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Exploring the Relationships among Perceived Teacher's Autonomy Support, Motivational Regulations, and Social-Emotional Outcomes

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The present study examined the relationships among perceived teacher's autonomy support, four motivational regulations (external, introjected, identified, intrinsic), and four social-emotional outcomes (self-efficacy, resilience, test anxiety, and perceived stress). A total of 130 primary students aged between 10 and 11 (M = 10.36; SD = 0.48) were recruited in Singapore. In particular, the mediating effects of four motivational regulations in the relationship between teacher's autonomy support and social-emotional outcomes were tested using bootstrapping method. Results of the study indicated that external regulation and intrinsic motivation were two mediators between teacher's autonomy support and test anxiety. Surprisingly, introjected regulation was positively associated with test anxiety and perceived stress and functioned as a significant mediator between teacher's autonomy support and test anxiety and perceived stress. Teacher's autonomy support may serve as a potential approach to develop students' positive social-emotional outcomes such as self-efficacy and resilience while reduce negative social-emotional influences such as test anxiety and stress through activating students' motivational resources. The present study provides novel insights into the relationships between SDT and four social-emotional outcomes by considering the four types of motivational regulation as mediators to investigate the effects of perceived teacher's autonomy support on students' SEL-related outcomes.

Keywords: virtual simulation, web-based application, multimedia, teaching, learning

INTRODUCTION

Teacher's autonomy support influences students' autonomous learning motivation, which in turn reduces students' burnout due to stress (Ljubin-Golub et al. (2020). Students' autonomous motivation also mediated the relationship between perceived teacher's support and creative self-efficacy of junior high school students in China (Liu et al., 2021). This suggests that teacher's support supported students' basic needs

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satisfaction which in turn enhanced students' autonomous motivation, and subsequently improved students' positive psychosocial function. However, most studies focused on exploring the mediating roles of autonomous or controlled motivation (e.g., Liu et al., 2021; Mossman et al., 2022) between teacher's autonomy support and social-emotional outcomes. Yet, there is a lack of focus on the mediating effects of the specific types of motivation.

Based on existing literature, there is limited research investigating the relationship between types of motivational regulation and social-emotional outcomes of primary school students. The present paper extends and contributes to the SDT literature in exploring the role of the four types of motivational regulation on social-emotional outcomes. Grounded on the SDT, this study aims to examine the role of perceived teacher's autonomy support (PTAS) on the social-emotional outcomes. The main research question is to test whether the type of motivational regulation (i.e., external, introjection, integration, and intrinsic) would be a mediator between PTAS and four social-emotional outcomes.

Literature Review

Self-determination Theory and Social-Emotional Learning

Based on self-determination theory (SDT; Ryan & Deci, 2000a), people behave differently due to different motives and different levels of motivation they have. One type of motivation, which is termed as intrinsic motivation, is volitional and originated from individuals' inner interests and curiosity.

The four types of motivational regulation are external, introjected, identified, and integrated regulation. External regulation refers to one's behaviors due to instrumental reasons; introjected regulation involves one to internalize rules and behave due to internal pressure; identified regulation involves an identification in which one feels a sense of choice. and integrated regulation is congruent with many qualities of intrinsic motivation (Ryan & Deci, 2000a). The former two motivational regulations are represented as controlling motivation, whereas the latter two are depicted as autonomous motivation. Integrated regulation is congruent with many qualities of intrinsic motivation (Ryan & Deci, 2000b; Ng et al., 2016). In this paper, integrated regulation is termed as intrinsic motivation. A recent meta-analysis (Howard et al., 2021) concluded that suggested that intrinsic motivation is closely associated with student success and increased well-being, while ego-involved motives (introjected regulation) and external regulation are more related to indicators of ill-being.

Social-emotional learning (SEL) is a process of acquiring and developing knowledge and skills that are related to individuals' emotional regulation, self-awareness, and interpersonal skills, which are essential for individuals' school, work and life (CASEL, 2013). Developing children's SEL contributes to enhanced emotional regulation, social adjustment and well-being (Carroll et al., 2020). Countries such as the United States, the UK, Australia and Asian countries integrated SEL into their national education system (Li et al., 2022). Effective SEL programs are associated with students' positive social-emotional outcomes, such as enhancing students' self-efficacy (Oh et al., 2020),

boosting resilience (Green et al., 2021), reducing test anxiety (McLeod & Boyes, 2021), and alleviating stress in schools (Vestad & Tharaldsen, 2022). These studies support the four social-emotional outcomes, as described subsequently.

Social-emotional Outcomes

Self-efficacy refers to individuals' self-beliefs towards their capabilities to overcome difficulties and challenges (Bandura, 1994). Individuals with strong self-efficacious outlook tend to be more intrinsically motivated, and they set more challenging goals and make stronger commitment to pursue these goals in life. Prior research (e.g., Li et al., 2020; Zimmermann et al., 2021) has documented a positive relationship between autonomy-supportive teaching environment and students' self-efficacy. Resilience refers to individuals' capability to recover or "bounce back" from obstacles or adversities (King & Caleon, 2021). In a school setting, resilience is one psychological resource fundamental for students to overcome environmental adversities and achieve success in school and life. Students with teacher's support tend to be more resilience when facing challenges (Montero-Carretero & Cervelló, 2020). In educational domain, test anxiety refers to students' negative response that occurs in assessment contexts such as an examination (Putwain, 2008). Stress is a product of interactions between individuals and the environment (Lazarus & Folkman, 1984). Students experience stress when they are exposed to environmental stressors such as academic pressure or fear of failure (Lee & Jeong, 2019). Moderate stress may benefit students to some extent, while excess stress affects motivation and emotional well-being (Trigueros et al., 2020).

Empirical Studies on Autonomy Support and Social-emotional Outcomes

Previous studies (e.g., Li et al., 2020; Montero-Carretero & Cervelló, 2020) suggested that teacher's autonomy support may be a predictor of students' social-emotional outcomes. Specifically, teacher's autonomy support is an instructional practice whereby teachers adopt a student-focused attitude during teaching and use six acts to foster students' intrinsic motivation (Reeve & Cheon, 2021). When teachers are autonomy-supportive, they provide meaningful rationales for class activities, attend to students' negative feelings, avoid using controlling languages, offer choices to students, vitalize students' interests, and show patience to students. As such, teachers vitalize students' inner motivational resources and satisfy students' basic psychological needs (Reeve, 2016). Students taught by teachers using motivational messages and teaching approach had better learning results (Budasi et al., 2020; Lauc et al., 2020). Based on prior studies (e.g., Li et al., 2020), students' PTAS is positively correlated with students' level of self-efficacy. An interesting study exploring the associations between physical education (PE) teacher's autonomy support and secondary students' appraisals of control and emotions claimed that students' perceptions of teacher's autonomy support positively correlated with students' self-efficacy appraisals. Autonomy-supportive teachers adopt pedagogical practices including offering choices, exhibit interpersonal support, demonstrate empathy, and accept constructive criticism (Zimmermann et al., 2021). These strategies are conducive to establishing a learning environment where honest and transparent teacher-student communications are embraced, and students' motivations towards endeavor and experimentation are enhanced. Consequently, it is

likely that students experience higher levels of self-efficacy appraisals under such context. Likewise, the level of resilience may increase when students are exposed to an autonomy-supportive learning environment. This increased resilience is achieved through enhanced autonomous motivation, need satisfaction, and cooperation under autonomy-supportive instructional practices (Salazar-Ayala et al., 2021). Students may be less test-anxious and less stressed under autonomy-supportive teaching. Autonomy-supportive teachers take students' perspectives and mitigate students' negative emotions such as anxiety, stress, fear, and anger through transforming stress-inducing into de-stressing (Reeve, 2016). A recent study showed that by using autonomy-supportive practices during teaching, teachers strengthen students' positive self-perception to their abilities, which in turn may reduce students' stress in school (Zheng et al., 2020). Hence, motivation might be a leading factor affecting students' social-emotional outcomes.

METHOD

Participants and Procedure

The present study used a cross-sectional design, and it was a follow-up paper to examine whether the four motivational regulations would be mediator between PTAS and social-emotional outcomes. The previous paper focused on the basic psychological needs as mediators (Wu et al., 2023). Convenience sampling was adopted, with participants selected based on their availability and willingness. Data were collected from 130 students aged between 10 and 11 (M = 10.36; SD = 0.48) in a Singapore primary school. Out of the 130 participants, there were 68 female and 62 male students from primary four and five. Prior to data collection, ethical clearance was obtained from the university's Institutional Review Board and approved by the Ministry of Education. Parental and students' consents were sought prior to data collection. Information sheets were given to the students to inform them of the main purpose of the study. In order to prevent students' fatigue, all self-report measures were reviewed by an experienced teacher-in-charge and the number of items was acknowledged to be adequate. Data collection was conducted in a regular classroom, and participants were given about 20 minutes to respond to the questionnaire. They were encouraged to give honest responses by assuring them the anonymity and confidentiality of their responses.

Measures

For self-report measures, students rated items in 5-point Likert scales, with 1 being "Not true at all" and 5 being "Very true." For scoring, items in each scale were averaged, and means were calculated for data analysis.

The Learning Climate Questionnaire (LCQ; Black & Deci, 2000) was used as a measure of students' PTAS. The validated LCQ reported high internal consistency and reliability. An example of the items was "I feel that my teacher provides me choices and options." For the current sample, the internal consistency for PTAS was $\alpha = .89$.

The Self-regulation Questionnaire for Academic (SRQ-A; Ryan & Connell, 1989) was used to measure the quality of students' motivation in school. The adapted SRQ-A comprised four subscale scores: external regulation, introjected regulation, identified

regulation, and intrinsic regulation. Sample items include "I do my homework because I Because I want the teacher to think I am a good student." Internal consistencies (Cronbach's alphas) for the four subscales involved in the adapted SRQ-A were reported as .72, .76, .79, and .83, respectively.

The Self-efficacy Scale (Ng, 2018) was adapted to measure the degree to which students are self-efficacious. An example of the items was "I am confident I can do an excellent job on the problems and tasks assigned for my schoolwork." For the current sample, Cronbach's alpha for measuring the degree of students' self-efficacy was .75.

The School Resilience Scale (SRS; King & Caleon (2021) was used to measure the degree to which students experience subjective school resilience. Previous study (i.e., Caleon et al., 2019) reported high internal consistency of the scale (α = .94). An example of the items was "I manage disagreements with classmates well." Cronbach's alpha for the present sample for measuring the degree to which students perceive themselves as resilient was .71.

The five-item Anxiety Scale (Ng, 2018) was used to assess the degree to which young children experience psychological anxiety especially before examination. A sample item of the scale was "When I take an exam, I think about how poorly I am doing compared with other students." Cronbach's alpha for the measurement of the degree of young children's anxiety was .76 in current sample.

The Perceived Stress Scale (PSS; Lee & Jeong, 2019) was used to measure the degree to which young children perceive themselves as experiencing psychological stress in a school setting. The current scale was adapted from the original PSS-10-item scale, and Cronbach's alpha for the PSS in the current sample was .75.

Data Analyses

All data analyses were run using SPSS 28.0. Cronbach's alpha of the scales was first calculated, followed by the descriptive statistics (i.e., means and standard deviations) for the variables in the study. To examine the nature of relationships between variables, Pearson product-moment correlations were then conducted. In the main analyses, all the mediation analyses were conducted applying PROCESS statistical program (version 4.1) in SPSS. Compared with the Baron and Kenny's approach which was criticized for its lack of directly testing the significance of indirect effect (Abu-Bader & Jones, 2021), PROCESS is based on bootstrapping and considered as more advantageous since it simplifies the mediation analyses (Hayes, 2009). The four selected mediators (i.e., external regulation, introjected regulation, identified regulation, and intrinsic regulation) were entered separately to test the mediation models using the bootstrapping method. The total and specific direct effects in the mediation models were calculated via bootstrapping set at 5000 samples. Confidence intervals were calculated and reported with the lowest to the highest of these 5000 samples of the original datasets.

FINDINGS

Descriptive Statistics and Correlations

Table 1 presents descriptive statistics and correlations among variables measured in this study. Correlations among all the study variables were statistically significant except for relationships between the following variables: between external regulation and self-efficacy, between introjected regulation and school resilience, and between intrinsic regulation and perceived stress. Noticeably, results indicated that PTAS was positively correlated with introjected regulation ($r = .19$, $p < .05$) while negatively associated with external regulation ($r = -.22$, $p < .05$). This suggests that as students perceived their teacher as more autonomy-supportive, they experienced higher introjected regulation and lower external regulation. Another interesting correlational finding is that there was a positive relationship between introjected regulation and students' self-efficacy ($r = .20$, $p < .05$). In other words, students with stronger introjected regulation experienced enhanced self-efficacy.

Table 1
Descriptive statistics and correlations of variables measured.

	Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1	PTAS	3.66	0.84	-							
2	External regulation	3.05	1.17	-.22*							
3	Introjected regulation	3.24	0.95	.19*	.41***						
4	Identified regulation	4.04	0.94	.60***	-.23**	.32***					
5	Intrinsic regulation	3.04	1.15	.49***	-.25**	.25**	.58***				
6	Self-efficacy	3.32	0.76	.48***	-.14	.20*	.49***	.47***			
7	School resilience	3.27	0.85	.52***	-.26**	.10	.44***	.26**	.40***		
8	Test anxiety	2.87	1.01	-.28**	.43***	.28**	-.24**	-.31***	-.26**	-.36***	
9	Perceived stress	2.43	0.95	-.22*	.40***	.24**	-.22*	-.14*	-.27**	-.36***	.63***

Note. $N = 130$; *SD* = standard deviation; *M* = mean.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Regression Analyses

The regression analyses were conducted to test whether each type of motivational regulation is a mediator between PTAS and four social-emotional outcomes. The findings for each type of regulation in terms of its mediating role on the relationships between PTAS and social-emotional outcomes are summarized in Tables 2-5.

External Regulation

To test whether PTAS is significantly predictor of external regulation, the value of external regulation was regressed onto PTAS score. Results indicated that PTAS negatively predicted external regulation ($\beta = -.22$, $p = .013$, $R2 = 0.05$, 95%CI [-0.54, -

0.07]). Results suggested that participants with greater PTAS were likely less externally regulated. To examine whether external regulation is significantly correlated to the four social emotional outcomes, the score of external regulation was regressed onto the values of the four social-emotional outcomes, respectively. Results confirmed the positively predictive role of external regulation on perceived stress (β = .37, p = .000, R2 = 0.17, 95%CI [0.17, 0.43]), suggesting that more externally regulated participants experienced higher levels of perceived stress in school. The total effect of PTAS on perceived stress was significant, β = -.22, p = .012, R2 = 0.05, 95%CI [-0.44, -0.06]. The indirect effect of PTAS on perceived stress via external regulation was significant, β = -.09, 95%CI [-0.02], while the direct effect of PTAS on perceived stress was an insignificant level when taking external regulation into account, β = -.16, p = .094, 95%CI [0.03, -0.14]. Taken together, regression results confirmed that external regulation was a full mediator between PTAS and perceived stress. Results demonstrated that students were likely to experience less stress when they perceived their teacher as more autonomy-supportive, and this association was achieved through the underlying mechanism of external regulation.

The same analysis was conducted to examine the associations among PTAS, external regulation, and test anxiety. Results showed that there was significant total effect of PTAS on test anxiety, β = -.33, p = .001, 95%CI [-0.54, -0.13]. There was also a significant direct effect of PTAS on test anxiety, β = -.23, p = .018, 95%CI [-0.42, -0.04]. Moreover, the indirect effect of PTAS on test anxiety, mediated by external regulation, demonstrated significant effect, β = -.10, 95%CI [-0.21, -0.02]. There was a mediating effect of external regulation on the relationship between PTAS and test anxiety, indicating that students greater PTAS were likely less externally regulated in their behaviors, thereby experiencing less anxiety.

Table 2
A summary of mediation analysis for PTAS, external regulation, and four social-emotional outcomes (PROCESS)

	β	*p*	BootLLCI	BootULCI
Mediation Analysis for PTAS, External Regulation, and Self-efficacy				
PTAS predicting the mediator variable external regulation	-.22	.013	-.54	-.07
PTAS predicting the dependent variable self-efficacy	.48	.000	.30	.58
External regulation predicting the dependent variable self-efficacy	-.04	.622	-.013	.07
Direct effect of PTAS on self-efficacy	.43	.000	.29	.57
Indirect effect of PTAS on self-efficacy	.01		-.02	.06
Mediation Analysis for PTAS, External Regulation, and School Resilience				
PTAS predicting the mediator variable external regulation	-.22	.013	-.54	-.07
PTAS predicting the dependent variable school resilience	.52	.000	.37	.67
External regulation predicting the dependent variable school resilience	-.16	.045	-.22	-.00
Direct effect of PTAS on school resilience	.49	.000	.33	.64
Indirect effect of PTAS on school resilience	.03		-.00	.08
Mediation Analysis for PTAS, External Regulation, and Test Anxiety				
PTAS predicting the mediator variable external regulation	-.22	.013	-.54	-.07
PTAS predicting the dependent variable test anxiety	-.28	.001	-.54	-.13
External regulation predicting the dependent variable test anxiety	.39	.000	.20	.47
Direct effect of PTAS on test anxiety	-.23	.018	-.04	-.19
Indirect effect of PTAS on test anxiety	-.10		-.21	-.02
Mediation Analysis for PTAS, External Regulation, and Perceived Stress				
PTAS predicting the mediator variable external regulation	-.22	.013	-.54	-.07
PTAS predicting the dependent variable perceived stress	-.22	.012	-.44	-.06
External regulation predicting the dependent variable perceived stress	.37	.000	.17	.43
Direct effect of PTAS on perceived stress	-.16	.094	-.34	.03
Indirect effect of PTAS on perceived stress	-.09		-.18	-.02

N = 130; Bootstrap sample size = 5000.
LLCI = low limit confidence interval; ULCI = upper limit confidence interval; PTAS = perceived teacher's autonomy support.

Introjected Regulation

Introjected regulation was tested as a mediator on the relationship between PTAS and social-emotional outcomes. Obtained results of mediational analysis were presented in Table 3. As shown, the association between PTAS and test anxiety was significant (β = -.28, p = .001, 95%CI [-0.54, -0.13]). Similarly, PTAS was a positive predictor of introjected regulation, β = .19, p = .032, 95%CI [0.02, 0.42]. In addition, controlling for PTAS, introjected regulation positively predicted test anxiety, β = .35, p < .000, 95%CI [0.20, 0.54]. Furthermore, the relationship between PTAS and test anxiety was mediated by introjected regulation, demonstrating a significant effect, β = .08, 95%CI [0.00, 0.19]. The direct effect of PTAS on test anxiety, when introjected regulation was considered, was also significant, β = -.41, p < .000, 95%CI [-0.61, -0.22]. Overall, the results revealed that introjected regulation partially mediated the relationship between

PTAS and test anxiety, suggesting that students with greater PTAS experienced less test anxiety through the effect of introjected regulation.

Similarly, analysis was performed to test the relationships among PTAS, introjected regulation, and perceived stress. Based on the findings, the total effect of PTAS on perceived stress was significant, β = -.25, p = .012, 95%CI [-0.44, -0.06]. The direct effect of PTAS on perceived stress was also significant, β = -.31, p = .001, 95%CI [-0.50, -0.12]. Moreover, the relationship between PTAS and perceived stress, mediated by introject regulation, demonstrating significant effect, β = .06, 95%CI [0.00, 0.15]. Taken together, there was a mediating effect of introjected regulation on the relationship between PTAS and perceived stress, indicating that students who perceived their teacher as more autonomy-supportive tended to experience less stress via the effect of introject regulation.

Table 3
A summary of mediation analysis for PTAS, introjected regulation, and four social-emotional outcomes (PROCESS)

	β	*p*	BootLLCI	BootULCI
Mediation Analysis for PTAS, Introjected Regulation, and Self-efficacy				
PTAS predicting the mediator variable introjected regulation	.19	.032	.02	.41
PTAS predicting the dependent variable self-efficacy	.48	.000	.30	.58
Introjected regulation predicting the dependent variable self-efficacy	.11	.153	-.03	.22
Direct effect of PTAS on self-efficacy	.42	.000	.28	.56
Indirect effect of PTAS on self-efficacy	.02		-.01	.06
Mediation Analysis for PTAS, Introjected Regulation, and School Resilience				
PTAS predicting the mediator variable introjected regulation	.19	.032	.02	.41
PTAS predicting the dependent variable school resilience	.52	.000	.37	.67
Introjected regulation predicting the dependent variable school resilience	.01	.939	-.13	.14
Direct effect of PTAS on school resilience	.52	.000	.37	.67
Indirect effect of PTAS on school resilience	.00		-.04	.04
Mediation Analysis for PTAS, Introjected Regulation, and Test Anxiety				
PTAS predicting the mediator variable introjected regulation	.19	.032	.02	.41
PTAS predicting the dependent variable test anxiety	-.28	.001	-.54	-.13
Introjected regulation predicting the dependent variable test anxiety	.35	.000	.20	.54
Direct effect of PTAS on test anxiety	-.41	.000	-.61	-.22
Indirect effect of PTAS on test anxiety	.08		.00	.19
Mediation Analysis for PTAS, Introjected Regulation, and Perceived Stress				
PTAS predicting the mediator variable introjected regulation	.19	.032	.02	.41
PTAS predicting the dependent variable perceived stress	-.22	.012	-.44	-.06
Introjected regulation predicting the dependent variable perceived stress	.29	.001	.13	.46
Direct effect of PTAS on perceived stress	-.31	.001	-.50	-.12
Indirect effect of PTAS on perceived stress	.06		.00	.15

N = 130; Bootstrap sample size = 5000.
LLCI = low limit confidence interval; ULCI = upper limit confidence interval; PTAS = perceived teacher's autonomy support.

Identified Regulation

Identified regulation was also predicted as a mediator on the relationship between PTAS and social-emotional outcomes. Regression results (see Table 4) showed that there were significant total effects of PTAS on self-efficacy (β = .44, p < .000, 95%CI [0.30, 0.58]) and school resilience (β = .52, p < .000, 95%CI [0.37, 0.67]). Likewise, results also indicated significant direct effects of PTAS on self-efficacy (β = .27, p = .002, 95%CI [0.10, 0.43]) and school resilience (β = .40, p < .000, 95%CI [0.22, 0.59]). Noticeably, significant results were also found in terms of the indirect effect of PTAS on self-efficacy (β = .17, 95%CI [0.07, 0.28]) and school resilience (β = .12, 95%CI [0.02, 0.23]). These results confirmed the mediating effect of identified regulation on the relationships between PTAS and the two social-emotional outcomes (i.e., self-efficacy and school resilience), suggesting that greater PTAS boosted students' self-efficacy and school resilience via enhancing their identified regulation.

Table 4
A summary of mediation analysis for PTAS, identified regulation, and four social-emotional outcomes (PROCESS)

	β	*p*	BootLLCI	BootULCI
Mediation Analysis for PTAS, Identified Regulation, and Self-efficacy				
PTAS predicting the mediator variable identified regulation	.60	.000	.51	.82
PTAS predicting the dependent variable self-efficacy	.48	.000	.30	.58
Identified regulation predicting the dependent variable self-efficacy	.31	.000	.11	.41
Direct effect of PTAS on self-efficacy	.27	.002	.10	.43
Indirect effect of PTAS on self-efficacy	.17		.07	.28
Mediation Analysis for PTAS, Identified Regulation, and School Resilience				
PTAS predicting the mediator variable identified regulation	.60	.000	.51	.82
PTAS predicting the dependent variable school resilience	.52	.000	.37	.67
Identified regulation predicting the dependent variable school resilience	.20	.034	.01	.35
Direct effect of PTAS on school resilience	.40	.000	.22	.59
Indirect effect of PTAS on school resilience	.12		.02	.23
Mediation Analysis for PTAS, Identified Regulation, and Test Anxiety				
PTAS predicting the mediator variable identified regulation	.60	.000	.51	.82
PTAS predicting the dependent variable test anxiety	-.28	.001	-.54	-.13
Identified regulation predicting the dependent variable test anxiety	-.11	.285	-.35	.10
Direct effect of PTAS on test anxiety	-.25	.051	-.51	.00
Indirect effect of PTAS on test anxiety	-.08		-.23	.08
Mediation Analysis for PTAS, Identified Regulation, and Perceived Stress				
PTAS predicting the mediator variable identified regulation	.60	.000	.51	.82
PTAS predicting the dependent variable perceived stress	-.22	.012	-.44	-.06
Identified regulation predicting the dependent variable perceived stress	-.14	.187	-.36	.07
Direct effect of PTAS on perceived stress	-.15	.213	-.39	-.09
Indirect effect of PTAS on perceived stress	-.10		-.23	.04

N = 130; Bootstrap sample size = 5000.
LLCI = low limit confidence interval; ULCI = upper limit confidence interval; PTAS = perceived teacher's autonomy support.

Intrinsic Regulation

Intrinsic regulation was also predicted as a mediator on the relationship between PTAS and social-emotional outcomes. Regression results (see Table 5) showed that PTAS had a significant effect on self-efficacy, β = .44, p < .000, 95%CI [0.30, 0.58]. When controlling for the effect of intrinsic regulation, the direct effect of PTAS on self-efficacy was still significant, β = .30, p = .002, 95%CI [0.14, 0.45]. The indirect effect of PTAS on self-efficacy, as mediated by intrinsic regulation, was also significant, β = .14, 95%CI [0.06, 0.23]. The combined results confirmed the partial mediating role of intrinsic regulation in the relationship between PTAS and self-efficacy.

When examining the mediating effect of intrinsic regulation on the relationship between PTAS and test anxiety, the effect of PTAS on test anxiety was also significant, β = -.33, p = .001, 95%CI [-0.54, -0.13]. The direct effect of PTAS on test anxiety was not significant, β = -.20, p = .089, 95%CI [-0.43, 0.03]. Results showed significant indirect effect of PTAS on test anxiety mediated by intrinsic regulation, β = -.14, 95%CI [-0.29, -0.00]. Overall, the results supported that intrinsic regulation functioned as a full mediator between PTAS and test anxiety, suggesting PTAS can be directly associated with students' decreased test anxiety through the effect of students' intrinsic motivation.

Table 5
A summary of mediation analysis for PTAS, intrinsic regulation, and four social-emotional outcomes (PROCESS)

	β	*p*	BootLLCI	BootULCI
Mediation Analysis for PTAS, Intrinsic Regulation, and Self-efficacy				
PTAS predicting the mediator variable intrinsic regulation	.49	.000	.47	.88
PTAS predicting the dependent variable self-efficacy	.48	.000	.30	.58
Intrinsic regulation predicting the dependent variable self-efficacy	.31	.000	.09	.32
Direct effect of PTAS on self-efficacy	.30	.000	.15	.45
Indirect effect of PTAS on self-efficacy	.14		.06	.23
Mediation Analysis for PTAS, Intrinsic Regulation, and School Resilience				
PTAS predicting the mediator variable intrinsic regulation	.49	.000	.47	.88
PTAS predicting the dependent variable school resilience	.52	.000	.37	.67
Intrinsic regulation predicting the dependent variable school resilience	.01	.907	-.12	.14
Direct effect of PTAS on school resilience	.52	.000	.34	.69
Indirect effect of PTAS on school resilience	.01		-.11	.10
Mediation Analysis for PTAS, Intrinsic Regulation, and Test Anxiety				
PTAS predicting the mediator variable intrinsic regulation	.49	.000	.47	.88
PTAS predicting the dependent variable test anxiety	-.28	.001	-.54	-.13
Intrinsic regulation predicting the dependent variable test anxiety	-.23	.019	-.37	-.03
Direct effect of PTAS on test anxiety	-.20	.089	-.43	.03
Indirect effect of PTAS on test anxiety	-.14		-.29	-.03
Mediation Analysis for PTAS, Intrinsic Regulation, and Perceived Stress				
PTAS predicting the mediator variable intrinsic regulation	.49	.000	.47	.88
PTAS predicting the dependent variable perceived stress	-.22	.012	-.44	-.06
Intrinsic regulation predicting the dependent variable perceived stress	-.05	.632	-.20	.12
Direct effect of PTAS on perceived stress	-.22	.051	-.45	.00
Indirect effect of PTAS on perceived stress	-.03		-.14	.08

N = 130; Bootstrap sample size = 5000.
LLCI = low limit confidence interval; ULCI = upper limit confidence interval; PTAS = perceived teacher's autonomy support.

DISCUSSION

Grounded on the SDT approach (Ryan & Deci, 2000a), the present study makes a unique contribution to extend previous studies by examining the associations among PTAS, four social-emotional outcomes, and four specific types of motivational regulations within a cohort of young primary school students.

First, external regulation was found to be a mediator between PTAS and test anxiety. Based on SDT (Ryan & Deci, 2000b), external motivation is categorized as controlled motivation, which has been associated with various negative outcomes such as high test anxiety (Ng et al., 2016). Naturally, it is plausible to reason that PTAS affects students' level of test anxiety indirectly via external regulation. External regulation was also the mediator between PTAS and perceived stress. Results revealed that students with PTAS are likely less externally regulated, thereby experiencing less stress in school. Parents and teachers play multiple roles for children and students, serving as both potential stressors and valuable social supporters (Ancho, 2023; Camara et al., 2013). For teachers, when they support children's autonomy and satisfy their inner needs, children become less externally motivated or regulated in their behaviors (Ljubin-Golub et al., 2020). Being less externally regulated means being more self-determined and less likely to be affected by external stressors such as school grades related to teachers. In this way, a teacher's autonomy support may serve more as a buffer than a stressor for teenagers when handling obstacles. Naturally, children tend to be less stressed in an autonomy-supportive learning environment.

Second, introjected regulation was a mediator between PTAS and test anxiety and perceived stress. Introjected regulation was found to be positively related to students' test anxiety and perceived stress, which is consistent with previous studies (e.g., Cents-Boonstra et al., 2019; Choi et al., 2022). One possible explanation is that teacher's autonomy support may affect students' introjected regulation in anxiety and stress. A recent study (Choi et al., 2022) showed that introjected motivation mediated between perfectionism (high standards, discrepancy) and burnout (due to stress). This study suggested that introjected motivation, though representing a part of the self, is still considered as "a quite controlling regulation" (Ryan & Deci, 2000a, p. 62). Specifically, individuals regulated by introjected motivation tend to obtain ego enhancement and the avoidance of guilt or anxiety. Hence, this externally regulated characteristic may have been responsible for the positive relationship between introjected regulation and test anxiety and stress in the present study.

Third, identified regulation was a mediator between PTAS and self-efficacy and school resilience. Identified regulation had a strong association with self-efficacy, which is an important indicator of positive educational outcomes. Current findings are aligned with previous research (Cents-Boonstra et al., 2019; Vansteenkiste et al., 2018), indicating that autonomy-supportive practices foster students' autonomous motivation (identified), which in turn enhance students' self-efficacy. Individuals with high identified regulation freely choose to pursue their goals based on their personal values. This regulation is relevant with greater self-efficacy because self-efficacy beliefs are positively correlated with choice, performance, and persistence (Guay et al., 2020).

Identified regulation also positively affected individuals' self-concept (Lohbeck, 2018). Building individuals' self-concept through an internal locus of control in their behaviors is likely to shape an adaptive understanding of oneself and perceived success, contributing to resilience development.

Fourth, intrinsic regulation was found to be a mediator between PTAS and Self-efficacy. Autonomy-supportive practices foster students' intrinsic motivation which in turn enhance students' self-efficacy. Intrinsically regulated individuals tend to be more self-efficacious as they believe they can control their behaviors, and they are less prone to discouragement in their pursuit of goals (Karimi & Fallah, 2021). Finally, intrinsic regulation was also the mediator between PTAS and test anxiety. Students with greater PTAS are more intrinsically motivated and they experienced less test anxiety (Ng et al., 2016). Prior research has identified that when after negative performance feedback, students' intrinsic motivation declines because of changes in students' ability self-concept (Weidinger, 2016). Instead, using autonomy-supportive practices, teachers provide choices and meaningful feedback to students as well as enhance students' intrinsic motivation which was found to be a significant moderator of the negative effects of test anxiety (Khalaila, 2015).

CONCLUSION

The findings of the present study contributed to both research and practice by identifying the relationships among PTAS, four types of motivational regulation (i.e., external, introjection, integration, and intrinsic) and four social-emotional outcomes. Specifically, external regulation was the mediator between PTAS and perceived stress, while intrinsic motivation is the mediator between PTAS and test anxiety. The current findings not only provide empirical support for the tenets of SDT in school contexts, particularly regarding the roles of the four motivational regulations act and its influences on social-emotional aspects, but also highlight the interconnectedness of motivational variables and SEL, particularly regarding the specific contributions of the four different motivations to SEL. By investigating how PTAS influences the four SEL-related variables, the study also provides valuable insights into the underlying mechanisms driving primary students' self-efficacy, resilience, test anxiety and stress in school. To be specific, this study identifies the key roles of the four specific motivational resources that played in the potential interventions targeting at helping support students' self-efficacy and resilience as well as regulate their test anxiety and stress. For example, the study identified introjected regulation as a mediator between PTAS and test anxiety/perceived stress, implying that it is reasonable to tailor interventions or support programs that can address this regulatory mechanism and help students regulate themselves internally. However, there are a few limitations in this study. One main limitation of this study is that sample size is not significant enough to generalize the primary student population. Future research could investigate a larger sample to profile both teachers and students for intervention design studies. Another limitation is the reliance on students' self-reports as the primary method of data collection as there might be bias in responses given the young age of the participants. Future studies may benefit from combining diverse methods of data collection such as incorporating teachers' reports or behavioral assessments.

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