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Bullying is socially-regulated, but autonomy-supportive teaching and autonomy need satisfaction are effective antidotes

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Abstract

Autonomy-supportive teaching interventions generally decrease classroom bullying. The present study compared three models to explain why this is so: A socio-ecological model in which autonomy-supportive teaching decreases the classroom's bully culture (single mediation model); a self-determination theory model in which autonomy-supportive teaching increases autonomy need satisfaction experiences (single mediation model); and a combined model in which autonomy-supportive teaching both decreases the bully culture and increases autonomy satisfaction (double mediation model). We randomly assigned teachers (33% female, 34.2 years old) from 86 secondary PE classrooms to participate in an autonomy-supportive teaching workshop (experimental condition) or a no-intervention control condition, while their 2,491 students (38.5% female, 14.4 years old) reported their classmates' bullying and their own autonomy satisfaction and individual bullying at the beginning, middle, and end of an 18-week semester. Using the classroom as the unit of analysis, all three models fit the data well. The double mediation model fit the data the best, and it accounted for a greater proportion of explained variance in decreased individual bullying: Greater autonomy-supportive teaching; a lesser pro-bullying classroom culture; and greater autonomy need satisfaction.

Keywords Autonomy \cdot Autonomy support \cdot Bullying \cdot Intervention \cdot RCT \cdot Self-determination theory \cdot Social ecological model

Bullying involves intentionally repeated acts of aggression that victims experience as harmful (Eisenberg & Aalsma, 2005). These sustained acts of aggression and intimidation take place within a power imbalance between bully and victim (Olweus, 2013). Educators call for effective antibullying intervention programs because systematic reviews and meta-analyses reveal the serious negative ramifications from both victimization and bullying (e.g., psychological distress, depression, suicidal ideation, poor academic outcomes, reduced school engagement/absenteeism, loneliness and social isolation, poorer physical health, and multiple types of abuse, delinquency, and criminal offending; Juvonen & Graham, 2014; Juvonen et al., 2003; Nansel et al., 2001; Schacter, 2021; Van der Wall et al., 2003; Wolke et al., 2013). Unfortunately, anti-bullying interventions tend to produce either no or only minimal benefits (Gaffney et al., 2019, 2021; Juvonen & Graham, 2014; Ng et al., 2022). More optimistically, as researchers have recently moved away from an individual differences deficit model (e.g., a few "bad" kids attacking a few "weak" kids; Espelage & Swearer, 2004) to embrace social- and group-based explanatory processes, some progress has been made. For instance, interventions aimed at cultivating prosocial norms (Van Ryzin & Roseth, 2018), a supportive classroom climate (Cheon et al., 2023a), and the mobilization of a critical mass of pro-victim peer bystanders (Kärnä et al., 2011) have shown statistically significant reductions in bullying and victimization.

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A social-ecological model

A social-ecological model highlights the role of the peer culture in the initiation, maintenance, escalation, de-escalation, and prevention of bullying (Hendrickx et al., 2016; Hong & Espelage, 2012). The social-ecological model views bullying as a social phenomenon, one regulated by group norms, status concerns, and social contextual forces, such as a hierarchical, status-centric, and "me vs. you" competitive classroom climate or social ethos (Di Stasio et al., 2016; Garandeau et al., 2014). Once established, these social forces guide the peer-to-peer interactions that occur in that classroom (Thornberg et al., 2018; Van Ryzin & Roseth, 2018). For instance, when a classroom has pro-bully social norms, students in that classroom tend to collectively cheer on, reinforce, assist, and even join in on bullying (Espelage et al., 2003; Salmivalli et al., 2011). If left to naturally occurring social processes (i.e., the absence of intervention), adolescents tend to side with and reinforce the bully (Lansford et al., 2010), and they rarely intervene during bully-victim episodes either to defend the victim or to stop the bully (Espelage et al., 2003). In other words, adolescents do not naturally mobilize into collective action to defend victims. Instead, they tend to do the opposite (e.g., mobilize into collective action to cheer on the bully-what Olweus [1973] referred to as a "mobbing" effect).

In the presence of an intervention, however, an in-class peer ecology can become significantly more cooperative, supportive, and egalitarian (Cheon et al., 2023a; Gest & Rodkin, 2011; Van Ryzin & Roseth, 2018). When present, these prosocial norms and interpersonal dynamics tend to purge acts of aggression, intimidation, bullying, and victimization (Assor et al., 2018; Van Ryzin & Roseth, 2018). By training teachers in cooperative learning (Van Ryzin & Roseth, 2018) or autonomy-supportive (Reeve et al., 2022; Cheon et al.,, 2023a) teaching practices, it is possible to create and maintain a classroom climate that tends to cultivate the caring, supportive peer-to-peer relations that prevent and purge bullying.

Autonomy-supportive teaching interventions

Autonomy-supportive teaching (AST) means teaching in ways that allow students to experience the autonomy satisfaction they need to volitionally and wholeheartedly engage themselves in classroom learning activities (Aelterman et al., 2019a). Autonomy-supportive teaching is based on selfdetermination theory principles and research findings (SDT; Ryan & Deci, 2017). In practice, it involves the skillful enactment of teaching practices such as perspective taking, interest support, and value support (Reeve & Cheon, 2021). Thus, when teachers participate in an autonomy-supportive professional development workshop, they learn how to (a) take their students' perspective, (b) present learning activities in autonomy need-satisfying ways, and (c) facilitate students' volitional internalization of unappealing but important assignments, requirements, and classroom procedures (Reeve et al., 2022). After teachers participate in such an intervention, they do tend to teach in more autonomysupportive ways, as perceived by their students (Cheon et al., 2022) and as rated by classroom observers (Cheon et al., 2022).

The primary reasons why autonomy-supportive teaching interventions reduce bullying is because autonomy-supportive teaching (1) creates a supportive, egalitarian classroom climate (Cheon et al., 2019a, Cheon et al., 2022, Cheon et al., 2023a, Cheon et al., 2023b) and (2) facilitates students' valuing and volitional internalization of prosocial norms and behaviors (Assor et al., 2018; Kaplan & Assor, 2012; Roth et al., 2011). In the present study, we integrate a socialecological model with autonomy-supportive teaching practices to suggest these two position statements:

- Bullying is socially-generated, community-regulated, and interpersonally contagious (Hendrickx et al., 2016; Van Ryzin & Roseth, 2018). Thus, the more normative classroom bullying behavior is, the more likely it becomes that any individual student in that classroom will bully.
- Autonomy-supportive teaching interventions establish a caring classroom climate that reduces and prevents class wide bullying (Cheon et al., 2023b; Roth et al., 2011; Thornberg et al., 2018). Thus, autonomy-supportive teaching is an antidote to bullying.

Why would autonomy satisfaction be a second antidote to individual bullying?

As its name suggests, the primary effect of autonomysupportive teaching is to help students experience autonomy psychological need satisfaction during classroom instruction.

Autonomy is the psychological need to experience personal causation, volition, and self-endorsement during the initiation and on-going regulation of one's behavior (Ryan & Deci, 2017). When students experience autonomy need satisfaction, they tend to take personal responsibility for their behavior (Ryan & Deci, 2017), develop interpersonal and social skills (e.g., communication, teamwork; Cronin et al., 2019), pursue prosocial goals (Delrue et al., 2017), internalize prosocial values (e.g., Roth et al., 2011), and become increasingly willing to help others (e.g., beneficence; Martela & Ryan, 2016). Such *self*-determined motivation tends to facilitate prosocial and caring, rather than antisocial and hurtful, tendencies, behaviors, and social interactions (Cheon et al., 2018; Cronin et al., 2019; Pavey et al., 2011).

A personal motivation explanation for reduced bullying (i.e., autonomy need satisfaction) is somewhat at odds with a social-ecological explanation. But we see these two explanatory processes as complementary and additive, rather than opposing. This is because rigorous empirical tests (i.e., randomized control trials with longitudinally-assessed dependent measures) show that social contextual factors (e.g., classroom climate) only partially explain (mediate) the direct effect an autonomy-supportive teaching intervention has on reduced bullving (Cheon et al., 2023b, 2023a). Partial mediation suggests that the intervention may be producing an additional, unaccounted for anti-bullying effect. The purpose of the present study was to test whether autonomy need satisfaction might be that additional, unaccounted for mediator. Thus, the present study compared three models to explain reduced individual bullying: (a) one that included both a social mediator (i.e., class wide classmates' bullying) and a motivational mediator (i.e., class wide autonomy satisfaction); (b) one that included only the social mediator;

and (c) one that included only the motivational mediator. We knew from the studies reviewed above that the social contextual mediator would likely explain decreased individual bullying, so the key test was whether class wide autonomy satisfaction would emerge as a second, independent predictive mediator.

Hypothesized mode

We tested and compared three explanatory models. Model 1 served as our hypothesized model. Model 1 featured the two explanatory processes of "class wide classmates' bullying" and "class wide autonomy satisfaction" (double mediation model; see Fig. 1). It featured four embedded hypothesized paths: Experimental condition would decrease class wide classmates' bullying (H1); experimental condition would increase class wide autonomy satisfaction (H2); class wide classmates' bullying would increase individual bullying (H3); and class wide autonomy satisfaction would independently (incrementally) decrease individual bullying (H4). Model 2 was a nested model embedded within the hypothesized model that featured the single mediator class wide classmates' bullying. Model 2 was the same as Model 1,



Fig. 1 Hypothesized Model 1. H = Hypothesis. A1 to A4 represents items 1-4 on the autonomy satisfaction scale

except that it zero-weighted the H2 (Experimental condition T2 class wide autonomy satisfaction) and H4 (T2 class wide autonomy satisfaction T3 individual bullying) paths. Model 3 was also a nested model within the hypothesized model, but it featured the single mediator class wide autonomy satisfaction. Model 3 was also the same as Model 1, except that it zero-weighted the H1 (Experimental condition T2 class wide classmates' bullying) and H3 (T2 class wide classmates' bullying T3 individual bullying) paths. By contrasting the fit (or explanatory power) of these three models, we tested whether (a) the double mediation model would explain reduced T3 individual bullying better than would either of the single mediation models and (b) both individual T2 predictors would emerge as significant, independent mediators even after controlling for the explanatory power of the other mediator.

Method

Participants

Teachers were 45 full-time certified physical education (PE) teachers (30 males, 15 females) who taught 86 classrooms in one of 45 different schools (31 middle, 14 high) dispersed throughout the metropolitan areas of Seoul, Gyeonggi-do, or Incheon, South Korea. All teachers were ethnic Korean. On average, teachers were 34.2 years old (SD = 4.5; range= 25-43) and had 7.8 years (SD = 3.9; range = 1-15) of PE teaching experience. All 45 teachers completed all aspects of the study (retention rate =100%), and each received the equivalent of USD\$50 at the end of the study in appreciation of their participation (though they were not previously told of this honorarium). Because we planned to use the classroom (rather than the teacher) as the unit-of-analysis, we collected data in two classrooms from each teacher (i.e., 45 teachers, 86 classrooms). We sampled from Korean secondary grade classrooms because bullying tends to peak during the middle school years (ages 12-15 years; Hymel & Swearer, 2015) and because the Korean Ministry of Education recognizes bullying as a national concern with an accelerating growth rate (Kim et al., 2019).

In these 86 classrooms were 2,491 ethnic Korean students (M= 29.0 students/class). The student retention rate over the 3 waves of data collection was 93.5%, and missing values on the completed questionnaires were rare (< 0.1%). The 2,491 students were, on average, 14.4 years old (SD= 1.6, range= 13–18), and included 958 (38.5%) females, 1504 (60.4%) males, and 29 (1.2%) who preferred not to say and 1,802 (72.3%) middle and 689 (27.7%) high schoolers. As to the a priori adequacy of our sample size, multilevel analyses require a sample of 50 L2 units that include at least 10 to

15 participants per unit (per classroom) (Morin et al., 2021). The present sample met those requirements (86 classrooms, 29.0 students/class), suggesting adequate statistical power for multilevel analyses.

Procedure

The Korea University Research Ethics Committee approved the research protocol. After recruiting teachers to participate in a study on "classroom instructional strategies", we randomly assigned each teacher into either the experimental (intervention; n = 22 teachers, 42 classrooms) or control (no intervention; n = 23 teachers, 44 classrooms) condition. We collected three waves of data in which students completed the same 3-page questionnaire at the beginning (T1, week 1, February 2022), middle (T2, week 10, May 2022), and end (T3, week 18, July 2022) of the academic year's first semester. Because it was the first week of classes of the new academic year, we did not expect experimental condition to affect students' T1 [baseline] scores, as teachers and students had little experience together at T1. Instead, we were interested in the extent to which students' T2 and T3 scores changed from that baseline status as a function of experimental condition.

At each timepoint, we administered the survey at the beginning of the class period. The questionnaire began with a consent form, we asked students to completed it in reference to their experience in that particular PE class, and we assured students that their responses would be confidential and used only for the research study.

These data are all original data. These data have not been used or analyzed in any previous publication.

The delivery of the 3-part, 8-hour autonomy-supportive teaching workshop followed the contents, activities, and procedures of previously published interventions (Cheon et al., 2018, Cheon et al., 2019a, Cheon et al., 2019b). A detailed, step-by-step outline of the workshop appears in the Supplemental Material. Briefly, Part 1 was a 3-hour morning presentation that featured an information- and mediarich presentation on the benefits, empirical evidence, and PE-specific examples of six recommended autonomy-supportive instructional behaviors-namely, take the students' perspective, invite students to pursue their personal interests, present learning activities in need-satisfying ways, provide an explanatory rationale for teacher each request, acknowledge negative feelings, and rely on invitational language. Part 2 was a same-day, 3-hour afternoon workshop that focused on practicing the "how-to" of the recommended autonomy-supportive instructional behaviors. Part 3 took place one month into the semester, and it featured a peer-based group discussion about teachers' early-semester experiences with and questions about autonomy-supportive teaching.

Measures

We collected two categories of dependent measures. First, trained raters observed and scored each teacher's in-class usage of autonomy-supportive and controlling instructional behaviors. Second, students self-reported the study's dependent measures on a questionnaire. For each English-language questionnaire, we had a previously back-translated Korean version. Each questionnaire used the same 1-7 response scale (1 = strongly disagree, 7=strongly agree). For each measure, we calculated the inter-item (α) and intraclass correlation coefficients (ICC1, ICC2) across all three waves of data. The alpha coefficient (α) reports each scale's internal consistency, the ICC1 statistic reports the extent of a shared agreement on that dependent measure among students in the same class (i.e., proportion of the variance in the dependent measure attributable to classroom membership), and the ICC2 statistic reports the reliability of that group consensus score.

Rater-scored autonomy-supportive and controlling instructional behaviors

A team of graduate students used the Behavior Rating Scale (BRS; Cheon et al., 2018) to make mid-semester ratings of each teacher's in-class usage of autonomy-supportive and controlling instructional behaviors. During either week 8 or 9, a pair of raters visited one 50-minute class period of each teacher. The raters were blind to the teacher's assigned condition, made independent ratings, and used a unipolar scale (1 = not at all, 7 = very much). Raters scored the six BRS autonomy-supportive behaviors in a consistent way (e.g., takes the students' perspective; Mr of six behaviors, r(45)=0.75, range = 0.68 to 0.85), and raters scored the six BRS controlling behaviors in a consistent way (e.g., uses pressuring language; Mr of six behaviors, r(45) = 0.70, range= 0.51 to 0.80). To create a single "rater-scored autonomysupportive instructional behaviors" score, we averaged the two observer's six ratings and then aggregated them into a single dependent measure (6-item $\alpha = 0.94$). We followed the same aggregation strategy to create a single "rater-scored controlling instructional behaviors" score (6-item $\alpha = 0.93$).

Perceived autonomy-supportive and controlling teaching

We assessed perceived autonomy-supportive teaching with the 6-item Learning Climate Questionnaire (Black & Deci, 2000; e.g., "In this PE class, I feel understood by my PE teacher."). Students' reports were internally consistent across the three waves of data collection (α s at T1, T2, and T3 were 0.90, 0.93, and 0.94, respectively), showed a rising within-class consensus (*ICC1s* =0.092, 0.160, and 0.185), and a high reliability of that group consensus (*ICC2s* =0.746, 0.847, and 0.868). We assessed perceived controlling teaching with the 4-item Controlling Teacher Questionnaire (Jang et al., 2009; e.g., "In this PE class, my PE teacher uses forceful language."). Students' reports were internally consistent (α s =0.75, 0.82, and 0.83, respectively), showed a rising within-class consensus (*ICC1s* =0.090, 0.160, and 0.165), and a high reliability of that consensus (*ICC2s* =0.739, 0.847, and 0.851).

Autonomy satisfaction

For autonomy satisfaction, we used the 4-item Perceived Autonomy scale (Standage et al., 2006; "In this PE class, I can decide which activities I want to do"). Students' reports on their autonomy need satisfaction were internally consistent (α s =0.87, 0.90, and 0.92), showed a moderate withinclass consensus (*ICC1*s =0.056, 0.080, and 0.099), and a moderate reliability of that class-wide consensus (*ICC2*s =0.612, 0.716, and 0.762).

Individual and classmates' bullying

We assessed individual and classmates' bullying with two versions of the Bullying Behaviour Questionnaire (BBQ; Hein et al., 2015). The BBQ contains five items-three to assess verbal bullying, one to assess physical bullying, and one to assess social bullying. Because we wanted to equally weight these three aspects of bullying to create the latent variables used in test of our hypothesized model, we made a pre-study decision to use one verbal, one physical, and one social item rather than all five items (to avoid overweighting the verbal aspect; following Marsh et al.'s (2011) equally-weighted tripartite operational definition of adolescent bullying). The item referent for the individual bullying version of the BBQ was "I" (e.g., "In this PE class, I threatened to hit or hurt another student"; 3-item T1, T2, and T3 α 's = 0.74, 0.85, and 0.86; *ICC1*s = 0.111, 0.166, and 0.086; ICC2s = 0.784, 0.851, and 0.732). The item referent for the classmates' bullying version of the BBQ was "The students in this class" (e.g., "The students in this PE class pushed, shoved, slapped, or kicked other students"; 3-item α 's = 0.85, 0.91, and 0.92; *ICC1*s = 0.102, 0.139, and 0.103; ICC2s = 0.720, 0.824, and 0.724). All BBQ items appear in Table 1. We used the classmates version of the BBQ to assess how socially pervasive and normative bullying in

Table 1 Descriptive statistics with unstandardized and standardized Beta weights for the 20 indicators	include	d in the	measure	ment m	odel							
Name of latent variable	Time 1				Time 2			Τ	ime 3			
Indicator of latent variable (Observed Variable)	В	SE	d	β	B S	E I		B B	S	E p	β	
All 10 items began with this sentence stem, "In this PE class,"												
Individual Bullying												
1. I threatened to hit or hurt another student (Verbal)	1.00	I	Ι	0.96				1.	- 00.	Ι	0	.92
2. I pushed, shoved, slapped, or kicked another student (<i>Physical</i>)	1.00	0.06	0.001	0.94				1	.03 0	.06 0.	001 0	.97
3. I said things about a student to make other students laugh at them (Social)	0.94	0.08	0.001	0.80				1	.05 0	.08 0.	001 0	.89
Class wide classmates' bullying												
1. The students in this class threatened to hit or hurt other students (Verbal)	1.00	I	I	0.95	1.00 -		_	.96				
2. The students in this class pushed, shoved, slapped, or kicked other students (<i>Physical</i>)	1.05	0.06	0.001	0.94	0.98 0	.06	0.001 (.99				
3. The students in this class said things about a student to make other students laugh at them (Social)	0.86	0.07	0.001	0.85	0.96 0	.04	0.001 (.94				
Class wide autonomy satisfaction												
1. I feel that I do class activities because I want to.	1.01	0.06	0.001	0.93	0.91 0	.06	0.001 (.94				
2. I have some choice and options in what I want to do.	0.91	0.06	0.001	0.84	0.88 0	.08	0.001 (.89				
3. I can decide which activities to engage in.	1.00	I	Ι	0.91	1.00 -		_	.92				
4. I have a say regarding what activities I engage in.	1.01	0.07	0.001	0.93	1.02 0	.05 (0.001 (.92				

that classroom was (i.e., the "social context"; Morin et al., 2021, p. 11).

Data analyses

Manipulation checks

We conducted two types of manipulation checks to assess the intervention's fidelity. First, raters scored teachers' mid-semester in-class usage of autonomy-supportive and controlling instructional behaviors. To test for the effect of experimental condition on these two rater-scored dependent measures, the unit-of-analysis was the teacher (N= 45) and the statistical test was a 2-group independent *t*-test. To provide effect size information, we used Cohen's *d* (Cohen, 1988).

Second, students reported their perceptions of autonomysupportive and controlling teaching at T1, T2, and T3. To test for the effect of experimental condition on these two student-reported dependent measures, we conducted two growth model analyses. First, we regressed the 6-indicator latent variable of perceived autonomy-supportive teaching (6 items from the LCQ) on the slope of the T1, T2, and T3 scores (weighted as 0, 1, 2). Then, we regressed the 4-indicator latent variable of perceived controlling teaching (4 items from the CTQ) on the slope of the T1, T2, and T3 scores. In both analyses, experimental condition (control =0, experimental =1) was the critical independent variable, while gender (male = 0, female = 1), grade level (middle = 0, high = 1), and class size (M= 29.0 students/class, SD= 3.9) were covariates. For these analyses, we were simply interested in evaluating for a significant condition x time interaction effect in which T1-to-T3 linear growth (longitudinal change) occurred more in the experimental condition than in the control condition.

Intervention effect on individual bullying

We conducted a third growth model analysis to test the extent to which the intervention (experimental condition) produced a T1-to-T3 downward linear trend on individual bullying. To do so, we regressed the 3-indicator latent variable of individual bullying on the slope of the T1, T2, and T3 scores (weighted as 0, 1, 2). Again, the critical independent variable was experimental condition while we further included the three statistical controls of gender, grade level, and class size.

Test of the hypothesized model

In the test of the hypothesized and two nested models, the unit of analysis was the classroom, so the dependent

measures were class average scores. The data therefore had a 2-level longitudinal structure with the class average data from 86 classrooms (3 waves of repeated measures) nested within teachers (k=45). To analyze these multilevel data, we performed a structural equation model analysis, using Mplus 8.3 (Muthén & Muthén, 2019) with the maximum likelihood-robust estimator (MLR) and the full information maximum likelihood (FIML) estimation procedure to handle missing data. To evaluate model fit, we used the following goodness-of-fit statistics: Root-mean-square error of approximation (RMSEA), standardized root-mean-square residual (SRMR), comparative fit index (CFI), and Tucker-Lewis index (TLI). For RMSEA and SRMR, adequate and excellent fit are reflected by values lower than 0.08 and 0.06; for CFI and TLI, adequate and excellent fit are reflected by values greater than 0.90 and 0.95 (e.g., Marsh et al., 2005). The test of the hypothesized model evaluated its overall fit as well as its four embedded hypotheses (see Fig. 1).

The hypothesized and nested models are mediation models, so we tested for mediation effects. To do so, we used the "model indirect" command in Mplus.

Test of the two nested models

We evaluated the two nested single mediator models (Models 2 and 3) in the same way that we evaluated the overall hypothesized model (Model 1). Model 2 (class wide classmates' bullying single mediator) was the same as Model 1, except that it zero-weighted the two paths representing H2 and H4 (in Mplus language: IBULLY3 ON IBULLY1 CBULLY2 AUTONOMY1@0 CBULLY1 AUTON-OMY2@0 GENDER GRADE SIZE). Model 3 (class wide autonomy satisfaction single mediator) was the same as Model 1, except that it zero-weighted the two paths representing H1 and H3 (in Mplus language: IBULLY3 ON IBULLY1 CBULLY1@0 CBULLY2@0 AUTONOMY1 AUTONOMY2 GENDER GRADE SIZE). The critical tests were (1) to contrast the fit of the hypothesized model vs. the fit of each nested model, as evaluated by the ΔX^2 ($\Delta df = 2$) statistic, and (2) to contrast the magnitude of the R^2 value of T3 individual bullying of the hypothesized model vs. the corresponding R^2 value of T3 individual bullying for each nested model.

Test of the measurement model

It is important (for interpretative considerations) to establish multiwave measurement isomorphism (T1 vs. T2 vs. T3) within the measurement model underlying the hypothesized model (Morin et al., 2021). The measurement model included 20 indicators to create 6 latent variables (see Fig. 1). Isomorphism means metric invariance in which the factor loadings for each latent variable are fixed to be equal across the three waves of data, such that the factor loadings of the indicators of the latent variables at T2 and T3 are fixed to their T1 (or baseline) values. If the measurement model that constrains these indicators to be invariant across time shows little or no decrement in fit (according to the goodness-of-fit statistics) compared to the measurement model in which the indicators are free to vary, then measurement isomorphism is verified (Marsh et al., 2011).

Results

Manipulation checks

Rater-scored autonomy-supportive and controlling instructional behaviors

According to the classroom observers, teachers in the experimental group displayed more in-class autonomy-supportive instructional behaviors than did teachers in the control group (Ms= 5.75 vs. 4.48), t(43) =9.36, p<.001, d= 2.79. Similarly, according to the raters, teachers in the experimental group displayed less controlling instructional behaviors than did teachers in the control group (Ms= 1.97 vs. 2.91), t(43) =7.22, p<.001, d= 2.15.

Students' perceived autonomy-supportive and controlling teaching

As shown in Fig. 2A, students of teachers in the experimental group reported greater upward T1-to-T3 growth in perceived autonomy-supportive teaching ($M \Delta$ from baseline =+ 0.93) than did students of teachers in the control group ($M \Delta$ from baseline =+ 0.13), as the condition x time effect was significant, B = 0.27, SE = 0.08, t = 3.48, p = .001. Similarly, as shown in Fig. 2B, students of teachers in the experimental group reported greater downward T1-to-T3 growth for perceived controlling teaching ($M \Delta$ from baseline =-0.47) than did students of teachers in the control group ($M \Delta$ from baseline =+ 0.07), as the condition x time effect was significant, B = -0.20, SE = 0.05, t = 3.79, p < .001.

Did the intervention decrease individual bullying?

As shown in Fig. 2C, students of teachers in the experimental group reported greater downward T1-to-T3 growth in individual bullying ($M \Delta$ from baseline =- 0.40) than did students of teachers in the control group ($M \Delta$ from baseline =+ 0.22), as the condition x time effect was significant, B =-0.25, SE = 0.05, t = 4.55, p < .001.









Test of the measurement model

The measurement model fit the data reasonably well, $X^2(145) = 227.97$, p < .001, RMSEA = 0.082, SRMR = 0.058, CFI = 0.965, and TLI = 0.954. As shown in Table 1, factor loadings for the 20 indicators for the six latent constructs were all substantial and statistically significant (p < .001). After constraining the T2 and T3 indicators to their T1 values, the invariant measurement model continued to fit the data well and showed little or no decrement in the fit indices, $X^2(152) = 236.06$, p < .001, RMSEA = 0.080, SRMR = 0.077, CFI = 0.964, and TLI = 0.955; $\Delta \chi^2$ ($\Delta df = 7$) = 8.09, p = .325, thereby establishing multiwave (T1, T2, T3) measurement isomorphism.

Test of the hypothesized model

The hypothesized model fit the data reasonably well, $X^2(217) = 378.85$, p < .001, RMSEA = 0.093, SRMR = 0.088, CFI = 0.933, and TLI = 0.917. The descriptive statistics and intercorrelations among experimental condition, the six latent dependent measures, and the three statistical controls appear in Table 2. The unstandardized beta weights (with standard errors in parentheses) for the individual paths, autoregressive effects, and baseline controls appear in Fig. 3. For clarity of presentation, beta weights for the three statistical controls (i.e., gender composition, grade level, and class size) do not appear in Fig. 3 as their effects were not statistically significant.

As shown by the two upwardly sloped boldface lines on the left side of Fig. 3, experimental condition significantly predicted both (1) T2 class wide classmates' bullying (B =-0.49, SE = 0.11, t = 4.37, p < .001), controlling for T1 class wide classmates' bullying (B = 0.44, p < .001), and (2) T2 class wide autonomy satisfaction (B = 0.59, SE = 0.08, t = 7.20, p < .001), controlling for T1 class wide autonomy satisfaction (B = 0.40, p < .001). These findings confirm H1 and H2.

As shown by the two downwardly sloped boldface lines on the right side of Fig. 3, in the prediction of T3 individual bullying, both T2 class wide classmates' bullying (B= 0.27, SE= 0.09, t= 3.06, p= .002) and T2 class wide autonomy satisfaction (B= -0.29, SE= 0.12, t= 2.37, p= .018) were individually significant predictors, controlling for T1 individual bullying (B= 0.31, p= .153), T1 class wide classmates' bullying (B= -0.15, p= .320), T1 class wide autonomy satisfaction (B= -0.02, p=.820), experimental condition (B= -0.15, p= .087), and the three covariates. These findings confirm H3 and H4.

In the test for mediation, T2 class wide classmates' bullying was an individually significant mediator, B = -0.13, SE = 0.06, t = 2.37, p = .018, T2 class wide autonomy satisfaction was another individually significant mediator, B = -0.17, SE = 0.08, t = 2.23, p = .026, and the otherwise direct effect of experimental condition on T3 individual bullying (see Fig. 2C) was reduced to a non-significant effect, B = -0.15, SE = 0.09, t = 1.71, p = .087.

Test of the two nested models

Test of the class wide classmates' bullying single mediator model

The class wide classmates' bullying single mediator nested model fit the data reasonably well, $X^2(219) = 391.19$, p < .001, *RMSEA* = 0.096, *SRMR* = 0.088, *CFI* = 0.929, and

/ariable	1	2	3	4	5	6	7	8	9	10
. Experimental Condition	_	0.34	0.24	- 0.19	- 0.54	0.64	- 0.61	- 0.03	0.31	0.10
ïme 1 Baseline										
. Individual Bullying		_	0.86	-0.42	0.04	0.30	0.01	-0.18	-0.02	0.16
. Class Wide Classmates' Bullying			_	- 0.36	0.11	0.21	0.04	- 0.29	0.01	0.15
. Class Wide Autonomy Satisfaction				_	-0.06	0.14	- 0.09	0.08	0.01	- 0.09
Time 2										
. Class Wide Classmates' Bullying					-	- 0.66	0.72	-0.22	-0.08	0.00
. Class Wide Autonomy Satisfaction						_	- 0.69	0.00	0.12	-0.04
Time 3										
. Individual Bullying							_	- 0.19	- 0.06	0.00
Statistical controls										
. Student Gender (1 = Female)								_	- 0.33	0.00
. Grade Level Taught (1 = High School)									_	-0.04
0. Class Size										_
Descriptive statistics										
Aean	0.50	1.79	1.73	4.78	1.66	5.24	1.70	0.38	0.28	29.0
tandard deviation	0.50	0.31	0.32	0.33	0.40	0.39	0.33	0.24	0.45	3.9

Table 2 Intercorrelations and descriptive statistics for all latent variables and statistical controls included in the test of the hypothesized model

Note: N= 86 classrooms. Anyr> .28, p < .01



Fig. 3 Results of the Test of Double Mediation Hypothesized Model. A1 to A4 represents items 1–4 on the autonomy satisfaction scale. Numbers represent unstandardized beta weights (with standard errors

TLI = 0.912. As shown in Fig. 4, T2 class wide classmates' bullying increased T3 individual bullying (B=0.44, SE=0.06, t = 7.84, p < .001), controlling for T1 individual bullying (B = 0.28, p = .167), T1 class wide classmates' bullying (B = -0.19, p = .250), experimental condition (B = -0.22, p = .250)p = .008), and the three covariates. The effects associated with H1 and H2 from the hypothesized model remained virtually unchanged. This nested model fit the data significantly worse that did Fig. 3's double mediation hypothesized model, ΔX^2 ($\Delta df = 2$) = 12.34, p < .001. It also explained less of the variance in T3 individual bullying than did the hypothesized model (i.e., R^2 's = 0.63 vs. 0.70). In the test for mediation, T2 class wide classmates' bullying successfully mediated the otherwise direct effect of experimental condition on T3 individual bullying, B = -0.22, SE = 0.04, t = 4.87, p < .001. The direct effect of experimental condition on T3 individual bullying remained an individually significant effect, B = -0.22, SE = 0.08, t = 2.67, p = .008 (i.e., partial, rather than full, mediation). Overall, these findings (X^2, R^2) confirm the relative superiority of the hypothesized double mediation model over this first nested single mediation model.

Test of the class wide autonomy satisfaction single mediator model

The class wide autonomy satisfaction single mediator nested model fit the data reasonably well, $X^2(219) = 388.19$,

in parentheses). R^2 = Percentage of variance in the outcome measure explained by the set of predictor variables. For clarity, betas for indicators not shown, but can be seen in Table 1

p < .001, RMSEA = 0.093, SRMR = 0.108, CFI = 0.930, and TLI = 0.914. As shown in Fig. 5, T2 class wide autonomy satisfaction reduced T3 individual bullying (B = -0.51,SE = 0.10, t = 5.18, p < .001), controlling for T1 individual bullying (B = 0.32, p = .001), T1 class wide autonomy satisfaction, (B = 0.09, p = .183), and experimental condition (B = -0.15, p = .110), and the three covariates. The effects associated with H1 and H2 from the hypothesized model remained virtually unchanged. This nested model fit the data significantly worse that did Fig. 3's double mediation hypothesized model, ΔX^2 ($\Delta df = 2$) = 9.34, p = .009. It also explained less of the variance in T3 individual bullying than did the hypothesized model (i.e., R^2 's =0.67 vs. 0.70). In the test for mediation, T2 class wide autonomy satisfaction successfully mediated the otherwise direct effect of experimental condition on T3 class wide individual bullying, B = -0.30, SE = 0.08, t = 3.77, p < .001. The direct effect of experimental condition on T3 individual bullving was reduced to a non-significant effect, B = -0.15, SE= 0.09, t = 1.60, p = .110 (i.e., full mediation). Overall, these findings (X^2, R^2) findings confirm the relative superiority of the hypothesized double mediation model over this second nested single mediation model.



Fig. 4 Results of the Test of the Class Wide Classmates' Bullying Nested Model. A1 to A4 represents items 1–4 on the autonomy satisfaction scale. Numbers represent unstandardized beta weights (with

standard errors in parentheses). R^2 = Percentage of variance in the outcome measure explained by the set of predictor variables. For clarity, betas for indicators not shown, but can be seen in Table 1



Fig. 5 Results of the Test of the Class Wide Autonomy Satisfaction Nested Model. A1 to A4 represents items 1–4 on the autonomy satisfaction scale. Numbers represent unstandardized beta weights (with

standard errors in parentheses). R^2 = Percentage of variance in the outcome measure explained by the set of predictor variables. For clarity, betas for indicators not shown, but can be seen in Table 1

Discussion

We invited teachers of adolescents to participate in an autonomy-supportive teaching intervention so that we could experimentally manipulate their autonomy-supportive teaching to a high level. When highly autonomy supportive, teachers produced two class wide effects. First, they decreased the bully culture that might have otherwise arose within their classroom (lesser T2 class wide classmates' bullying). Second, they increased their students' experienced autonomy need satisfaction (greater T2 class wide autonomy satisfaction).

In classrooms where class wide classmates' bullying decreased during the first half of the semester, the extent of individual bullving decreased during the second half of the semester. This result reflects a socio-ecological phenomenon (i.e., changes in individual behavior follow changes in group behavior). But on top of this social-ecological effect. we observed a second phenomenon. In classrooms where autonomy need satisfaction increased during the first half of the semester, the extent of individual bullying also decreased during the second half of the semester. This reflects a motivational-based self-determination effect where individual bullying rises and falls in response to how much personal responsibility and personal ownership students embrace over their classroom behavior. Importantly, both effects produced a significant, independent, and roughly equal-inmagnitude T3 antibullying effect (Bs of -0.29 and +0.27, respectively; see the two boldfaced lines on the right side of Fig. 3). Further, this double mediator model reduced end-ofsemester bullying more than did either the class wide classmates' bullying single mediator model (R^2 of 0.70 vs. 63) or the class wide autonomy satisfaction single mediator model $(R^2 \text{ of } 0.70 \text{ vs. } 67)$. We point out that previous research had already shown that autonomy-supportive teaching (antidote #1) and a less conflictual classroom culture (antidote #2) could reduce individual bullying, so the new finding was that greater autonomy need satisfaction also produced an antibullying effect (antidote #3).

Why does an autonomy-supportive teaching intervention reduce bullying?

Five reasons explain why greater autonomy-supportive teaching tends to reduce bullying. First, autonomy-supportive teaching reduces or prevents a bully group culture from arising in the classroom. This was found in the present study (as per H1), and a similar effect has been found in previous research in that autonomy-supportive teaching reduces or prevents a hierarchical, conflictual, and "me vs. you" competitive classroom climate from arising in the classroom (Cheon et al., 2022, 2023a, 2023b). Second, autonomy-supportive teaching promotes or increases a prosocial group culture (prosocial behavior, defending bystander behavior) and a more egalitarian, supportive, and cooperative classroom climate (Cheon et al., 2023a, 2023b; Assor et al., 2018; Kapan & Assor, 2012). This represents a complementary yet opposite group-based pathway to reduce bullying by increasing prosocial forces and the quality of classroom relationships (Cheon et al., 2023b).

Third, autonomy-supportive teaching increases autonomv need satisfaction. This bully-reduction effect was found in the present study (H2). Because it is a newly discovered effect, it needs to be explained. Autonomy is the psychological need to experience self-direction and personal endorsement in the initiation and regulation of one's behavior (Rvan & Deci, 2017). With autonomy, people act with volition and personal causation, they take personal responsibility and ownership over their behavior, and they tend toward prosocial goals, prosocial values, and prosocial behaviors (e.g., benevolence, empathy, caring, helping, and a willingness to accept and internalize values such as "be considerate to others"; Cronin et al., 2019; Fousiani et al., 2016; Roth et al., 2011). Such *self*-determined motivation helps students rise above any prevailing pro-bullying social contextual forces to not join in on bullying to instead act more volitionally and prosocially.

Fourth, autonomy-supportive teaching decreases autonomy need frustration. Autonomy frustration spills over to antisocial behavior and bullying because it tends to give rise to frustration-infused negative emotions (e.g., anger; Hein et al., 2015), a tendency to objectify others (Delrue et al., 2017), social dominance goals (McHoskey, 1999), an unwillingness to internalize social recommendations (e.g., defiance; Aelterman et al., 2019b), and compromised selfregulatory capacities that would otherwise inhibit antisocial impulses (Bindman et al., 2015). These relatively maladaptive ways of feeling, thinking, and relating to others tend people toward bullying or joining in on bullying (Cheon et al., 2018, Cheon et al., 2023a, 2023b).

Fifth, during autonomy-supportive teacher training, teachers learn how to transform their existing controlling teaching practices (e.g., pressuring language, directives without explanations) into autonomy-supportive alternatives (e.g., invitational language, provide explanatory rationales). Controlling teaching practices include pressure-inducing behaviors such as yelling, scolding, intimidating, and various intrusive and manipulative socialization practices such as punishing and denying rights (Assor et al., 2005) as well as coercive guilt-inducing practices such as shaming and expressions of disappointment (De Meyer et al., 2016). While we know of no study than has experimentally manipulated controlling teaching to a high level,

longitudinal research suggests that high levels of teacher control facilitate antisocial tendencies (as well as autonomy frustration and a conflictual classroom climate; Cheon et al., 2022, 2023b).

Future research

Though the present autonomy-supportive teaching intervention produced a strong antibullying effect (see Fig. 2C), it was not actually designed to be an antibullying program. That is, the intervention's eight hours of professional development did not actually discuss the topics of bullying, victimization, or bystanding behavior. So, it is rather remarkable that the intervention reduced bullying. The intervention reduced bullying because it addressed those motivational and relational processes that do function as reliable bullying antidotes. Given these observed findings (see Fig. 3), future research might want to take the next step to adapt the autonomy-supportive teaching intervention to address bullying-related issues directly. For instance, it makes for two interesting future research questions to ask (1) what autonomy-supportive teaching practices best address classroom instances of bullying and pro-bullying bystanding behavior and (2) whether the addition of these teaching practices to the existing intervention would produce a stronger antibullying effect.

A second future research question is to ask whether the best antidote to bullying is autonomy need satisfaction specifically or psychological need satisfaction generally (i.e., autonomy, competence, and relatedness). Low relatedness and antisocial behavior do tend to covary (Tian et al., 2018), but it is not clear if low relatedness (or high relatedness frustration) is a cause or consequence of bullying. Bullying is interpersonal rejection, so we suspect that low relatedness satisfaction and high relatedness frustration tend to be consequences of bullying, but the relatedness-bullying relation may be reciprocal as well. For the purposes of the present study, we did not include relatedness satisfaction in the hypothesized model because we feared its inclusion would introduce unnecessary multicollinearity into the test of the hypothesized model (because relatedness and bullying overlap considerably, especially at the classroom [L2] level). Low competence satisfaction, high competence frustration, and bullying-victimization also tend to covary (Menéndez Santurio et al., 2020). We leave it to future research to determine which is the more effective bullying antidote: autonomy need satisfaction in specific or psychological need satisfaction in general.

Limitations

We note three concerns as potential limitations. First, the generalizability of these findings is not yet clear. These findings emerged for adolescents enrolled in various Korean PE courses. Future research is necessary to determine the extent to which these findings might apply to different grade levels (e.g., elementary school), different subject matters (e.g., math, language, art), different settings (e.g., classroom vs. gym/field), and different nations.

Second, we assessed bullying by using a 1—7 response scale (strongly disagree/strongly agree). In contrast, it is more common to assess the prevalence of bullying by using a frequency-based response scale (e.g., never, once a semester, once a month, once a week, etc.; Bjereld et al., 2020). Both assessment strategies have their strengths and weaknesses, and it makes as much sense to assess bullying via its frequency as via its agreement-disagreement.

Third, our investigation focused on increasing autonomy satisfaction, rather than on decreasing autonomy frustration. In SDT, the motivational basis for antisocial behavior is often recognized to be psychological need frustration (Cheon et al., 2018, 2019a; Hein et al., 2015; Ryan & Deci, 2017, Chap. 24; Tian et al., 2018). Nevertheless, we focused on autonomy satisfaction for two reasons. First, need frustration is so integrated with a conflictual classroom climate, antisocial behavior, and bullying that it becomes difficult to distinguish between these classroom phenomena, especially at the classroom level. That is, massive multicollinearity exists among need frustration, a conflictual climate, and bullying. Second, we pursued a practical objective-namely, identify what constructive course of action teachers might take to reduce bullying. In practice, "be more autonomy supportive" worked rather well.

Conclusion

Bullying is largely a socially-regulated phenomenon. That is, classroom bullying rises and falls with changing social forces, such as what is normative. We agree with this statement and consider prosocial ecological forces to be antidote #1 to individual bullying. The new finding was that greater autonomy need satisfaction also reduced bullying, so we consider this to be antidote #2 to individual bullying. Finally, we showed that autonomy-supportive teaching, when manipulated to a high level, not only decreased bullying directly (see Fig. 2C) but it also decreased bully-related normative behavior and increased autonomy satisfaction, so we consider greater autonomy-supportive teaching to be antidote #3. **Acknowledgements** This research was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2019S1 A5 A2 A01041790).

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Declarations

Conflict of interest None.

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