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# When teachers learn how to provide classroom structure in an autonomy-supportive way: Benefits to teachers and their students

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## HIGHLIGHTS

- Teachers learned how to support autonomy, provide structure, and provide structure in an autonomy-supportive way.
- Two intervention studies used an experimental, longitudinal research design.
- In Study 1, teacher participation in the intervention produced multiple teacher benefits.
- In Study 2, teacher participation in the intervention produced multiple student benefits.

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## ABSTRACT

In two experimentally-based and longitudinally-designed studies, secondary-level PE teachers were randomly assigned to participate or not in a new intervention to help them learn all of the following: support autonomy, provide structure, and provide structure in an autonomy-supportive way. In Study 1, teachers who participated in the intervention showed longitudinal gains in all five hypothesized teacher benefits (e.g., teaching efficacy, job satisfaction). In Study 2, students of teachers who participated in the intervention showed longitudinal gains in all four hypothesized student benefits (e.g., classroom engagement, skill development). Overall, teachers and students benefited after teachers provided structure in an autonomy-supportive way.



## 1. Introduction

Autonomy-supportive teaching enables numerous benefits for students and teachers alike. That is, when teachers take their students' perspective and support their initiative, students generally become more interested (Tsai, Kunter, Lüdtke, Trautwein, & Ryan, 2008) and engaged (Patall et al., 2018) while teachers gain in teaching efficacy and job satisfaction (Cheon, Reeve, Yu, & Jang, 2014). Sometimes, however, teachers feel the need to give priority to their own instructional purposes, as might occur when students perform poorly, become disengaged, or seriously misbehave. In these instances, teachers may prefer to structure students' classroom activity by communicating their expectations and by mentoring for behavioral change. This dual pull of "support autonomy" yet "provide structure" can leave teachers feeling anxious that autonomy support risks permissiveness while structure risks external control (Aelterman et al., 2019). The ideal would be to offer students high autonomy support and high structure in a synergistic way (Jang, Reeve, & Deci, 2010; Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). But it may be difficult to integrate autonomy support and structure, as there is always the question as to whether these two approaches to instruction go hand-in-hand or are inherently at odds with one another.

When autonomy supportive, the teacher takes the students' perspective and provides choices (Patall, Dent, Oyer, & Wynn,

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2013), supports students' interests (Tsai et al., 2008), allows students to work in their own way (Jang, Reeve, & Halusic, 2016; Reeve & Jang, 2006) and at their own pace (Assor, Kaplan, & Roth, 2002), communicates a tone of understanding (Reeve, 2016), provides explanatory rationales (Steingut, Patall, & Trimble, 2017), acknowledges negative feelings (Deci, Eghrari, Patrick, & Leone, 1994), and uses invitational language (Vansteenkiste, Simons, Soenens, & Lens, 2004). Such instruction allows students to experience autonomy need satisfaction that energizes their interest-taking, classroom engagement, conceptual learning, and well-being (Cheon, Reeve, & Song, 2016; Jang, Kim, & Reeve, 2016; Jang, Reeve, & Halusic, 2016; Mouratidis, Vansteenkiste, Sideridis, & Lens, 2011).

When providing structure, the teacher communicates clear expectations (Cheon, Reeve, & Song, 2019), clarifies what competent functioning looks like (Grolnick & Pomerantz, 2009), provides step-by-step guidance for how students can make progress and attain desired outcomes (Vansteenkiste et al., 2012), scaffolds progress and offers helps (Jang et al., 2010), monitors and adjusts task difficulty as needed (Belmont, Skinner, Wellborn, & Connell, 1992), and provides constructive feedback (Carpentier & Mageau, 2016; Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008). Such instruction allows students to experience greater self-confidence and competence need satisfaction that energizes their challenge-seeking, classroom engagement, skill development, performance, and the use of deep and sophisticated learning strategies (Aelterman et al., 2019; Carpentier & Mageau, 2013; Mouratidis, Vansteenkiste, Michou, & Lens, 2013; Vansteenkiste et al., 2012).

### 1.1. Providing structure in an autonomy-supportive way

By itself, autonomy support yields numerous benefits. But teacher-provided structure, by itself, may or may not enrich students' motivation, engagement, and performance (Grolnick & Pomerantz, 2009). This is because teachers can provide any individual element of classroom structure in either an autonomy-supportive way (e.g., with perspective-taking, choice, and a supportive tone of voice) or a controlling way (e.g., with pressure, demands, and a harsh tone of voice). An increasing number of studies now show that controlling structure undermines motivation and generates few benefits, while autonomy-supportive structure enhances motivation and generates numerous benefits (Carpentier & Mageau, 2013, 2016; Cheon et al., 2019; Curran, Hill, & Niemiec, 2013; Eckes, Großmann, & Wilde, 2018; Koestner, Ryan, Bernieri, & Holt, 1984; Mouratidis, Lens, & Vansteenkiste, 2010; Mouratidis, Michou, Aelterman, Haerens, & Vansteenkiste, 2018; Ryan, 1982; Trouilloud, Sarrazin, Bressou & Bois, 2006; Vansteenkiste et al., 2012;). This dual effect of controlling versus autonomy-supportive structure has been shown to apply to a wide range of different individual elements of classroom structure, such as teacher-provided directions (Eckes et al., 2018), rules (Koestner et al., 1984), goals (Vansteenkiste et al., 2004), corrective feedback (De Muynck et al., 2017; Mouratidis et al., 2010), verbal communications (Curran et al., 2013), behavior change requests (Vansteenkiste et al., 2018), and assessment criteria (Haerens et al., 2018).

What has not been done is to provide a theory-based intervention to help teachers offer their students practically any element of classroom structure in an autonomy-supportive way. That is, what is needed is a formal intervention program to help teachers learn how to provide their rules, expectations, directions, daily schedule, goals, standards, assessments, guidance, help, role models, differentiated instruction, scaffolding, mentoring, and feedback in a highly autonomy-supportive way. Recognizing this, the purpose of the present investigation was to offer such an intervention to demonstrate its benefits to both teachers (Study 1) and their students (Study 2).

How teachers might infuse autonomy support into any individual element of their classroom structure appears in Fig. 1. Teachers first learn how to support students' autonomy, and they do this by learning how to take their students' perspective, present learning activities in ways that appreciate and support students' autonomy, provide explanatory rationales for their requests, accept expressions of negative affect, and rely on invitational language (Reeve, 2016). Teachers second learn how to provide structure, and they do this by learning how to communicate clear expectations, offer step-by-step guidance, and provide progress-enabling feedback (Aelterman et al., 2019). Finally, teachers learn how to provide individual aspects of the aforementioned structure in an autonomy-supportive way. For instance, when introducing a classroom rule (e.g., “use respectful language”), teachers learn—before, during, and after introducing the rule—to take the students' perspective (“Do all the insults and put-downs bother you?”), provide an explanatory rationale (“By using respectful language, we can create a classroom environment of acceptance, safety, and friendship.”), acknowledge any negative feelings (e.g., “Yes, I realize that I'm asking you to do what few of your classmates currently do.”), and use invitational language (“You may want to try saying something like, ‘While I disagree with you, I do understand your point.’”).

The premise on which the present investigation was based was that teacher participation in such an intervention would allow them to develop an optimal motivating style—one that would produce meaningful benefits to both teachers and their students. Students were expected to benefit because teacher-provided autonomy support promotes their autonomy need satisfaction, teacher-provided structure promotes their competence need satisfaction, and structure infused with autonomy support promotes psychological need satisfaction more generally (Aelterman et al., 2019; Cheon et al., 2019). According to self-determination theory (Ryan & Deci, 2017), autonomy is the psychological need to experience volition and self-endorsement in one's behavior, and it is satisfied by autonomy-supportive teaching. Similarly, competence is the psychological need to experience a sense of effectance in one's interactions with the environment, and it is satisfied by structured teaching. Once supported, autonomy and competence need satisfaction produce many educationally-important benefits. Accordingly, in Study 2, we assessed the following four dependent measures to document students' thriving: (1) classroom engagement, (2) course-specific skill development, (3) anticipated course achievement, and (4) future intentions to engage in exercise.

Teachers were expected to benefit because autonomy support, structure, and structure provided in an autonomy-supportive way represents highly-skilled teaching that can fundamentally change the classroom dynamics for the better, such as enhancing students' classroom engagement and performance as well as improving the quality of teacher-student relationships (Reeve & Cheon, 2014). When teachers are able to change the classroom dynamics for the better, they will likely see their teaching as effective, which can be documented through longitudinal gains in (1) teaching efficacy (Tschannen-Moran & Woolfolk Hoy, 2001) and a reliance on (2) intrinsic instructional goals (Sebire, Standage, & Vansteenkiste, 2008). They would also likely experience greater teaching well-being, which can be documented through longitudinally gains in (3) harmonious passion (Vallerand et al., 2003) and (4) job satisfaction (Caprara, Barbaranelli, Borgogni, & Steca, 2003). They would further likely experience improved teacher-student relationships, which can be documented through longitudinal gains in their (5) felt relationship satisfaction with their students. Accordingly, in Study 1, we assessed all five of these dependent measures to

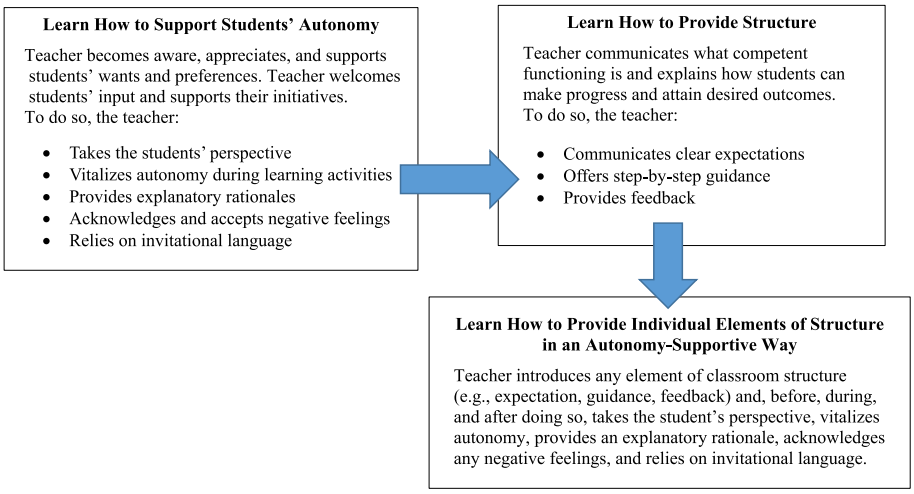


**Fig. 1.** How teachers integrate autonomy support into various aspects of classroom structure.

document teachers' thriving. Accordingly, two studies were conducted to answer the investigation's basic question—namely, would teachers (Study 1) and their students (Study 2) benefit meaningfully after teachers learned how to provide individual elements of structure in an autonomy-supportive way?

## 2. Study 1: teacher benefits

The purpose of Study 1 was to test the capacity of teacher participation in the new intervention to generate important teacher benefits. *Hypothesis 1* was that teachers who were randomly assigned to participate in the intervention would become significantly both more autonomy-supportive and more structured, compared to teachers in the no-intervention control condition. *Hypothesis 2* was that teachers who participated in the intervention, compared to teachers who did not, would report longitudinal gains in five teacher benefits—namely, teaching efficacy, intrinsic goals, harmonious passion, job satisfaction, and relationship satisfaction. *Hypothesis 3* proposed a mediation-based model in which intervention-enabled gains in both T2 autonomy support and T2 structure would explain the hypothesized year-end gains in each of the five T3 teacher benefits.

### 2.1. Method

#### 2.1.1. Participants

**Teacher-participants.** Teacher-participants were 35 full-time, ethnic Korean, certified PE teachers (25 males, 10 females) who taught in 35 different schools in Seoul, Korea (3 elementary, 22 middle, and 10 high schools). Teachers averaged 6.6 years of PE teaching experience ($SD = 2.6$; *range* = 2–12) and were, on average, 33.7 years old ($SD = 3.1$; *range* = 27–39). Each teacher completed all aspects of the study, including all three parts of the intervention and all three waves of data collection. In appreciation for their participation, each teacher-participant received the equivalent of $50. This monetary compensation was given at the end of the academic year (i.e., it was offered as an "unexpected reward"), and it was framed as an expression of appreciation for the extra time teachers gave to complete all aspects of the study.

**Student-participants.** Student-participants were the 1072 students who consented to complete the study questionnaire over all three waves of data collection, including 620 (57.8%) males and 452 (42.2%) females, 85 (7.9%) elementary, 699 (65.2%) middle, and 288 (26.9%) high school students, and 556 (51.9%) in the experimental and 516 (48.1%) in the control condition. Students were on average 14.8 years old ($SD = 1.3$, *range* = 11–18).

#### 2.1.2. Measures

Each measure used the same 7-point Likert scale (1 = *Strongly Disagree*, 7 = *Strongly Agree*), except for the teaching efficacy measure (TSES) because its authors recommend the use of a 9-point scale (Tschannen-Moran & Woolfolk Hoy, 2001). Teachers and students completed a professionally translated and back-translated Korean version of each measure (originally developed in English) that had been used in previous research (Cheon, Hwang et al., 2016; Cheon, Reeve, & Moon, 2012; Song, Kim, & Cheon, 2017).

**Student Perceptions of Teachers' Motivating Style.** To assess *perceived autonomy support*, students completed the 6-item Learning Climate Questionnaire (LCQ, "My PE teacher listens to how I would like to do things."; Williams & Deci, 1996), whose scores were reasonably internally consistent across the three waves of data collection (Cronbach's alpha coefficients: $\alpha s = 0.88$, 0.92, and 0.94) and whose baseline (T1) scores showed moderate between-teacher variability ($ICC = 0.09$). To assess *perceived structure*, students completed the 8-item Structure scale from the Teacher as Social Context Questionnaire (TASC; "My PE teacher makes sure I understand before he/she goes on"; Belmont et al., 1992; $\alpha s = 0.88$, 0.91, and 0.93; $ICC = 0.08$).

**Teachers' Self-Reported Motivating Style**. To assess self-reported motivating style, teachers completed the Situations in School (SIS) questionnaire (Aelterman et al., 2019). The SIS presents 15 common teaching situations as brief vignettes (e.g., "You want to establish classroom rules") accompanied by four response options to represent four different ways that a teacher might handle that teaching situation (i.e., autonomy supportive, structured, controlling, and chaotic). Teachers' scores on the 15 autonomy-supportive response options were averaged into a single score (e.g., "Offer a very interesting, highly engaging lesson"; $\alpha s = 0.83$, 0.90, and 0.92), and teacher scores on the 15 structure response options were similarly averaged into a single score (e.g., "Communicate which

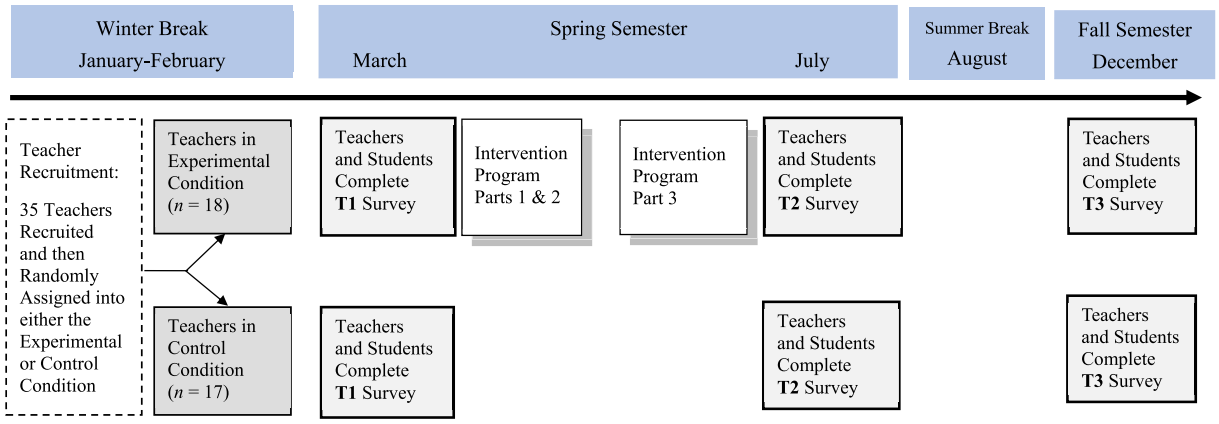


**Fig. 2.** Procedural timeline for the events included in the delivery of the intervention and data collection in Study 1.

learning goals you expect students to accomplish by the end of the lesson"; αs = 0.72, 0.69, and 0.75).[1]

**Teacher Benefits**. For teaching efficacy, teachers completed the Teachers' Sense of Efficacy Scale short form (TSES; Tschannen-Moran & Woolfolk Hoy, 2001), and we combined the four items on the Instructional Strategies scale with the four items on the Student Engagement scale into an overall 8-item score (e.g., "How much can you do to motivate students who show low interest in schoolwork?"; αs = 0.92, 0.94, and 0.95). For intrinsic instructional goals, teachers completed the Goal Content Questionnaire (GCQ; Sebire et al., 2008) and we combined the four items on the Skill Development scale with the four items on the Social Affiliation scale into an overall 8-item score ("My goal is to acquire new teaching skills to motivate my PE students"; αs = 0.77, 0.90, and 0.91). For harmonious passion, we used the 6-item Harmonious Passion scale (HP, Vallerand et al., 2003; "The new things that I discover while teaching PE allow me to appreciate it even more"; αs = 0.91, 0.94, and 0.94). For job satisfaction, we used the 4-item Job Satisfaction Scale for Teachers (JS, Caprara et al., 2003; "I am satisfied with my job as a PE teacher"; αs = 0.88, 0.86, and 0.92). For relationship satisfaction with students, we used the single item, "I have a good and satisfying relationship with my students."

### 2.1.3. Procedure

The study procedure was approved by the Institutional Review Board of the first author's home institution. The procedural timeline for the three-part intervention and the three waves of data collection appears in Fig. 2. In the Korean academic year, spring is the first semester while fall is the second semester, as the academic year runs from March through December. One month before the beginning of the school year, we contacted 35 PE teachers who worked in and around the Seoul metropolitan area to participate in a year-long study of the "classroom dynamics". During the recruitment, teachers knew that the study involved an intervention and that each teacher would be randomly assigned into either the experimental ($n = 18$) or control ($n = 17$) condition. For teachers in the experimental condition, we delivered the intervention in three parts (see next section). For teachers in the control condition, they taught their classes using their existing motivating styles to represent what constituted "practice as usual" for the teachers and students in these schools.

For the data collection, students completed the same four-page questionnaire three times, including the first week of the spring semester (Week 1, Time 1), the last week of the spring semester (Week 23, Time 2), and the last week of the fall semester (Week 47, Time 3). The survey began with a consent form, and it was administered at the beginning of the class period. Students completed the questionnaire in reference to that particular teacher and that particular class, and students were assured that their responses would be confidential and used only for the purposes of the research study.

### 2.1.4. Implementation of the intervention

The intervention featured three parts (see Fig. 2). Part 1 helped teachers learn how to support students' autonomy, Part 2 helped teachers learn how to provide structure and how to provide individual elements of structure in an autonomy-supportive way, while Part 3 was a group discussion to help teachers integrate the recommended instructional behaviors into an overall autonomy-supportive and structured motivating style. Excerpts from the intervention content appear in the Supplemental Materials.

Part 1 was a 3-h morning workshop that took place in the week before the academic year began. It introduced autonomy-supportive teaching and used professionally-created video clips to model and recommend the following autonomy-supportive instructional behaviors: take the students' perspective, present learning activities in a way that appreciates and supports students' autonomy, provide explanatory rationales, acknowledge and accept expressions of negative affect, and use invitational language. Teachers further received sample scripts of each instructional behavior paired with one-on-one coaching to help them learn how to implement each instructional behavior in their own class with their own students.

Part 2 was a 3-h afternoon workshop that took place on the same day as Part 1—following a lunch break. The workshop first introduced structured teaching, and it used professionally-created brief video clips to model and recommend the following structure-providing instructional behaviors: communicate clear expectations, offer step-by-step guidance, and provide feedback. Teachers received sample scripts for each recommended behavior along with one-on-one coaching. Once teachers were confident with the structure-providing instructional behaviors, they then

[1] We used teachers' self-reports and students' perceptions as two independent sources of information to evaluate the effectiveness of the intervention (i.e., manipulation checks). To test for the agreement between these two informants, we regressed teachers' mid-year (T2) self-reports on students' mid-year (T2) perceptions, using HLM analyses (Raudenbush et al., 2011). For autonomy support, teachers' self-reports ($M = 5.01$, $SD = 1.02$, $n = 35$, Level 2 predictor) significantly predicted (i.e., agreed with) students' perceptions ($M = 5.04$, $SD = 1.07$, $n = 1{,}072$, Level 1 outcome): $\beta = 0.21$, $SE = 0.07$, $t(33) = 3.17$, $p = .003$. For structure, teachers' self-reports ($M = 5.51$, $SD = 1.01$) also significantly predicted students' perceptions ($M = 5.34$, $SD = 1.04$): $\beta = 0.17$, $SE = 0.07$, $t(33) = 2.28$, $p = .029$.

learned how to provide each of those individual elements of structure in an autonomy-supportive way (recall Fig. 1), through modeling, practice, feedback, and discussion.

Part 3 was a 2-h peer-to-peer group discussion that took place during week 6. During the discussion, teachers reported on their early-semester classroom experiences of providing structure in an autonomy-supportive way and how their students reacted to the new approach to instruction. Teachers shared tips and suggestions to help each other become more able to provide each element of classroom structure in an autonomy-supportive way.

#### 2.1.5. Data analyses

We conducted a series of repeated measures analysis to test both H1 (experimental condition would predict teacher-reported autonomy support and structure) and H2 (experimental condition would predict the five teacher benefits). Experimental condition (control group = 0, experimental group = 1) served as the between-groups independent variable, time (wave) served as the within-groups repeated measure, and the critical hypothesis test was for a significant condition × time interaction (i.e., to test if longitudinal change in the dependent measure depended on experimental condition). To provide effect size information for each condition × time interaction, we report the eta squared ($\eta^2$) statistic, which can be interpreted as similar to the $R^2$ statistic (i.e., the percentage of the variance accounted for in the dependent measure by that predictor variable; Cohen, 1973; Levine & Hullett, 2002). For $\eta^2$, a value of 0.01 represents a small effect, a value of 0.06 represents a medium effect, while a value of 0.14 represents a large effect (Cohen, 1988).

H3 was a mediation hypothesis. To test for mediation—whether T2 autonomy support and T2 structure mediated the direct effect of experimental condition on each hypothesized T3 teacher benefit, we used the INDIRECT macro in SPSS to conduct bootstrapping analyses based on 1000 resamples (Preacher & Hayes, 2008).

Prior to the data collection, we considered whether our statistical tests were adequately powered. To do so, we calculated what the minimal sample size would be for a *F*-test-based multiple regression that used conventional statistics ($\alpha = 0.05$, power = 0.95) to detect the capacity of strong intervention effect ($d = 0.89$, based on the average $\beta = 0.40$ for the three teacher-focused outcomes included in Cheon, Reeve, Lee, & Lee's (2018), teacher intervention study). That minimal sample size would be 23, based on Faul, Erdfelder, Lang, and Buchner's (2007) G*Power 3 software program. Because our analyzed sample size was $N = 35$, we determined that our hypothesis tests were adequately powered.

### 2.2. Results

#### 2.2.1. Preliminary analyses

Missing data were rare (<0.1%), so we used the expectation-maximization (EM) algorithm to impute missing values. We also tested for possible associations between teachers' demographic characteristics (gender, grade level taught, years of teaching experience, and age) and all baseline measures, but none of these 28 associations were statistically significant.

Descriptive statistics for the student-reported and teacher-reported measures of autonomy support and structure and the five teacher benefits appear in Table 1 broken down by experimental condition and time of assessment. The right side of Table 1 also provides that statistical results from the hypothesis tests.

#### 2.2.2. Manipulation checks

For students' *perceived autonomy support*, the condition × time interaction was significant, $F(2, 66) = 13.76$, $p < .001$ ($\eta^2 = 0.14$), with perceived autonomy support increasing significantly more from T1 to T3 in the experimental condition ($\Delta = +0.72$, $t = 8.22$, $p < .001$) than it did in the control condition ($\Delta = +0.24$, $t = 2.71$, $p = .010$).

For students' *perceived structure*, the condition × time interaction was again significant, $F(2, 66) = 22.79$, $p < .001$ ($\eta^2 = 0.34$), with perceived structure increasing significantly from T1 to T3 in the experimental condition ($\Delta = +0.42$, $t = 5.17$, $p < .001$) while it remained unchanged in the control condition ($\Delta = -0.06$, $t = 0.66$, $p = .514$).

#### 2.2.3. Intervention effects on motivating styles and teacher benefits

**Hypothesis 1. Motivating Styles**. For teacher-reported *autonomy support*, the condition × time interaction was significant, $F(2, 66) = 33.11$, $p < .001$ ($\eta^2 = 0.28$), with autonomy support increasing significantly from T1 to T3 in the experimental condition ($\Delta = +1.60$, $t = 12.99$, $p < .001$) while it remained unchanged in the control condition ($\Delta = +0.21$, $t = 1.70$, $p = .099$).

For teacher-reported *structure*, the condition × time interaction was significant, $F(2, 66) = 16.55$, $p < .001$ ($\eta^2 = 0.25$), with structure increasing significantly in the experimental condition ($\Delta = +0.80$, $t = 6.42$, $p < .001$) while it remained unchanged in the control condition ($\Delta = +0.02$, $t = 0.12$, $p = .907$).

**Hypothesis 2. Teacher Benefits.** As can be seen in Table 1, the condition × time interaction was significant across all five hypothesized teacher benefits and with large effect sizes: *teaching efficacy* ($\eta^2 = 0.24$); *intrinsic instructional goals* ($\eta^2 = 0.19$); *harmonious passion* ($\eta^2 = 0.24$); *job satisfaction* ($\eta^2 = 0.15$); and *relationship satisfaction with students* ($\eta^2 = 0.15$). For teachers in the experimental condition, all five teacher benefits increased from T1 to T3: teaching efficacy ($\Delta = +1.40$, $t = 6.14$, $p < .001$); intrinsic goals ($\Delta = +0.71$, $t = 5.30$, $p < .001$); harmonious passion ($\Delta = +1.07$, $t = 6.57$, $p < .001$); job satisfaction ($\Delta = +1.06$, $t = 4.95$, $p < .001$); and relationship satisfaction ($\Delta = +0.89$, $t = 3.80$, $p < .001$). For teachers in the no-intervention control condition, all five teacher benefits remained statistically unchanged from T1 to T3: teaching efficacy ($\Delta = -0.18$, $t = 0.75$, $p = .457$); intrinsic goals ($\Delta = -0.09$, $t = 0.66$, $p = .514$); harmonious passion ($\Delta = -0.26$, $t = 1.60$, $p = .118$); job satisfaction ($\Delta = +0.09$, $t = 0.37$, $p = .716$); and relationship satisfaction ($\Delta = -0.29$, $t = 1.22$, $p = .231$).

**Hypothesis 3. Mediation Effects.** For the intervention effect on T3 *teaching efficacy*, the indirect path through T2 autonomy support was significant ($\beta = .66$, $SE = .30$, $p = .038$) and the bias-corrected 95% confidence interval (CI) did not include zero (.04, 1.28) to confirm mediation, while the indirect path through T2 structure was not significant ($\beta = .19$, $SE = .42$, $p = .645$) and the bias-corrected CI did include zero (−.66, 1.04) to disconfirm mediation. For the intervention effect on T3 *intrinsic instructional goals*, the indirect path through T2 autonomy support was significant ($\beta = .53$, $SE = .16$, $p = .003$) and the bias-corrected CI did not include zero (.20, .86) to confirm mediation, while the indirect path through T2 structure was not significant ($\beta = .21$, $SE = .22$, $p = .356$) and the bias-corrected CI did include zero (−.24, .66) to disconfirm mediation. For the intervention effect on T3 *harmonious passion*, the indirect path through T2 autonomy support was significant ($\beta = .50$, $SE = .22$, $p = .034$) and the bias-corrected CI did not include zero (.04, .95) to confirm mediation, while the indirect path through T2 structure was not significant ($\beta = -.01$, $SE = .30$, $p = .975$) and the bias-corrected CI did include zero (−.63, .61) to disconfirm mediation. For the intervention effect on T3 *job satisfaction*, the indirect path through T2 autonomy support was only marginally significant ($\beta = .53$, $SE = .29$, $p = .080$) and the bias-corrected CI did include zero (−.07, 1.13) to disconfirm mediation,

**Table 1**
Descriptive Statistics for the Nine Dependent Measures Broken Down by Experimental Condition and Time of Assessment together with the Condition, Time, and Condition x Time Effects (Study 1).

| Dependent Measure | | Intervention Group ($n = 18$) | | | Control Group ($n = 17$) | | | *Condition Main Effect* | *Time Main Effect* | *Condition × Time Interaction* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | T1 | T2 | T3 | T1 | T2 | T3 | $F(1, 33)$ $\eta^2$ | $F(2, 66)$ $\eta^2$ | $F(2, 66)$ $\eta^2$ |
| **Manipulation Checks** | | | | | | | | | | |
| Student Perceived Autonomy Support | *M* (*SD*) | 4.61 (0.28) | 5.20 (0.40) | 5.33 (0.40) | 4.69 (0.39) | 4.86 (0.41) | 4.93 (0.41) | 3.56 .10 | 53.92** .53 | 13.76** .14 |
| Student Perceived Structure | *M* (*SD*) | 5.15 (0.23) | 5.55 (0.32) | 5.58 (0.36) | 5.20 (0.37) | 5.09 (0.46) | 5.15 (0.42) | 6.07* .15 | 10.38** .16 | 22.79** .34 |
| **Motivating Style** | | | | | | | | | | |
| Teacher-Reported Autonomy Support | *M* (*SD*) | 4.62 (0.52) | 5.91 (0.61) | 6.22 (0.40) | 4.92 (0.62) | 5.02 (0.63) | 5.14 (0.55) | 12.65** .28 | 53.35** .45 | 33.11** .28 |
| Teacher-Reported Structure | *M* (*SD*) | 4.96 (0.44) | 5.61 (0.46) | 5.76 (0.37) | 5.28 (0.62) | 5.26 (0.52) | 5.30 (0.63) | 1.18 .03 | 16.50** .25 | 16.55** .25 |
| **Teacher Benefits** | | | | | | | | | | |
| Teaching Efficacy | *M* (*SD*) | 5.84 (0.96) | 6.64 (1.02) | 7.24 (0.87) | 5.88 (1.12) | 5.48 (1.20) | 5.70 (0.91) | 9.35** .22 | 7.50** .14 | 13.09** .24 |
| Intrinsic Goals | *M* (*SD*) | 5.36 (0.68) | 5.90 (0.64) | 6.07 (0.55) | 5.47 (0.53) | 5.31 (0.50) | 5.38 (0.50) | 6.58* .17 | 4.41* .10 | 8.72** .19 |
| Harmonious Passion | *M* (*SD*) | 5.22 (0.79) | 6.11 (0.90) | 6.29 (0.64) | 5.49 (0.73) | 5.42 (0.61) | 5.23 (0.59) | 7.24* .18 | 5.71** .11 | 12.27** .24 |
| Job Satisfaction | *M* (*SD*) | 4.74 (0.85) | 5.60 (0.81) | 5.79 (0.81) | 4.94 (1.19) | 4.76 (0.72) | 5.03 (0.75) | 3.86 .10 | 7.23** .15 | 7.34** .15 |
| Relationship Satisfaction | *M* (*SD*) | 5.39 (1.09) | 5.94 (0.73) | 6.28 (1.07) | 5.53 (1.01) | 5.24 (1.09) | 5.24 (0.75) | 4.35* .12 | 1.43 .04 | 6.00** .15 |

*$p < .05$. **$p < .01$. Possible range for all dependent measures, 1–7, except for teaching efficacy, 1–9. $\eta^2$ = eta squared.

while the indirect path through T2 structure was not significant ($\beta = .01$, $SE = .40$, $p = .972$) and the bias-corrected CI did include zero (−.80, .83) to disconfirm mediation. For the intervention effect on T3 *relationship satisfaction with students*, the indirect path through T2 autonomy support was not significant ($\beta = .18$, $SE = .35$, $p = .614$) and the bias-corrected CI did include zero (−.54, .89) to disconfirm mediation, while the indirect path through T2 structure was significant ($\beta = .99$, $SE = .47$, $p = .044$) and the bias-corrected CI did not include zero (.03, 1.96) to confirm mediation.

### 2.3. Discussion

By participating in the intervention, teachers learned how to support students' autonomy, provide competence-supportive classroom structure, and provide these elements of structure in an autonomy-supportive way. This upgrade in the quality of their classroom motivating style allowed teachers in the experimental group to show notable year-end benefits in their teaching effectiveness (teaching efficacy, intrinsic goals), well-being (harmonious passion, job satisfaction), and relationship satisfaction with their students. The mediation analyses showed that the catalyst to the year-end gains in teaching effectiveness and well-being was an intervention-enabled boost in their autonomy-supportive teaching, while the catalyst to the year-end gains in relationship satisfaction was an intervention-enabled boost in their structured teaching. The confidence intervals around the parameter estimates (i.e., unstandardized coefficients) in these mediation analyses were rather large, and this was because the sample size of 35 teachers was small (and hence the standard errors used in the confidence intervals were large).

## 3. Study 2: student benefits

The purpose of Study 2 was to test the capacity of teacher participation in the intervention to generate important student benefits. The sequence of the three proposed hypotheses was similar to the sequence presented in Study 1. *Hypothesis 1* was that students of teachers who were randomly assigned to the intervention, compared to students of teachers in the no-intervention control, would experience greater autonomy and competence need satisfaction. *Hypothesis 2* was that students of teachers who participated in the intervention would report longitudinal gains in four student benefits—namely, (1) classroom engagement, (2) skill development, (3) anticipated course performance, and (4) future intentions to exercise. *Hypothesis 3* proposed a mediation-based model in which students' greater T3 autonomy and competence satisfaction would explain the hypothesized year-end gains in each of the four T4 student benefits.

### 3.1. Method

#### 3.1.1. Participants and missing data

**Teacher-Participants**. Teacher-participants were 46 full-time, ethnic Korean, certified physical education (PE) teachers (29 males, 17 females) who taught in 46 different secondary-grade schools in the Seoul, South Korea metropolitan area (35 middle schools, 11 high schools). Teachers averaged 7.6 years of PE teaching

experience ($SD = 4.9$, *range* = 1–19) and 34.1 years of age ($SD = 5.8$, *range* = 25–47). Each teacher completed all aspects of the study, except that the raters were unable to observe two teachers' in-class instructional behavior. In appreciation for their participation, each teacher-participant received the equivalent of $50. This monetary compensation was given at the end of the academic year (i.e., it was offered as an "unexpected reward"), and it was framed as an expression of appreciation for the extra time teachers gave to complete all aspects of the study.

**Student-Participants**. Student-participants were 3123 Korean secondary grade students. Students were on average 14.7 years old ($SD = 1.3$, *range* = 13–18). Of these, 2745 (87.9%) provided complete data across the four waves of data collection. The remaining 378 (12.1%) students were missing some data (i.e., a wave of data or a missing value). These data were missing at random, according to Little's MCAR, $X^2$ ($df = 9208$) = 797.98, $p = .999$. Given this, we used the expectation-maximization algorithm to impute the missing cases and values. By doing so, we were able to analyze the full sample, including 1698 (54.4%) males and 1425 females (45.6%), 2355 middle (75.4%) and 768 high (24.6%) school students, and 1624 (52.0%) in the experimental and 1499 (48.0%) in the control condition.

### 3.1.2. Measures

**Students' Perceptions of their Teachers' Motivating Style.** To assess *perceived autonomy support*, students completed the same 6-item Learning Climate Questionnaire used in Study 1 (Cronbach's alpha coefficients: $as = 0.88$, 0.93, 0.94, and 0.94) and whose baseline (T1) scores showed moderate between-teacher variability ($ICC = 0.09$). To assess *perceived structure*, students completed the 5-item Structure scale from the Teacher Rating Scale (TRS; Reeve, Jang, Carrell, Jeon, & Barch, 2004; "My PE teacher provides me with very helpful feedback"; $as = 0.86$, 0.91, 0.93, and 0.93; $ICC = 0.11$) that has been used in past studies (Aelterman et al., 2019).

**Need Satisfaction**. For *autonomy need satisfaction*, students completed the 5-item Perceived Autonomy Scale ("In this PE class, I feel that I do activities because I want to"; Standage, Duda, & Ntoumanis, 2006; $as = 0.86$, 0.92, 0.93, and 0.93; $ICC = 0.06$). For competence need satisfaction, students completed the 4-item Perceived Competence Scale from the Intrinsic Motivation Inventory ("I think I am pretty good at physical education"; McAuley, Duncan, & Tammen, 1989; $as = 0.89$, 0.91, 0.91, and 0.92; $ICC = 0.04$).

**Engagement**. We assessed students' classroom engagement as a multidimensional construct assessing behavior, emotion, cognition, and agency (Jang et al., 2016). To assess behavioral and emotional engagement, students completed the 5-item behavioral engagement scale ("In this PE class, I work as hard as I can"; $as = 0.92$, 0.95., 0.96, and 0.96) and the 5-item emotional engagement scale ("When I'm in this PE class, I feel good"; $as = 0.93$, 0.95, 0.96, and 0.96) from the Engagement vs. Disaffection with Learning measure (Skinner, Kindermann, & Furrer, 2009). To assess cognitive engagement, students completed the Metacognitive Strategies Questionnaire (Wolters, 2004; "When doing work for this PE class, I try to relate what I'm learning to what I already know"; $as = 0.89$, 0.93, 0.94, and 0.95). To assess agentic engagement, students completed the 5-item agentic engagement scale (Reeve, 2013; "I let my PE teacher know what I need and want"; $as = 0.92$, 0.95, 0.96, and 0.96). Because the engagement scales were positively intercorrelated (4-scale $\alpha s = 0.90$, 0.94, 0.95, and 0.95), we averaged the four engagement scores at each wave of data collection into an overall engagement score ($ICC = 0.06$).

**Skill Development**. To assess students' perception that they were developing sport and exercise skills during the PE course, students completed the 4-item Skill Development in PE scale (SDPE; Cheon et al., 2012; "I improved my sport and exercise skills in this PE course"); "I learn something new almost every day in this PE course; $as = 0.92$, 0.95, 0.96, and 0.96; $ICC = 0.07$).

**Future Intentions to Exercise**. To assess future intentions toward exercise, students completed a 3-item measure used previously by multiple researchers in the PE domain (Chatzisarantis, Biddle, & Meek, 1997; Ntoumanis, 2005; Taylor, Ntoumanis, Standage, & Spray, 2010). Students completed the 3-item scale ["In the future, I intend to make sports and physical activity a part of my life"; "I do not intend to engage in physical activity or sport after I have graduated from school" (reverse scored); $as = 0.82$, 0.86, 0.88, and 0.88; $ICC = 0.05$].

**Anticipated PE Performance**. To assess anticipated performance in the PE course, we used Jeon's (2004) single item, "In this PE class, I expect that my course grade will be ___ points (enter a number between 0 and 100)." ($ICC = 0.06$), which has been used in prior longitudinal research (Jang, Kim, & Reeve, 2012).

**Observers' Rating Sheets**. Before the data collection, a team of four undergraduate and graduate students who were familiar with self-determination theory, teachers' motivating styles, and Korean PE classrooms, received training and practice with rating sheets adapted from previous studies (Cheon, Reeve, & Ntoumanis, 2018). Raters worked in pairs to score teachers' in-class autonomy support and structure, using a 1–7 unipolar scale (1 = *not at all*, 7 = *very much*) for each rating. The two observers rated the following four *autonomy-supportive instructional behaviors* in a consistent way: takes the students' perspective, $ICC = 0.77$; offers learning activities in ways that appreciate and support students' autonomy, $ICC = 0.76$; uses invitational language, $ICC = 0.73$; tries to understand negative emotion and behavior, $ICC = 0.78$. We averaged the two observers' correlated ratings into a single score for each behavior and then averaged these four scores into one overall score (4-items, $\alpha = 0.94$). The two observers also rated the following three *structured instructional behaviors* in a consistent way: clear expectations, $ICC = 0.62$; how-to guidance, $ICC = 0.72$; and constructive feedback, $ICC = 0.70$. We averaged the two observers' correlated ratings into a single score for each behavior and then averaged these three scores into one overall score (3-items, $\alpha = 0.76$).

### 3.1.3. Procedure

As in Study 1, we again recruited PE teachers to participate in a study of "classroom dynamics." Teachers were then randomly assigned into either the experimental ($n = 24$) or control ($n = 22$) condition. The procedural timeline for the year-long intervention and the four waves of data collection appear in Fig. 3. The design and implementation of the intervention was the same as that used in Study 1.

For the data collection, students completed the same four-page questionnaire across four waves, including the first week of the spring semester (Week 1, Time 1), midway through the spring semester (Week 10, Time 2), the last week of the spring semester (Week 23, Time 3), and the last week of the fall semester (Week 47, Time 4). The survey began with a consent form and was administered at the beginning of the class period; students completed the questionnaire in reference to that particular teacher and class; and students were assured that their responses would be confidential and used only for research purposes.

A pair of trained raters visited each classroom halfway through the spring semester (during week 10–14, see Fig. 3) to score objectively each teacher's in-class autonomy-supportive and structured instructional behaviors. Raters gained teachers' permission in advance, came to the class unannounced 5–10 min before its start, did not know into which group (experimental or

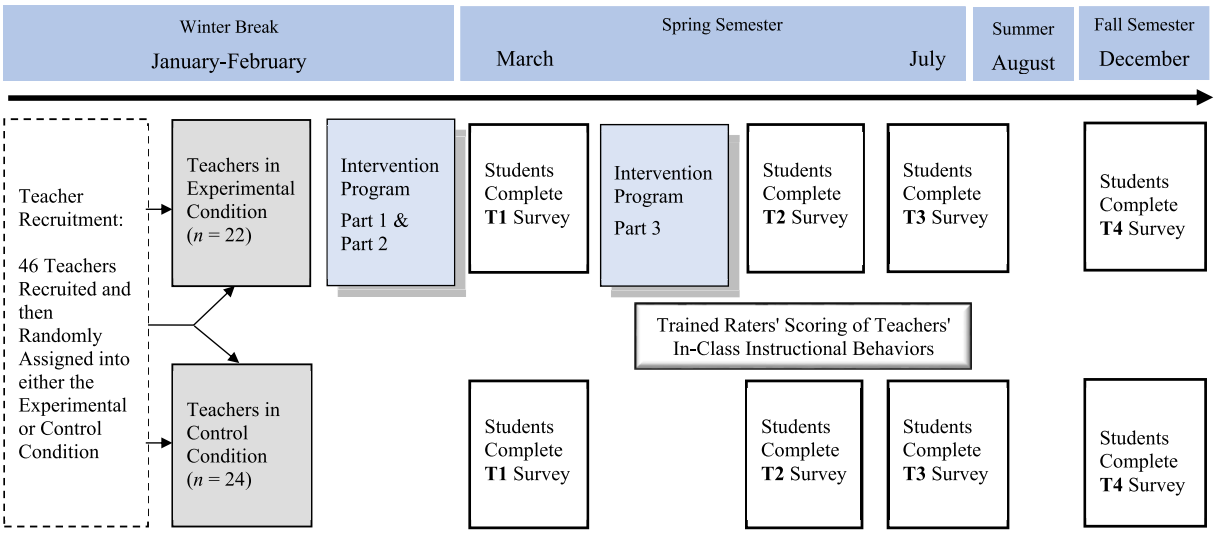


**Fig. 3.** Procedural timeline for the events included in the delivery of the intervention and data collection in Study 2.

control) the observed teacher had been randomly assigned, and made independent ratings.

### 3.1.4. Data analysis

To test the manipulation checks, we conducted a pair of t-tests to determine the intervention's effect on both rater-scored autonomy support and rater-scored structure.

To test both H1 (experimental condition predicts student-reported autonomy and competence satisfaction) and H2 (experimental condition predicts the five student benefits), we conducted multi-level repeated measures analyses using hierarchical linear modeling (HLM software; Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011), because the student data had a 3-level hierarchical (i.e., multilevel) structure with repeated measures (Level 1, 4-waves) nested within students (Level 2, $N = 3123$) nested within teachers (Level 3, $k = 46$). At level 1 (within student), the longitudinal data allowed us to measure students' increase or decrease on each dependent measure over the academic year. Accordingly, we entered "time" as a within-groups repeated measures independent variable (scored as 0, 1, 2, 3). At level 2 (between students), we entered gender and grade level to function as a pair of group mean centered covariates. At level 3 (between teachers), we entered experimental condition as an un-centered between-groups independent variable (control group = 0, experimental group = 1). Finally, and most importantly, we created the hypothesis-testing condition × time interaction term as a cross-level predictor (experimental condition was a level 3 predictor, time was a level 1 predictor) to test the extent to which the year-long changes in each dependent measure depended on experimental condition. To provide effect size information for these interaction effects, we used the independent-groups pretest-posttest design test ($d_{\text{IGPP-CHANGE}}$) that is appropriate for multilevel, repeated-measures group comparisons to determine the magnitude of the change in the dependent variable in the intervention group relative to the magnitude of the change in the control group (Feingold, 2009).

H3 was a mediation hypothesis (i.e., autonomy and competence satisfaction would both mediate the direct effect of experimental condition on each student benefit). The typical procedure to test for such mediation effects is to use resampling methods to generate bias-corrected confidence intervals (as done in Study 1), but this conventional bootstrapping method cannot be applied to multilevel modeling, because the assumption of independence of observations is violated when using nested or clustered data (Preacher & Selig, 2012). Accordingly, we utilized a Monte Carlo approach to resampling that allowed us to construct the appropriate confidence intervals (CI) necessary to test for the significance of the eight possible indirect effects (2 mediators to predict the 4 student benefits). To do so, we used Selig and Preacher's (2008) web-based utility (http://quantpsy.org/medmc/medmc.htm) to generate and run R code for simulating the sampling distribution of each indirect effect (20,000 values). If the 95% CI from this simulation excludes zero, then the indirect effect test is significant ($p < .05$).

## 3.2. Results

### 3.2.1. Preliminary analyses

Values for skewness and kurtosis for the 32 dependent measures (8 measures *x* 4 waves; see Table 2) were all less than |1.20|, indicating little deviation from normality, except for the T1-T4 "anticipated PE performance" scores which were relatively high in kurtosis (*range* = 2.6 to 4.9). Given these kurtosis values, we transformed the four performance scores into five equal *n* groups (i.e., 1 = lowest 20% of scores, 2 = low, 3 = medium, 4 = high, and 5 = highest 20% of scores), which reduced the kurtosis values of all four scores to less than |1.28|. We also explored for associations between students' demographic characteristics (gender, grade level) with their baseline scores on each dependent measure. Male and female students differed significantly on 6 of the 8 baseline measures, while middle and high school students differed significantly on 4 of the 8 baseline measures. Given these associations, we included gender (females = 0; males = 1) and grade level (middle school = 0; high school = 1) as covariates (statistical controls) in all subsequent analyses.

Descriptive statistics for the two manipulation checks, two psychological needs, and four student benefits appear in Table 2 broken down by experimental condition and time of assessment. The right side of Table 2 also provides that statistical results from the hypothesis tests.

### 3.2.2. Manipulation checks

To evaluate whether the intervention increased both autonomy-

**Table 2**
Descriptive Statistics for the Eight Student-reported Dependent Measures Broken Down by Experimental Condition and Time of Assessment together with the Condition, Time, and Condition x Time Effects (Study 2).

| Dependent Measure | | Intervention Group ($n = 1624$) | | | | Control Group ($n = 1499$) | | | | *Condition Main Effect* | *Time Main Effect* | *Condition × Time Interaction* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | T1 | T2 | T3 | T4 | T1 | T2 | T3 | T4 | $t(44)$ | $t(3,075)$ | $t(9,321)$ $d_{\text{IGPP-CHANGE}}$ |
| **Motivating Style** | | | | | | | | | | | | |
| Autonomy Support | *M* | 4.58 | 5.49 | 5.60 | 5.68 | 4.62 | 4.83 | 4.85 | 4.79 | 2.31* | 6.32** | 25.13** |
| | (*SD*) | (0.82) | (1.04) | (1.06) | (1.06) | (0.88) | (0.97) | (1.03) | (0.94) | | | 1.15 |
| Structure | *M* | 4.71 | 5.54 | 5.64 | 5.72 | 4.75 | 4.96 | 4.95 | 4.92 | 2.16* | 5.92** | 22.83** |
| | (*SD*) | (0.85) | (1.04) | (1.09) | (1.06) | (0.90) | (0.95) | (0.99) | (0.95) | | | 1.00 |
| **Psychological Needs** | | | | | | | | | | | | |
| Autonomy Satisfaction | *M* | 4.67 | 5.44 | 5.55 | 5.67 | 4.69 | 5.03 | 5.00 | 5.00 | 2.16* | 10.79** | 18.72** |
| | (*SD*) | (0.98) | (1.08) | (1.11) | (1.07) | (1.01) | (1.14) | (1.11) | (1.09) | | | 0.71 |
| Competence Satisfaction | *M* | 4.11 | 5.02 | 5.14 | 5.30 | 4.16 | 4.52 | 4.56 | 4.60 | 2.07* | 15.09** | 17.88** |
| | (*SD*) | (1.20) | (1.27) | (1.28) | (1.23) | (1.19) | (1.25) | (1.22) | (1.15) | | | 0.65 |
| **Student Benefits** | | | | | | | | | | | | |
| Classroom Engagement | *M* | 4.90 | 5.63 | 5.69 | 5.76 | 4.91 | 5.17 | 5.13 | 5.12 | 1.76 | 7.38** | 19.69** |
| | (*SD*) | (0.90) | (1.02) | (1.06) | (1.03) | (0.97) | (1.01) | (1.03) | (1.00) | | | 0.74 |
| Skill Development | *M* | 4.63 | 5.59 | 5.68 | 5.73 | 4.62 | 5.03 | 5.09 | 5.03 | 1.00 | 13.98** | 16.15** |
| | (*SD*) | (1.01) | (1.09) | (1.11) | (1.11) | (1.07) | (1.12) | (1.10) | (1.06) | | | 0.71 |
| Anticipated PE Performance | *M* | 2.41 | 2.76 | 2.92 | 3.13 | 2.65 | 2.65 | 2.66 | 2.74 | 3.18* | 3.03* | 15.27** |
| | (*SD*) | (1.20) | (1.36) | (1.39) | (1.44) | (1.28) | (1.30) | (1.33) | (1.37) | | | 0.64 |
| Future Intentions to Exercise | *M* | 5.06 | 5.69 | 5.75 | 5.87 | 5.06 | 5.28 | 5.23 | 5.26 | 1.66 | 5.87** | 15.21** |
| | (*SD*) | (1.11) | (1.16) | (1.18) | (1.11) | (1.20) | (1.18) | (1.19) | (1.20) | | | 0.56 |

*$p < .05$. **$p < .001$. Possible range for all dependent measures, 1–7, except for anticipated PE course achievement, 1–5.

supportive and structured teaching, we used both observers' ratings and students' perceptions.[2] Observers scored PE teachers in the experimental group, relative to those in the control group, higher on both *rated autonomy support* (*M*s, 5.34 *vs*. 4.51), $t(42) = 5.57$, $p < .001$, $d = 1.68$, and *rated structure* (*M*s, 5.53 *vs*. 5.22), $t(42) = 2.27$, $p = .028$, $d = 0.68$.

For students' *perceived autonomy support*, the condition × time interaction was significant, $t(9,321) = 25.13$, $p < .001$ ($d_{\text{IGPP-CHANGE}} = 1.15$), as perceived autonomy support increased more from T1 to T4 for students in the experimental condition ($\Delta = +1.10$, $t = 47.83$, $p < .001$) than it did for students in the control condition ($\Delta = +0.17$, $t = 7.08$, $p < .001$).

For students' *perceived structure*, the condition × time interaction was significant, $t(9,321) = 22.83$, $p < .001$ ($d_{\text{IGPP-CHANGE}} = 1.00$), as perceived structure increased more from T1 to T4 for students in the experimental condition ($\Delta = +1.01$, $t = 42.98$, $p < .001$) than it did for students in the control condition ($\Delta = +0.17$, $t = 6.94$, $p < .001$).

### 3.2.3. Intervention effects on psychological needs and student benefits

**Hypothesis 1. Psychological Needs.** For *autonomy need satisfaction*, the condition × time interaction was significant, $t(9,321) = 18.72$, $p < .001$ ($d_{\text{IGPP-CHANGE}} = 0.71$), as autonomy satisfaction increased more from T1 to T4 for students in the experimental condition ($\Delta = +1.00$, $t = 38.50$, $p < .001$) than it did for students in the control condition ($\Delta = +0.32$, $t = 11.74$, $p < .001$).

For *competence need satisfaction*, the condition × time interaction was significant, $t(9,321) = 17.88$, $p < .001$ ($d_{\text{IGPP-CHANGE}} = 0.65$), as competence satisfaction increased more from T1 to T4 for students in the experimental condition ($\Delta = +1.19$, $t = 40.93$, $p < .001$) than it did for students in the control condition ($\Delta = +0.44$, $t = 14.87$, $p < .001$).

**Hypothesis 2. Student Benefits**. As can be seen in Table 2, the condition × time interaction was significant across all four hypothesized student benefits and with large effect sizes: *classroom engagement* ($d_{\text{IGPP-CHANGE}} = 0.74$); *skill development* ($d_{\text{IGPP-CHANGE}} = 0.71$); *anticipated PE performance* ($d_{\text{IGPP-CHANGE}} = 0.64$); and *future intentions to exercise* ($d_{\text{IGPP-CHANGE}} = 0.56$). For the students of teachers in the experimental condition, all four student benefits increased from T1 to T4: classroom engagement ($\Delta = +1.19$, $t = 35.83$, $p < .001$); skill development ($\Delta = +1.10$, $t = 41.51$, $p < .001$); anticipated PE performance ($\Delta = +0.72$, $t = 21.70$, $p < .001$); and future intentions to exercise ($\Delta = +0.81$, $t = 28.28$, $p < .001$). For students of teachers in the no-intervention control condition, all four student benefits also increased from T1 to T4 albeit at a slower pace than for the students of teachers in the experimental condition: classroom engagement ($\Delta = +0.44$, $t = 14.87$, $p < .001$); skill development ($\Delta = +0.41$, $t = 14.91$, $p < .001$); anticipated PE performance ($\Delta = +0.09$, $t = 2.50$, $p = .006$); and future intentions to exercise ($\Delta = +0.20$, $t = 6.63$, $p < .001$).

[2] We used observers' ratings and students' perceptions as two independent sources of information to evaluate the effectiveness of the intervention (i.e., manipulation checks). To test for the agreement between these two informants, we regressed observers' ratings on students' perceptions using HLM analyses. For autonomy support, observers' ratings scored at the teacher level ($M = 4.96$, $SD = 0.64$, Level 2 predictor) significantly predicted (i.e., agreed with) students' perceptions scored at the student level ($M = 5.17$, $SD = 1.06$, Level 1 outcome): $\beta = 0.48$, $SE = 0.07$, $t(42) = 6.56$, $p < .001$. For structure, observers' ratings ($M = 5.39$, $SD = 0.47$) also significantly predicted students' perceptions ($M = 5.26$, $SD = 1.04$): $\beta = 0.39$, $SE = 0.06$, $t(42) = 6.20$, $p < .001$.

**Hypothesis 3. Mediation Effects**. For the intervention effect on T4 classroom engagement, the indirect path through T3 autonomy satisfaction was significant ($\beta = .42$, $SE = .02$, $p < .001$) and the 95% confidence interval (95% CI) to test for mediation did not include zero (.15, .30) to confirm mediation, and the indirect path through T3 competence satisfaction was also significant ($\beta = .13$, $SE = .02$, $p < .001$) and its 95% CI also did not include zero (.05, .11). For the intervention effect on T4 perceived skill development, the indirect path through T3 autonomy satisfaction was significant ($\beta = .44$, $SE = .02$, $p < .001$) and the CI to test for mediation did not include zero (.16, .31) to confirm mediation, and the indirect path through T3 competence satisfaction was also significant ($\beta = .09$, $SE = .02$, $p < .001$) and its CI also did not include zero (.03, .09). For the intervention effect on T4 anticipated PE performance, the indirect path through T3 autonomy satisfaction was significant ($\beta = .15$, $SE = .03$, $p < .001$) and the 95% CI to test for mediation did not include zero (.04, .13) to confirm mediation, and the indirect path through T3 competence satisfaction was also significant ($\beta = .25$, $SE = .03$, $p < .001$) and the CI did not include zero (.10, .21) to confirm mediation. For the intervention effect on T4 future intentions to exercise, the indirect path through T3 autonomy satisfaction was significant ($\beta = .30$, $SE = .03$, $p < .001$) and the CI to test for mediation did not include zero (.11, .22) to confirm mediation, and the indirect path through T3 competence satisfaction was also significant ($\beta = .19$, $SE = .02$, $p < .001$) and the CI did not include zero (.08, .16) to confirm mediation.

### 3.3. Discussion

As in Study 1, teachers who participated in the intervention learned how to support autonomy, provide competence-supportive structure, and provide that structure in an autonomy-supportive way. Just as teachers showed post-intervention benefits in Study 1, their students showed post-intervention benefits in Study 2. This upgrade in the quality of their classroom motivating style allowed teachers in the experimental group to provide need-supportive instruction that enabled notable year-end student benefits in terms of classroom engagement, skill development, anticipated course performance, and future intentions toward exercise. The mediation analyses showed that the intervention-enabled boosts in both autonomy and competence satisfaction functioned as twin catalysts to the year-end gains in all four student benefits.

## 4. General discussion

Formal intervention programs have been developed to help teachers learn how to become both more autonomy supportive (Cheon, Reeve et al., 2016; Cheon, Reeve, & Ntoumanis, 2018) and more structured (Aelterman, Vansteenkiste, Van den Berghe, & De Meyer, 2014; Tessier, Sarrazin, & Ntoumanis, 2010). The present investigation went one step further by using self-determination theory principles (Ryan & Deci, 2017) to develop and implement a new intervention to help teachers learn how to support autonomy, provide structure, and provide those elements of classroom structure in an autonomy-supportive way. Across both studies, manipulation checks (teacher reports, student reports, observer ratings) confirmed the intervention's effectiveness. This upgraded motivating style enabled important educational benefits for both teachers (Study 1) and their students (Study 2).

### 4.1. Teachers' upgraded motivating style

In developing the intervention, our strategy was first to help teachers learn how to become more autonomy supportive, second to help teachers learn how to become more structured in their instruction, and finally to integrate these two motivating styles into a coherent overall motivating style in which they were able to offer the individual elements of classroom structure in an autonomy-supportive way. By integrating the two motivating styles, teachers were able to teach in a way that supported their students' psychological needs, and also in a way that avoided controlling (i.e., structure without autonomy support) and permissive (i.e., autonomy support without structure) instruction.

This integration of autonomy-supportive and structured teaching represents an ideal motivating style, a claim that can be supported by the large and educationally-important benefits it was able to generate. Though teachers learned how to support autonomy, provide structure, and provide structure in an autonomy-supportive way, it was the intervention-enabled growth in their capacity to teach in an autonomy-supportive way that specifically allowed teachers to (1) gain the confidence they needed to know that they could promote their students' motivation and engagement (teaching efficacy; Cheon, Reeve, Lee et al., 2018), (2) walk into their classrooms with explicit purposes such as to increase their teaching skill (i.e., an intrinsic instructional goal; Sebire et al., 2008), (3) come to see teaching as a "beloved activity" (harmonious passion; Carbonneau & Vallerand, 2013, p. 744), and (4) find teaching to be a more personally satisfying vocation (i.e., job satisfaction). Similarly, the intervention-enabled growth in their capacity to teach in a structured way specifically allow teachers to (5) develop a more satisfying relationship with their students.

Teachers' greater motivating style skill also benefited their students. Student of the teachers in the intervention experienced greater autonomy and competence need satisfaction during instruction. It was this intervention-enabled (i.e., teacher-enabled) boost in students' autonomy and competence need satisfaction that allowed these students to become more engaged during learning activities, develop greater sport and exercise skill, improve their course performance, and develop future intentions toward greater exercise. It is worth emphasizing that teachers were able to promote both greater autonomy and greater competence, because these two motivational satisfactions generally contribute independent (i.e., additive) positive effects of indicators of students' positive functioning and well-being (De Muynck et al., 2017).

Across both studies, teachers in the control condition were fairly high functioning. They reported motivating style scores around 5.0 (on a 1–7 scale; see Tables 1 and 2) and scores in the 5.0 to 5.5 range (see Table 1) on the measures of teaching effectiveness, well-being, and relationship satisfaction. As the academic year progressed, these teachers maintained relatively stable and high level of functioning across all the measures of motivating style and teacher benefits. Teachers randomly assigned to participate in the intervention program (i.e., the experimental condition) similarly showed high functioning baseline (T1) scores across all measures (i.e., motivating style, teaching effectiveness, teaching well-being, and relationship satisfaction). As the academic year progressed, these teachers showed a consistent rise across all aspects of their teaching. The observed effect sizes of these longitudinal gains in motivating style and benefits were large, as judged by values of .25 for $\eta^2$ (see last column in Table 1) and 1.00 for $d$ (see last column in Table 2) (Cohen, 1988, 1992). A large effect size represents "an effect that is visible to the naked eye" (Cohen, 1992, p. 156). So, overall, teachers in the experimental-intervention condition upgraded the quality of their classroom motivating style, experienced teacher benefits, and generated student benefits that were both obvious ("visible to the naked eye") and rather remarkable (given the high

functioning observed in the comparison teachers from the control group).

### 4.2. Limitations

The most pressing limitation of the investigation was that the research design utilized across both studies did not include either an "autonomy supportive only" or a "structure only" intervention (experimental) condition. Instead, we compared the new intervention only to standard practice (control group). We acknowledge that a research design comparing the new intervention against either or both an autonomy-supportive only intervention or a structure only intervention could produce useful data, but we chose our 2-group research design for two primary reasons. First, we wanted to include a sufficient sample size of teachers in each condition. Second, we did not include a "structure only" condition for the reason identified earlier—namely, we do not actually recommend such an intervention because our interpretation of this literature is that teacher-provided structure needs to be presented in an autonomy-supportive way before it produces its benefits. Another limitation was that all the measures used to document the teacher and student benefits were self-report. Our investigation could be made methodologically stronger with the addition of objective ratings of both teacher and student benefits (though both studies did include objective measures of teachers' autonomy-supportive and structured motivating styles).

## 5. Conclusion

Overall, two conclusions emerged. First, in both studies, teachers were able to meaningfully upgrade the quality of their classroom motivating style. Second, once teachers learned how to provide structure in an autonomy-supportive way, they were able to generate important year-end benefits both for themselves and their students. The reason why teachers gained teaching efficacy, intrinsic instructional goals, harmonious passion, and job satisfaction was because the intervention boosted their autonomy support, and the reason why teachers gained relationship satisfaction with their students was because the intervention boosted their structure. The reason why students gained classroom engagement, skill development, anticipated course achievement, and future intentions to exercise was because the intervention boosted teachers capacity to provide them with a flow of instruction that afforded rich opportunities for both autonomy and competence need satisfaction.

## Declaration of competing interest

None.

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## Appendix A. Supplementary data

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