teacher control (and for T1 disengagement and T2 engagement).

4. Method

4.1. Participants and procedure

Participants were 407 high-school students taking 12 different

[1] For purposes of clarity, the correlations among within-wave error terms and several non-hypothesized paths do not appear in Fig. 1. As to the error terms, the six predictors at T1 were allowed to correlate freely, and the errors of the six within-wave variables at both T2 and at T3 were allowed to correlate. As to the missing paths, there are two types. First, Fig. 1 does not show the "cross-over" effects of how the "darker side" variables might predict the "brighter side" variables, and vice versa. Second, Fig. 1 does not show the non-hypothesized effect of the T1 variables on T3 scores. It is necessary to include these T1 → T3 paths in the prediction of the T3 variables because they render the effect of the T2 predictors on the T3 outcomes as the effect of changes in the T1 → T2 predictor and not the effect of T2 predictor per se.

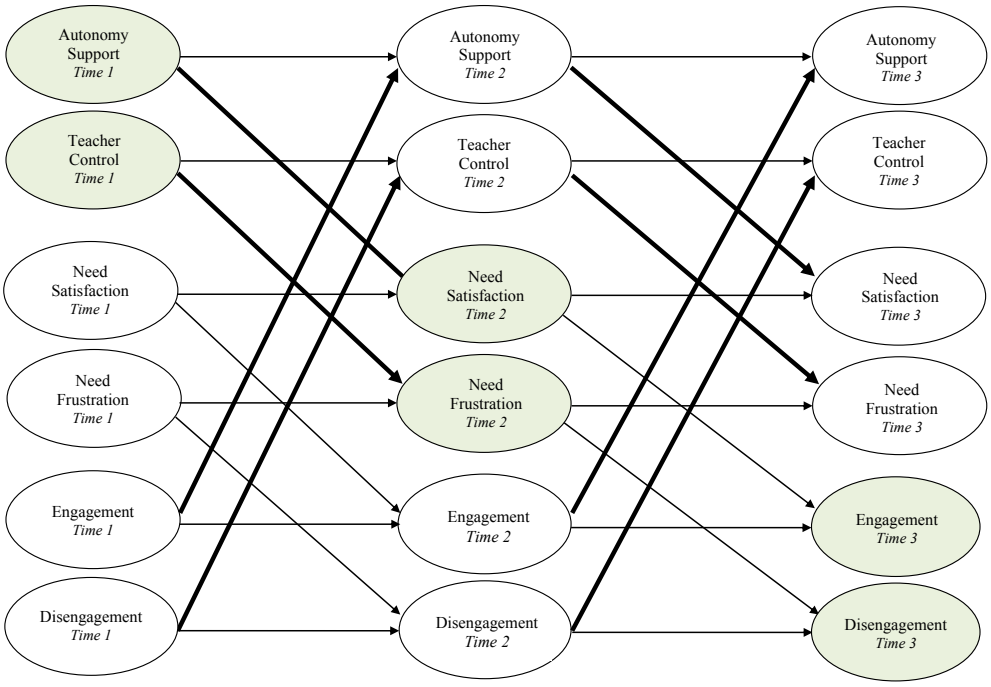

Fig. 1. Hypothesized model. Boldface downwardly-slopped lines show how teachers are hypothesized to affect students, while boldface upwardly-slopped lines show how students are hypothesized to affect teachers. The thin downwardly-slopped lines show how motivation is hypothesized to affect engagement. The 12 thin horizontal lines represent statistical controls for the repeated measures. The six shaded ovals visually represent the variables included within the dual-process motivation mediation model.

classes situated within a large urban high school in Seoul, Korea who consented to complete the study questionnaire during the first week of classes (T1), and all students who were present in class did consent to participate. All students were ethnic Korean, and in either grade 1, 2, or 3 of high school (grades 10, 11, and 12 in the United States) taking a course in either English, Korean, mathematics, or social science.

During the second wave of data collection, 396 of the original 407 student-participants agreed to complete the questionnaire (retention rate = 97.3%). The 396 persisting students from T1 did not differ significantly from the 11 T2 dropout students on any of the 16 T1 student-assessed dependent measures, all *ts* (405) < 1.28, *ns*, a result that suggests that student drop out occurred for random, rather than for systematic, reasons. During the third wave of data collection, 366 of the 396 students from the first two waves of data collection agreed to complete the questionnaire. The 366 persisting students from T3 did not differ significantly from the 30 T3 dropouts on any of the 16 T1 or 16 T2 dependent measures, all *ts* (394) < 1.63, *ns*. This final sample of 366 student-participants represented a retention rate of 89.9% (366/407) and consisted of 174 (48%) females and 192 (52%) males in grade 1 (184; 50%), grade 2 (57; 16%), or grade 3 (125; 34%).

4.2. Procedure

Participants completed the same four-page questionnaire three times during the 17-week semester—during week 1 (T1), week 9 (T2), and week 17 (T3). The survey was administered at the beginning of the class period, students were asked to complete the questionnaire in response to their experiences associated with that particular class, and students were assured that their responses would be confidential and used only for purposes of the research study.

The time frame for the data collection was one semester. We selected this one-semester, 17-week time frame for two reasons. First, the Korean school year occurs from March to June (Semester 1) and from September to December (Semester 2), with January–February and July–August set as between-semester breaks. This schedule makes our one-semester time frame more suitable to Korean education than to Western education, because the 2-month break makes each semester a somewhat self-contained experience. Second, we knew from previous research how long it takes students and teachers to be affected by each other's classroom activity. Students, for instance, need about one month to become aware of, accommodate to, and be affected by their teacher's motivating style (Deci, Schwartz, Sheinman, & Ryan, 1981). By two months, students show longitudinal changes in their motivation and engagement as a function of their teacher's actual (Cheon et al., 2012) or perceived (Jang et al., 2012) motivating style. After two months, these motivating style-induced changes tend to stabilize (Cheon & Reeve, 2013, 2015). Thus, we assessed the dependent measures using an 8-week interval between waves.

4.3. Measures

The 67-item questionnaire included a statement of consent and the measures to assess perceived autonomy support, perceived teacher control, need satisfaction (autonomy, competence, and relatedness), need frustration (autonomy, competence, and relatedness), engagement (behavioral, emotional, agentic, and cognitive), and disengagement (behavioral, emotional, agentic, and cognitive). All 67 questionnaire items appear in Table 1. Throughout the questionnaire, we used the same 1–5 Likert response scale (1 = *strongly disagree*, 5 = *strongly agree*), and we mixed the order of presentation of the 67 items throughout the questionnaire, though we grouped items by construct (items 1–10 assessed motivating style; items 11–28 assessed need satisfaction-need frustration; and items 29–67 assessed engagement–disengagement). Each measure was originally written in English, but we had available a professionally back-translated Korean-language version of each

Table 1
The 67 questionnaire items on the study questionnaire designed to assess the multiple aspects of perceived motivating style, motivation, and engagement (grouped by the 16 different scales).

Perceived autonomy support
1. My teacher provides me with choices and options.
2. I feel understood by my teacher.
3. My teacher conveys confidence in my ability to do well in this course.
4. My teacher encourages me to ask questions.
5. My teacher listens to how I would like to do things.
6. My teacher tries to understand how I see things before suggesting a new way to do things.

Perceived teacher control
1. My teacher tries to control everything I do.
2. My teacher is inflexible.
3. My teacher uses forceful language.
4. My teacher puts a lot of pressure on me.

Autonomy need satisfaction
1. In this class, I feel free.
2. I feel free to be my "true self" in this class.
3. I get to do interesting things in this class.

Competence need satisfaction
1. In this class, I feel successful in terms of completing difficult tasks and projects.
2. I like and accept the hard challenges in this class.
3. I do well in this class, even on the hard things.

Relatedness need satisfaction
1. I feel a close sense of connection with people in this class.
2. I feel close and connected with people in this class.
3. I feel a strong sense of intimacy with people in this class.

Autonomy need frustration
1. People in this class boss me around and tell me what I have to do.
2. In this class, I feel a lot of aversive pressure.
3. I have to do things against my will in this class.

Competence need frustration
1. In this class, I expect failure and to feel incompetent.
2. I feel incompetent in this class.
3. I struggle with tasks that I should be good at in this class.

Relatedness need frustration
1. In this class, I feel lonely.
2. I feel unappreciated by people in this class.
3. I have disagreements and conflicts with people in this class.

Behavioral engagement
1. When I'm in this class, I listen very carefully.
2. I pay attention in this class.
3. I try hard to do well in this class.
4. In this class, I work as hard as I can.
5. When I'm in this class, I participate in class discussions.

Emotional engagement
1. When we work on something in this class, I feel interested.
2. This class is fun.
3. I enjoy learning new things in this class.
4. When I'm in this class, I feel good.
5. When we work on something in this class, I get involved.

Agentic engagement
1. I let my teacher know what I need and want.
2. I let my teacher know what I am interested in.
3. During this class, I express my preferences and opinions.
4. During class, I ask questions to help me learn.
5. When I need something in this class, I'll ask the teacher for it.

Cognitive engagement
1. When reading for this class, I try to explain the key concepts in my own words.
2. When learning about a new topic in this course, I usually try to summarize it in my own words.
3. When reading for this class, I try to connect the ideas I am reading about with what I already know.
4. When thinking about the concepts in this class, I try to generate examples to help me understand them better.

Behavioral disengagement
1. When I'm in this class, I just act like I'm working.
2. I don't try very hard in this class.
3. In this class, I do just enough to get by.
4. When I'm in this class, I think about other things.
5. When I'm in this class, my mind wanders.

Emotional disengagement
1. When we work on something in this class, I feel bored.
2. This class is no fun for me.
3. When I am in this class, I feel bad.
4. When I'm in this class, I feel worried.
5. When we work on something in this class, I feel discouraged.

Agentic disengagement
1. Most of the time in this class, I am passive.
2. Most of the time in this class, I am silent and unresponsive.

(*continued on next page*)

Table 1 (*continued*)

3. During this class, I hide from the teacher what I am thinking about.
4. In this class, I avoid asking any questions.
5. In this class, I do only what I am told to do—nothing more.

Cognitive disengagement

1. I find it difficult to develop a study plan for this course.
2. In this course, I often find that I don't know what to study or where to start.
3. I'm not sure how to study for this course.
4. In this course, I find it difficult to organize my study time effectively.
5. When I study for this course, I have trouble figuring out what to do to learn the material

measure that had been used previously in published research (Cheon & Reeve, 2013; Jang et al., 2012; Reeve, 2013).

Perceived Autonomy Support and Controlling Teaching. To assess perceived autonomy support, we used the six-item short version of the Learning Climate Questionnaire (LCQ; Williams & Deci, 1996). The LCQ has shown strong psychometric properties (internal consistency, predictive validity of need satisfaction) in previous studies (Cheon et al., 2012; Jang et al., 2009), and scores on this measure were internally consistent throughout each assessment period ($\alpha = .91$ at T1; $\alpha = .92$ at T2; $\alpha = .94$ at T3). To assess perceived teacher control, we used the four-item Controlling Teacher Scale (CTS; Jang et al., 2009). The CTS has shown strong psychometric properties (internal consistency, predictive validity of need frustration) in previous studies (Cheon & Reeve, 2013; Jang et al., 2009), and scores on this measure were internally consistent throughout each assessment period ($\alpha = .86$ at T1; $\alpha = .83$ at T2; $\alpha = .90$ at T3).

Psychological Need Satisfaction and Dissatisfaction. To assess autonomy, competence, and relatedness need satisfaction as well as autonomy, competence, and relatedness need frustration, participants completed the 18-item Balanced Measure of Psychological Needs (BMPN: Sheldon & Hilpert, 2012). The BMPN features 3-items on each of its six scales. The BMPN has shown strong psychometric properties in previous investigations (internal consistency, factorial validity, predictive validity of students' classroom functioning; Costa et al., 2015; Unanue et al., 2014). Scores produced by each BMPN scale in the present study were found to be internally consistent throughout all three assessment periods: Autonomy satisfaction (α s at T1, T2, and T3 were .85, .88, and .91); competence satisfaction (α s were .85, .88, and .91); relatedness satisfaction (α s were .85, .88, and .91); autonomy frustration (α s were .85, .88, and .91); competence frustration (α s were .85, .88, and .91); and relatedness frustration (α s were .85, .88, and .91).

Engagement and Disengagement. We assessed engagement–disengagement as multidimensional constructs that featured behavioral, emotional, agentic, and cognitive aspects (Reeve, 2013; Reeve & Tseng, 2011). To assess behavioral and emotional engagement–disengagement, we used the 5-item behavioral engagement, 5-item emotional engagement, 5-item behavioral disaffection, and 5-item emotional disaffection scales from the Engagement versus Disaffection with Learning measure (Skinner et al., 2009). Each of these scales has shown strong psychometric properties (Skinner et al., 2009), and all four showed high internal consistency in the present study: behavioral engagement (α s at T1, T2, and T3 were .87, .91, and .93); emotional engagement (α s were .89, .88, and .87); behavioral disengagement (α s were .70, .69, and .75); and emotional disengagement (α s were .83, .84, and .89). To assess agentic engagement–disengagement, we used the 5-item agentic engagement and the 5-item agentic disengagement scales from the Agentic Engagement Scale (Reeve, 2013). These two AES scales have shown strong psychometric properties (Reeve, 2013; Reeve & Tseng, 2011), and both showed high internal consistency in the present study: agentic engagement (α s were .84, .85, and .81) and agentic disengagement (α s were .70, .72, and .75). To assess cognitive engagement, we used the four-item Deep Learning measure (Senko & Miles, 2008). This measure has shown strong psychometric properties (Pintrich & De Groot, 1990), and it showed high internal consistency in the present study (α s were .83, .89, and .88). To assess cognitive disengagement, we used the five-item Study Disorganization measure (Elliot et al., 1999). This measure has shown strong psychometric properties (Senko & Miles, 2008), and it showed high internal consistency in the present study (α s were .91, .92, and .93).

4.4. Data analysis

We analyzed the six variables in the hypothesized model (see Fig. 1) as latent variables. For the need satisfaction and need frustration latent constructs, we used scores on the BMPN scales for autonomy, competence, and relatedness satisfaction as 3 indicators and scores on the BMPN scales for autonomy, competence, and relatedness frustration as 3 indicators. For the engagement and disengagement latent constructs, we used scores on the behavioral, emotional, agentic, and cognitive engagement scales as 4 indicators and scores on the behavioral, emotional, agentic, and cognitive disengagement scales as 4 indicators. For the perceived autonomy support and teacher control latent constructs, we created two 3-item parcels from the 6-item LCQ to serve as 2 indicators for perceived autonomy support and we created two 2-item parcels from the 4-item CTQ to serve as 2 indicators for perceived teacher control (by combining the higher with the weaker loading items from factor analyses; Little, Cunningham, Shahar, & Widaman, 2002).

Before testing our hypothesized model, we conducted multilevel analyses using hierarchical linear modeling (HLM, version 7; Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011) to determine whether or not meaningful between-class differences might have affected students' self-reports. The hierarchical structure of the data was that students' scores (level 1) were nested within classrooms (level 2). The *ICC*s calculated for each of the 54 measured variables (18 indicators $\times$ 3 waves) from unconditional models averaged 8.6%, and we considered these between-classroom *ICC*s large enough to warrant the use of multi-level structural equation modeling (LISREL 8.80; Joreskog & Sorbom, 2006). The use of multilevel modeling further allows for more accurate estimates of the standard errors for each parameter estimate.

5. Results

5.1. Preliminary analyses

Missing data were rare (<.5%), so we used the Expectation–Maximization (EM) algorithm for imputing missing values. We also explored whether the distribution of scores for each of the 232 measured items (67 items $\times$ 3 waves) deviated from normality and found that all values for skewness and kurtosis were less than |1.2|, indicating little deviation from normality.

Table 2
Descriptive statistics, unstandardized, and standardized beta weights associated with all 54 indicators within the measurement model.

Observed Variable	Time 1					Time 2					Time 3				
	M	(*SD*)	*B*	SE	*β*	*M*	(*SD*)	*B*	SE	*β*	*M*	(*SD*)	*B*	SE	β
Autonomy support indicators															
1 Parcel 1 (3-items)	3.06	(.91)	1.00	–	.95	3.32	(.92)	1.00	–	.98	3.25	(.95)	1.00	–	.96
2 Parcel 2 (3-items)	3.04	(.90)	.99	.12	.95	3.32	(.93)	.94	.10	.92	3.23	(.94)	.97	.11	.94
Teacher control indicators															
1 Parcel 1 (2-items)	2.22	(1.07)	1.00	–	.89	2.16	(1.03)	1.00	–	.87	2.45	(1.16)	1.00	–	.91
2 Parcel 2 (2-items)	2.44	(1.10)	.89	.12	.79	2.31	(.99)	.94	.13	.81	2.54	(1.14)	.96	.12	.88
Need satisfaction indicators															
1 Autonomy satisfaction	3.23	(.77)	.89	.12	.70	3.26	(.84)	.93	.12	.76	3.17	(.81)	.95	.11	.84
2 Competence satisfaction	3.01	(.87)	1.00	–	.79	3.01	(.88)	1.00	–	.82	2.98	(.85)	1.00	–	.88
3 Relatedness satisfaction	3.23	(.83)	.80	.12	.63	3.29	(.93)	.84	.11	.69	3.31	(.84)	.76	.10	.67
Need frustration indicators															
1 Autonomy frustration	2.06	(.87)	1.00	–	.86	2.00	(.86)	1.00	–	.84	2.34	(.92)	1.00	–	.86
2 Competence frustration	2.25	(.88)	.82	.12	.71	2.24	(.87)	.87	.12	.73	2.38	(.86)	.89	.12	.77
3 Relatedness frustration	1.77	(.72)	.83	.12	.71	1.77	(.70)	.82	.12	.69	2.08	(.80)	.81	.12	.70
Engagement indicators															
1 Behavioral engagement	3.43	(.80)	.90	.11	.75	3.48	(.89)	.85	.11	.72	3.41	(.84)	.83	.11	.70
2 Emotional engagement	2.95	(.89)	1.00	–	.83	3.09	(.89)	1.00	–	.85	3.05	(.82)	1.00	–	.84
3 Agentic engagement	2.87	(.74)	.91	.11	.75	3.00	(.80)	.90	.11	.76	3.05	(.68)	.91	.11	.77
4 Cognitive engagement	3.15	(.76)	.89	.11	.73	3.16	(.85)	.84	.11	.71	3.15	(.74)	.77	.11	.65
Disengagement indicators															
1 Behavioral disengagement	2.54	(.71)	1.00	.13	.76	2.51	(.73)	.98	.13	.78	2.62	(.73)	.87	.11	.73
2 Emotional disengagement	2.36	(.85)	1.00	–	.76	2.24	(.85)	1.00	–	.79	2.53	(.94)	1.00	–	.84
3 Agentic disengagement	2.90	(.73)	.78	.12	.58	2.85	(.76)	.77	.12	.61	2.87	(.73)	.73	.11	.61
4 Cognitive disengagement	2.68	(.95)	.85	.12	.64	2.66	(1.01)	.91	.12	.72	2.78	(.94)	.78	.11	.66

The possible range for each observed variable was 1–5.
M = mean; (*SD*) = standard deviation; *B* = unstandardized beta weight; *SE* = standard error; β = standardized beta weight.

5.2. Hypothesized model

Test of the measurement model. The measurement model featured two indicators for perceived autonomy support, two indicators for perceived teacher control, three indicators for need satisfaction, three indicators for need frustration, four indicators for engagement, and four indicators for disengagement, all assessed across three waves of data collection for a total of 54 indicators (18 indicators of 6 latent constructs × 3 waves). To represent the longitudinal character of the data set, we allowed the between-wave error terms of each of the 18 observed indicators to correlate with itself from T1 to T2 and from T2 to T3. Overall, the measurement model fit the data very well, X^2 (2673) = 597.98, p = .999, *RMSEA* (90% *CI*) = .000 (.000, .000), *SRMR* = .031, *CFI* = 1.00, *NNFI* = 1.00. The descriptive statistics, unstandardized coefficients, and standardized coefficients for each of the 54 items included in the measurement model appear in Table 2.

Test of the measurement model underlying the engagement–disengagement questionnaire. The LCQ, CTQ, and BMPN questionnaires are all widely-used scales that have shown strong factorial validity. But our use of the 39-item, 8-scale engagement–disengagement questionnaire is a new addition to the literature. While these 8 scales have all shown acceptable psychometric properties as individual scales, no study has demonstrated strong factorial validity for all eight measures in a single analysis. Toward that end, we performed a confirmatory factor analysis (CFA) using the T2 data.[2] The overall 39-item, 8-factor measurement model fit the data reasonable well, X^2 (1454) = 2806.03, p < .001, *RMSEA* (90% *CI*) = .062 (.058, .066), *SRMR* = .078, *CFI* = .96, *NNFI* = .96. The unstandardized coefficients, standardized coefficients, and *ICC*s for each of the 39 items included in the CFA appear in Table 3, while the intercorrelations among the 8 latent variables (i.e., factors from the CFA) appear in Table 4.

Test of the hypothesized structural model. The intercorrelations among the 18 latent variables within the structural model appear in Table 5. The hypothesized model (depicted in Fig. 1) fit the data well overall, X^2 (2787) = 1046.18, p = .999, *RMSEA* (90% *CI*) = .000 (.000, .000), *SRMR* = .054, *CFI* = 1.00, *NNFI* = 1.00. The percentage of the variance in the chi-square attributable to the student level was 93.3% (975.7/1046.2), while the percentage of the variance in the chi-square attributable to the teacher level was 6.7% (70.5/1046.2). The path diagram showing the standardized estimates for each significant path in the structural model appears in Fig. 2. For clarity, we do not show the non-significant paths in Fig. 2, but we do report the result for each path (hypothesized, non-hypothesized, and statistical control) included in the statistical test in the text below.

To examine in individual hypothesized paths within the structural model, we first examined how beginning-of-semester perceptions of motivating style affected students' mid-semester changes in need satisfaction-frustration. In the prediction of T2 need satisfaction, after controlling for T1 need satisfaction (*beta* = .51, p < .001) and T1 teacher control (*beta* = −.01, *ns*), the hypothesized path from T1 autonomy support was significant (*B* = .16, *SE* = .07, *beta* = .24, t = 2.38, p = .018, d = .25). In the prediction of T2 need frustration, after controlling for T1 need frustration (*beta* = .37, p < .001) and T1 autonomy support (*beta* = −.01, *ns*), the hypothesized path from T1 teacher control was significant (*B* = .28, *SE* = .09, *beta* = .30, t = 3.09, p = .002, d = .32).

We further examined how mid-semester changes in perceived motivating style affected end-of-semester changes in students' need satisfaction-frustration. In the prediction of T3 need satisfaction, after controlling for T2 need satisfaction (*beta* = .33, p < .001), T2 teacher control (*beta* = −.12, *ns*), and T1 autonomy support (*beta* = .18, *ns*), the hypothesized path from T2 autonomy support was significant (*B* = .20, *SE* = .09, *beta* = .27, t = 2.39,

[2] Follow-up CFAs using the T1 and T3 data from the 39-item engagement–disengagement questionnaire produced very similar results as those summarized in Tables 2 and 3 (based on model fit statistics, unstandardized and standardized coefficients, and factor intercorrelations).

Table 3
Unstandardized and standardized beta weights and interclass correlation coefficients for the 8-factor CFA of the 39-item engagement-disengagement questionnaire.

Observed variable	*B*	*SE B*	β	*ICC* (%)
Latent factor including the behavioral engagement items				
I try hard to do well in this class.	1.00	–	.89	3.4
I pay attention in this class.	.99	.04	.88	4.4
In this class, I work as hard as I can.	.98	.04	.88	3.2
When I'm in this class, I listen very carefully.	.98	.04	.88	1.2
When I'm in this class, I participate in the class discussions.	.66	.05	.59	1.9
Latent factor including the emotional engagement items				
I enjoy learning new things in this class.	1.00	–	.86	10.0
This class is fun.	.95	.05	.81	13.5
When I'm in this class, I feel good.	.95	.05	.81	17.3
When we work on something in this class, I feel interested.	.89	.05	.76	7.0
When we work on something in this class, I get involved.	.80	.05	.69	4.6
Latent factor including the agentic engagement items				
I let my teacher know what I am interested in.	1.00	–	.77	6.0
During this class, I express my preferences and opinions.	.99	.07	.76	2.3
I let my teacher know what I need and want.	.97	.07	.75	3.8
During class, I ask questions to help me learn.	.97	.07	.75	4.0
When I need something in this class, I'll ask the teacher for it.	.81	.07	.62	4.9
Latent factor including the cognitive engagement items				
When reading for this class, I try to connect the ideas I am…	1.00	–	.85	.1
When learning about a new topic in this course, I … summarize…	.97	.05	.82	1.8
When thinking about the concepts in this class, I try to generate…	.95	.05	.81	1.1
When reading for this class, I try to explain the key concepts…	.94	.05	.79	2.3
Latent factor including the behavioral disengagement items				
I don't try very hard in this class.	1.00	–	.75	4.2
When I'm in this class, my mind wanders.	.93	.07	.70	6.8
When I'm in this class, I just act like I'm working.	.76	.07	.57	1.4
When I'm in this class, I think about other things.	.74	.07	.56	5.4
In this class, I do just enough to get by.	.23	.07	.17	1.4
Latent factor including the emotional disengagement items				
When I am in this class, I feel bad.	1.00	–	.85	8.5
When I'm in this class, I feel worried.	.89	.06	.75	9.5
This class is no fun for me.	.82	.06	.69	9.6
When we work on something in this class, I feel discouraged.	.82	.06	.70	5.1
When we work on something in this class, I feel bored.	.76	.06	.64	11.9
Latent factor including the agentic disengagement items				
In this class, I avoid asking any questions.	1.00	–	.80	8.5
In this class, I do only what I am told to do—nothing more.	.86	.07	.69	6.7
Most of the time in this class, I am silent and unresponsive.	.75	.07	.60	4.0
During this class, I hide from the teacher what I am thinking about.	.68	.07	.55	3.3
Most of the time in this class, I am passive.	.29	.07	.23	.1
Latent factor including the cognitive disengagement items				
When I study for this course, I have trouble figuring out what to…	1.00	–	.90	7.0
I'm not sure how to study for this course.	.95	.04	.86	5.7
In this course, I find it difficult to organize my study time …	.95	.04	.86	5.6
In this course, I often find that I don't know what to study…	.94	.04	.85	4.3
I find it difficult to develop a study plan for this course.	.82	.05	.74	5.1

Note. *B* = unstandardized beta weight; *SE* = standard error; β = unstandardized beta weight.
ICC = interclass correlation coefficient.

$p = .017$, $d = .25$). In the prediction of T3 need frustration, after controlling for T2 need frustration (*beta* = .35, $p < .001$), T2 autonomy support (*beta* = −.12, *ns*), and T1 teacher control (*beta* = .03, *ns*), the hypothesized path from T2 teacher control was significant ($B = .44$, $SE = .15$, *beta* = .44, $t = 2.95$, $p = .003$, $d = .31$).

Table 4
Descriptive statistics and intercorrelations among the eight latent variables (factors) in the engagement-disengagement questionnaire CFA.

Latent factor	1	2	3	4	5	6	7	8
1 Behavioral engagement	–							
2 Emotional engagement	.60	–						
3 Agentic engagement	.59	.70	–					
4 Cognitive engagement	.63	.69	.72	–				
5 Behavioral disengagement	−.78	−.61	−.57	−.53	–			
6 Emotional disengagement	−.32	−.53	−.27	−.27	.66	–		
7 Agentic disengagement	−.44	−.45	−.51	−.35	.63	.49	–	
8 Cognitive disengagement	−.39	−.45	−.42	−.38	.64	.58	.61	–

$N = 366$. All correlations are $p < .01$.

We next examined how beginning-of-semester engagement–disengagement affected changes in students' mid-semester perceptions of motivating style. In the prediction of T2 autonomy support, after controlling for T1 autonomy support (*beta* = .30, $p < .001$), the non-hypothesized path from T1 disengagement was the significant predictor ($B = -.48$, $SE = .10$, *beta* = −.38, $t = 4.61$, $p < .001$, $d = .48$) while the hypothesized path from T1 engagement was not (*beta* = .09, *ns*). In the prediction of T2 teacher control, after controlling for T1 teacher control (*beta* = .36, $p < .001$) and T1 engagement (*beta* = −.09, *ns*), the hypothesized path from T1 disengagement was significant ($B = .40$, $SE = .10$, *beta* = .35, $t = 3.93$, $p < .001$, $d = .41$).

We further examined how mid-semester changes in engagement–disengagement affected changes in students' end-of-semester perceptions of motivating style. In the prediction of T3 autonomy support, after controlling for T2 autonomy support (*beta* = .31, $p < .001$), T1 engagement (*beta* = .01, *ns*), and the unexpected significant path from T2 disengagement ($B = -.27$, $SE = .13$, *beta* = −.23, $t = 2.04$, $p = .042$, $d = .21$), the hypothesized

Table 5
Intercorrelation matrix among the 18 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.	16.	17.	18.
1 Autonomy support, T1	–																	
2 Teacher control, T1	−.63	–																
3 Need satisfaction, T1	.56	−.24	–															
4 Need frustration, T1	−.44	.61	−.58	–														
5 Engagement, T1	.60	−.34	.89	−.53	–													
6 Disengagement, T1	−.44	.55	−.67	.78	−.84	–												
7 Autonomy support, T2	.55	−.45	.41	−.41	.54	−.46	–											
8 Teacher control, T2	−.32	.64	−.33	.50	−.37	.53	−.58	–										
9 Need satisfaction, T2	.33	−.15	.68	−.51	.69	−.60	.61	−.28	–									
10 Need frustration, T2	−.19	.39	−.47	.62	−.39	.63	−.40	.60	−.53	–								
11 Engagement, T2	.39	−.22	.66	−.43	.77	−.65	.69	−.34	.90	−.32	–							
12 Disengagement, T2	−.34	.37	−.58	.63	−.63	.74	−.42	.66	−.70	.79	−.69	–						
13 Autonomy support, T3	.45	−.35	.31	−.27	.39	−.31	.56	−.44	.45	−.41	.45	−.41	–					
14 Teacher control, T3	−.36	.53	−.23	.27	−.25	.29	−.51	.60	−.33	.46	−.34	.43	−.65	–				
15 Need satisfaction, T3	.44	−.19	.72	−.39	.60	−.49	.54	−.35	.71	−.40	.65	−.56	.63	−.45	–			
16 Need frustration, T3	−.34	.33	−.31	.47	−.35	.51	−.39	.54	−.46	.61	−.37	.57	−.45	.67	−.48	–		
17 Engagement, T3	.40	−.19	.61	−.32	.67	−.53	.51	−.42	.70	−.42	.68	−.57	.66	−.45	.88	−.42	–	
18 Disengagement, T3	−.35	.40	−.43	.46	−.52	.70	−.45	.59	−.55	.57	−.60	.72	−.51	.66	−.60	.82	−.70	–

$N = 366$. All r's, $p < .01$. T1 = Time (wave) 1; T2 = Time 2; T3 = Time 3.

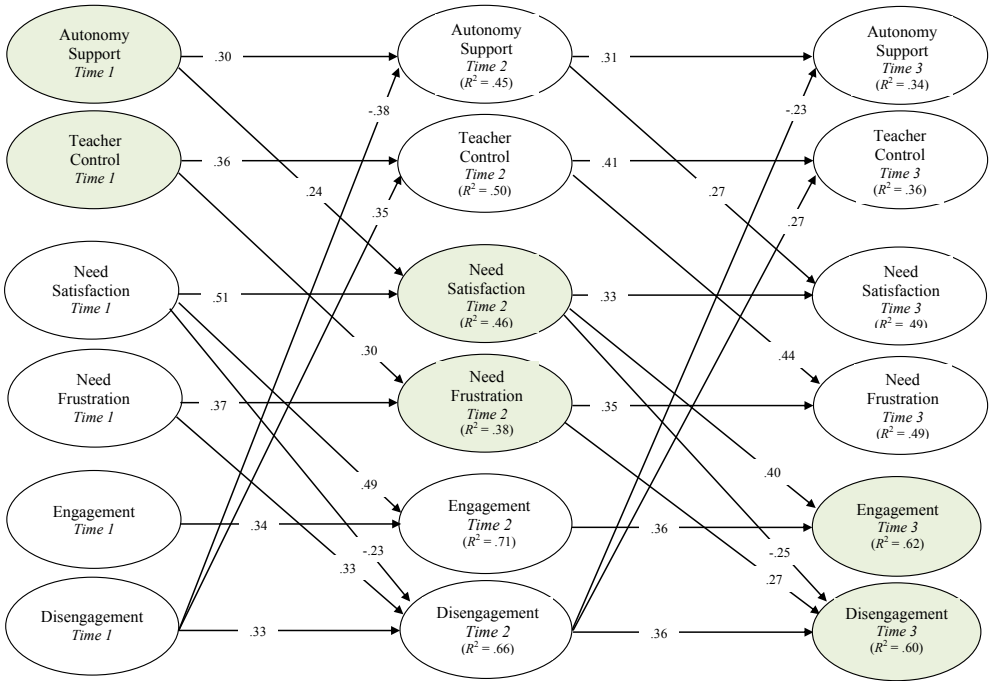

Fig. 2. Standardized parameter estimates (beta coefficients) for the hypothesized structural model. Only significant paths ($p < .05$) are shown; non-significant paths have been deleted for purposes of clarify, but are reported in the text. Also for clarity, within-wave correlations among the six T1 exogenous variables (but see Table 5) and the six T2 and six T3 error terms are not shown.

path from T2 engagement was not significant (*beta* = .15, *ns*). In the prediction of T3 teacher control, after controlling for T2 teacher control (*beta* = .41, $p < .001$), T2 engagement (*beta* = −.01, *ns*), and T1 disengagement (*beta* = .01, *ns*), the hypothesized path from T2 disengagement was significant ($B = .25$, $SE = .12$, *beta* = .27, $t = 2.04$, $p = .042$, $d = .21$).

We additionally examined how beginning-of-semester need satisfaction-frustration affected mid-semester changes in students' engagement–disengagement. In the prediction of T2 engagement, after controlling for T1 engagement (*beta* = .34, $p < .001$) and T1 need frustration (*beta* = −.05, *ns*), the hypothesized path from T1 need satisfaction was significant ($B = .45$, $SE = .11$, *beta* = .49, $t = 4.14$, $p < .001$, $d = .43$). In the prediction of T2 disengagement, after controlling for T1 disengagement (*beta* = .33, $p < .001$) and for the non-hypothesized but significant path from T1 need satisfaction ($B = -.20$, $SE = .09$, *beta* = −.23, $t = 2.34$, $p = .020$, $d = .25$), the hypothesized path from T1 need frustration was significant ($B = .31$, $SE = .10$, *beta* = .33, $t = 3.20$, $p = .001$, $d = .34$).

Lastly, we examined how mid-semester changes in need satisfaction-frustration affected students' end-of-semester changes in engagement–disengagement. In the prediction of T3 engagement, after controlling for T2 engagement (*beta* = .36, $p < .001$), T2 need frustration (*beta* = −.13, *ns*), and T1 need satisfaction (*beta* = .08, *ns*), the hypothesized path from T2 need satisfaction was significant ($B = .53$, $SE = .18$, *beta* = .40, $t = 2.92$, $p = .004$, $d = .31$). In the prediction of T3 disengagement, after controlling for T2 disengagement (*beta* = .36, $p < .001$), T1 need frustration (*beta* = .11, *ns*), and the significant but non-hypothesized path from

T2 need satisfaction ($B = -.32$, $SE = .12$, $beta = -.25$, $t = 2.62$, $p < .009$, $d = .27$), the hypothesized path from T2 need frustration was significant ($B = .26$, $SE = .11$, $beta = .27$, $t = 2.33$, $p = .020$, $d = .24$).

Mediation. We predicted that T1 perceived autonomy support would longitudinally increase T3 engagement through its facilitating effect on changes in T2 need satisfaction, and also that T1 perceived teacher control would longitudinally increase T3 disengagement through its facilitating effect on changes in T2 need frustration (i.e., the shaded ovals in Fig. 1). To test for this mediation, we used the "product-of-coefficient estimate" test (MacKinnon, Fairchild, & Fritz, 2007). This test assesses the statistical significance of the product of two regression coefficients ($\alpha\beta$) where α represents the predictor-to-mediator path while β represents the mediator-to-outcome path and this statistic is equivalent to $c - c'$. Changes in T2 need satisfaction did mediate the T1 autonomy support to T3 engagement path ($\alpha\beta = .113$, $p < .001$, 95% $CI = .063–.169$), and changes in T2 need frustration did mediate the T1 teacher control to T3 disengagement path ($\alpha\beta = .076$, $p < .001$, 95% $CI = .045–.113$).

6. Discussion

We based the current investigation on the two classroom processes of reciprocal effects and the dual-process motivation mediation model, and we found support for both. As to reciprocal effects, students' perceptions of their teachers' motivating style led to changes in their need satisfaction-need frustration, and students' engagement–disengagement led to (reciprocal) changes in perceived motivating style. As to the dual-process motivation mediation model, perceived autonomy support longitudinally increased students' engagement because it nurtured changes in need satisfaction, just as perceived teacher control longitudinally increased students' disengagement because it nurtured changes in need frustration, though low need satisfaction did also surprisingly cross-over to contribute to longitudinally increased disengagement.

It is worth noting that the pattern of early-semester (T1 → T2) effects was nearly identical to the pattern of late-semester (T2 → T3) effects. That is, all seven significant paths observed early in the semester were also observed late in the semester, and each path that was not significant early in the semester was also not significant late in the semester. Further, the magnitude of the early-semester effects were about the same as the magnitude of the late-semester effects.

6.1. Reciprocal effects

In looking at the relation between students' perceptions of their teachers' motivating style and students' own engagement–disengagement, we hypothesized reciprocal effects. Perceived motivating style affected students' classroom motivation (need satisfaction-frustration), and students' classroom functioning (i.e., disengagement) in turn affected perceptions of their teachers' motivating style toward them.

These observed effects were reciprocal but also somewhat unbalanced. That is, students' perceptions of their teachers' motivating style affected changes in their T3 engagement–disengagement only indirectly by affecting a change in their T2 motivational resources (need satisfaction) and vulnerabilities (need frustration). These motivational mediation effects seemed to unfold gradually over the course of the 17-week semester. In contrast, the (reciprocal) effect that students' disengagement had on perceived motivating style was direct and perhaps even immediate (i.e., something that occurred within a single class period). Though we only assessed changes in perceived motivating style after a two-month lag, experimental research has shown that students' disengagement (specifically, their low effort) can rather immediately (within a single class period) bring out a teacher's reaction of heightened control (e.g., "Extend the arms, I have told you that 10 times."; "What have I just said?"; "Shut up."; "You are a complete numskull."; Sarrazin et al., 2006, p. 292).

6.2. Dual-process motivation mediation model

The correlations reported in Table 5 showed that perceived autonomy support and perceived teacher control were substantially negatively correlated (*r*'s at T1–T3 were −.63, −.58, and −.65), as were need satisfaction and need frustration (*r*'s at T1–T3 were −.58, −.53, and −.65) and engagement and disengagement (*r*'s at T1–T3 were −.84, −.69, and −.70). These intercorrelations are a bit higher than those reported in previous research on the dual-process model (e.g., Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011b; Bartholomew, Ntoumanis, Ryan, & Thogersen-Ntoumani, 2011a; Haerens et al., 2015). Still, the measurement model summarized in Table 2 and the CFA summarized in Tables 3 and 4 showed rather convincingly that our student-participants made clear distinctions between perceived autonomy support and perceived teacher control, between need satisfaction and need frustration, and between classroom engagement and disengagement. So, overall, these constructs were substantially negatively correlated, yet distinct nevertheless.

Overall, the brighter side pathways involving perceived autonomy support, need satisfaction, and engagement were largely distinct from the darker side pathways involving perceived teacher control, need frustration, and disengagement. Nevertheless, some cross-over paths emerged as significant. Higher T2 need frustration and lower T2 need satisfaction both predicted changes in T3 disengagement. Similarly, T1 disengagement and changes in T2 disengagement predicted both higher T2 and T3 perceived teacher control and lower T2 and T3 perceived autonomy support. These significant cross-over paths suggest that a dual-process model that features only brighter-side pathways (with no cross-over effects) and only darker-side pathways (with no cross-over effects) is not the best way to represent the model. Instead, a dual-process model that features strong brighter-side pathways with some milder darker-side cross-over effects and strong darker-side pathways with some milder brighter-side cross-over effects is a better way to represent the model.

6.3. Students feeling in and out of synch with their teachers

In one sense, students perceived that they and their teachers were in synch. That is, students benefitted from their teachers' perceived autonomy support by reporting greater need satisfaction which, in turn, fueled greater classroom engagement. But in another sense, students perceived that they and their teachers were out of synch (i.e., were in conflict). That is, students suffered from their teachers' perceived control by reporting greater need frustration which, in turn, fueled greater classroom disengagement. Still, there was one rather glaring omission in terms of students feeling in synch with their teachers. Through their classroom engagement (and changes in their classroom engagement), students were unable to bring out greater perceived autonomy support. This same non-effect has emerged in two previous studies. In one study of teachers' actual motivating style, teachers did not react to immediate (in-class) displays of students' classroom engagement (specifically, their high effort) with heightened autonomy-supportive instructional behaviors (e.g., "You can choose the group you want."; "Maybe you could try different positions to jump

over this obstacle and choose the best."; "Which exercise do you want to start with?"; Sarrazin et al., 2006, p. 292). In another study of perceived motivating style, students reported that their teachers did not react to their displays of engagement with greater longitudinal autonomy support over the course of a semester (Jang et al., 2012). Thus, in three separate investigations, including the present one, students have reported the absence of a key means to become more in synch with their teacher.

That students lacked a key means to become more in synch with their teachers suggests that teacher-student classroom interactions are not ideal. All of the darker side pathways emerged as significant and were occurring in these classrooms, as perceived teacher control, need frustration, and classroom disengagement all had significant deleterious downstream (longitudinal) and reciprocal effects. But only some of the brighter side pathways emerged as significant. Perceived teacher autonomy support and need satisfaction had significant salubrious downstream effects while classroom engagement did not.

The most reliable way to bring out greater teacher autonomy support (actual and perceived) is to have teachers participate in theory-based, carefully-designed autonomy-supportive intervention programs (Chatzisarantis & Hagger, 2009; Cheon & Reeve, 2013, 2015; Cheon et al., 2012, 2014). This suggests that an intervention to help teachers become more autonomy supportive is one effective way to help teachers and students be more in synch with each other in terms of facilitating the brighter side aspects. But this also suggests the need for students to find ways to help teachers become more in synch with them. In this regard, perhaps the general construct of students' engagement is not able to achieve this synchrony; perhaps it is only the specific construct of students' agentic engagement that is able to draw out greater autonomy support from teachers (Reeve, 2013, 2015).

6.4. Limitations

We identify three limitations. First, our data were all self-report. In addition, these self-reported data were only from the students', not the teachers', perspective. Had we asked trained raters to score our dependent measures objectively or had we asked teachers to report their perceptions, observed findings may or may not have come out differently. Given this uncertainly, we suggest that future research collect a data set that is able to compare students' perceptions, teachers' perceptions, and observers' ratings (for examples, see Haerens et al., 2015; Skinner & Belmont, 1993). Another way to approach this same limitation would be to analyze classroom data sets at both the student and teacher levels (at both levels 1 and 2 in HLM, not just only at level 1 as in the present study). Given the small number of teachers in our study ($k = 12$), we did not feel comfortable in the generalizability of an analysis at the classroom level. But, future research that collects a similar data set that includes many more classrooms ($k > 100$) would likely yield two informative—yet potentially different—tests of our hypothesized model (i.e., one test at the student level and another at the teacher level).

Second, there may be room for improvement in both the conceptual and operational definitions of students' classroom disengagement, and this may be especially true for cognitive disengagement and agentic disengagement. Engagement researchers distinguish three categories of cognitive engagement—deep learning (prototype of cognitive engagement), surface learning (low cognitive engagement), and disorganized learning (prototype of cognitive disengagement). While deep learning and surface learning have been extensively examined (Dinsmore & Alexander, 2012), little research has been carried out on the nature of cognitive disengagement. The present findings suggest that this is an unfortunate state of the literature, because disengagement was the better predictor of outcomes than was engagement. Agentic engagement is a relatively new construct in the engagement literature, and agentic disengagement is just now beginning to receive empirical attention (Reeve, 2012). We conceptualize agentic disengagement as "passively accepting one's environment as it is, even if it is non-supportive, need-neglecting, or need-frustrating", but there is still some question as to how this new construct is best conceptually and operationally defined.

Third, our sample was limited to Korean high-school students. Both Korean classrooms and secondary-grade classrooms may be more formal and more teacher-centric than are Western classrooms and elementary-grade classrooms. Because of these cultural and grade-level constraints, we limit our conclusions to the domain of Korean high school classrooms.

6.5. Conclusion

We adopted a dual-process model with a self-determination theory framework to investigate why students sometimes tend toward a longitudinal trajectory of rising classroom engagement and why they other times tend toward a trajectory of rising disengagement. We found that a trajectory of rising engagement emerges out of the brighter side processes of perceived autonomy support and need satisfaction, while a trajectory of rising disengagement emerges out of the darker side processes of perceived teacher control and need frustration. We found further that high levels of disengagement led students to perceive from their teachers a trajectory of rising control and falling autonomy support.

Authors' note

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