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Why autonomy-supportive interventions work: Explaining the professional development of teachers' motivating style

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HIGHLIGHTS

- Post-intervention, teachers' motivating style became more autonomy supportive.
- During the intervention, teachers developed three personal-professional resources.
- Intervention-enabled gains in teaching efficacy explained greater autonomy support.
- Intervention-enabled gains in intrinsic goals explained greater autonomy support.

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ABSTRACT

Carefully designed interventions consistently help K-12 teachers learn how to implement a more autonomy-supportive classroom motivating style. In the present study, we investigated what resources teachers acquired during these interventions that explained why they are so able to successfully upgrade the quality of their motivating style. We randomly assigned 91 full-time teachers to participate or not in a year-long autonomy-supportive intervention program (ASIP), and we longitudinally assessed autonomy support and three hypothesized mediating resources—gains in need satisfaction during teaching, gains in teaching efficacy, and a greater adoption of intrinsic instructional goals. The ASIP did increase teachers' autonomy support, as expected, and the two resources that explained this professional developmental achievement were intervention-enabled gains in teaching efficacy and intrinsic instructional goals.

In every class, teachers ask their students to engage in various learning activities. While doing so, teachers inevitably rely on a particular motivating style, the most widely studied of which is autonomy support (Assor, Kaplan, & Roth, 2002; Cheon, Reeve, Yu, & Jang, 2014; Deci, Schwartz, Sheinman, & Ryan, 1981). Autonomy support is an interpersonal tone of support and understanding in which the teacher appreciates, vitalizes, and actively supports students' inner motivational resources (e.g., intrinsic motivation, psychological needs) by utilizing teaching practices such as taking the students' perspective, creating opportunities for students' input and initiative, offering learning activities in need-satisfying ways, providing explanatory rationales for teacher requests, and acknowledging and accepting students' expressions of negative affect as both understandable and okay. A teacher's classroom autonomy-supportive motivating style is important because its presence catalyzes high-quality and engagement-fostering motivations (need satisfaction, autonomous motivation, intrinsic goals) and hence students' adaptive classroom functioning and outcomes (Assor et al., 2002; Cheon, Reeve, & Moon, 2012; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004; Vansteenkiste, Simons, Lens, Soenens, & Matos, 2005).

When K-12 teachers participate in carefully-designed, theory-

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based, and workshop-oriented training programs to learn how to become more autonomy supportive toward their students during instruction, two reliable effects occur. First, most teachers capitalize on this professional developmental opportunity and successfully upgrade the quality of their classroom motivating style (more autonomy supportive), as documented both by students' post-intervention perceptions of their teacher's motivating style (Cheon et al., 2012; Cheon, Reeve, & Song, 2016) and by observers' objective ratings of teachers' post-intervention teaching behavior (Cheon et al., 2014; Cheon & Reeve, 2015). Second, after teachers become more autonomy supportive, their students show large, educationally-important, and wide-ranging gains in autonomous motivation, classroom engagement, conceptual learning, academic achievement, and well-being (Cheon et al., 2012, 2016; Chatzisarantis & Hagger, 2009; Tessier, Sarrazin, & Ntoumanis, 2010; Vansteenkiste, Matos, Lens, & Soenens, 2007).

What this research literature has not yet been able to do is to explain precisely what personal resources teachers acquire during these interventions that allow them to upgrade the quality of their motivating style so successfully and so reliably. That is, these interventions work, but it is still an open question as to precisely why they work as well as they do.

1. Explaining why autonomy-supportive intervention programs work

We propose that teacher participation in an ASIP allows teachers to develop three empowering personal-professional resources—namely, greater psychological need satisfaction during teaching, greater teaching efficacy, and the adoption of relatively more intrinsic (and less extrinsic) instructional goals.

Greater need satisfaction. The reason why students of autonomy-supportive teachers show a wide range of important positive educational outcomes (e.g., greater engagement) is clear—it is because they first experience greater psychological need satisfaction during classroom instruction (i.e., greater autonomy, competence, and relatedness satisfaction; Cheon et al., 2012). That is, gains in need satisfaction produce a wide range of positive outcomes (Ryan & Deci, 2017). That is, students show more interest during instruction, become more engaged, and learn more conceptually after they first experience greater autonomy, competence, and relatedness need satisfaction. Interestingly, teachers too experience this same boost in their own need satisfaction after they learn how to teach in more autonomy-supportive ways (Cheon et al., 2014). That is, just as their students show greater need satisfaction from receiving autonomy support, teachers show greater need satisfaction from giving autonomy support. Other research shows that a teacher's autonomy-supportive motivating style and his or her need satisfaction during teaching tend to positively covary (Quiles, Moreno-Murcia, & Lacarcel, 2015). Given this evidence, we propose that teacher participation in an ASIP will enhance teachers' need satisfaction during teaching and this intervention-enabled boost in need satisfaction will, in turn, explain why teachers are able to use the ASIP to learn how to become more autonomy supportive.

Greater teaching efficacy. Teaching efficacy is a teacher's judgment of his or her capacity to cope with the teaching situation in ways that bring about desired outcomes, and it revolves principally around teachers' confidence in being able to implement instructional strategies that reliably boost students' learning, engagement, and desired behavior (Tschannen-Moran & Woolfolk Hoy, 2001). Like other teacher training programs to increase teaching efficacy (e.g., Liaw, 2017), teachers who participate in autonomy-supportive interventions also show a rather pronounced increase in their teaching efficacy (Cheon et al., 2014), and this increase occurs because, during an ASIP, teachers (1) expand their existing repertoire of instructional behaviors to incorporate new-and-improved and evidence-based ways to enhance their students' conceptual learning, engagement, and behavior and (2) come to believe that these newly-learned autonomy-supportive instructional behaviors (e.g., "take the students' perspective", "provide explanatory rationale for requests") are both highly effective and easy-to-do (Reeve & Cheon, 2016). Given that participation in an ASIP has been shown to increase teaching efficacy and given that ASIP participation helps teachers see autonomy-supportive instructional behaviors as both effective and easy-to-implement, we propose that a second reason why teachers learn to be more autonomy supportive is because the intervention enhances their sense of teaching efficacy.

Teaching efficacy and competence need satisfaction are similar, but not interchangeable, motivational constructs (Rodgers, Markland, Selzler, Murray, & Wilson, 2014). Both constructs can be experienced and measured in somewhat similar ways (e.g., as perceived competence), but they are also different in important ways. Teaching efficacy is a key concept in social-cognitive theory (Bandura, 1986), and it represents a teacher's situation-specific self-confidence. Teaching efficacy develops as teachers reflect on whether they can execute specific teaching behaviors under specific circumstances. Once formulated, teaching efficacy predicts behavioral initiation, effort, and persistence, but it does not concern the outcomes of such teaching (e.g., need satisfaction, well-being). The need for competence is a key concept in self-determination theory (Ryan & Deci, 2017), and it represents a teacher's sense of effective functioning during teaching. Competence need satisfaction during teaching predicts the proactive desire (intrinsic motivation) to exercise and grow one's capacities and teaching skill, and it generates a willingness (even an eagerness) to seek out new challenges and to want to make progress and to learn something new. When teachers add new instructional stills to their repertoire, they do not so much formulate a judgment of efficacy but, instead, experience a deep sense of satisfaction and well-being from a job well done. In terms of measurement, self-efficacy and competence need satisfaction have been shown to be two distinct constructs—conceptually and statistically (as per confirmatory factor analysis; Rodgers et al., 2014).

Adoption of intrinsic instructional goals. Instructional goals represent the priorities or desired outcomes that teachers bring with them into the classroom. According to a self-determination theory framework (Kasser & Ryan, 1996, 2001; Sheldon, Ryan, Deci, & Kasser, 2004), these priorities can be divided into two categories of intrinsic and extrinsic instructional goals. Extrinsic instructional goals are those classroom priorities and teacher strivings to promote their students' socially-valued indicators of worth, such as high test scores, while intrinsic instructional goals are those classroom priorities and teacher strivings to promote their students' personal and relationship growth (Jang, 2017). Adopting intrinsic goals can be expected to increase teachers' use of autonomy-supportive instructional behaviors because autonomy support is literally the means by which teachers pursue their intrinsic instructional goals [i.e., "To accomplish my intrinsic instructional goal (e.g., to promote my students' personal growth), I will need to teach in an autonomy-supportive way."], just as adopting extrinsic goals can be expected to take teachers away from autonomy-supportive instructional behaviors [i.e., "To accomplish my extrinsic instructional goal (e.g., to promote my students' high test scores), I will need to forego teaching in an autonomy-supportive way."]. Given the close relation between intrinsic goals and autonomy-supportive teaching practices (Jang, 2017), we

propose that a third reason why teachers learn to be more autonomy supportive is because they adopt a greater usage of intrinsic instructional goals.

2. Research questions and hypotheses

The starting point of the present study was the observation that K-12 teachers learn how to become more autonomy supportive toward their students when they participate in carefully-designed and theory-based interventions (i.e., an ASIP). Given this starting point, our research question was to ask why teachers are able to use these interventions as professional developmental opportunities to upgrade the quality of their motivating style. Stated a bit differently, our research question was this: What personal-professional resources do teachers acquire during these interventions that might explain why they are able to upgrade the quality of their classroom motivating style?

Hypothesis 1 was that the intervention would produce its intended effect—that is, the teachers who were randomly assigned to participate in the intervention would report a more autonomy-supportive motivating style at year end than would the teachers who were randomly assigned into the control group. *Hypothesis 2* was that all three possible paths to becoming more autonomy supportive—greater need satisfaction, greater teaching efficacy, and adopting more intrinsic goals—would each individually explain why the intervention worked. Hypothesis 2 was therefore a mediation hypothesis—namely, that participation in the ASIP would allow teachers to develop these three personal-professional resources, and that each of these resources in turn would explain why teachers who participated in the ASIP showed a more autonomy-supportive motivating style at year end.

3. Method

3.1. Participants

Every summer, the Korean Ministry of Education requires all certified teachers throughout the nation to complete an official teacher training (or teacher education) program, the purpose of which is to further teachers' professional and career growth and development. During this two-day session, we were allowed to approach all physical education (PE) teachers in attendance to invite them to participate in our study. One hundred and two teachers agree to participate in the study. All 102 teachers were full-time, certified, and experienced PE teachers who taught in one of 102 different schools dispersed across 12 different school districts throughout the nation of South Korea. Over the course of the academic year (two semesters—Fall and Spring), 11 of these teachers were unable to complete all parts of the study, so the final analyzed sample included 91 PE teachers (57 males, 34 females; 20 elementary, 44 middle, and 27 high schools), all of whom were ethnic Korean. The teacher retention rate throughout the year-long intervention was therefore 89.2% (91/102). The 11 teachers who did not complete the study did not differ from the 91 teachers who did complete all aspects of the study on any T1 dependent measure or on any teacher demographic characteristic, all t's(100) < 1.50, *ns*. The teacher-participants in the analyzed sample had, on average, 10.4 years of teaching experience (SD = 8.2; *range* = 1–33) and were, on average, 35.9 years old (SD = 8.9; *range* = 23–57). In addition, 11 of the 91 teachers taught students with special needs in their classes. In appreciation of 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 a statement of appreciation for the extra time teachers gave to complete all aspects of the study.

3.2. Procedure and implementation of the ASIP intervention

Teacher-participants were randomly assigned into either the experimental (n = 48) or control (n = 43) condition. Participation (or not) in the intervention was the study's independent variable. The procedural timeline for the year-long intervention and the three waves of data collection appear in Fig. 1.

For the data collection, teacher-participants completed the 4-page questionnaire for the first time before they participated in Part 1 of the intervention (T1, in August during the summer break—2 weeks prior to the beginning of the Fall semester), for a second time after the Fall semester's final examination (T2, late December), and for a third time after the Spring semester's final examination (T3, early July). For teachers in the control condition, they taught their classes using their pre-existing motivating styles (i.e., "practice as usual"). For teachers in the experimental condition, we delivered the ASIP in three parts.

Part 1 was a 3-hour workshop delivered by the author team that took place in the early afternoon two weeks prior to the beginning of the Fall semester (during the August summer break). It introduced autonomy-supportive teaching, contrasted autonomy support against teacher control, provided empirical evidence on the benefits of autonomy support and the cost of control, and introduced teachers to the following six recommended autonomy-supportive instructional practices: Take the students' perspective; vitalize students' psychological needs during learning activities; rely on invitational language; provide explanatory rationales for teacher requests; display patience; and acknowledge and accept expressions of negative affect.

Part 2 was a second 3-hour workshop that took place in the late afternoon (on the same day) following the completion of Part 1 and a lunch break. It provided live and videotaped examples of the six autonomy-supportive instructional behaviors and revolved mostly around describing, modeling, explaining, coaching, and scaffolding the "how to" of each recommended instructional behavior. It also provided examples and tips in how to transform controlling instructional behaviors into more autonomy-supportive ones. While Part 1 was mostly an informational presentation, Part 2 was mostly a practical and skill-based "how to" workshop that featured practice and group discussion. Many questions in the group discussion were "how to" based, but other questions revolved around how realistic, how effective, and how easy to implement the recommended autonomy-supportive instructional behaviors were, especially in the context of a pressure-inducing school system. After Part 2, the research team kept in contact with all teacher-participants (via email, text messages, and telephone calls). About half of the teachers in the experimental group initiated contact with the research team, and most of these questions asked about how to cope with particular obstacles (e.g., lack of time) or difficulties (e.g., large class size) while trying to implement autonomy-supportive instruction.

Part 3 was a 3-hour session in which the first hour reviewed the materials from Parts 1 and 2, while the last two hours featured a teacher-to-teacher (peer-based) group discussion. Because teachers were geographically diverse, Part 3 took place during the between-semester winter break when teachers' schedules were flexible enough to accommodate such a meeting (see Fig. 1). During the group discussion, teachers shared their classroom experiences and exchanged tips and suggestions in how to become more autonomy supportive and less controlling toward their students during instruction. After these group discussions, about one-third of teacher-participants in the experimental condition again kept in contact with members of research team by calling, texting, or e-mailing

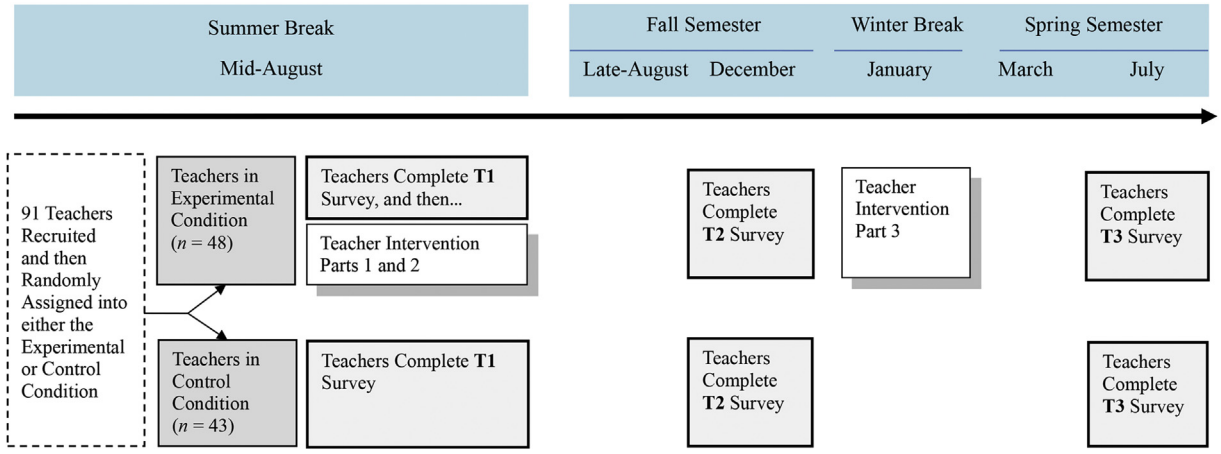

Fig. 1. Procedural timeline for the events included in the delivery of the year-long intervention and in the data collection.

with most questions asking for scaffolding in the specific autonomy-supportive instructional behaviors they were trying to implement.

3.3. Measures

Each measure used the same 7-point scale that ranged from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*), except for the teaching efficacy measure because its authors recommend the use of a 9-point scale (Tschannen-Moran & Woolfolk Hoy, 2001). While each measure was originally written in English, we used a previously translated and back-translated Korean-language version of each measure, which we had available to us through our access to previously published research (Cheon et al., 2014, 2016; Klassen et al., 2009).

Autonomy-Supportive Motivating Style. We assessed two indicators of teachers' autonomy-supportive motivating style. For self-rated autonomy support, teachers completed the 6-item teacher-version of the Learning Climate Questionnaire (LCQ; Cheon et al., 2016). Sample items include "I provide my students with choices and options" and "I try to understand how my students see things before I suggest a new way they might do things". This measure was internally consistent in the present study (α = 0.79 at T1; α = 0.82 at T3). For personal endorsement of autonomy-supportive teaching, teachers completed the Teaching Scenarios measure (Cheon et al., 2014). This measure presents a 263-word description of prototypical autonomy-supportive teaching that is then followed by 4 questions that referenced that teaching scenario, including "This approach to teaching describes how I teach my students on a daily basis" and "This is an accurate and true description of what I do during my teaching". This measure was also assessed in an internally consistent way ($\alpha = 0.78$ at T1; $\alpha = 0.89$ at T3). These two indicators of autonomy support were moderately correlated with each other ($r = 0.42$ at T1, $r = 0.65$ at T2).

Need Satisfaction. We assessed autonomy, competence, and relatedness need satisfaction with three separate scales. For autonomy satisfaction, we used a teacher-version of the 5-item Perceived Autonomy scale (Standage, Duda, & Ntoumanis, 2006). A sample item is, "I feel that I teach because I want to" (α at T1 = 0.83; α at T2 = 0.86). For competence satisfaction, we used a teacher-version of the 4-item Perceived Competence scale from the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989). A sample item is, "I think I am pretty good at teaching" (α at T1 = 0.88; α at T2 = 0.91). For relatedness satisfaction, we used a teacher version of the 5-item Perceived Relatedness scale from the Basic Needs Satisfaction in Sport Scale (Ng, Lonsdale, & Hodge, 2011). A sample item is, "I have close relationships with people in my class" (α at T1 = 0.79; α at T2 = 0.76). Because scores on the three measures were adequately intercorrelated [r's among the autonomy, competence, and relatedness measures were 0.71, 0.32, and 0.34 at T1 (3-scale $\alpha = 0.71$) and were 0.74, 0.39, and 0.41 at T2 (3-scale α = 76)], we equally-weighted and averaged the three scores into a single overall score for need satisfaction.

Teaching Efficacy. To assess teaching efficacy, teachers completed the widely-used short form of the Teachers' Sense of Efficacy Scale (TSES; Tschannen-Moran & Woolfolk Hoy, 2001). The 12-item TSES assesses three aspects of teaching efficacy (for instructional strategies, student engagement, and classroom management). Scores on the 4-item teaching efficacy for instructional strategies scale (e.g., "How much can you do to provide an alternative explanation when students are confused?") showed acceptable internal consistency ($\alpha = 0.84$ at T1; $\alpha = 0.90$ at T2), as did the scores on the 4-item teaching efficacy for student engagement scale (e.g., "How much can you do to motivate students who show low interest in school work?") ($\alpha = 0.81$ at T1; $\alpha = 0.89$ at T2), as did the scores on the 4-item teaching efficacy for classroom management scale (e.g., "How much can you do to calm a student who is disruptive or noisy?") (α = 0.82 at T1; α = 0.87 at T2). Because scores on the three measures were adequately intercorrelated [r's among the instructional strategies, student engagement, and classroom management measures were 0.63, 0.81, and 0.73 at T1 (3-scale $\alpha = 0.88$) and 0.80, 0.91, and 0.77 at T2 (3-scale $\alpha = 94$)], we equally-weighted and averaged the three scores into a single overall score for teaching efficacy.

Relative Intrinsic Instructional Goals. To assess intrinsic and extrinsic instructional goals, teachers completed the 20-item Goal Content Questionnaire (GCQ; Sebire, Standage, & Vansteenkiste, 2008). The GCQ assesses five aspirations or goals (skill development, social affiliation, health management, image, and social recognition), the first three of which are scored as intrinsic goals and the last two of which are scored as extrinsic goals. Teachers rated each item responding to the stem, "Please indicate to what extent these goals are important for you while teaching." Scores on the 4-item intrinsic skill development goal scale (e.g., "To acquire new teaching skills.") showed acceptable internal consistency ($\alpha = 0.87$ at T1; $\alpha = 0.92$ at T2), as did scores on the 4-item social affiliation goal scale (e.g., "To form close bonds with my students"; αs at T1 and T2 = 0.81 and 0.91), as did scores on the 4-item health management goal scale (e.g., "To improve my students overall

health"; αs = 0.93 and 0.95). Similarly, scores on the 4-item extrinsic image goal scale (e.g., "To be professional so to look expert to others.") showed acceptable internal consistency (αs = 0.89 and 0.90), as did scores on the 4-item social recognition goal scale (e.g., "To be socially respected by others"; αs = 0.91 and 0.95). At T1, teachers' intrinsic goals ($M = 5.55$, $SD = 0.64$, $\alpha = 0.84$) correlated positively ($r = 0.48$, $p < 0.01$) with their extrinsic goals ($M = 3.33$, $SD = 1.12$, $\alpha = 0.92$), but at T2 teachers' intrinsic goals ($M = 5.63$, $SD = 0.73$, $\alpha = 0.91$) were largely independent ($r = -0.15$, $p = 0.163$) of their extrinsic goals ($M = 3.72$, $SD = 1.14$, $\alpha = 0.93$). Following the tradition established in this research (Sheldon & Kasser, 1995, 1998, 2008), we computed one overall "relative intrinsic instructional goals" score by subtracting the mean score on the 8 extrinsic items from the mean score on the 12 intrinsic items. In the interpretation of this score, it is not so much that teachers adopt intrinsic or extrinsic instructional goals as it is that they adopt intrinsic goals to a greater degree than they adopt extrinsic goals.

3.4. Data analyses

The unit of analysis was the teacher, and the research design was longitudinal. To analyze both hypotheses, we used structural equation modeling (SEM; LISREL 8.80, Joreskog & Sorbom, 2006). To evaluate model fit, we relied on the chi-square test statistic and multiple indices of fit (as recommended by Kline, 2011), including the root-mean-square error of approximation (RMSEA), the standardized root-mean-square residual (SRMR), and the comparative fit index (CFI). For RMSEA and SRMR, values less than 0.08 indicate good fit; for CFI, values greater than 0.95 indicate good fit (Hu & Bentler, 1999; Kline, 2011).

We assessed the study's outcome measure—autonomy-supportive motivating style—as a latent variable created from the two indicators of self-rated autonomy support (LCQ score) and personal endorsement of autonomy-supportive teaching (Teaching Scenarios score). We assessed the study's three hypothesized mediators as observed variables. Specifically, for psychological need satisfaction, we equally-weighted and averaged teachers' score on the autonomy, competence, and relatedness satisfaction scales; for teaching efficacy, we equally-weighted and averaged teachers' score on the instructional strategies, student engagement, and classroom management scales; and for relative intrinsic goals, we equally-weighted and averaged teachers' scores on the intrinsic goals and extrinsic goals scales (after reverse scoring the extrinsic goal score). In each case, we used an equally-weighted score because we had no a priori reason to overweight or under-weight any one aspect of teachers' need satisfaction, teaching efficacy, or instructional goals. The analytic decision to use only observed scores to represent the three hypothesized mediators was necessitated by the statistical need to keep the ratio of participants (91) to measured variables (8) in line with the recommended minimally acceptable 10.0 participants/measured variables ratio (Maxwell, 2000). Had we assessed the three hypothesized mediators as latent variables, the participants:measured variables ratio would have dropped from an acceptable 11.4 down to an unreliable ratio of only 4.6 (91:20).

We also considered whether or not our statistical tests were adequately powered. To estimate the sample size needed to reach generalizable conclusions, 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 seven moderately potent antecedents ($d = 0.30$) among a set of 11 total predictors (7 antecedents in Fig. 1 plus the 4 statistical controls) to predict the outcome measure. That minimal sample size would be 81, based on Faul, Erdfelder, Lang, and Buchner's (2007) G*Power 3 software program. Because our analyzed sample size was $N = 91$, we determined that our hypothesis tests were adequately powered, though just barely so.

In the test of hypothesis 1, autonomy support was the repeated measures within-subjects outcome variable, experimental condition was the between-subjects independent variable, and gender, grade level taught, special education class, and years of teaching experience served as T1 covariates. We included these teachers' demographic characteristics because they are frequently correlated with teachers' motivating style (Cheon et al., 2016) and because, in the present data, teacher gender and special education classes were associated with 1 of the 8 assessed dependent measures, grade level taught was associated with 2 dependent measures, and years of teaching experience was associated with 4 dependent measures (see these statistics in Table 1). Given these associations, we included gender (females = 0, males = 1), grade level taught (elementary = 0, middle = 1, high school = 2), special education classes (no = 0, yes = 1) and years of teaching experience as a set of four covariates (i.e., a statistical controls) in all subsequent analyses.

In the test of hypothesis 2, autonomy support was the repeated measures within-subjects dependent variable, experimental condition was the between-subjects independent variable, need satisfaction, teaching efficacy, and relative intrinsic instructional goals were three repeated measures within-subjects independent variables, and gender, grade level, special education class, and teaching experience served as covariates. The five T1 predictor variables (experimental condition, autonomy-supportive motivating style, need satisfaction, teaching efficacy, and intrinsic goals) and the four statistical controls (gender, grade level, special education class, and years of teaching experience) were allowed to correlate freely. The three T2 within-wave mediators (need satisfaction, teaching efficacy, and intrinsic instructional goals) were allowed to correlate. To represent the longitudinal character of the data set, we allowed the between-wave error terms of each observed variable to correlate with itself from T1 to T2 (for the four mediators) and from T1 to T3 (for the two indicators of autonomy-supportive motivating style). Finally, to test for mediation, we used the INDIRECT macro in SPSS to conduct bootstrapping analyses based on 1000 bootstrapping resamples (Preacher & Hayes, 2008).

4. Results

4.1. Preliminary analyses

Missing data were rare (<0.1%), so we used the expectation-maximization (EM) algorithm to produce a multiple imputed data set (generating 200 iterations). We also explored whether the distribution of scores for each measured indicator deviated from normality and found that all values for skewness and kurtosis were less than |1.0|, indicating little deviation from normality. Finally, we tested for the equivalence of our two groups at T1. Teachers randomly assigned into the experimental group did not differ from teachers assigned into the control group on any of the eight T1 measures/indicators (autonomy support, 3 hypothesized predictors, 4 statistical controls).

4.2. Did the ASIP work? (Hypothesis 1)

The structural model to test Hypothesis 1 (i.e., experimental condition would predict increased T3 autonomy support, controlling to T1 autonomy support) fit the data well, X^2 (9) = 10.80, $p = 0.289$, *RMSEA* = 0.041, *SRMR* = 0.045, *CFI* = 0.99. As expected, experimental condition (ASIP participation) predicted increased T3 autonomy support ($B = 0.39$, *SE B* = 0.12, $\beta = 0.39$, $t = 3.23$, $p = 0.002$), even after controlling for T1 autonomy support

Table 1
Descriptive statistics and correlation matrix for experimental condition, the latent variables for T1 and T3 autonomy support, the observed variables for the three T1 and T2 hypothesized predictors, and the four T1 statistical controls.

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. ASIP Experimental Condition	–												
2. T1 Autonomy Support	-0.03	–											
3. T3 Autonomy Support	0.41	0.55	–										
4. T1 Need Satisfaction	0.20	0.42	0.44	–									
5. T1 Teaching Efficacy	0.15	0.28	0.30	0.58	–								
6. T1 Relative Intrinsic Goals	0.01	0.22	0.08	0.02	-0.01	–							
7. T2 Need Satisfaction	0.36	0.28	0.43	0.73	0.42	0.02	–						
8. T2 Teaching Efficacy	0.49	0.22	0.57	0.43	0.60	0.03	0.56	–					
9. T2 Relative Intrinsic Goals	0.35	0.10	0.37	0.10	0.02	0.48	0.26	0.42	–				
10. Teacher Gender	0.31	0.15	0.18	0.01	0.23	0.06	0.09	0.20	-0.03	–			
11. Grade Level Taught	0.08	-0.05	0.13	0.05	0.22	-0.21	-0.02	-0.04	-0.09	0.16	–		
12. Special Education Classes	-0.15	0.04	0.00	-0.14	-0.25	0.10	-0.07	-0.06	-0.01	-0.10	-0.49	–	
13. Years of Teaching Experience	0.35	0.10	0.31	0.24	0.10	-0.14	0.31	0.24	0.09	0.06	0.01	-0.13	–
Mean	0.53	5.26	5.53	4.01	5.96	0.76	5.52	6.27	1.17	0.63	0.95	0.13	10.4
Standard Deviation	0.50	0.65	0.73	0.52	0.90	0.91	0.71	1.07	1.21	0.49	0.75	0.34	8.23
Possible Range	0–1	1–7	1–7	1–7	1–9	−6 to +6	1–7	1–9	−6 to +6	0–1	0–2	0–1	1–33

Note. r's(91) $\geq$ 0.21, $p < 0.05$; r's(91) $\geq$ 0.26, $p < 0.01$; and r's(91) $\geq$ 0.33, $p < 0.001$. $N = 91$. T1 = Time or Wave 1; T2 = Time 2; T3 = Time 3.
Experimental condition: control condition = 0, ASIP experimental = 1. Gender: women = 0, men = 1.
Grade Level Taught: elementary = 0, middle school = 1; high school = 2. Special Education Classes: no = 0, yes = 1.

(β = 0.69, $p < 0.001$), gender (β = −0.09, $p = 0.323$), grade level (β = −0.15, $p = 0.105$), special education class (β = −0.09, $p = 0.280$), and teaching experience (β = 0.11, $p = 0.199$). This result—the statistically significant effect of experimental condition on a change in teachers' T3 autonomy-supportive motivating style—shows that the ASIP worked (i.e., produced the hypothesized direct effect).

4.3. Why did the ASIP work? (Hypothesis 2)

The descriptive statistics and intercorrelations among experimental condition, T1 and T3 autonomy support, T1 and T2 need satisfaction, teaching efficacy, and relative intrinsic instructional goals, and the four T1 covariates appear in Table 1. The structural model to test Hypothesis 2 fit the data reasonably well, $X^2(30) = 45.55$, $p = 0.034$, *RMSEA* = 0.064, *SRMR* = 0.046, *CFI* = 0.98. The path diagram showing the standardized estimates for each hypothesized path appears in Fig. 2. For clarity, we do not show the four T1 statistical controls in the figure, but we do report their results in the full statistical findings below.

In the prediction of each of the three hypothesized T2 mediators (see the downwardly-sloped lines on the upper-left side of Fig. 2), ASIP participation (1) *increased T2 need satisfaction* ($B = 0.19$, *SE* $B = 0.08$, β = 0.19, $t = 2.47$, $p = 0.015$), even after controlling for T1 need satisfaction (β = 0.69, $p < 0.001$), gender (β = 0.03, $p = 0.633$), grade level (β = −0.05, $p = 0.510$), special education class (β = 0.04, $p = 0.582$), and teaching experience (β = 0.08, $p = 0.272$); (2) *increased T2 teaching efficacy* ($B = 0.42$, *SE* $B = 0.08$, β = 0.42, $t = 5.34$, $p < 0.001$), even after controlling for T1 teaching efficacy (β = 0.59, $p < 0.001$), gender (β = −0.04, $p = 0.563$), grade level (β = −0.15, $p = 0.058$), special education class (β = 0.08, $p = 0.351$), and teaching experience (β = 0.05, $p = 0.486$); and (3) *increased T2 relative intrinsic instructional goals* ($B = 0.39$, *SE* $B = 0.09$, β = 0.39, $t = 4.14$, $p < 0.001$), even after controlling for T1 relative intrinsic goals (β = 0.49, $p < 0.001$), gender (β = −0.18, $p = 0.045$), grade level (β = 0.00, $p = 0.971$), special education class (β = −0.02, $p = 0.871$), and teaching experience (β = 0.03, $p = 0.706$).

In the prediction of T3 autonomy-supportive motivating style (see the downwardly-sloped lines on the lower-right side of Fig. 2), *T2 teaching efficacy* ($B = 0.33$, *SE* $B = 0.12$, β = 0.33, $t = 2.45$, $p = 0.016$) and *T2 relative intrinsic instructional goals* ($B = 0.22$, *SE* $B = 0.10$, β = 0.22, $t = 2.09$, $p = 0.039$) were both individually statistically significant predictors, while *T2 need satisfaction* was not an individually statistically significant predictor ($B = -0.18$, *SE* $B = 0.12$, β = −0.18, $t = 1.48$, $p = 0.142$), at least after controlling for experimental condition (β = 0.28, $p = 0.011$), T1 autonomy support (β = 0.57, $p = 0.003$), T1 need satisfaction (β = 0.09, $p = 0.562$), T1 teaching efficacy (β = −0.09, $p = 0.500$), T1 intrinsic instructional goals (β = −0.23, $p = 0.037$), gender (β = 0.03, $p = 0.727$), grade level (β = −0.21, $p = 0.027$), special education class (β = −0.09, $p = 0.324$), and teaching experience (β = 0.08, $p = 0.372$).

In the test for mediation, the indirect effect of experimental condition on T3 autonomy-supportive motivating style through all three hypothesized T2 mediators, including all three T1 teacher resources and all four T1 covariates as a set of seven statistical controls, were as follows. T2 teaching efficacy predicted T3 autonomy support, and its bias-corrected 95% confidence interval did not include zero, $\beta = 0.21$, [0.03, 0.41], confirming mediation. T2 relative intrinsic instructional goals also predicted T3 autonomy support, and its bias-corrected 95% confidence interval did not include zero, $\beta = 0.12$ [0.01, 0.28], confirming mediation. Finally, T2 need satisfaction did not predict T3 autonomy support, and its bias-corrected 95% confidence interval did include zero, $\beta = -0.14$ [-0.20, 0.02], confirming the lack of mediation.

5. Discussion

The present study asked this question: Why do teachers who participate in carefully-designed, theory-based, and workshop-oriented intervention programs learn a more autonomy-supportive motivating style as well as and as reliably as they do? Accordingly, we sought to discover what personal-professional resources these teachers acquired during the intervention that allowed them to so successfully upgrade the quality of their classroom motivating style. While we tested the validity of three possible explanatory mediating processes, only two emerged as individually statistically significant mediators—namely, greater teaching efficacy and a greater tendency to adopt intrinsic (relative to extrinsic) instructional goals.

Teaching efficacy emerged as the first autonomy-supportive-enabling resource teachers acquired during the ASIP. Much of what teachers learned during the ASIP was the "how to" of six recommended instructional behaviors that previous research had documented to be reliable and potent catalysts to enhancing

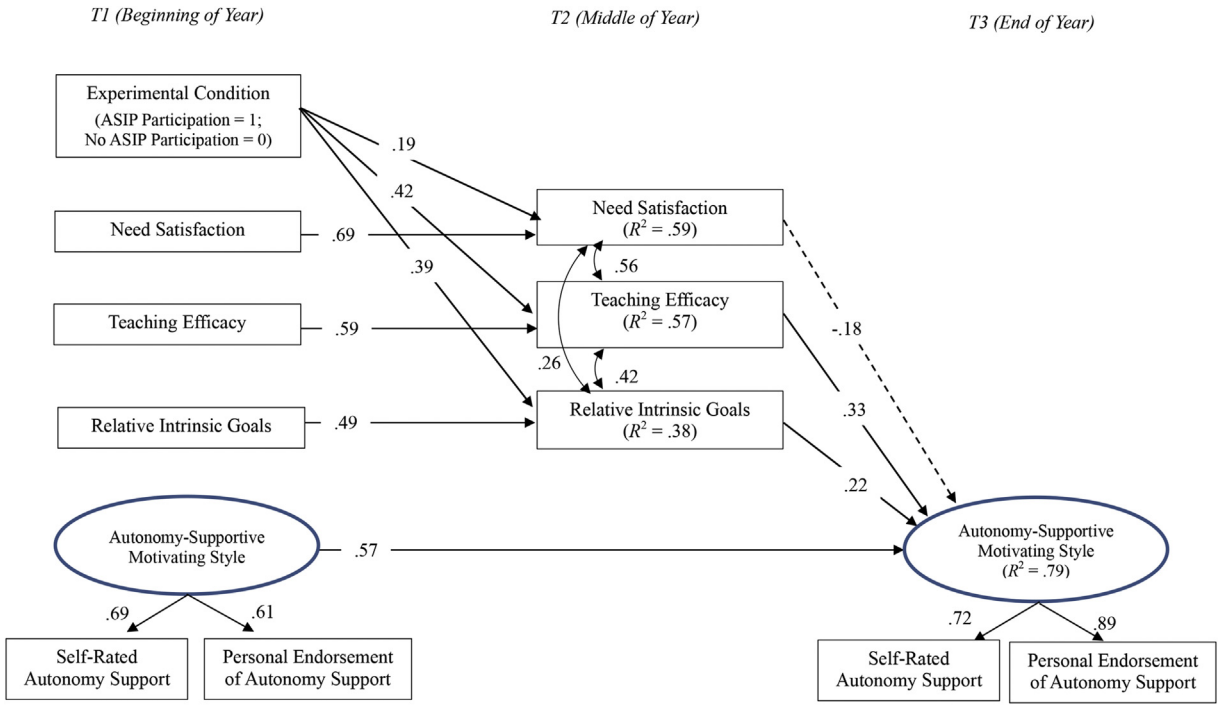

Fig. 2. Hypothesized mediation model to test which of teachers' three personal resources explain why the intervention (experimental condition) worked to increase end-of-year autonomy-supportive motivating style. Solid lines represent statistically significant paths ($p < 0.05$); dashed lines represent statistically non-significant paths. Numbers are standardized beta weights.
ASIP = Autonomy-supportive intervention program.

students' autonomous motivation, classroom engagement, and conceptual learning (Cheon et al., 2012). During the ASIP, teachers learned both the "how to" of each of the following instructional practices and also how to substitute these autonomy-supportive instructional behaviors for common but motivationally-suppressive controlling instructional behaviors: take the students' perspective (to replace take only the teacher's perspective); vitalize inner motivational resources during learning activities (to replace introduce extrinsic motivators); provide explanatory rationales (to replace directives without explanations); use invitational language (to replace use pressuring language); acknowledge and accept negative affect (to replace counter and try to change negative affect); and display patience (to replace pushing for an immediate desired behavior or right answer). Teachers also observed modeling and received encouragement and support for these new autonomy-supportive instructional behaviors as well as hands-on practice, coaching, and scaffolding, which are well-known antecedent conditions to building strong and resilient teaching efficacy beliefs (Tschannen-Moran & Woolfolk Hoy, 2007). Because autonomy-supportive instructional behaviors are highly effective in promoting students' autonomous motivation, classroom engagement, conceptual learning, and desired behavior, teachers' efficacy increased as they observed first-hand these benefits occur in their own classrooms and as a function of their own instructional behavior. Thus, learning the new autonomy-supportive instructional behaviors gave teachers the "skill" they needed to become more autonomy supportive, while acquiring a greater sense of teaching efficacy gave teachers the confidence and "will" they needed to become more autonomy supportive.

Intrinsic instructional goals emerged as the second autonomy-supportive-enabling resource teachers developed during the ASIP. Just as teachers who participated in the ASIP learned to use autonomy-supportive instructional behaviors more, teachers who participated in the ASIP further learned to pursue intrinsic, relative to extrinsic, instructional goals. The more participating teachers adopted intrinsic instructional goals, the more sense it made for them to move toward a greater reliance on autonomy-supportive instructional behaviors because such acts of instruction (e.g., taking the students' perspective, making the learning activity more interesting and self-relevant) are a natural extension of the pursuit of an intrinsic instructional goal. That is, autonomy-supportive instructional behaviors are the means through which teachers pursue their intrinsic instructional goals. For a teacher who is committed to more extrinsic instructional goals (e.g., promote high test scores), these same autonomy-supportive behaviors make less sense, as more authoritarian (i.e., controlling) ways of teaching may make more sense as a logical means to that end.

The findings from the present study did not support greater need satisfaction as a mediating process. Teachers who participated in the intervention did report a significant increase in T2 need satisfaction during teaching (see the statistically significant path from experimental condition to need satisfaction in Fig. 2). So, these teachers did gain the personal-professional resource. And, autonomy-supportive teaching and need satisfaction during teaching were highly positively correlated both at T1 ($r = 0.59$) and at T2 ($r = 0.55$). Nevertheless, we did not find that these T2 gains in need satisfaction could explain unique variance in teachers' increased T3 autonomy-supportive motivating style.

It is always difficult to interpret a null effect, but it may be a fruitful undertaking to help guide future investigations so we introduce three considerations. First, teachers' need satisfaction was more stable over the semester than were either teaching efficacy or relative intrinsic instructional goals (βs = 0.69 *vs.* 0.59 and 0.49). The intervention may have focused more on how teachers relate to students (the skills and goals they utilize) and less on elevating the teachers' own personal experience during teaching.

We suggest this possibility because the intervention produced a more substantial change in T2 teaching efficacy and intrinsic instructional goals (βs = 0.42 and 0.39) than it did on a change in T2 need satisfaction (βs = 0.19). Second, all three hypothesized mediators were positively intercorrelated, such that each predictor competed against the other two for explanatory variance (instead of functioning as independent predictors). Had teaching efficacy and relative intrinsic instructional goals not been included in the hypothesized model, it is likely that need satisfaction would have emerged as statistically significant predictor, given its relatively large correlations with T3 autonomy support (r's = 0.55; see Table 1). Third, it could be that the relation between autonomy support and need satisfaction is that greater autonomy support and the constructive classroom changes it brings (e.g., greater student engagement) may lead to gains in teachers' need satisfaction—and not the other way around.

These findings have theoretical and practical importance for improved teaching. Theoretically, the present findings help us understand how these processes (autonomy supportive teaching and its antecedents) complement and support each other. That is, just as ASIP participation boosts teachers' sense of teaching efficacy and adoption of intrinsic instructional goals (i.e., the upper-left side of Fig. 2), boosts in teaching efficacy and instructional goals in turn explain (and even accelerate) subsequent gains in teachers' autonomy-supportive teaching (i.e., the lower-right side of Fig. 2). That is, teaching efficacy and intrinsic instructional goals function as both antecedents to and consequences of greater autonomy-supportive teaching.

Practically, the findings are important because they explain what personal-professional resources teachers are developing week-by-week during their ASIP experience. Consequently, during future ASIPs or similar teacher-focused interventions, we suggest that educators monitor and support not only developing changes in teachers' motivating style and classroom instructional behaviors but also developing changes in these two key professional developmental catalysts to a more autonomy-supportive motivating style.

6. Conclusion

Experienced teachers routinely benefit by participating in a carefully designed ASIP. Knowing this, we investigated what resources teachers acquired during these interventions that might explain why they are able to upgrade the quality of their motivating style. We found that teachers were able to use the intervention experience to become more autonomy supportive to the extent that they were able to build in themselves a greater sense of teaching efficacy and a greater reliance on intrinsic instructional goals.

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