Recommending goals and supporting needs: An intervention to help physical education teachers communicate their expectations while supporting students' psychological needs

Sung Hyeon Cheon[a], Johnmarshall Reeve[a,*], Yong-Gwan Song[b]

[a] *Korea University, South Korea*
[b] *Pukyong National University, South Korea*

ABSTRACT

Objective: We expanded a traditional teacher-focused autonomy-supportive intervention program (ASIP Only) to design and implement a new autonomy-supportive plus intrinsic goals intervention (ASIP + Intrinsic Goals) to determine if student outcomes would be greater than those observed in a traditional ASIP.
Design: Experimental, longitudinal.
Method: Thirty-two experienced PE teachers (6 women, 26 men; 26 middle, 6 high school) and their 2313 students were randomly assigned into one of three conditions: an ASIP Only experimental condition, an ASIP + Intrinsic Goals experimental condition, or a no-intervention control condition. For the data collection, students reported their need satisfaction, need frustration, intrinsic goal pursuits, physical self-concept, and problematic peer relationships at the beginning, middle, and end of a semester.
Results: As expected, students of teachers who participated in the ASIP Only intervention showed gains in all dependent measures, compared to students of teachers in the control condition. The new finding was that students of teachers who participated in the ASIP + Intrinsic Goals intervention showed further gains in all dependent measures, compared to students of teachers in the ASIP Only condition.
Conclusion: PE teachers in the new ASIP + Intrinsic Goals intervention generated even greater student benefits than did PE teachers in the traditional ASIP Only intervention.

1. Introduction

In any given physical education (PE) class, students become physical active, learn the value and benefits of exercise and a healthy lifestyle, and develop their motor skills (Haerens, Kirk, Cardon, De Bourdeauhuji, & Vansteenkiste, 2010; SHAPE America, 2014). As the academic year progresses, PE class affords students with continuing and cumulative opportunities to learn important life skills (Cronin & Allen, 2017), to develop positive physical self-perceptions (Schmidt, Valkanover, Roebers, & Conzelmann, 2013; Standage, Gillison, Ntoumanis, & Treasure, 2012), and to build personal character via sport-based learning activities (MOE, 2018). These objectives are most likely to be realized when PE classes offer students encouragement and support, such as a supportive teacher (Behzadnia, Adachi, Deci, & Mohammadzedeh, 2018), prosocial peers (Cheon, Reeve, & Ntoumanis, 2018), and a social climate that promotes sportsmanship and community over intense competition and problematic relationships (Lee & Cho,

2014).

Teachers can learn how to provide highly supportive PE environments by participating in carefully-designed interventions (Cheon et al., 2018; Cheon, Reeve, & Moon, 2012). Post-intervention, students of participating teachers show gains in their adaptive motivation and functioning (e.g., autonomous motivation, engagement, achievement, prosocial behavior, well-being) and declines in their maladaptive motivation and functioning (e.g., amotivation, disengagement, antisocial behavior, ill-being) (Chatzisarantis & Hagger, 2009; Cheon et al., 2018; Cheon & Reeve, 2015; Cheon, Reeve, & Song, 2016; Moustaka, Vlachopoulos, Kabitsis, & Theodorakis, 2012; Tessier, Sarrazin, & Ntoumanis, 2010). These are highly valued student attainments, but it is helpful to keep in mind that teachers have goals that they too would like to accomplish.

Ideal instruction fulfills the needs of students, but it also fulfills the goals and priorities of teachers. Compromised instruction would either over-prioritize teachers' goals and preferences while suppressing or

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* Corresponding author. 633 Uncho-Useon Hall, Department of Education, Korea University, Anam-dong, Seongbuk-gu, Seoul, 02841, South Korea.
E-mail address: reeve@korea.ac.kr (J. Reeve).

sacrificing those of students (i.e., controlling instruction), or over-prioritize students' needs and preferences while sacrificing those of teachers (i.e., permissive or laissez-faire instruction). The ideal would fulfill the needs and goals of both students and teachers. In self-determination theory, such instruction represents the combined offering of both high autonomy support and high structure (Aelterman et al., 2018)—or providing well-structured lessons in highly autonomy-supportive ways (Curran, Hill, & Niemiec, 2013; Jang, Reeve, & Deci, 2010; Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009).

1.1. Autonomy support and structure

Autonomy support is a teacher's interpersonal tone of understanding that appreciates and actively supports students' psychological need for autonomy (Jang, Kim, & Reeve, 2012; Reeve, 2016). When autonomy supportive, teachers take their students' perspective, show interest in their preferences, welcome students' input and suggestions, introduce learning activities in ways that vitalize students' psychological needs, and help students work through their motivational and behavioral problems (e.g., disengagement, disrespectful language) by acknowledging and accepting their negative affect, providing explanatory rationales for recommended behavior change, offering meaningful choices, relying on informational (rather than pressuring) language, and displaying patience (Assor, Kaplan, & Roth, 2002; Mouratidis, Vansteenkiste, Lens, & Sideridis, 2011; Reeve, Jang, Hardre, & Omura, 2002; Vansteenkiste, Simons, Soenens, & Lens, 2004). Such autonomy support enables a student experience of autonomy need satisfaction that energizes interest-taking, internalization (i.e., authentic valuing of uninteresting activities, such as stretching), volitional classroom engagement, and greater physical activity (Chatzisarantis & Hagger, 2009; Jang et al., 2012, 2016). Experimentally-designed intervention research confirms that teachers can learn how to become more autonomy supportive and, when they do, that their students benefit in these important and wide-ranging ways (Cheon et al., 2012, 2016, 2018).

Structure is a teacher's interpersonal tone of guidance that appreciates and actively supports students' psychological need for competence (Aelterman et al., 2018; Ryan & Deci, 2017). Indeed, structure is alternatively referred to as "competence support" in the SDT literature (Tessier et al., 2010). When structured, teachers first communicate clear expectations about what student are to do and what competent functioning looks like, and they then provide step-by-step "how to" guidance, scaffolding, and feedback to help student re-arrange their strategies, behaviors, and coping to make progress toward meeting these expectations (Aelterman et al., 2018; Aelterman, Vansteenkiste, Van den Berghe, De Meyer, & Haerens, 2014; Jang et al., 2010; Koka & Hein, 2005; Mageau & Vallerand, 2003; Sierens et al., 2009). Such competence-support fosters students competence need satisfaction (i.e., feeling effective and masterful with a sense of making progress and growing in skill and capacity) that energizes challenge-seeking, concentration, persistence, and deep-level learning strategies (Mouratidis, Michou, Aelterman, Haerens, & Vansteenkiste, 2018; Tessier et al., 2010; Vansteenkiste et al., 2012). Like autonomy support, teachers can learn how to become more structured (Aelterman et al., 2014) and, when they do, their students show important benefits (Mouratidis et al., 2018; Tessier et al., 2010; Vansteenkiste et al., 2012), though some null effects (no benefits to students) have also been reported (Eckes, Großmann, & Wilde, 2018; Guay, Valois, Falardeau, & Lessard, 2016).

Null effects sometimes occur because structure needs to be offered in an autonomy-supportive way before it produces its benefits (Chatzisarantis & Hagger, 2009; Curran et al., 2013; Eckes et al., 2018; Koestner, Ryan, Bernieri, & Holt, 1984). For instance, rules imposed in a controlling way do not enhance students' intrinsic motivation, performance, or creativity, whereas the same rules communicated in an autonomy-supportive way do (Koestner et al., 1984). Coach-provided structure generally supports athletes' need satisfaction, but athletes'

need satisfaction increases when coaches offer autonomy-supportive structure while it actually decreases when coaches impose structure in a controlling way (Curran et al., 2013). In the Eckes et al. (2018) investigation, teacher-provided structure was unable to increase students' perceived competence (Study 1), but when the same structure was re-designed to be offered in an autonomy-supportive way then it did boost students' perceived competence (Study 2). Similarly, when PE teachers provided students with feedback, it did not generally enhance students' autonomous motivation and physical activity—until (and unless) that same feedback was paired with choice and acknowledgement of feelings (Chatzisarantis & Hagger, 2009). The conclusion appears to be that the benefits from teacher-provided structure are "conditional", and that necessary condition is an overlay of autonomy support.

1.2. Providing structure in an autonomy-supportive way in the PE context

Structure is multidimensional (clear expectations paired with how-to guidance and skill-building feedback). Nevertheless, we focused more narrowly only on expectations and on teacher-recommended instructional goals in particular. This narrower focus is the same approach taken by other SDT researchers (Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004), including those who focus specifically on the PE domain (Trouilloud, Sarrazin, Bressoux, & Bois, 2006; Vansteenkiste, Simons, Soenens, et al., 2004). Still, we recognize that PE teachers communicate their expectations in multiple ways (not just through goals), as when they are clear about assessment criteria for an upcoming test (Haerens et al., 2018).

When PE teachers communicate a goal (e.g., "Your goal today is to learn a new skill in basketball."), the type (or content) of the recommended goal has meaningful implications for students' motivation and functioning (Deci & Ryan, 2000; Sebire, Standage, & Vansteenkiste, 2008). Importantly, a distinction can be made between intrinsic and extrinsic goals. Intrinsic goals generally promote greater concentration, persistence, and satisfaction during their pursuit than do extrinsic goals (Gunnell, Crocker, Mack, Wilson, & Zumbo, 2014; Vansteenkiste, Simons, Lens, et al., 2004; Vansteenkiste, Simons, Soenens, et al., 2004), leading some researchers to conclude that "not all goals are equal" (Ryan, Sheldon, Kasser, & Deci, 1996).

In the exercise domain, three relevant intrinsic goals are those for skill development, social affiliation, and health maintenance (Sebire et al., 2008). A skill development goal is the pursuit to develop greater skill (e.g., "To acquire new exercise skills"); a social affiliation goal is the pursuit of closer social bonds (e.g., "To form close bonds with others"); and a health maintenance goal is the pursuit of improved health or fitness (e.g., "To improve my overall health") (Sebire et al., 2008). Two relevant extrinsic goals are strivings for image (e.g., "To improve my appearance") and social recognition ("To be well thought of by others"), but we focused only on helping teachers recommend intrinsic goals, because others have shown that extrinsic goals (relative to no goals) do not produce motivational, learning, and performance benefits (Vansteenkiste et al., 2004)—thus rendering this practice imprudent. Moreover, these three intrinsic goals, which have been investigated in the exercise rather than in the PE domain, align well with the internationally recognized goals for PE.

1.3. An intervention to promote both intrinsic goals and autonomy support

Interventions have been developed to help teachers learn how to become more autonomy supportive (e.g., Cheon et al., 2016), but what this research literature has not yet done is to help teachers set instructional goals while simultaneously supporting students' autonomy. Most interventions to increase autonomy-supportive teaching have been evaluated by comparing an experimental condition in which teachers participate in an autonomy supportive intervention program vs. a neutral-intervention control condition (Chatzisarantis & Hagger, 2009), but it is unknown whether an intervention that combines both

recommending intrinsic goals and autonomy-supportive teaching might be more effective than a traditional ASIP.

The volitional pursuit of intrinsic goals over the course of a semester can be expected to yield meaningful student benefits. In the present study, we focused particularly on longitudinal gains in physical self-concept and declines in problematic peer relationships.

1.4. Physical self-concept and non-problematic relationships

Physical self-concept is a subdomain of students' overall self-concept; it incorporates aspects of the self related to perceived health and physical capacities/abilities (Marsh, 2002). As adolescence is a crucial period in self-concept development, it is considered an important student outcome for PE teachers to pursue because a positive physical self-concept is associated with greater physical activity (Marsh, Chanal, & Sarrazin, 2006), greater engagement during exercise situations (Peart, Marsh, & Richards, 2005), and enhanced performance in sport settings (Marsh & Craven, 2006; Marsh & Perry, 2005). These gains in physical activity occur even after controlling for students' prior activity and skill levels (Marsh, Papaioannou, & Theodorakis, 2006; Marsh & Perry, 2005). Thus, a gain in physical self-concept is a valuable personal-developmental resource in its own right, but such a gain also facilitates subsequent physical activity.

During the PE course, peer-to-peer relationships can be cooperative and harmonious, but they can also be conflictual and problematic. PE participation affords students with multiple opportunities to develop harmony-promoting and conflict-minimizing attitudes and social skills, such as interpersonal communication, teamwork, leadership, sportsmanship and fair play, social responsibility, making friends, sharing and taking turns, negotiation, regulating negative emotionality, and asking for and giving help (Cronin & Allen, 2017; Samalot-Rivera & Porreta, 2009). We looked at problematic (rather than harmonious) relationships, however, because we wanted to highlight one positive or "bright side" post-intervention student outcome (i.e., physical self-concept) but also one negative or "dark side" student outcome (i.e., problematic relationships). Minimizing problematic peer-to-peer relationships is an important student outcome for PE teachers to pursue because when students dislike and criticize their classmates, they become more likely to engage in maladaptive behaviors such as aggression, bullying, and antisocial behavior (Asher & McDonald, 2009; Cheon et al., 2018; Hein, Koka, & Hagger, 2015; Hodge & Gucciardi, 2015) and to display both maladjustment (Ladd, 2006) and poor academic performance (Flook, Repetti, & Ullman, 2005).

1.5. Manipulation checks, hypothesized outcomes, and an overall model

The present study featured three conditions: (1) a no-intervention control condition, (2) an autonomy-supportive (ASIP Only) experimental condition, and (3) an autonomy supportive and intrinsic goals (ASIP + Intrinsic Goals) experimental condition. We focused on five manipulation checks (perceived autonomy support, perceived teacher control, skill development goal, social affiliation goal, and health maintenance goal) and four hypothesized outcomes (high psychological need satisfaction, low psychological need frustration, high physical self-concept, and low problematic relationships).

We hypothesized that students of teachers in the ASIP Only condition would show better student outcomes than would students of teachers in the no-intervention control condition. We further hypothesized that students of teachers in the ASIP + Intrinsic Goals condition would show better student outcomes than would students of teachers in the ASIP Only condition.

In addition to the main effect hypotheses, we proposed an overall explanatory model to hypothesize that (1) the ASIP Only intervention would boost students' need satisfaction and diminish their need frustration, and also that the ASIP + Intrinsic Goals intervention would further (additionally) boost students' need satisfaction and diminish

their need frustration (controlling for T1 need satisfaction and T1 need frustration) and (2) intervention-enabled gains in T2 need satisfaction and declines in T2 need frustration would both facilitate longitudinal gains in physical self-concept and declines in problematic relationships (controlling for T1 physical self-concept, problematic relationships, need satisfaction, and need frustration). The hypothesized effects of need satisfaction and frustration on physical self-concept have not been previously investigated, but we based this new hypothesis on the idea that need satisfaction allows people to accept and take ownership of (i.e., internalize and integrate into the self-concept) a value or belief so that it then becomes identity relevant while need frustration tends people toward rejection of that same value or belief (Soenens & Vansteenkiste, 2011). We based our hypothesized links between need satisfaction and frustration with problematic relationships because previous PE investigations had shown that need satisfaction predicts prosocial attitudes and behaviors while need frustration predicts antisocial attitudes and behaviors (Cheon et al., 2018).

2. Method

2.1. Participants

2.1.1. Teacher participants

Teacher-participants were 32 full-time certified PE teachers (26 males, 6 females) who taught in one of 32 different schools dispersed throughout the southern part of South Korea (26 middle, 6 high schools). All teacher-participants were ethnic Korean. Teachers on average had 6.7 years of PE teaching experience (SD = 4.4; $range$ = 2–22) and were, on average, 33.8 years old (SD = 5.5; $range$ = 24–47). All 32 teachers completed all aspects of the study, including all three parts of the intervention and all three waves of data collection (i.e., retention rate = 100%). In appreciation of their participation, each teacher-participant received the equivalent of $50 at the end of the study.

2.1.2. Student participants

During the first wave of data collection, 2313 students consented to complete the study questionnaire. By the end of the semester (T3), 2131 of these students had completed all three waves of data collection (92.1%). For these 2131 student-participants, missing data were rare (< 0.02%) and were missing at random. As to the remaining 204 participants who missed one wave of the data collection, they did not differ from the 2131 participants with full data by experimental condition, gender, grade level, or any T1, T2, or T3 score—with one exception, as more middle school students missed the second wave of data collection (94 of 1712) than did high school students (16 of 601), X^2 (df = 1) = 7.86, p = .005. To produce a multiple imputed data set, we used the expectation-maximization (EM) algorithm (generating 200 iterations). On average, students were 14.9 years old (SD = 1.4; $range$ = 13–18) and included the following: 1132 (53.1%) males and 999 (46.9%) females; 1566 (73.5%) middle and 565 (26.5%) high school students; and 782 (36.7%) in the ASIP + Intrinsic Goals condition, 749 (35.1%) in the ASIP Only condition, and 600 (28.2%) in the Control condition.

2.2. Procedure and implementation of the ASIP and ASSIP interventions

We recruited PE teachers to participate in a semester-long study on "classroom instructional strategies." These 32 PE teachers were randomly assigned into either the "ASIP + Intrinsic Goals" experimental condition (n = 11), the "ASIP Only" experimental condition (n = 10), or the Control condition (n = 11). The two eligibility criteria for a teacher-participant to be included in the study were to be a full-time teacher who was certified to teach PE in Korea. To randomize the 32 teachers into one of the three experimental conditions, we used the program found at www.random.org/sequences.
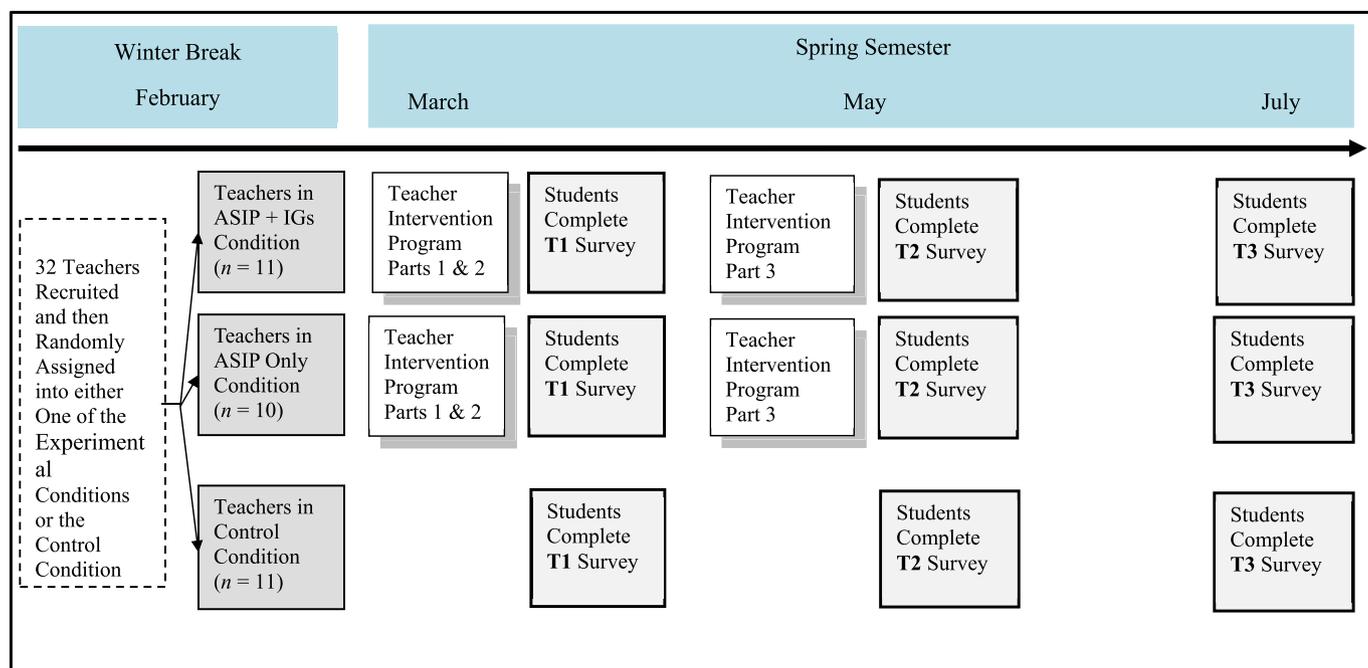
Fig. 1. Procedural timeline for the events included in the delivery of the two interventions and in the data collection. In interpreting the figure, it is important to note that the Korean school year begins in early March and the first semester ends in July.

The procedural timeline for the semester-long intervention program and the three waves of data collection appear in Fig. 1. For teachers in the control condition, they taught their classes using their pre-existing motivating styles (i.e., "practice as usual"). For teachers in the two experimental conditions, we delivered the ASIP Only and the ASIP + Intrinsic Goals interventions in three parts.

Parts 1 and 3 of the two interventions were the same, while Part 2 differed by experimental condition. Part 1 was a 3-h morning workshop delivered by the author team that took place in the week before the semester began. It introduced autonomy-supportive teaching and recommended six autonomy-supportive instructional strategies: Adopt the students' perspective; vitalize students' psychological needs; rely on invitational language; provide explanatory rationales; display patience; and acknowledge and accept negative affect. Part 3 was a 2-h peer-to-peer group discussion that took place in the sixth week of the semester. During the group discussion, teachers shared their classroom experiences and exchanged tips, suggestions, and strategies.

Part 2 was a 3-h afternoon workshop that followed Part 1 (after a lunch break). For teachers in the ASIP Only condition, Part 2 reviewed the autonomy-supportive instructional behaviors and featured a 2 ½ hour "how to" workshop to help teachers develop, refine, and personalize the teaching skill needed to deliver the 6 recommended autonomy-supportive instructional behaviors. Participation included viewing videos ("how to" modeling), receiving sample instructional scripts for each instructional behavior, and hands-on practice with guidance, corrective feedback, and discussion until teachers felt confident that they could enact each recommended instructional behavior in their own classroom with their own students. For teachers in the ASIP + Intrinsic Goals condition, Part 2 introduced the intrinsic goals and featured a 2 ½ hour "how to" workshop to help teachers develop, refine, and personalize the teaching skill needed to (a) deliver the 6 recommended autonomy-supportive instructional behaviors, (b) introduce the 3 recommended intrinsic goals, and (c) recommend those intrinsic goals in an autonomy-supportive way. As to the latter, teachers learned how to recommend each intrinsic goal ("develop greater skill in badminton") while taking the students' perspective ("Is there any specific skill you would like to work on today?"), relying on invitational language ("you may want to consider griping the racket like this"),

providing an explanatory rationale for the goal ("the more skill you gain, the more enjoyable badminton will become"), and acknowledging negative affect ("Yes, I understand; learning a new skill can be difficult and frustrating"). Participation included viewing videos, receiving sample instructional scripts for each intrinsic goal and autonomy-supportive behavior, and hands-on practice with guidance, corrective feedback, and discussion until teachers felt confident that they could enact each recommended act of instruction in their own classroom with their own students.

As to the data collection, it was conducted in three waves in which students completed the same four-page questionnaire at the beginning (T1; week 1), middle (T2; week 10), and end (T3; week 19) of the first semester of the academic year. The survey was administered at the beginning of the class period, and students completed the questionnaire in reference to that particular class. Students were assured that their responses would be confidential.

2.3. Measures

Each measure used the same 7-point Likert scale that ranged from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Students completed the professionally translated and back-translated Korean version of each measure that had been used in previous research (Cheon et al., 2012; Song, Kim, & Cheon, 2017).

2.3.1. Perceived autonomy support and perceived teacher control

We assessed perceived autonomy support with the 6-item version of the 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", and it has been widely-used to assess perceived autonomy-supportive teaching (Jang et al., 2012). Students' LCQ scores in the present study were internally consistent across the 3 waves of data collection (α's = 0.90, 0.94, and 0.94, respectively). We assessed perceived teacher control with the 4-item Controlling Teacher Scale (CTS; Jang, Reeve, Ryan, & Kim, 2009). The CTQ includes items such as, "My PE teacher puts a lot of pressure on me", and it has been used in previous studies to assess perceived teacher control (Jang, Kim, & Reeve, 2016). Students' CTS scores were reasonably internally consistent in

each assessment period (α's = 0.79, 0.85, and 0.86).

2.3.2. Psychological need satisfaction and frustration

We assessed students' autonomy, competence, and relatedness satisfaction with 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 = 0.89, 0.92, and 0.92). 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 = 0.88, 0.89, and 0.90). We assessed relatedness need satisfaction by combining Furrer and Skinner's (2003) 2-item Perceived Relatedness with Peers Scale ("When I am with my classmates in PE, I feel important"; α's = 0.71, 0.75, and 0.78) with the 2-item Perceived Relatedness with Teacher Scale ("When I am with my PE teacher, I feel important"; α's = 0.71, 0.78, and 0.78). Scores from the two relatedness scales were highly correlated (r's at T1, T2, and T3 = 0.71, 0.78, and 0.79), so we averaged them into a single relatedness need satisfaction score. Because these three scores were highly intercorrelated (3-scale α's = 0.80, 0.83, and 0.85), we equally-weighted and averaged the autonomy, competence, and relatedness scores into a single overall need satisfaction score for the hypothesis tests. In the test of the overall hypothesized model, however, we used students' scores on each scale as three separate indicators of the "need satisfaction" latent variable.

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 ("In PE class, I feel pushed to behave in certain ways."; α's = 0.89, 0.92, and 0.93), competence ("In PE class, there are situations where I am made to feel inadequate."; α's = 0.91, 0.94, and 0.95), and relatedness ("I feel rejected by my PE classmates."; α's = 0.91, 0.93, and 0.94) need frustration. The PNTS has been used previously in the PE context (Hein et al., 2015; Liu & Chung, 2015). Because these three scores were highly intercorrelated (3-scale α's = 0.92, 0.95, and 0.96), we equally-weighted and averaged the autonomy, competence, and relatedness scores into a single overall need frustration score for the hypothesis tests. In the test of the hypothesized model, however, we used students' scores on each scale as three separate indicators of the "need frustration" latent variable.

2.3.3. Intrinsic goals

We assessed students' intrinsic goals with the Korean-translated and validated version (Song, Cheon, Kim, & Yoo, 2016) of the Goal Content for Exercise Questionnaire (GCEQ; Sebire et al., 2008). The GCEQ is a 5-scale, 20-item questionnaire that features three intrinsic goals (skill development, social affiliation, and health maintenance) and two extrinsic goals (image, social recognition) in the exercise domain, though we used scores only from the intrinsic goal scales. The Korean version of the GCEQ breaks the single social affiliation goal into two separate goals by dividing "social affiliation with others" scale into "social affiliation with classmates" and "social affiliation with teacher" scales. Participants rated each item in response to the stem, "Please indicate to what extent these goals are important for you during PE class." A sample item from the 4-item skill development scale is, "To acquire new exercise skills" (α's = 0.89, 0.92, and 0.92). A sample item from the 4-item social affiliation with classmates scale is, "To form close bonds with my PE classmates" (α's = 0.90, 0.92, and 0.92). A sample item from the 3-item social affiliation with teacher scale is, "To develop a close relationship with my PE teacher" (α's = 0.86, 0.88, and 0.88). Because scores on these two social affiliation goals were positively correlated (α's = 0.84, 0.88, and 0.88), we averaged them into a single overall social affiliation score. A sample item from the 4-item health maintenance goal is, "To improve my overall health." (αs = 0.89, 0.92, and 0.93). The GCEQ is a measure to assess students' pursuit of intrinsic

goals during the PE class, rather than a measure of students' perception of how much their teachers recommend they pursue those intrinsic goals.

2.3.4. Physical self-concept

We assessed physical self-concept with the 3-item Global Physical subscale from the 11-scale, 40-item Physical Self-Description Questionnaire-S (PSDQ-S; Marsh, Martin, & Jackson, 2010). The PSDQ-S was developed for adolescents, and this scale has been used previously in the PE context (Taylor, Spray, & Pearson, 2014). A sample item is, "Physically, I feel good about myself." We list all three items from the PSDQ-S in Table 1. The PSDQ-S has shown strong psychometric properties in previous investigations (Marsh, 1996), and it showed high internal consistency in the present study (αs = 0.93, 0.95, and 0.95).

2.3.5. Problematic relationships

We assessed problematic relationships with the 4-item Problematic Relationships Scale (PRS; Cheon & Jang, 2012). A sample item is, "My PE classmates make fun of me if I made a mistake". We list all four items from the PRS in Table 1. The PRS has been used in previous investigations in the PE context (Cheon et al., 2016), and it showed high internal consistency in the present study (αs = .93, .95, and .95).

2.4. Data analyses

We conducted two sets of analyses. The first tested for the effect of experimental condition on each manipulation check and each dependent measure. For these analyses, we conducted multilevel analyses using hierarchical linear modeling (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011), because the data had a 3-level hierarchical structure with repeated measures (Level 1, 3 waves) nested within students (Level 2, $N = 2131$) nested within teachers (Level 3, $k = 32$). At level 1 (within student), the longitudinal data allowed us to measure students' increase or decrease on each measure over three time points—the beginning, middle, and end of the semester. Accordingly, we entered "time" as an un-centered independent variable (scored as 0, 1, 2) with students' T1 beginning-of-semester score serving as an initial or baseline measurement so that the T3 scores could then function as semester-long change scores. At level 2 (between students), we entered gender and grade level as two group mean-centered covariates to function as statistical controls. At level 3 (between teachers), we created a pair of contrast codes to serve as un-centered independent variables to represent the unique predictive contribution of the two experimental conditions. To create the "ASIP Only" contrast, we coded the ASIP Only condition as +0.5, the no-intervention condition as −0.5, and the ASIP + Intrinsic Goals condition as 0 (to contrast ASIP Only vs. no-intervention control). To create the "ASIP + Intrinsic Goals" contrast, we coded the "ASIP + Intrinsic Goals" condition as +0.5, the ASIP Only condition as −0.5, and the no-intervention control group as 0 (to contrast ASIP + Intrinsic Goal vs. ASIP Only). For both of these contrast effects, we entered the contrast × time interaction as a cross-level predictor (each contrast was a level 3 predictor, time was a level 1 predictor) to test the extent to which the changes in students' T3 scores depended on experimental condition. For each hypothesis test, the critical test was for a significant "condition (i.e., contrast code) x time interaction" effect.[1]

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[1] In the multilevel modeling analyses for the 9 dependent measures, we report in the text only the results from each hypothesis test, which was a test for a significant condition (contrast code) x time interaction effect. Concerning the unreported effects, all 9 "time" main effects were statistically significant ($p < .001$), 7 of the 9 "condition" main effects for the ASIP Only contrast were significant (all but perceived teacher control and the social affiliation goal), 8 of the 9 "condition" main effects for the ASIP + Intrinsic Goal contrast were

Table 1

Descriptive statistics, unstandardized, and standardized factor loadings associated with the measures included in the measurement model.

	Time 1					Time 2					Time 3				
Dependent Measure	M	(SD)	B	SE	β	M	(SD)	B	SE	β	M	(SD)	B	SE	β
Need Satisfaction Indicators															
1. Autonomy	4.65	(1.03)	1.00	–	.90	5.06	(1.11)	1.00	–	.92					
2. Competence	4.17	(1.18)	.85	.02	.77	4.61	(1.25)	.86	.02	.79					
3. Relatedness	4.56	(1.08)	.69	.02	.62	4.79	(1.22)	.71	.02	.63					
Need Frustration Indicators															
1.Autonomy	2.71	(1.21)	1.00	–	.93	2.48	(1.26)	1.00	–	.95					
2.Competence	2.70	(1.23)	1.00	.01	.93	2.47	(1.28)	1.00	.01	.95					
3.Relatedness	2.40	(1.14)	.89	.02	.83	2.27	(1.20)	.93	.01	.88					
Physical Self-Concept Indicators															
1. I feel good about who I am physically.	4.66	(1.37)	.95	.01	.92	4.99	(1.38)	.96	.01	.93	5.06	(1.32)	.94	.01	.92
2. Physically, I feel good about myself.	4.72	(1.35)	1.00	–	.97	5.04	(1.35)	1.00	–	.97	5.14	(1.25)	1.00	–	98
3. Physically, I am happy with myself.	4.65	(1.35)	.86	.01	.83	4.97	(1.35)	.89	.01	.86	5.10	(1.26)	.89	.01	.87
Problematic Relationships Indicators															
1. I dislike playing with my classmates in PE.	2.26	(1.33)	.88	.02	.82	2.09	(1.31)	.90	.01	.86	2.15	(1.31)	.94	.01	.90
2. I feel uncomfortable getting along with my classmates in PE.	2.14	(1.24)	.99	.01	.91	1.98	(1.22)	1.00	.01	.96	2.07	(1.27)	1.00	.01	.96
3. My PE classmates make fun of me if I make a mistake.	2.19	(1.29)	1.00	–	.92	2.02	(1.27)	1.00	–	.95	2.07	(1.30)	1.00	–	.96
4. I feel nervous when I am with my classmates in PE.	2.22	(1.33)	.95	.02	.87	2.05	(1.30)	.94	.01	.90	2.08	(1.29)	.95	.01	.91

Notes. All *B*s are statistically significant ($p < .001$). Time 3 measures of the need satisfaction and need frustration indicators were assessed, but they are not reported in the table because they were not included in the specification or test of the measurement model. Possible range for each variable, 1–7.

To estimate effect sizes for these analyses, we used the independent-groups pretest-posttest design test ($d_{IGPP-RAW}$) that is appropriate for repeated-measures group comparisons (Feingold, 2009). The $d_{IGPP-RAW}$ statistic is computed from the following formula: $d_{IGPP-RAW}$ = (M $_{CHANGE-T, T3-T1}$/SD $_{RAW-T\ at\ T1}$) – (M $_{CHANGE-C, T3-T1}$/SD $_{RAW-C\ at\ T1}$). This statistic reports the extent of intervention-enabled (or "T" for "Treatment") change in the dependent measure compared to the extent of change in the same dependent measure observed in the baseline group ("C" for "Control"). We report this statistic for both the ASIP Only and the ASIP + Intrinsic Goal contrast effects. The $d_{IGPP-RAW}$ statistic may be interpret in the same was as is Cohen's *d*, which is .20 for a small effect, 0.50 for a moderate effect, and 0.80 for a large effect (Cohen, 1988).

The second analysis tested the hypothesized model, using multilevel latent variable structural equation modeling (LISREL 9.2; Joreskog & Sorbom, 2015). To evaluate model fit, we relied on the chi-square test statistic and multiple indices of fit (as recommended by Kline, 2011), including the root-mean-square error of approximation (*RMSEA*), the standardized root mean square residual (*SRMR*), the comparative fit index (*CFI*), and the non-normed fit index (*NNFI*). For *RMSEA* and *SRMR*, values less than 0.08 generally indicate good fit; for *CFI* and *NNFI*, values greater than 0.95 generally indicate good fit.

3. Results

3.1. Preliminary analyses

Values for skewness and kurtosis for the 27 dependent measures (9 measures *x* 3 waves) were all less than |1.18|, indicating little deviation from normality. We also tested for possible associations between students' demographic characteristics (gender, grade level) with their baseline scores on the 9 dependent measures. Middle school students scored significantly higher than did high school students on 7 of the 9 dependent measures, and males scored significantly higher than females on 8 of the 9 dependent measures. Given these associations (see Table 2), we included gender (females = 0; males = 1) and grade level (middle school = 0; high school = 1) as covariates (i.e., a statistical control) in all subsequent analyses.

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(footnote continued)

significant (all but physical self-concept), and all 9 random effects test for meaningful classroom-level variance were statistically significant ($p < .001$).

3.2. Descriptive statistics

We provide the means and standard deviations for all nine dependent measures broken down by experimental condition and time of assessment in Supplemental Table 1. We also present these same statistics in easier-to-interpret bar graphs (one for each dependent measure) in Supplemental Figs. 1, 2, 3, and 4. In this table and in these four figures, we report perceived autonomy support, perceived teacher control, skill development goal, social affiliation goal, and health maintenance goal (the five manipulation checks) as observed variables, while we report need satisfaction, need frustration, physical self-concept, and problematic relationships (the four dependent measures) as latent variables.

3.3. Manipulation checks

For *perceived autonomy* support, the ASIP Only contrast × time interaction was significant, $t(4,227) = 16.06$, $p < .001$ ($d_{IGPP-RAW} = 0.67$). Perceived autonomy support increased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = +0.55$, $t = 15.04$, $p < .001$), while it decreased significantly (though modestly) for students of teachers in the control condition ($\Delta = -0.09$, $t = 2.30$, $p = .022$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 12.68$, $p < .001$ ($d_{IGPP-RAW} = 0.30$), as perceived autonomy support increased significantly more for students of teachers in the ASIP + Intrinsic Goals condition from T1 to T3 ($\Delta = +0.86$, $t = 23.78$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = +0.55$).

For *perceived teacher control*, the ASIP Only contrast × time interaction was significant, $t(4,227) = 9.95$, $p < .001$ ($d_{IGPP-RAW} = 0.32$). Perceived teacher control decreased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = -0.22$, $t = 4.89$, $p < .001$), while it increased significantly for students of teachers in the control condition ($\Delta = +0.14$, $t = 3.09$, $p = .002$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 11.45$, $p < .001$ ($d_{IGPP-RAW} = 0.48$), as perceived teacher control decreased significantly more for students of teachers in the ASIP + Intrinsic Goals condition ($\Delta = -0.77$, $t = 17.91$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = -0.22$).

For *skill development goal*, the ASIP Only contrast × time interaction

Table 2

Intercorrelation matrix among the 2 experimental conditions, 10 dependent measures, and 2 statistical controls included in the test of the hypothesized model.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.ASIP Only Contrast	–													
2. ASIP + Intrinsic Goals Contrast	-.52	–												
Time 1														
3. Need Satisfaction	-.01-	-.02												
4. Need Frustration	-.01	.10	-.36	–										
5. Physical Self-Concept	-.02	.02	.63	-.29	–									
6. Problematic Relationships	.08	.11	-.26	.69	-.24	–								
Time 2														
7. Need Satisfaction	.16	.04	.56	-.17	.32	-.14	–							
8. Need Frustration	-.17	.05	-.28	.41	-.09	.30	-.46	–						
9. Physical Self-Concept	.08	.02	.42	-.23	.47	-.16	.72	-.43	–					
10. Problematic Relationships	-.13	.05	-.22	.31	-.17	.33	-.36	.70	-.37	–				
Time 3														
11. Physical Self-Concept	.14	.07	.38	-.21	.40	-.16	.54	-.33	.61	-.26	–			
12. Problematic Relationships	-.29	.01	-.18	.27	-.15	.25	-.30	.48	-.27	.52	-.39	–		
Statistical Controls														
13. Gender	.12	-.24	-.13	-.09	-.10	-.11	-.16	-.05	-.05	-.03	-.07	-.09	–	
14. Grade Level	.12	-.33	-.06	-.13	-.05	-.12	-.07	-.09	-.10	-.10	.00	-.14	.28	–

$N = 2131$. r's ≥ 0.05, $p < .05$; r's ≥ 0.06, $p < .01$.

For gender, female = 0 and male = 1. For grade level, middle School = 0 and high school = 1.

was significant, $t(4,227) = 10.61$, $p < .001$ ($d_{IGPP-RAW} = 0.44$). The skill development goal increased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = +0.32$, $t = 7.73$, $p < .001$), while it decreased significantly for students of teachers in the control condition ($\Delta = -0.16$, $t = 3.45$, $p < .001$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 7.85$, $p < .001$ ($d_{IGPP-RAW} = 0.19$), as the skill development goal increased significantly more for students of teachers in the ASIP + Intrinsic Goals condition ($\Delta = +0.54$, $t = 13.35$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = +0.32$).

For *social affiliation goal*, the ASIP Only contrast × time interaction was significant, $t(4,227) = 8.13$, $p < .001$ ($d_{IGPP-RAW} = 0.27$). The social affiliation goal increased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = +0.30$, $t = 6.94$, $p < .001$), while it remained unchanged for students of teachers in the control condition ($\Delta = -0.02$, $t = 0.33$, $p = .744$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 8.56$, $p < .001$ ($d_{IGPP-RAW} = 0.26$), as the social affiliation goal increased significantly more for students of teachers in the ASIP + Intrinsic Goals condition ($\Delta = +0.61$, $t = 14.52$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = +0.30$).

For *health maintenance goal*, the ASIP Only contrast × time interaction was significant, $t(4,227) = 8.98$, $p < .001$ ($d_{IGPP-RAW} = 0.39$). The health maintenance goal increased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = +0.27$, $t = 6.23$, $p < .001$), while it decreased significantly for students of teachers in the control condition ($\Delta = -0.18$, $t = 3.85$, $p < .001$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 6.79$, $p < .001$ ($d_{IGPP-RAW} = 0.15$), as the health maintenance goal increased significantly more for students of teachers in the ASIP + Intrinsic Goals condition ($\Delta = +0.45$, $t = 10.60$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = +0.27$).

3.4. Interventions effects on need states, self-concept, and problematic relationships

For *need satisfaction*, the ASIP Only contrast × time interaction was significant, $t(4,227) = 14.89$, $p < .001$ ($d_{IGPP-RAW} = 0.58$). Need satisfaction increased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = +0.55$, $t = 15.22$, $p < .001$), while

it remained unchanged for students of teachers in the control condition ($\Delta = -0.01$, $t = 0.39$, $p = .700$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 10.81$, $p < .001$ ($d_{IGPP-RAW} = 0.23$), as need satisfaction increased significantly more for students of teachers in the ASIP + Intrinsic Goals condition ($\Delta = +0.76$, $t = 21.18$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = +0.55$).

For *need frustration*, the ASIP Only contrast × time interaction was significant, $t(4,227) = 14.69$, $p < .001$ ($d_{IGPP-RAW} = 0.66$). Need frustration decreased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = -0.33$, $t = 7.90$, $p < .001$), while it increased significantly for students of teachers in the control condition ($\Delta = +0.40$, $t = 8.52$, $p < .001$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 10.75$, $p < .001$ ($d_{IGPP-RAW} = 0.22$), as need frustration decreased significantly more for students of teachers in the ASIP + Intrinsic Goals condition ($\Delta = -0.59$, $t = 14.17$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = -0.33$).

For *physical self-concept*, the ASIP Only contrast × time interaction was significant, $t(4,227) = 9.34$, $p < .001$ ($d_{IGPP-RAW} = 0.27$). Physical self-concept increased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = +0.36$, $t = 7.73$, $p < .001$), while it remained unchanged for students of teachers in the control condition ($\Delta = 0.00$, $t = 0.04$, $p = .968$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 6.15$, $p < .001$ ($d_{IGPP-RAW} = 0.24$), as physical self-concept increased significantly more for students of teachers in the ASIP + Intrinsic Goals condition ($\Delta = +0.68$, $t = 14.88$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = +0.36$).

For *problematic relationships*, the ASIP Only contrast × time interaction was significant, $t(4,227) = 15.24$ $p < .001$ ($d_{IGPP-RAW} = 0.70$). Problematic relationships decreased significantly for students of teachers in the ASIP Only condition from T1 to T3 ($\Delta = -0.23$, $t = 5.36$, $p < .001$), while it increased significantly for students of teachers in the control condition ($\Delta = +0.60$, $t = 12.42$, $p < .001$). The ASIP + Intrinsic Goals contrast × time interaction was also significant, $t(4,227) = 11.02$, $p < .001$ ($d_{IGPP-RAW} = 0.26$), as problematic relationships decreased significantly more for students of teachers in the ASIP + Intrinsic Goals condition ($\Delta = -0.54$, $t = 12.49$, $p < .001$) than it did for students of teachers in the ASIP Only condition ($\Delta = -0.23$).

3.5. Test of the overall model

We first tested the measurement model, which featured 10 latent variables (the 2 latent variables of need satisfaction and need frustration at T1 and T2 and the 2 latent variables of physical self-concept and problematic relationships at T1, T2, and T3), including three indicators for need satisfaction (autonomy, competence, and relatedness), three indicators for need frustration (autonomy, competence, and relatedness), three indicators for physical self-concept (3 items from the PSDQ-S), and four indicators for problematic relationships (4 items from the PRS). To represent the longitudinal character of the data set, we allowed the between-wave error terms of each repeated-measures indicator to correlate with itself from T1 to T2 for need satisfaction and need frustration and from T1 to T2, T1 to T3, and T2 to T3 for physical self-concept and problematic relationships. The measurement model fit the data reasonably well, X^2 (1214) = 4246.92, $p < .001$, $RMSEA = 0.046$ (90% CI: 0.045 to 0.048), $SRMR = 0.035$, $CFI = 0.983$, $NNFI = 0.981$. Table 1 shows the descriptive statistics and factor loadings for all 33 individual indicators included in the measurement model, while Table 2 shows the intercorrelations among the two contrast codes, the 10 latent variables, and the two statistical controls.

In the test of the hypothesized (structural) model, the six T1 predictors and two statistical controls were allowed to correlate freely. Within T2 and T3, the errors of the within-wave variables were allowed to correlate (four errors at T2, two errors at T3; see Fig. 2). The hypothesized model fit the data reasonably well, X^2 (1249) = 5016.38, $p < .001$, $RMSEA = 0.051$ (90% CI: 0.049 to 0.052), SRMR = 0.076,

$CFI = 0.979$, $NNFI = 0.977$. The path diagram showing the standardized estimates for each hypothesized path appears in Fig. 2. For clarity, we do not show the T1 statistical controls in the figure, but we do report their full statistical results below.

For *T2 need satisfaction*, both the ASIP Only ($B = 0.17$, $SE\ B = 0.02$, $\beta = 0.20$, $t = 10.95$, $p < .001$) and the ASIP + Intrinsic Goals ($B = 0.12$, $SE\ B = 0.02$, $\beta = 0.14$, $t = 7.21$, $p < .001$) contrasts were significantly associated with increased T2 need satisfaction, while controlling for T1 need satisfaction ($B = 0.48$, $SE\ B = 0.02$, $\beta = 0.49$, $t = 24.86$, $p < .001$), gender ($B = -0.06$, $SE\ B = 0.01$, $\beta = -0.07$, $t = 3.94$, $p < .001$), and grade level ($B = 0.01$, $SE\ B = 0.02$, $\beta = 0.01$, $t = 0.41$, $p = .682$).

For *T2 need frustration*, both the ASIP Only ($B = -0.09$, $SE\ B = 0.02$, $\beta = -0.10$, $t = 5.37$, $p < .001$) and the ASIP + Intrinsic Goals ($B = -0.05$, $SE\ B = 0.02$, $\beta = -0.05$, $t = 2.56$, $p = .011$) contrasts were significantly associated with decreased T2 need frustration, while controlling for T1 need frustration ($B = 0.33$, $SE\ B = 0.02$, $\beta = 0.33$, $t = 18.95$, $p < .001$), gender ($B = -0.02$, $SE\ B = 0.01$, $\beta = -0.03$, $t = 1.61$, $p = .108$), and grade level ($B = -0.02$, $SE\ B = 0.02$, $\beta = -0.02$, $t = 1.10$, $p = .271$).

For *T3 physical self-concept*, increases in T2 need satisfaction ($B = 0.18$, $SE\ B = 0.03$, $\beta = 0.16$, $t = 5.56$, $p < .001$) but not decreases in T2 need frustration ($B = -0.04$, $SE\ B = 0.02$, $\beta = -0.04$, $t = 1.78$, $p = .075$) were significantly associated with increased T3 physical self-concept, while controlling for T2 physical self-concept ($B = 0.43$, $SE\ B = 0.03$, $\beta = 0.42$, $t = 16.82$, $p < .001$), T1 physical self-concept ($B = 0.09$, $SE\ B = 0.03$, $\beta = 0.09$, $t = 3.77$, $p < .001$), T1 need satisfaction ($B = 0.04$, $SE\ B = 0.03$, $\beta = 0.04$, $t = 1.26$, $p = .208$),
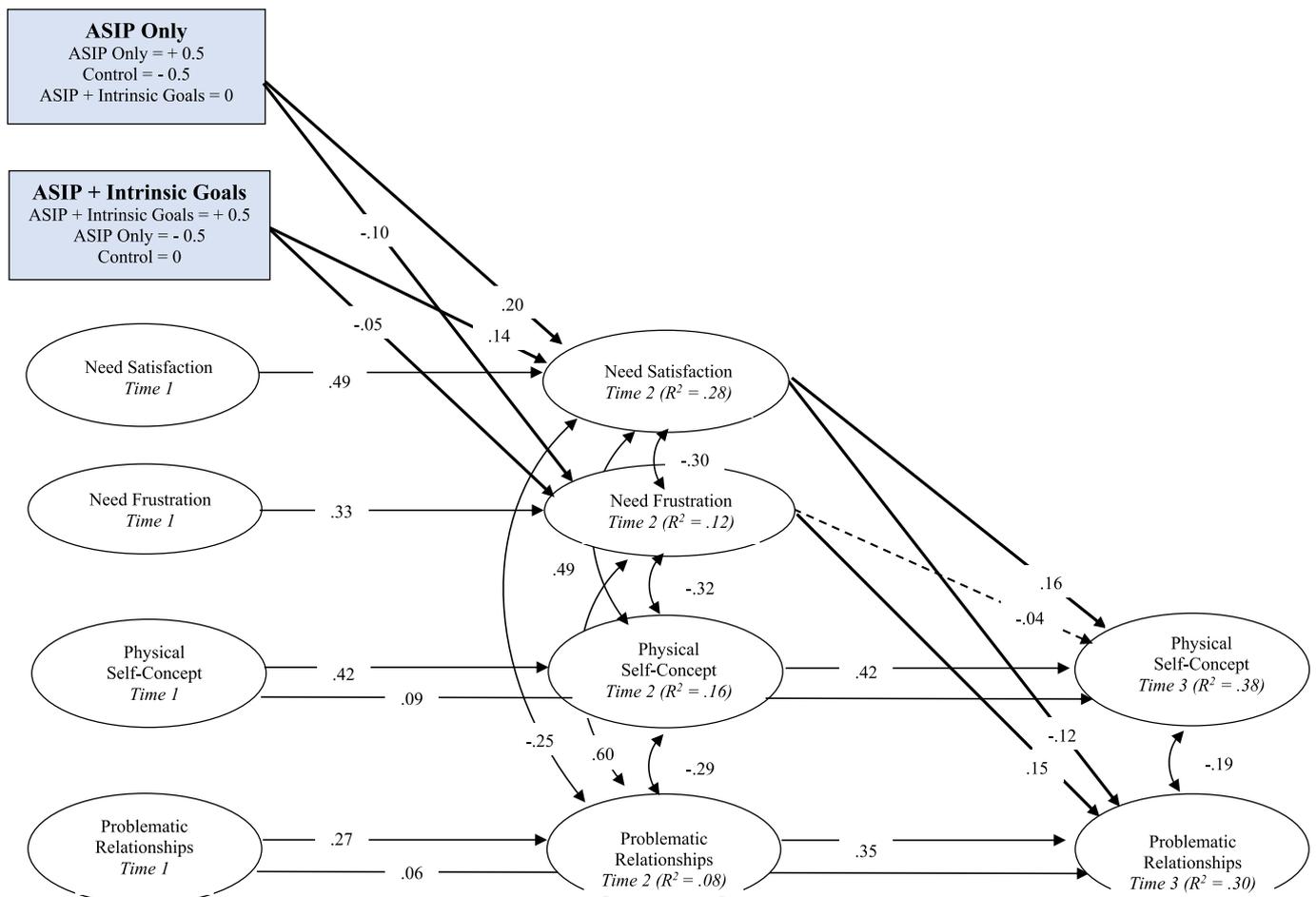

Fig. 2. Test of the hypothesized model to explain changes in students' T3 physical self-concept and problematic relationships. Solid lines represent significant paths; dashed lines represent non-significant paths.

T1 need frustration ($B = -0.01$, $SE\ B = 0.02$, $\beta = -0.01$, $t = 0.50$, $p = .617$), gender ($B = 0.00$, $SE\ B = 0.02$, $\beta = 0.00$, $t = 0.04$, $p = .968$), and grade level ($B = 0.03$, $SE\ B = 0.02$, $\beta = 0.03$, $t = 1.83$, $p = .067$).

For *T3 problematic relationships*, decreases in T2 need satisfaction ($B = -0.14$, $SE\ B = 0.03$, $\beta = -0.12$, $t = 5.02$, $p < .001$) and increases in T2 need frustration ($B = 0.16$, $SE\ B = 0.03$, $\beta = 0.15$, $t = 5.58$, $p < .001$) were both significantly associated with increased T3 problematic relationships, while controlling for T2 problematic relationships ($B = 0.35$, $SE\ B = 0.03$, $\beta = 0.35$, $t = 13.98$, $p < .001$), T1 problematic relationships ($B = 0.06$, $SE\ B = 0.03$, $\beta = 0.06$, $t = 2.22$, $p = .027$), T1 need satisfaction ($B = 0.03$, $SE\ B = 0.03$, $\beta = 0.03$, $t = 1.15$, $p = .250$), T1 need frustration ($B = 0.02$, $SE\ B = 0.03$, $\beta = 0.02$, $t = 0.60$, $p = .549$), gender ($B = -0.07$, $SE\ B = 0.02$, $\beta = -0.08$, $t = 4.10$, $p < .001$), and grade level ($B = -0.07$, $SE\ B = 0.02$, $\beta = -0.08$, $t = 4.10$, $p < .001$).

4. Discussion

Each experimental condition generated a meaningfully different classroom experience. In the no-intervention condition, students experienced a less than ideal PE course, as their pursuit of the skill development and health maintenance goals decreased, physical self-concept remained unchanged, while need frustration and problematic relationships both increased. The rise in problematic relationships was particularly notable. This same phenomenon of observing increasingly poorer quality motivation and functioning over time for students in naturally-occurring (no intervention) PE classrooms has been reported by other researchers as well (Bartholomew et al., 2018). The overall pattern of findings suggests that the overarching goals of the PE course—students become physically active, learn to value exercise and a healthy lifestyle, develop motor skills, learn important life skills, develop positive physical self-perceptions, and build character—remained largely unrealized.

In the ASIP Only condition, however, students experienced a meaningfully upgraded PE course, as their need satisfaction and physical self-concept increased while their need frustration and problematic peer relationships decreased. In the ASIP + Intrinsic Goals condition, students experienced a PE course that was something close (or at least closer) to the ideal, as their need satisfaction and physical self-concept increased while their need frustration and problematic peer relationships decreased to an even greater extent than did these outcomes for the students in the ASIP Only condition.

4.1. What teachers in the ASIP + intrinsic goals condition did differently

The teachers in the ASIP + Intrinsic Goals and ASIP Only conditions were perceived to be both highly autonomy supportive and minimally controlling. The difference between them was that only teachers in the ASIP + Intrinsic Goals condition further recommended intrinsic goal pursuit. To illustrate how this latter group of teachers recommended intrinsic goals in an autonomy-supportive way, Table 3 provides a suggested sample script. In using the script, teachers first learned to recommend an intrinsic goal. In addition, they then learned how to take the students' perspective and create opportunities for intrinsic motivation (#3 in Table 3) or internalization of the goal pursuit (#4 in Table 3).

4.2. Why the student benefits occurred

Two reasons explain why PE students enhanced their physical self-concept and diminished their problematic relationships: (1) increased need satisfaction and (2) decreased need frustration. Intervention-enabled increases in T2 need satisfaction explained longitudinal gains in T3 physical self-concept ($\beta = 0.16$, $p < .001$), while intervention-enabled decreases in T2 need frustration explained longitudinal decreases

Table 3

Sample script for teachers in the ASIP + intrinsic goal condition to recommend an intrinsic goal in an autonomy-supportive way.

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1. Begin the learning activity by recommending students pursue an intrinsic goal. For instance:
   "*Today's goal is to develop greater skill in rope skipping.*"
2. As you do so, take the students' perspective by inviting their input concerning the goal pursuit:
   "*Is greater rope skipping skill important to you?*
   Does this sound fun and worthwhile?
   Do you feel mostly confident, or are you a little unsure and hesitant?"
3. If students express high interest-enthusiasm for the goal, promote intrinsic motivation (i.e., need satisfaction) by:
   For Autonomy: "*There are many different ways to skip rope: forwards, backwards, one-leg, double-skip, alone or with others. You might select one of these, and try it out.*"
   For Competence: *You may want to challenge yourself. See if you can skip forwards 5 times in a row without a miss.*
   For Relatedness: *It might be helpful to pair up with a classmate and do the activity together—you can share tips and help each other out.*
4. If students express low interest-enthusiasm for the goal, promote internalization by:
   Acknowledge and Accept Negative Feelings: "*Some of you may worry about doing poorly or about being embarrassed. Okay, I understand. Probably everyone in the class feels this way, at least a little.*"
   Provide Explanatory Rationales: "*Rope skipping is excellent exercise. Athletes find it useful in their fitness routines. Perhaps it will help your fitness too.*"
   Use Invitational Language: "*You may want to try out one of these new techniques.*"

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in problematic relationships ($\beta = 0.15$, $p < .001$), though T2 gains in need satisfaction explained additional longitudinal decreases in problematic relationships ($\beta = -0.12$, $p < .001$).

Given the importance of these two need states, we suggest two ways that teachers in our interventions supported students' psychological needs. First, teacher-provided autonomy support by itself enabled need satisfaction ($\beta = 0.20$, $p < .001$), but so additionally did the recommending of intrinsic goals ($\beta = 0.14$, $p < .001$). Like autonomy support, the pursuit of intrinsic goals also enables experiences of need satisfaction (Gunnell et al., 2014; Sebire, Standage, & Vansteenkiste, 2009). Students of teachers in the ASIP + Intrinsic Goals condition therefore introduced two complementary sources of greater need satisfaction and lesser need frustration (Vansteenkiste, Simons, Lens, et al., 2004; Vansteenkiste, Simons, Soenens, et al., 2004).

Second, the instructional act of recommending an intrinsic goal might have provided PE teachers in the ASIP + Intrinsic Goals condition with a concrete context in which to be highly autonomy supportive. As they communicated an intrinsic goal, the teacher striving to be autonomy supportive would use invitational language, provide a rationale for the goal, and acknowledge possible negative feelings (e.g., Table 3). Without a goal to pursue, the recommended autonomy-supportive behaviors may at times come across as too open-ended an approach to instruction (e.g., listen carefully, be flexible; see Aelterman et al., 2018, for a discussion of this point). Perhaps it becomes easier for PE teachers to learn how to become more autonomy supportive when the "what to do" is clear and well-defined. Given the "what to do" (i.e., an intrinsic goal to pursue), autonomy supportive teaching then focuses on "why" (Deci & Ryan, 2000) and "how to" (Reeve, 2016) pursue that goal. Just as PE teachers can provide intrinsic goals in autonomy-supportive ways (Vansteenkiste et al., 2004), they can also learn to communicate their expectations (Trouilloud et al., 2006), directions (Eckes et al., 2018), rules (Koestner et al., 1984), assessment criteria (Haerens et al., 2018), and feedback (Carpentier & Mageau, 2013) in autonomy-supportive ways.

4.3. Future research

We designed the ASIP + Intrinsic Goals intervention to feature both learning how to become more autonomy supportive (Part 1) and

learning how to recommend intrinsic goals in an autonomy-supportive way (Part 2). If the reasoning expressed in the paragraph above is correct, it might actual make for a more effective intervention to first have teachers learn how to recommend intrinsic goals (Part 1) and then learn how to become more autonomy supportive (Part 2).

We also designed the ASIP + Intrinsic Goals intervention on the basis that autonomy support and intrinsic goals were two somewhat independent instructional pathways to support students' psychological needs during instruction. But, there is the possibility that merely being more autonomy supportive might tend teachers to recommend more intrinsic goals, just as recommending intrinsic goals might tend teachers toward a more autonomy-supportive motivating style. This possibility raises the need for future research to add a fourth experimental condition to our 3-condition research design—namely, an Intrinsic Goals Only intervention (experimental) condition. Such a research design would be able to isolate the unique contributions of autonomy support, intrinsic goals, and both autonomy support and intrinsic goals together.

Another line of possible future research might be to focus on the teacher-participants to record their motivations and aspects of functioning (e.g., need satisfaction, teaching efficacy, teaching self-concept, quality of teacher-student relationships, and end-of-course student evaluations). Learning how to become more autonomy supportive does produce a wide range of important personal and professional benefits for teachers (Cheon, Reeve, Yu, & Jang, 2014), so it may also be the case that learning how to recommend students pursue intrinsic goals in autonomy-supportive ways may produce incremental teacher benefits.

4.4. Limitations

Our findings are limited by six methodological decisions. First, we assessed all dependent measures using only students' self-reported data. Our study would be made stronger with the addition of objective ratings from the teacher or from trained classroom observers. Second, while we did collect student-reported manipulation checks to evaluate the effectiveness of the interventions, we did not collect teacher-reported fidelity checks (e.g., "Did you find the intervention useful?"). Third, teachers randomly assigned into the no-intervention control group did not participate in an active intervention, which means that a Hawthorne effect (the tendency for participants in an experiment to work harder and to perform better merely because of the extra attention paid to them) cannot be ruled out in explaining the benefits observed in the ASIP Only vs. control contrast. Fourth, our sample size was relatively large, so some group mean differences reported as statistically significant may nevertheless have relatively small effect sizes associated with them. Fifth, training teachers to recommend intrinsic goals is not the same as training them to provide full-blown, highly-structured instruction, which would involve not only setting goals (i.e., clarifying expectations) but also providing skill-building and progress-enabling guidance and feedback (Jang et al., 2010; Sierens et al., 2009).

Sixth, despite our use of random assignment, some baseline group mean differences emerged (according to one-way ANOVA and Student-Newman-Keuls post hoc tests). These T1 group mean differences may be seen in Appendix Table 1 or in Appendix Figs. 1-4. In each case, the group mean difference that emerged concerned scores from participants in the ASIP + Intrinsic Goals condition (compared to the other two conditions). This raises the possibility that the significant "ASIP + Intrinsic Goals contrast" interaction effects observed in the present study might have occurred simply due to a regression to the mean statistical phenomenon (i.e., T1 scores in the ASIP + Intrinsic Goals condition were unusually low or unusually high and simply normalized—or "regressed to the mean"—by T3). To address this alternative interpretation, we looked for group mean differences between these two conditions on students' T3 scores. For 7 dependent measures, participants in the ASIP + Intrinsic Goals condition showed a significantly more favorable T3 score than did participants in the ASIP Only

condition—namely, higher skill development goal, higher social affiliation goal, higher health maintenance goal, higher need satisfaction, lower need frustration, higher physical self-concept, and lower problematic relationships. Given that the T3 scores in the ASIP + Intrinsic Goals condition were significantly higher than were T3 scores in the ASIP Only condition, a regression to the mean alternative interpretation for the significant "ASIP + Intrinsic Goals contrast" interaction effects is not viable. For 2 dependent measures (perceived autonomy support, perceived teacher control), however, the T3 scores between these two conditions were not significantly different. Given that the T3 scores were not significantly different in these two cases, a regression to the mean alternative interpretation for the significant "ASIP + Intrinsic Goals contrast" interaction effect is viable, so we acknowledge that possibility here.

5. Conclusion

Students of teachers who participated in the ASIP + Intrinsic Goals intervention showed greater PE benefits than did students of teachers who participated in the ASIP Only intervention. This is a notable new finding in light of how substantial the student benefits are when teachers participate in an ASIP Only intervention.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psychsport.2018.12.008.

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