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The synergistic relationship of perceived autonomy support and structure in the prediction of self-regulated learning

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Background. Self-determination theory defines two important dimensions of teaching style: autonomy support and structure.

Aims. The purpose of the present study was to investigate the synergistic relationship of perceived teacher autonomy support and the provision of structure in the prediction of self-regulated learning.

Sample and method. Students ($N = 526$) completed questionnaires assessing perceived autonomy support, structure, and self-regulated learning.

Results. First, autonomy support and structure were found to be positively correlated, suggesting that the support of student autonomy generally goes hand in hand with the provision of structure and order in the classroom. Second, moderated regression analyses indicated that structure but not autonomy support yielded a main effect on self-regulated learning, although this main effect was qualified by a structure by autonomy support interaction.

Conclusion. The interaction suggests that structure was associated with more self-regulated learning under conditions of moderate and high autonomy support only. Therefore, when teachers want their students to evaluate themselves, to plan their study activities, and to think about themselves as learners, the teachers are encouraged to provide help, instructions, and expectations in an autonomy-supportive way.

The question how teachers can promote self-regulated learning (SRL) is of critical importance as self-regulation is a key to school success (Zimmerman & Martinez-Pons, 1986). SRL is defined as a goal-directed process where students engage in self-reflection and self-evaluation to obtain desired learning outcomes (Miller & Brickman, 2004). Self-regulating students set a particular learning standard, deliberately select strategies to achieve that goal (e.g. planning), engage in a variety of skills (e.g. self-testing) to monitor

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their progress, and make modifications (e.g. resetting their standard) when confronted with obstacles (Winne, 1995). In other words, self-regulated learners know 'how' they can become successful learners by using the appropriate (meta)cognitive, motivational, and affective strategies (Boekaerts, 1995).

However, SRL does not take place automatically (Winne, 2005) and is not easily induced (Struyven, Dochy, Janssens, Schelfhout, & Gielen, 2006). Therefore, research about the conditions that facilitate SRL merits greater attention (Richardson & Placier, 2001). To study the antecedent teaching style dimensions of SRL, the present research draws on self-determination theory (SDT; Deci & Ryan, 2000; Vansteenkiste, Lens, & Deci, 2006). Based on this theory, we aim to examine whether an adaptive engagement in learning activities will be fostered by teachers who are providing autonomy support and structure. It is expected that teacher autonomy support and teacher structure both promote SRL as they allow satisfaction of learners' basic psychological needs for autonomy and competence.

Basic need satisfaction and learning

According to SDT, human beings have three innate psychological needs: the need for autonomy, competence, and relatedness (Deci & Ryan, 2000). In an educational setting, autonomy refers to the experience of choice and psychological freedom with respect to one's study activities. It involves being self-organizing and having a sense of choice over one's study behaviour. Competence involves the experience of efficacy while completing a learning task. The need for relatedness concerns feeling connected to significant others, like teachers.

Within SDT, the satisfaction of these needs is said to represent a necessary condition for students' optimal learning. This is because need satisfaction yields an energizing effect, which enables learners to get more fully immersed in the learning process. In line with this idea, several studies have shown that the satisfaction of these needs predicts a variety of positive learning outcomes, including higher intrinsic motivation and more SRL (see Reeve, Deci, & Ryan, 2004, for an overview). Various studies have explored the contextual variables that support the satisfaction of these needs, including instructors' and parents' teaching and rearing style (e.g. Soenens & Vansteenkiste, 2005).

The present research aimed to add to this body of work by examining whether and how the teaching dimensions perceived teacher autonomy support and structure are related to SRL, an issue that has received little attention from a SDT-perspective. Examining the contextual antecedents of SRL deserves attention within the SRL literature as such knowledge would help to enrich our understanding of how instructors can promote SRL. Because SDT specifies the contextual environments that foster optimal learning, this theory represents a potentially interesting framework for studying favourable conditions for SRL. Specifically, according to SDT, teacher autonomy support and structure contribute to SRL by satisfying students' basic psychological needs.

Teacher autonomy support and structure

Within SDT, autonomy support implies facilitating and encouraging students to pursue their personal goals and supporting students' endorsement of classroom behaviours (Assor, Kaplan, & Roth, 2002). Autonomy-supportive teachers do so by providing students with an amount of choice (Katz & Assor, 2007), by giving a rationale when

choice is constrained, by trying to empathize with the learners' perspective, and by avoiding the use of controlling language (e.g. 'you should'). Several studies have demonstrated that autonomy-supportive teaching is related to educational benefits, including higher intrinsic motivation (e.g. Reeve & Jang, 2006), better time management and concentration (e.g. Vansteenkiste, Zhou, Lens, & Soenens, 2005), and higher performance (e.g. Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004), presumably because autonomy support allows for the satisfaction of the need for autonomy (Reeve, Ryan, Deci, & Jang, 2007).

Structure involves the communication of clear expectations with respect to student behaviour. Structuring teachers will set limits to students' behaviour and will consistently follow through. Moreover, structure involves providing learners with help for engaging in a task, so that they better know how to accomplish goals (Skinner & Belmont, 1993). Finally, teachers who provide structure will give competence-relevant feedback and express confidence in students' abilities to achieve the required class activities (Connell, 1990; Reeve *et al.*, 2004). The positive outcomes of structure for high-quality learning are well-established. Research shows that structure is related to more student engagement (e.g. Tucker *et al.*, 2002) and less passive and avoidant academic behaviour (Patrick, Turner, Meyer, & Midgley, 2003), presumably because structure allows for the satisfaction of the need for competence (Grolnick & Ryan, 1989).

SDT not only suggests that teacher autonomy support and structure are critical for students' optimal learning, but equally suggests that the positive relations of teacher structure to outcomes might depend on the way in which the structure is brought about (Reeve *et al.*, 2004). When structure is communicated in a context of respect for the learners' perspective, when instructors rely on non-controlling language to communicate expectations, and provide a meaningful rationale when introducing limits, students are more likely to follow the structure with a greater sense of psychological freedom. However, structure can also be imposed in a controlling way, for instance by linking external contingencies (e.g. punishments) to the (mis)attainment of the standards, by using pressuring language when communicating expectations and by countering negative emotions that signal resistance. In such cases, the structure is less likely to yield educational benefits, as students feel pressured and consequently fail to endorse the expectations.

A few studies have provided evidence for SDT's hypothesis that the relation of structuring elements to outcomes is moderated by an autonomy-supportive versus controlling communication style. For instance, Burgess, Enzle, and Schmaltz (2004) demonstrated in a group of university students that setting deadlines in an autonomy-supportive fashion resulted in higher intrinsic motivation and free-choice persistence compared to an externally imposed deadline group. The present study extends this small body of research by examining the independent and interactive contribution of autonomy support and structure in relation to SRL.

The present study

This study used a correlational design to study the interplay between teacher autonomy support and structure in its relation to SRL. Two measures of SRL were used, that is, the use of cognitive strategies and self-regulation (i.e. metacognitive and effort management strategies; Pintrich & De Groot, 1990). Cognitive strategy use refers to the actual cognitive strategies students use during their learning process, such as elaboration or

rehearsal strategies. The use of metacognitive strategies implies monitoring the learning process, such as planning and giving self-feedback (Wolters, 2003). Using effort management strategies denotes students' capacities to create and enact a learning intention, such as persisting in the face of competing attractions (Pintrich & De Groot, 1990). The present study involves students in their last years of secondary education and their first year in higher education. The selection of this age group is inspired by the notion that self-regulation is necessary for good school achievement, especially in the upper grades of one's school career (Zimmerman & Martinez-Pons, 1986).

We formulated three hypotheses. First, realizing that autonomy support and structure are both characteristics of an optimally motivating teaching style and based on previous research (Noels, 2003), it is assumed that autonomy support and structure can be differentiated through factor analysis, but that both will be positively correlated. Teachers who are effective in supporting students' need for autonomy on average tend to be effective in offering help and positive feedback, setting limits, and introducing rules (i.e. structure). This would be the case because teachers can better first empathically adopt learners' internal frame of reference (i.e. autonomy support) as to act in accordance with students' goals and desires and, hence, to provide differentiated help and feedback (i.e. structure). Thus, an autonomy-supportive stance might allow for a more student-attuned provision of structure, so that teachers who are perceived as autonomy-supportive are likely to be well structuring as well. Moreover, autonomy support and structure both reflect student-centred teaching dimensions, which might further help to explain why they are positively correlated.

Second and third, we examined the independent and interactive relations of teacher autonomy support and structure to SRL. Although both might yield an independent positive relation to SRL, we especially expected both dimensions to interact, so that the positive association of structure with SRL would become more evident in combination with high levels of autonomy support.

Structure is critical for students' SRL as, in order for SRL to take place, students need to be clearly explained how to regulate their study activities. Structuring precisely involves the provision of guidance and constructive feedback to students, which is likely to increase students' confidence to effectively monitor their study behaviour. Thus, well structuring teachers are likely to satisfy students' need for competence, which might lead students to engage in SRL. In addition, when teachers are highly structuring in their own teaching, students might begin to imitate these techniques in their own learning. Thus, highly structuring teachers are likely to foster SRL through a modelling process as well.

Although structure allows students to know how they can regulate their learning, it might not be sufficient to effectively do so. Learners also need to be energized to use these self-regulatory strategies and autonomy support might represent the 'fuel' for this to take place. This is because autonomy support nurtures students' interest and intrinsic motivation and promotes the endorsement of their classroom activities, so that students engage in their studies in a more volitional way. This enhanced volitional functioning (i.e. feelings of autonomy) would, in-turn, allow for a more willing use of self-regulating learning strategies.

In short, structure and autonomy support were expected to interact because structure primarily provides the necessary 'know-how' (competence) for SRL, whereas autonomy support primarily provides the willingness (autonomy) to initiate these self-regulatory strategies. Therefore, we expect structure to be especially related to SRL under autonomy-supportive conditions.

Method

Participants and procedure

Participants were 264 male and 262 female Belgian middle to late adolescents (Grade 11 and 12) from the academic track of two secondary schools and students from the first year of teacher education. Their age varied from 15 to 27 years ($M = 17.9$ years, $SD = 1.22$ years). Five students did not disclose their age. The participants filled out questionnaires in their regular classrooms and were assured of confidentiality. Teachers were asked to leave the room while the questionnaire was being filled out.

Measures

The instruments were initially developed in English and were translated into Dutch according to the guidelines of the International Test Commission (Hambleton, 1994). All items were answered using a five-point answer format, which ranged from 1 (*competely disagree*) to 5 (*completely agree*).

Teacher autonomy support and structure

Teacher context was assessed through students' reports of their interactions with the teacher. Half of the secondary school students rated their Dutch teacher while the others rated the mathematics teacher. All students from the teacher training institute described their teacher of educational sciences. These subjects were chosen because they represent the most common subjects in the curriculum and because they carry a heavy weight in the final achievement scores. We used the subscales Autonomy support (eight items; e.g. 'This teacher gives me a lot of choices about how to do my schoolwork') and Structure (eight items; e.g. 'If I can't solve a problem, this teacher shows me different ways to try to') of the shortened version of the Teacher as Social Context Questionnaire (TASC; Belmont, Skinner, Wellborn, & Connell, 1988). Scale scores were calculated by averaging the items within the scale (negative items were reverse coded). The construct validity of autonomy support and structure was examined with confirmatory factor analysis (CFA) using Lisrel 8.7 (Jöreskog & Sörbom, 1993). Two models were estimated and compared, that is, a model in which all teaching style items were used as indicators of a single underlying construct and a model in which items tapping structure and autonomy support were used as indicators of two separate constructs. A chi-squared comparison of the two models showed that a two-factor solution fitted the data significantly better ($\Delta\chi^2(1) = 29.39$, $p < .001$) than a one-factor solution. Furthermore, various indices were used to evaluate model fit of our two-factor solution (Kline, 1998). The standardized root mean square residual (SRMR), the root mean square error of approximation (RMSEA), and the comparative fit index (CFI) were .08, .07, and .94, respectively. These values indicated that the two-factor model yields an adequate fit (Hu & Bentler, 1999), suggesting that teacher autonomy support and structure represent two different constructs. Cronbach αs were .78 for autonomy support and .72 for structure.

Self-regulated learning

The use of self-regulatory strategies was assessed with students' reports of their study behaviour. The shortened version of the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991) as developed by Pintrich and

De Groot (1990) was used. This version consists of two subscales, that is, Cognitive strategy use (13 items), which pertains to the use of diverse cognitive strategies (i.e. elaboration strategies; e.g. 'When I study I put important ideas into my own words') and Self-regulation (nine items), which refers to the use of metacognitive strategies (i.e. planning; e.g. 'Before I begin studying I think about the things I will need to do to learn') and management of effort strategies (i.e. putting effort in and persisting at difficult tasks; e.g. 'When work is hard I either give up or study only the easy parts' (reverse coded)). Summary scores were calculated by averaging the items within a scale (after reversing the negatively worded items). Previous research indicates that reliability and validity of the scale is acceptable (see Pintrich & De Groot, 1990). In the present study, the Cronbach αs were .72 for the cognitive strategy use scale and .68 for the self-regulation scale.

Results

Preliminary analyses

The correlations between the two teaching style dimensions and the measures of SRL appear in Table 1. As predicted, autonomy support and structure were positively correlated. Both were positively correlated with both aspects of SRL. Cognitive strategy use and self-regulation were positively correlated as well.

Table 1. Correlations among study variables

Variable	1	2	3	4
1. Perceived teacher autonomy support	–	.67**	.31**	.25**
2. Perceived teacher structure		–	.39**	.35**
3. Cognitive strategy use			–	.59**
4. Self-regulation				–

Note. **p < .01.

To examine possible effects of domain (Dutch vs. mathematics vs. educational sciences), we performed a MANOVA with domain as between-subjects variable and all measured variables as dependent variables. Domain had an overall multivariate effect (Wilks' $\lambda = .77$; $F(8, 1,034) = 17.86$; $p < .001$; $\eta^2 = .12$). Follow-up univariate F values, η^2, and pairwise comparisons (using Tukey's honestly significance difference test) are shown in Table 2. The educational sciences subsample scored highest on all outcomes compared to both the Dutch and mathematics subsamples, while both did not differ from one another except for autonomy support, with the Dutch subsample scoring significantly lower than the mathematics subsample. Given the small differences between the two high school subsamples (Dutch and mathematics) and given that both differ substantially from the teacher education sample, we merged the Dutch and math subsample and contrasted this subsample with the teacher education sample. Consequently, we controlled for type of education (i.e. high school vs. teacher education) in the regression analyses.

To examine possible effects of gender, we compared the mean scores of male and female students for all measured variables in the secondary school and teacher training institute. The mean scores did not differ significantly ($t(523) = -0.30$, *ns*;

Table 2. Means and standard deviations of three domains of study together with univariate ANOVA's and *post-hoc* comparisons based upon Tukey HSD tests

	Domain				
Variable	Dutch (N = 193)	Math (N = 193)	Educational sciences (N = 140)	F value	η^2
Perceived teacher autonomy support	3.08_c (0.69)	3.30_b (0.73)	3.86_a (0.57)	54.31***	.17
Perceived teacher structure	3.07_b (0.60)	3.14_b (0.67)	3.59_a (0.56)	31.95***	.11
Cognitive strategy use	3.30_b (0.55)	3.36_b (0.52)	3.63_a (0.49)	17.59***	.06
Self-regulation	3.07_b (0.57)	3.14_b (0.70)	3.43_a (0.50)	15.21***	.06

Note. Means with a different subscript are significantly different from one another at $p < .05$. ***$p < .001$.

$t(523) = -0.73$, *ns*; $t(520) = -1.32$, *ns*; and $t(522) = -1.83$, *ns* for autonomy support, structure, cognitive strategy use, and self-regulation, respectively). Therefore, we did not control for gender in the regression analyses.

Primary analyses

To examine the independent and interactive effects of perceived teacher autonomy support and structure on SRL, we performed a series of hierarchical regression analyses. In Step 1, type of education, autonomy support, and structure were entered as simultaneous predictors. In Step 2, all the two-way interactions between the predictors were entered. In Step 3, finally, the three-way interaction between autonomy support, structure, and type of education was entered to determine whether the two-way interaction between autonomy support and structure is consistent across type of education. Interaction terms were created by multiplying the centred means of the predictors (Aiken & West, 1991).

Although the CFA indicated that teacher autonomy support and structure are distinct constructs, they were found to be highly positively correlated, which might cause problems of multicollinearity. To detect multicollinearity, we examined its impact on the precision of estimation of the regressors, which is reflected in the variance inflation index (VIF; Fox, 1991). When entering autonomy support and structure in the first step, we found that no single VIF exceeds the cut-off criterion of four (maximum VIF = 1.81). Similarly, the collinearity diagnostics table, which represents an alternative method of assessing the problem of multicollinearity, yielded no condition indices over 15 (Belsley, Kuh, & Welsch, 1980; maximum condition index = 2.24). These observations allowed us to conclude that there is no serious degrading in the precision of estimation of parameters (Miles & Shevlin, 2001) and that the main effects of perceived teacher autonomy support and structure can be interpreted in a reliable manner.

The results of our regression analyses can be found in Table 3. As can be noticed in Step 1, teacher structure, but not teacher autonomy support, yielded a positive effect on both aspects of SRL. In Step 2 the interaction between autonomy support and structure significantly added to the prediction of both types of SRL, that is, $\Delta R^2 = .03$, $p < .001$ for cognitive strategy use and $\Delta R^2 = .03$, $p < .001$ for self-regulation. This interaction was interpreted by examining simple regression lines for low (Mean -1 *SD*; $N = 74$), moderate (Mean; $N = 366$), and high (Mean $+1$ *SD*; $N = 86$) levels of perceived autonomy support (see Jaccard & Turrisi, 2003). It was found that structure was a

Table 3. Results of hierarchical regression analyses predicting self-regulated learning by type of education, autonomy support, and structure

| | Self-regulated learning | | | |
| | Cognitive strategy use | | Self-regulation | |
Step	1	2	1	2
1. Main effects				
Autonomy support	.06	.10	− .02	.00
Structure	.30***	.28***	.32***	.31***
Type of education	− .12**	− .11*	− .13**	− .14**
R^2	.17***		.14***	
2. Two-way interactions				
Autonomy support × structure		.18***		.20***
Autonomy support × type of education[+]		− .02		.04
Structure × type of education		.05		.03
R^2		.20***		.17***
ΔR^2		.03***		.03***

Note. *$p < .05$; **$p < .01$; ***$p < .001$; [+] Type of education was dummy coded with secondary school students = 0 and teacher training students = 1.

significant positive predictor of both types of SRL in average ($\beta = 0.33$, $p < .001$ and $\beta = 0.29$, $p < .001$ for cognitive strategy use and self-regulation, respectively) and high autonomy-supportive climates ($\beta = 0.46$, $p < .001$ and $\beta = 0.51$, $p < .001$ for cognitive strategy use and self-regulation, respectively) but not in low ($\beta = 0.06$, *ns* and $\beta = 0.06$, *ns* for cognitive strategy use and self-regulation, respectively) autonomy-supportive climates.[1] Figures 1 and 2 provide a graphical representation of these interaction effects using the simple slopes. The particular situation of high autonomy support and low structure was not represented in our sample. Finally, it should be noted that type of education did not interact with the two teaching style dimensions in relation to the SRL outcomes.

As the three-way interaction between autonomy support, structure, and type of education also was not significant and as adding this three-way interaction did not alter the initially observed effects in Steps 1 and 2, these results are not reported in Table 3. The lack of a three-way interaction indicates that the interaction between autonomy support and structure is not moderated by type of education. This finding justifies our approach where the samples from both types of education were examined together rather than separately.

Discussion

This study examined the relations between the teaching style dimensions autonomy support and structure and SRL. The following results emerged. First, perceived teacher autonomy support and structure could be empirically differentiated. Furthermore, both components of teaching style were positively correlated, suggesting that when teachers

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[1] *To test the curvilinear relations between autonomy support and structure in the prediction of SRL, we initially entered the quadratic interaction effect in the third step. No evidence was found for curvilinear structure effects on SRL.*
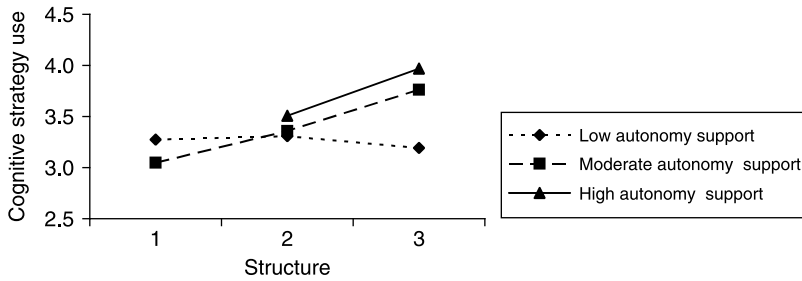
Figure 1. Simple slopes of perceived teacher structure predicting cognitive strategy use at varying levels of perceived teacher autonomy support. High levels are 1 *SD* above the mean; low levels are 1 *SD* below the mean.
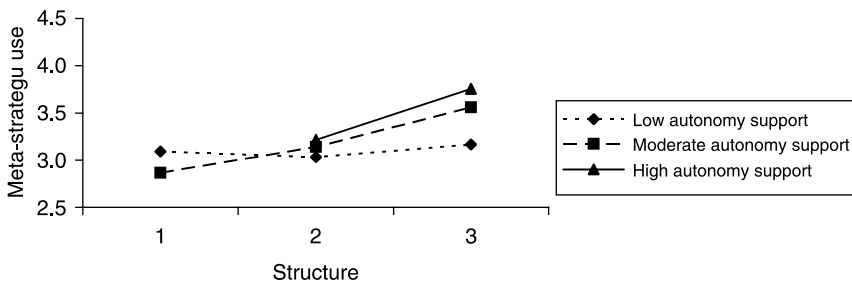
Figure 2. Simple slopes of perceived teacher structure predicting self-regulation at varying levels of perceived teacher autonomy support. High levels are 1 *SD* above the mean; low levels are 1 *SD* below the mean.

provide the necessary guidelines, rules, and feedback to guide students' behaviour, they, on average, tend to use an autonomy-supportive style. This finding confirms previous research (e.g. Noels, 2003) and is predictable from the SDT-perspective, as both autonomy support and structure share a student-centred focus. That is, autonomy-supportive teachers try to take the internal frame of reference of their students and highly structuring teachers try to provide student-attuned feedback, help and optimal challenge. Furthermore, the empathic stance that characterizes highly autonomy-supportive teachers might allow for the provision of individualized structure, which might further explain why teachers who are perceived as autonomy-supportive are more likely to be highly structuring as well.

Second, it was found that structure, but not autonomy support was positively related to the self-regulatory outcomes. Third, the main effect of structure, however, needed to be interpreted with caution, as it was qualified by a significant interaction between autonomy support and structure. Specifically, as hypothesized on the basis of SDT (Deci & Ryan, 2000), structure was found to have different relations with students' SRL depending on the level of autonomy support. It seems that structure needs to be coupled with at least a moderate amount of autonomy support to have a positive association with SRL. Under low autonomy-supportive conditions, students who experienced their teachers as offering structure were not likely to use self-regulatory strategies. These findings are in line with SDT, which suggests that structure provides students the necessary know-how to use self-regulatory strategies, while autonomy support provides students with the necessary energy to effectively engage in these

self-regulatory strategies. Both components seem to be needed, so that their simultaneous presence works in a synergistic fashion to facilitate SRL, presumably because students' basic needs for autonomy and competence are simultaneously supported.

Autonomy support and structure were each assessed with a rather brief eight-item scale. However, it would be interesting to assess subcomponents of autonomy support (e.g. choice and non-controlling language; see Assor & Kaplan, 2001; Reeve & Jang, 2006) and structure (e.g. help and positive feedback). This would allow for greater insight in these important teaching dimensions and their interrelations. Moreover, it could then be examined whether specific subcomponents of both structure and autonomy support interact in the prediction of SRL.

Limitations and further directions for future research

Some limitations should be taken into consideration when interpreting these findings. First, the cross-sectional design of the study does not allow drawing conclusions concerning the direction of effects although educational research typically assumes that teaching influences learning. It may be useful to collect longitudinal data and to use cross-lagged analyses in future studies to look for reciprocal effects of the dimensions of teaching style and the use of self-regulatory skills (see e.g. Skinner & Belmont, 1993). A second limitation refers to the possibility of shared method variance because our data are based on student self-reports. A multi-informant approach can prevent this problem. Furthermore, the sole reliance on self-reports makes it difficult to determine true teacher effects because we based our conclusions on perceived teaching. On the other hand, the way students interpret the teaching climate will most likely determine their study engagement, as the students are the ultimate recipients of teaching style. Third, future research might examine whether the current findings can be replicated and generalized to younger populations and to other aspects of SRL, such as affect regulation (Boekaerts, 1995). Finally, further research will be necessary to identify characteristics associated with adequate, or beyond-adequate, autonomy support.

Conclusion

Regardless of these limitations, our study is the first, to our knowledge, to demonstrate the interacting role of autonomy support and structure in relation to SRL. Because a central goal of educators is to optimize students' self-regulatory learning skills, our findings have some practical significance. They give indications as to how one can create conditions that promote active learning. Teachers can help students to generate their own planning, self-monitor, and evaluate their goal progress by providing differentiated help and clear expectations. It seems, however, critical that these structuring components are provided in an autonomy-supportive fashion to facilitate SRL, that is, by being respectful for students' opinion, allowing students to participate in the decision process, and by providing a rationale when giving guidelines.

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