Learning and Instruction 41 (2016) 1–10

Contents lists available at ScienceDirect

Learning and Instruction

journal homepage: www.elsevier.com/locate/learninstruc

Are both classroom autonomy support and structure equally important for students' engagement? A multilevel analysis

Virginie Hospel [a, *], Benoît Galand [b]

[a] Psychological Sciences Research Institute (IPSY), Université Catholique de Louvain (UCL), Aspirant of The National Fund for Scientific Research (F.R.S.-FNRS) of Fédération Wallonie-Bruxelles, Belgium
[b] Psychological Sciences Research Institute (IPSY), Université Catholique de Louvain (UCL), Belgium

ARTICLE INFO

Article history:
Received 25 June 2014
Received in revised form
1 August 2015
Accepted 1 September 2015
Available online xxx

Keywords:
Classroom learning environment
Structure
Autonomy support
Engagement
Multilevel analyses

ABSTRACT

The current study was carried out within the framework of self-determination theory and aimed to investigate specific, additive and combined effects of teachers' autonomy support and structure on students' engagement. Using multilevel analyses, main effects and interaction of autonomy support and structure provided at the classroom level were tested on behavioral, cognitive and emotional engagement. 744 ninth grade students from 51 classes completed a questionnaire about their engagement during language classes and their perceptions of the teacher's provision of autonomy support and structure. The results highlight the links between classroom context, especially structure, and the three components of engagement. Autonomy support has a complementary role as it was associated with emotional engagement. These results improve our understanding of the relationships between learning environment and engagement and provide more accurate indications to teachers and educators regarding the most effective ways to enhance students' engagement.

1. Introduction

Student engagement has attracted the attention of many researchers and education professionals in recent years (Fredricks & McColskey, 2012). According to self-determination theory (SDT; Deci & Ryan, 2008), engagement is the reflection of the positive development of an individual. In the context of schooling, engagement describes the level of energy or effort students invest in learning activities which has positive consequences, notably on achievement and well-being (Reeve, 2002; Skinner, Furrer, Marchand, & Kindermann, 2008). Engagement is considered to be a malleable state influenced by contextual factors (Fredricks, Blumenfeld, & Paris, 2004). Improving our understanding of the effects of these factors is important in the design of learning environments that foster student engagement and, in turn, achievement.

SDT emphasizes the role of different dimensions of the social context in enhancing or diminishing student engagement (Skinner et al., 2008). Recently, there has been much discussion of the relationships between the dimensions of autonomy support and structure, and their respective contributions to engagement (Jang, Reeve, & Deci, 2010; Vansteenkiste et al., 2012). Autonomy support refers to the amount of psychological freedom teachers allow students in determining their own behaviors (Assor, Kaplan, & Roth, 2002). It consists in supporting students in the pursuit of their own goals and in creating congruence between students' motives and classroom activities (Reeve, Jang, Carrell, Jeon, & Barch, 2004). Teachers support autonomy by offering choices and rationales for mandatory activities, by highlighting meaningful learning goals, by presenting interesting activities, by adopting students' perspectives and by avoiding the use of control (Jang et al., 2010; Reeve et al., 2004; Skinner & Belmont, 1993). Structure refers to the amount and the clarity of information given to students about how to satisfy teachers' expectations and achieve the desired educational outcomes (Jang et al., 2010; Skinner & Belmont, 1993). Teachers provide structure by communicating expectations, by providing guidance, optimal challenges, and feedbacks (Reeve, 2006; Vansteenkiste et al., 2012). SDT posits that both dimensions are important for engagement, but there is little evidence in support of this claim (Stroet, Opdenakker, & Minnaert, 2013). Moreover, the results of the few studies that include both dimensions show substantial inconsistencies. For instance, Jang et al.

* Corresponding author. Psychological Sciences Research Institute (IPSY), Université Catholique de Louvain, Place Cardinal Mercier, 10 – bte L3.05.01, 1348 Louvain-La-Neuve, Belgium.
E-mail addresses: virginie.hospel@uclouvain.be (V. Hospel), benoit.galand@uclouvain.be (B. Galand).

http://dx.doi.org/10.1016/j.learninstruc.2015.09.001
0959-4752/

(2010) found a positive link of autonomy support, but not of structure, with engagement. Skinner and Belmont (1993) found the opposite: Engagement was significantly enhanced only by structure. More work needs to be done to determine the relative importance of each dimension on engagement, and the value of combining them.

SDT postulates that autonomy support and structure are contextual characteristics affecting individual functioning. Many studies carried out in the SDT framework performed data analyses at the (student) individual level, and did not allow testing of learning environment effects (Marsh et al., 2012). Using a multilevel analytical framework, the present study aimed to investigate the main effects and interaction of autonomy support and structure at the classroom level on student engagement. Given the multidimensional nature of engagement, we investigated this question by distinguishing behavioral, cognitive and emotional engagement (Archambault, Janosz, Fallu, & Pagani, 2009; Shernoff, 2013).

1.1. Autonomy support and structure

SDT holds that teachers' autonomy support and structure contribute to the enhancement of academic engagement by fulfilling basic psychological needs. Autonomy support is hypothesized as fulfilling the need for autonomy, meaning the experience of a sense of volition. Structure is hypothesized as fulfilling the need for competence, meaning feeling effective (Dupont, Galand, Nils, & Hospel, 2014; Vansteenkiste et al., 2012).

Two main conceptions of the relations between autonomy support and structure have been proposed in the literature. On the one hand, they have sometimes been conceptualized as two opposed dimensions: Autonomy support is provided by removing structure and vice-versa (see Vansteenkiste et al., 2012). This conceptualization has been challenged for its interpretation of autonomy support as *laissez-faire*, or a lack of guidance (Reeve, 2002; Vansteenkiste et al., 2012). On the other hand, some authors have stressed that, according to SDT, autonomy support and structure should be conceptualized as distinct orthogonal dimensions, complementary and mutually supportive. Recent empirical studies support this latter conception (Jang et al., 2010; Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009; Vansteenkiste et al., 2012). This allows the examination of the most efficient combination of autonomy support and structure to promote students' engagement. Teachers can provide high or low levels of both dimensions to students, or a high level of one dimension and a low level of the other (Jang et al., 2010). However, it is unclear how autonomy support and structure enhance engagement in the most effective way. The effects of each dimension could be cumulative (*additive* effect): Each dimension makes its own positive contribution to engagement, and providing both would be particularly effective. One specific dimension could be more crucial for engagement than the other (*specific* effect). Providing students with the second dimension would have no significant effects beyond the effects of the first dimension. The positive effect of one dimension could be related to the presence or absence of the other (*combined* or interactive effect). The effect of one dimension on engagement could be accentuated when the level of the other dimension is high. Conversely, the provision of one dimension could compensate for the absence of the other.

Existing studies have left three important questions unanswered regarding the relationships between autonomy support/structure and engagement:

1) SDT states that providing both dimensions is important in enhancing engagement, as they tend to fulfill specific needs (see Dupont et al., 2014; Skinner & Belmont, 1993). But what is the relative weight of autonomy support and structure? Do they have additive, specific or combined effects on engagement?
2) Are autonomy support and structure related the same way to each component of engagement? SDT seems to postulate that the relationships are similar.
3) SDT claims that social context affects individual functioning. Is teacher provision of autonomy support and structure at the classroom level associated with student engagement at the individual level?

A review of the available evidence regarding those questions is presented below.

1.2. Do autonomy support and structure have additive, specific or combined effects on engagement?

Most studies have focused on autonomy support and highlighted its positive role for engagement (Assor et al., 2002; Reeve et al., 2004; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004), while Nie and Lau (2009) focused on structure and found a positive link with engagement. A few studies have investigated the effects of both dimensions simultaneously. Using students' ratings of teachers' autonomy support and structure, some authors found only a main effect of structure (Skinner & Belmont, 1993); a main effect of structure plus an interaction between autonomy support and structure (Sierens et al., 2009); or independent main effects of both dimensions (Tucker et al., 2002) on engagement. Using observers' ratings of teachers' autonomy support and structure, Jang et al. (2010) found only a main effect of autonomy support on students' self-reported engagement. These contradictory findings may be due to the component of engagement investigated in these studies.

1.3. Do autonomy support and structure have identical effects on each component of engagement?

Most scholars view engagement as a multidimensional construct composed of behavioral, cognitive and emotional components (Archambault et al., 2009; Fredricks & McColskey, 2012; Shernoff, 2013). Behavioral engagement refers to students' actions towards learning and school activities such as participation, attendance, etc. Emotional engagement refers to positive and negative affective reactions toward school, teachers, etc. Cognitive engagement consists in psychological involvement in learning, including students' use of learning and self-regulated strategies (Fredricks et al., 2004).

Regarding behavioral engagement, studies including both autonomy support and structure found only a positive main effect of structure (Skinner & Belmont, 1993; Wang & Eccles, 2013). Regarding cognitive engagement, results differ. Sierens et al. (2009) found a positive main effect of structure on self-regulated learning and a significant interaction: Self-regulated learning was higher when structure was combined with a moderate or high level of autonomy support. Wang and Eccles (2013) found a positive effect of autonomy support on the use of self-regulated strategies. These authors did not investigate interactions between autonomy support and structure. Regarding emotional engagement, only a main effect of autonomy support was found on positive emotions (Wang & Eccles, 2013). No effects of structure were found on interest (Kunter, Baumert, & Köller, 2007). Vansteenkiste et al. (2012) found that test anxiety was reduced when teachers used both autonomy support and structure, in comparison with teachers who used a low level of both or a high level of only one of them, suggesting a combined effect of both dimensions. Specific relationships with autonomy support and structure could therefore exist depending on the investigated components of engagement. Since these studies

analyzed these effects at the individual level, do their findings truly reflect learning environment effects?

1.4. Is teacher provision of autonomy support and structure at the classroom level linked with student engagement at the individual level?

Assessment of the effects of the learning environment on individual students must be based on analyses carried out at the environment level and not at the individual level (Marsh et al., 2012). Individual perceptions could reflect individual differences or idiosyncratic bias and interpretations rather than contextual influences (Galand, Philippot, & Frenay, 2006). Aggregation of the individual perceptions of the students in the same class gives a more accurate measure of the learning environment shared by students (Lüdtke, Robitzsch, Trautwein, & Kunter, 2009; Marsh et al., 2012). Multilevel analyses aim to differentiate such levels of analysis.

Among the studies cited in the Section 1.2, only a few authors (Jang at al., 2010; Nie & Lau, 2009; Kunter et al., 2007) have used multilevel analyses to test the effects of autonomy support and structure at the classroom level on student engagement. However, Jang et al. (2010) focused on a global measure of engagement and did not control for student characteristics and class composition (e.g., gender ratio). According to findings from teacher effectiveness research, observed effects at the classroom level could mix effects related to the teacher and to class composition (De Fraine, Van Damme, Van Landeghem, Opdenakker, & Onghena, 2003). Class composition variables should be controlled. Nie and Lau (2009) controlled for class composition, but did not investigate the effects of autonomy support and did not distinguish the components of engagement. Kunter et al. (2007) focused on structure. Further studies are thus needed to get a more accurate picture of the effects of autonomy support and structure at the class level on the components of engagement.

1.5. Aims and hypotheses

Using a multilevel analytical framework, the aims of the current study were to: (a) assess the magnitude of the classroom effect on behavioral, cognitive and emotional engagement; (b) examine the associations between autonomy support and structure at the classroom level and each component of engagement at the student level.

According to SDT, autonomy support and structure are both important in fostering engagement. As previously stressed, these dimensions may have specific, additive or combined effects on engagement. These effects may differ following the component of engagement considered. Even if SDT does not provide precise predictions on these topics, from the results of previous studies, we expected:

- Hypothesis 1: a positive association between structure, rather than autonomy support, and behavioral engagement, consistent with Skinner and Belmont (1993) and Wang and Eccles (2013).
- Hypothesis 2: a positive link between structure and cognitive engagement as well as an interaction (combined effect) between autonomy support and structure on this component of engagement, consistent with Sierens and colleagues' findings (2009). The combination of a high level of structure and a high level of autonomy support is expected to be positively associated with a higher level of cognitive engagement.
- Hypothesis 3 (a): a positive association between autonomy support and positive emotions, consistent with Wang and Eccles (2013). As these authors did not test interactions between both dimensions, an interaction may also exist.
- Hypothesis 3 (b): an interaction between autonomy support and structure on negative emotions, consistent with Vansteenkiste and colleagues' study (2004).

Individual characteristics and class composition variables were controlled in the analyses. As SDT provides no details regarding the effects of these variables on engagement, no specific hypotheses were formulated.

2. Method

2.1. Sample

Participants were 744 French-speaking students from 51 classes. They were in grade 9 (M age = 15.14; SD = 0.94). Forty-five percent were girls; 51% repeated a year at least once (consistent with the PISA 2012 report; Fédération Wallonie-Bruxelles, 2014); 40% were in general and 60% in vocational education.[1] They came from 10 schools located in several cities in Belgium and had varied socio-cultural backgrounds.

2.2. Procedure and measures

Students were invited to fill in a questionnaire assessing their perceptions of teacher autonomy support and structure, and their engagement during their French lessons. The questionnaire was administered by a researcher during regular class time. Students were informed that they were free to take part in the study and that the information would be kept confidential. Passive parental consent procedure was used to avoid bias in sample characteristics and to obtain a wide variety of social backgrounds (Pokorny, Jason, Schoeny, Townsend, & Curie, 2001).

Behavioral engagement was measured by means of 21 items which together formed one factor (α = 0.90). It assessed different students' behaviors: participation, effort, following instructions, withdrawal (reverse), and attendance during French class (e.g., "During French lessons, when the teacher asks the class a question, I try to answer") (Hospel & Galand, 2010). Emotional engagement consisted in a measure of the frequency of positive emotions (hope, curiosity, happiness; seven items, α = 0.78) and negative emotions (anger, sadness, stress, shame, boredom; 11 items, α = 0.84) felt during the French lessons. The items came from a validated French version (Galand & Philippot, 2005) of the Differential Emotion Scale (Izard, Dougherty, Bloxom, & Kotsh, 1974). Cognitive engagement consisted in students' self-regulated learning (i.e. management of effort strategies: "In French lessons I take care not to let myself get distracted"; five items, α = 0.78), and the use of deep processing strategies (e.g., "When we have a new topic in French I try to make connections with what I already know"; five items, α = 0.73; Galand, Raucent, & Frenay, 2010). Students responded to the items of these scales using a 5-point Likert scale (0 = *never* to 4 = *very often*).

Individual socio-demographic characteristics. Students reported their gender (0 = *girls*, 1 = *boys*), grade retention (0 = *never retained*, 1 = *retained once or more*) and socio-economic status (SES) measured through cultural (e.g., Do you get scientific books at home?) and material resources (e.g., Do you have your own

[1] In the French-speaking part of Belgium, the choice of general or vocational education is related to students' specific paths (e.g., general education makes it possible to enter university). Students in general and vocational education often differ in their academic levels (Fédération Wallonie-Bruxelles, 2014). Hence, we controlled for it in analyses.

bedroom?) that students have at home (0 = *they do not have this resource*; 1 = *they have it*). They were based on measures used in PISA studies (OECD, 2006).

Class composition was measured through several indicators: the gender ratio, the ratio of retained students, and the mean class SES (i.e. cultural and material resources). They were calculated on the basis of students' reports aggregated by class (using the mean of students' responses, Marsh et al., 2012). Educational track was also included (0 = *general track*; 1 = *vocational track*).

Autonomy support and structure provided by the French teacher in the classroom were measured through the aggregated students' perceptions (i.e. the mean of the responses given by the students of the same class, Marsh et al., 2012). The items were inspired by existing scales (Belmont, Skinner, Wellborn, & Connell, 1988; Reeve & Halusic, 2009). Duplicates were removed. Items focusing on the description of teacher behaviors (rather than on students' interpretation of teacher intentions/behaviors, e.g., "I feel that my teacher …") were selected. Items were translated and adapted to fit with the French lessons. The results of factorial analysis supported the distribution of the items between the two scales as expected.

Autonomy support included six items ($\alpha = 0.76$), which refer to the choice given to the students, the opportunities given for students' initiative-taking, teachers' acknowledgment of students' perspective and feelings (e.g., "the teacher gives us the opportunity to work at our own pace", "the teacher encourages us to think up original things"). Structure included six items ($\alpha = 0.71$), which refer to the communication by the teacher of his/her expectations, the guidance and the constructive feedbacks given (e.g., "before a test the teacher explains in detail the criteria he will use to assess it", "after a test the teacher checks whether each student has understood the mistakes he or she made"). Students responded to the items of these scales using a 5-point Likert scale (0 = *totally false* to 4 = *totally true*).

The reliability of the aggregated measures was evaluated through an indicator based on the intra-class correlation and the mean class size (ICC (2), see Lüdtke, Trautwein, Kunter, & Baumert, 2006). The value of ICC (2) for autonomy support and structure was 0.88. It was above the critical value of 0.70 and indicated a satisfactory reliability for both measures.

2.3. Data analytic strategy

Multilevel analyses (HLM7 software) were performed. A step by step procedure was used. Significance testing was undertaken at the 5% level. First, models without predictors (null models) were run to estimate the partition of variance between and within classes. Second, models including individual characteristics (at individual level) and class composition (at class level) were run. The variables introduced at this step were grand-centered (see Kyriakides & Creemers, 2008). Gender and grade retention were not centered as the value zero was meaningful for these variables (see Opdenakker & Van Damme, 2001). Third, teacher autonomy support and structure were added simultaneously in the models, controlling for the variables introduced at step 2. As this study aimed at testing the relationships between the learning environment and student engagement, autonomy support and structure were introduced at the classroom level (level 2) but not at the individual level (level 1). According to Marsh et al. (2012), the most appropriate measure of the learning climate consists in the aggregated students' perceptions introduced at level 2. Students' individual perceptions introduced at level 1 do not reflect the classroom learning environment. Classroom autonomy support and structure were standardized (i.e. transformed into Z scores) and their interaction term was computed (autonomy support*structure). Reduction in the residual between-classroom variance for each step is presented in the tables. Given that this calculation can be problematic (i.e. adding some variables can negatively contribute to the explanation of the variance), the proportional reduction in mean squared prediction error for the model variance at level 2 at each step is reported in the text (see Snijders & Bosker, 1994, p. 353). Finally, effects size was calculated using the formula $\delta = \frac{\gamma}{\sqrt{(\tau 00 + \sigma^2)}}$, "where γ is the association between the predictor and outcomes variables, and the denominator is the standard deviation of the outcome variable, where τ_{00} and σ^2; are the between- and within-groups variances, respectively (…)" (Reyes, Brackett, Rivers, White, & Salovey, 2012, p.706). δ is interpreted the same way as Cohen's (1988) *d* (0.2 = small; 0.5 = moderate; 0.8 = large).

3. Results

The means, standard deviations and correlations for the variables under research are reported in Table 1. Moderate correlations (Cohen, 1988) were found between dependent variables, and a high correlation was found between behavioral engagement and self-regulation. Autonomy support and structure were highly positively correlated.

3.1. Share of the variance in engagement related to the classroom environment

Null models were run to determine the share of between-class variance (i.e. given by the intra-class coefficient, ICC) in students' engagement. Regarding behavioral engagement, 13% of the variance (ICC = 0.13) lay between classes. Regarding cognitive engagement, 10% of the variance in self-regulation (ICC = 0.10) and 12% of the variance in the use of deep strategies (ICC = 0.12) lay between classes. Regarding emotional engagement, 7% of the variance in positive (ICC = 0.07) and 5% of the variance in negative (ICC = 0.05) emotions lay between classes. This significant between-class variance shows that student engagement differs depending on the class attended by the student.

3.2. Controlling for individual characteristics and class composition

Regarding individual characteristics (see Models 1 in Tables 2–6), girls reported significantly more behavioral ($\delta = 0.43$) and cognitive (use of deep strategies: $\delta = 0.23$; self-regulation: $\delta = 0.18$) engagement than did boys. The cultural and/or material resources the students reported having at home were positively related to their self-reported behavioral ($\delta_{\text{cultural resources}} = 0.41$; $\delta_{\text{material resources}} = 0.49$) and cognitive engagement (self-regulation: $\delta_{\text{cultural resources}} = 0.24$; $\delta_{\text{material resources}} = 0.37$; use of deep strategies: $\ddot{a}_{\text{cultural resources}} = 0.45$; $\ddot{a}_{\text{material resources}} = 0.36$) during French lessons. The student cultural resources were positively related to their positive emotions ($\delta = 0.32$). The introduction of individual characteristics into the models reduced the error for the prediction of the mean behavioral engagement of a randomly drawn class by 30.1%; of the mean use of deep processing strategies of a randomly drawn class by 21%; of the mean self-regulated learning of a randomly drawn class by 8% compared with the empty model. It did not affect the reduction of error for the prediction of emotional engagement.

Few significant effects of class composition (see Models 2 in Tables 2–6) were found. In classes with a higher ratio of girls, students reported more behavioral ($\delta = 0.41$) and cognitive engagement (i.e., use of deep processing strategies; $\delta = 0.44$). In vocational tracks, students reported more positive emotions ($\delta = 0.27$). Including class composition variables in the models reduced the error for the prediction of the mean behavioral engagement of a randomly drawn class by 34.2% (which was a reduction of 4.1%, compared with the model including the individual characteristics); of the mean use of deep

Table 1
Descriptive statistics and correlation matrix for indicators of engagement, autonomy support and structure (student level).

	M	SD	1	2	3	4	5	6	7
1. Behavioral engagement	2.60	0.62	1.00						
Cognitive engagement									
2. Self-regulation	2.30	0.76	0.74**	1.00					
3. Deep strategies	2.02	0.80	0.46**	0.50**	1.00				
Emotional engagement									
4. Positive emotions	2.25	0.73	0.47**	0.52**	0.44**	1.00			
5. Negative emotions	0.96	0.60	−0.25**	−0.22**	−0.16**	−0.34**	1.00		
Teacher									
6. Autonomy support	2.22	0.74	0.36**	0.33**	0.35**	0.39**	−0.22**	1.00	
7. Structure	2.53	0.68	0.42**	0.41**	0.32**	0.44**	−0.27**	0.60**	1.00

Note. **p < .01.

Table 2
Results of multilevel analyses for behavioral engagement.

	Model 1			Model 2			Model 3		
	Coefficient	SE	*p*	Coefficient	SE	*p*	Coefficient	SE	*p*
Intercept	2.80	(0.05)	<0.01	2.91	(0.06)	<0.01	2.76	(0.05)	<0.01
Student level									
Gender	−0.26	(0.05)	<0.01	−0.22	(0.05)	<0.01	−0.22	(0.05)	<0.01
Cultural resources	0.25	(0.07)	<0.01	0.23	(0.07)	<0.01	0.24	(0.08)	<0.01
Material resources	0.30	(0.09)	<0.01	0.30	(0.09)	<0.01	0.29	(0.09)	<0.01
Grade retention	−0.07	(0.05)	0.12	−0.06	(0.05)	0.18	−0.06	(0.04)	0.16
Classroom level									
1. Classroom composition									
Gender ratio				−0.25	(0.12)	0.04	−0.01	(0.10)	0.94
Cultural resources				-			-		
Material resources				-			-		
Ratio of retained students				-			-		
Educational track				-			-		
2. Teachers' practices									
Structure							0.15	(0.03)	<0.01
Autonomy support							0.05	(0.02)	0.06
Structure* Autonomy support							0.03	(0.03)	0.22
Δ *Between-classroom variance*	*31%*			*8%*			*46%*		
Total of between-classroom variance explained	*31%*			*39%*			*85%*		
Deviance	1298			1294			1283		

Note. $N_{students} = 744$; $N_{classrooms} = 51$.

Table 3
Results of multilevel analyses for cognitive engagement (use of deep strategies).

	Model 1			Model 2			Model 3		
	Coefficient	SE	*p*	Coefficient	SE	*p*	Coefficient	SE	*p*
Intercept	2.11	(0.06)	0.00	2.27	(0.09)	<0.01	2.27	(0.11)	<0.01
Student level									
Gender	−0.18	(0.06)	<0.01	−0.12	(0.07)	0.07	−0.13	(0.07)	0.07
Cultural resources	0.36	(0.10)	<0.01	0.33	(0.09)	<0.01	0.35	(0.09)	<0.01
Material resources	0.29	(0.12)	0.02	0.29	(0.12)	0.02	0.28	(0.12)	0.03
Grade retention	−0.02	(0.07)	0.74	−0.01	(0.07)	0.84	−0.02	(0.06)	0.69
Classroom level									
1. Classroom composition									
Gender ratio				−0.35	(0.16)	0.031	−0.26	(0.17)	0.13
Cultural resources				-			-		
Material resources				-			-		
Ratio of retained students				-			-		
Educational track				-			-		
2. Teachers' practices									
Structure							0.01	(0.06)	0.93
Autonomy support							0.08	(0.07)	0.23
Structure* Autonomy support							−0.05	(0.03)	0.09
Δ *Between-classroom variance*	*25%*			*8%*			*33%*		
Total of between-classroom variance explained	*25%*			*33%*			*66%*		
Deviance	1718			1713			1714		

Note. $N_{students} = 744$; $N_{classrooms} = 51$.

Table 4
Results of multilevel analyses for cognitive engagement (self-regulation).

	Model 1			Model 2			Model 3		
	Coefficient	SE	*p*	Coefficient	SE	*p*	Coefficient	SE	*p*
Intercept	2.38	(0.06)	<0.01	2.38	(0.06)	<0.01	2.37	(0.05)	<0.01
Student level									
Gender	−0.10	(0.05)	0.05	−0.10	(0.05)	0.05	−0.07	(0.05)	0.19
Cultural resources	0.18	(0.10)	0.06	0.18	(0.10)	0.06	0.19	(0.10)	0.04
Material resources	0.28	(0.11)	<0.01	0.28	(0.11)	<0.01	0.27	(0.11)	0.02
Grade retention	−0.05	(0.07)	0.47	−0.05	(0.07)	0.47	−0.05	(0.06)	0.37
Classroom level									
1. Classroom composition									
Gender ratio				-			-		
Cultural resources				-			-		
Material resources				-			-		
Ratio of retained students				-			-		
Educational track				-			-		
2. Teachers' practices									
Structure							0.14	(0.04)	<0.01
Autonomy support							0.07	(0.05)	0.18
Structure* Autonomy support							−0.01	(0.03)	0.93
Δ Between-classroom variance	*10%*			*0%*			*60%*		
Total of between-classroom variance explained	*10%*			*0%*			*70%*		
Deviance	1661			1661			1646		

Note. $N_{students} = 744$; $N_{classrooms} = 51$.

Table 5
Results of multilevel analyses for emotional engagement (positive emotions).

	Model 1			Model 2			Model 3		
	Coefficient	SE	*p*	Coefficient	SE	*p*	Coefficient	SE	*p*
Intercept	2.28	(0.07)	<0.01	2.19	(0.08)	<0.01	2.13	(0.05)	<0.01
Student level									
Gender	−0.04	(0.05)	0.44	−0.04	(0.05)	0.36	0.03	(0.04)	0.47
Cultural resources	0.23	(0.12)	0.04	0.28	(0.12)	0.02	0.26	(0.11)	0.02
Material resources	0.17	(0.10)	0.11	0.19	(0.10)	0.06	0.18	(0.10)	0.07
Grade retention	0.01	(0.06)	0.95	−0.06	(0.06)	0.30	−0.06	(0.05)	0.27
Classroom level									
1. Classroom composition									
Gender ratio				-			-		
Cultural resources				-			-		
Material resources				-			-		
Ratio of retained students				-			-		
Educational track				0.20	(0.09)	0.02	0.16	(0.06)	<0.01
2. Teachers' practices									
Structure							0.16	(0.04)	<0.01
Autonomy support							0.10	(0.04)	0.02
Structure* Autonomy support							0.06	(0.02)	<0.01
Δ Between-classroom variance	*0%*			*14%*			*71%*		
Total of between-classroom variance explained	*0%*			*14%*			*85%*		
Deviance	1634			1630			1608		

Note. $N_{students} = 744$; $N_{classrooms} = 51$.

processing strategies of a randomly drawn class by 25% (which was a reduction of 4%, compared with the model including the individual characteristics); of the mean positive emotions of a randomly drawn class by 12.5% compared with the empty model. It did not affect the reduction of error for the prediction of self-regulation and negative emotions.

These results highlight the importance of including control variables, especially individual characteristics, when testing the relationships between teacher autonomy support/structure and student engagement.

3.3. Effects of classroom autonomy support and structure

In a preliminary analysis, we checked if students' perceptions of structure and autonomy support differed between classes by investigating the partition of between-class variance for each dimension. Thirty-one percent of the variance in perception of structure and 31% of the variance in perception of autonomy support were attributed to the class level (ICC = 0.31). Students' perception of autonomy support and structure was not only related to their personal experiences, but also to the class they belonged to. Consequently, aggregated measures of autonomy support and structure were introduced at the class level in the models.

- Hypothesis 1: When considered together, only structure – and not autonomy support – is positively associated with student behavioral engagement.

Only structure was significantly associated with behavioral engagement ($\delta = 0.25$; see Table 2). Structure provided by the

Table 6
Results of multilevel analyses for emotional engagement (negative emotions).

	Model 1			Model 2			Model 3		
	Coefficient	SE	*p*	Coefficient	SE	*p*	Coefficient	SE	*p*
Intercept	0.97	(0.05)	<0.01	0.97	(0.05)	<0.01	1.02	(0.05)	<0.01
Student level									
Gender	−0.02	(0.04)	0.68	−0.02	(0.04)	0.68	−0.06	(0.04)	0.13
Cultural resources	−0.01	(0.08)	0.92	−0.01	(0.18)	0.92	0.01	(0.08)	0.98
Material resources	−0.20	(0.12)	0.09	−0.20	(0.12)	0.09	−0.19	(0.12)	0.10
Grade retention	−0.01	(0.05)	0.95	−0.01	(0.05)	0.95	−0.01	(0.05)	0.81
Classroom level									
1. Classroom composition									
Gender ratio				-			-		
Cultural resources				-			-		
Material resources				-			-		
Ratio of retained students				-			-		
Educational track				-			-		
2. Teachers' practices									
Structure							−0.06	(0.04)	0.15
Autonomy support							−0.09	(0.04)	0.03
Structure* Autonomy support							−0.04	(0.02)	0.05
Δ Between-classroom variance	*0%*			*0%*			*60%*		
Total of between-classroom variance explained	*0%*			*0%*			*60%*		
Deviance	1418			1418			1419		

Note. N students = 744; N classrooms = 51.

teacher at the class level was positively related to behavioral engagement at the student level.

- Hypothesis 2: Structure and the interaction between autonomy support and structure are positively associated with cognitive engagement.

Regarding the use of deep processing strategies, the results were non-significant. Only structure was significantly associated with self-regulation ($\delta = 0.19$; see Table 4). A higher level of teacher structure provided at the class level was related to more frequent use of self-regulation strategies among students. No significant interactions were found.

- Hypothesis 3 (a): When considered together, autonomy support – but not structure – and is positively associated with positive emotions.

Autonomy support ($\delta = 0.14$) and structure ($\delta = 0.22$) were both positively associated with positive emotions. Teacher provision of autonomy support and structure was associated with more positive emotions among students. An interaction between both dimensions was found ($\delta = 0.08$; see Table 5 and Fig. 1). Examination of this interaction showed that teacher provision of high levels of both structure and autonomy support was related with more positive emotions among students.

- Hypothesis 3 (b): The interaction between autonomy support and structure is negatively associated with negative emotions.

Autonomy support was significantly associated with negative emotions ($\delta = 0.14$; see Table 6). Teacher provision of autonomy support at the classroom level was negatively linked with student report of negative emotions. The interaction between autonomy support and structure was significant for negative emotions ($\delta = 0.06$). The negative association between autonomy support and negative emotions was stronger when structure was high (see Fig. 2).

The introduction of autonomy support and structure in the models reduced the error of the prediction for the mean behavioral engagement of a randomly drawn class by 63% (which was a reduction of 28.8%, compared with the model including classroom composition); for the mean self-regulation of a randomly drawn class by 47% (which was a reduction of 39%, compared with the model including the individual characteristics); for the mean

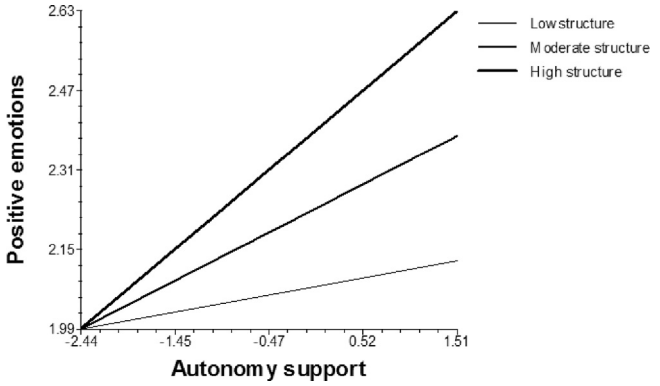

Fig. 1. Simple slopes of autonomy support predicting positive emotions for different levels of structure. High structure consists in 1 standard deviation above the mean; moderate structure refers to the mean; low structure consists in 1 standard deviation below the mean.

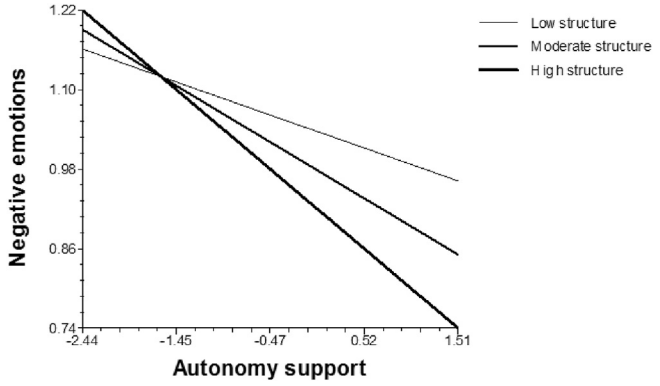

Fig. 2. Simple slopes of autonomy support predicting negative emotions for different levels of structure. High structure consists in 1 standard deviation above the mean; moderate structure refers to the mean; low structure consists in 1 standard deviation below the mean.

positive emotions of a randomly drawn class by 53% (which was a reduction of 40.5%, compared with the model including classroom composition); for the mean negative emotions of a randomly drawn class by 23% compared with the empty model.

4. Discussion

Given the pivotal role of engagement for achievement and academic success, the identification of the classroom factors related to engagement is a major issue. SDT (Deci & Ryan, 2008) highlights the role of such factors, notably the provision of autonomy support and structure, on engagement (Jang et al., 2010; Skinner et al., 2008). By using multilevel analyses, the current study shows that students' engagement is not only related to individual characteristics but also to class variables. Most of between-class differences in students' behavioral, cognitive and emotional engagement were linked to teacher provision of autonomy support and structure in the class. Class composition appears less crucial. These results are consistent with teacher effectiveness research showing the importance of class level and especially of teachers' practices for students' learning (e.g., Kyriakides & Creemers, 2008). They are also consistent with Jang et al. (2010) and Nie and Lau's findings (2009) who found an association between autonomy support/structure provided at the class level and student engagement.

4.1. Associations with components of engagement

As little is known about the respective importance of autonomy support and structure for the components of engagement, the aim of the current study was to test the associations between autonomy support and structure at the classroom level and students' engagement. Do both dimensions be related to engagement ("additive effect"), only one of them ("specific effect") or do they interact ("combined effects")? Consistently with previous studies based on student perceptions of teacher practices (Sierens et al., 2009), our results show that autonomy support and structure are highly and positively correlated. As expected (Hypothesis 1), a specific relationship between structure, but not autonomy support, and behavioral engagement is found. The fact that teacher provide more structure at the classroom level is positively associated with higher student behavioral engagement. It is consistent with previous findings (Skinner & Belmont, 1993; Wang & Eccles, 2013).

A specific link between structure and cognitive engagement and an interaction of autonomy support and structure were expected (Hypothesis 2). The results are non-significant regarding the use of deep processing strategies. A significant association between structure and self-regulation is found, consistent with Sierens et al. (2009). Teacher provision of structure at the classroom level is positively related to the report of the use of self-regulation strategies by the students. We did not find the expected interaction with autonomy support. As explained in the following discussion, this may be due to methodological differences between studies. Different results appear according to the indicator of cognitive engagement used: Structure has a significant relationship only with self-regulation but not with the use of deep processing strategies.

Regarding emotional engagement, we expected a specific association between autonomy support and positive emotions (Hypothesis 3a). However, both autonomy support and structure are associated with positive emotions, suggesting an additive effect. An interaction is also found. Wang and Eccles (2013) found only a main effect of autonomy support, but they did not test the interaction with structure. Our results show that the level of structure is also important: The fact that teacher combined high levels of both autonomy support and structure is related to higher levels of positive emotions. However, our results are contrary to Kunter' s and colleagues (2007) who found no effect of structure on interest. This could be due to differences in measures used: These authors focused on interest, combining the dimension of positive emotion and value commitment, while our measure of positive emotions includes several discrete emotions.

We found the expected interaction between autonomy support and structure on negative emotions (Hypothesis 3b). This is consistent with Vansteenkiste and colleagues' findings (2012). We also found a specific link between autonomy support and negative emotions. The teacher provision of autonomy support is negatively related to student report of negative emotions. The decomposition of the interaction show that the fact that the teacher provide high levels of both autonomy support and structure is related to lower levels of student negative emotions. The specific link found between autonomy support and negative emotions is contrary to Vansteenkiste and colleagues' study. However, they did not take the class level into account. Moreover, they focused on test anxiety while we used a global measure of negative emotions. The contextual variables which have a significant effect may differ depending on the emotion investigated (Frenzel, Pekrun, & Goetz, 2007).

4.2. Relative importance of structure and autonomy support

These results suggest the presence of specific but also additive and combined effects of autonomy support and structure, depending on the indicator of engagement used. Globally, a specific relationships of structure is found with several indicators of engagement. The fact that teacher provide structure in the classroom is positively associated with the level of students behavioral, cognitive (i.e. self-regulated learning) and emotional (i.e. positive emotions) engagement. Autonomy support has only a specific association with emotional engagement. Student report of positive emotions is positively associated with teacher provision of autonomy support in the classroom. Associations between both structure and autonomy support appear with emotional engagement, suggesting an additive effects of both dimensions. An interaction between autonomy support and structure also appears in relation to emotional engagement, suggesting a combined effect. The fact that teacher provide a combination of high levels of autonomy support and structure is positively related to positive emotions and negatively related to negative emotions. This highlights the interest of considering both dimensions in intervention to foster emotional engagement.

The effect sizes found show that what teachers do explains a large part of the differences in student engagement between classes. This is the case for the various components of engagement (except the use of deep processing strategies). This suggests that teachers may play a role for his/her students, and that it may be key to draw the attention of teachers to the benefits of providing their students with structure and, complementarily autonomy support.

Our study shows a number of specific relationships between autonomy support or structure depending and the components of engagement. SDT does not make specific predictions about the associations between each dimension and the components of engagement and no explanations were proposed in previous studies. According to cognitive load theory (CLT), given our limited cognitive resources, providing clear guidance reduces cognitive load related to the learning tasks and allows students to focus their attention on relevant information, which facilitates learning (Kirschner, Sweller, & Clark, 2006). By helping students to focus their cognitive resources on the lesson, structure could facilitate the use of cognitive strategies to deal with the work at hand. It could enhance behavioral engagement by focusing students' attention on the task and preventing students doing others things (e.g., chatting).

These results suggest that autonomy support may be good for

engagement but structure may have a more pivotal role. These findings are consistent with CLT and educational effectiveness research, which stress the value of providing structured activities, information about learning content and progression from simple to complex activities for achievement (Kirschner et al., 2006; Klahr & Nigam, 2004. Our findings suggest that the positive effect of structure on achievement could be partially explained through its effects on engagement.

4.3. Limitations and suggestions for future research

It is difficult to compare directly the result of the current study with previous studies in SDT conducted at the individual level. The theoretical interpretation of the results of those studies is difficult to establish. To what extent do individual perceptions reflect teacher behaviors, a common shared environment in the classroom, differential experience of this environment, idiosyncratic or biased interpretation, or more general individual differences? Studies relying solely on individual perceptions do not allow assessment of the effects of the learning environment (Lüdtke et al., 2009). Consequently, it seems hazardous to derive recommendations for educational practices from these results, especially as these findings have not been replicated in multilevel or experimental studies. Our study is one of the few to investigate both autonomy support and structure at the class level, and to test their interaction on student engagement. More studies using a similar design are needed to replicate our results.

Even if the use of measures at the class level is an improvement compared to measures at the individual level to study the effects of learning environment on students, the present multilevel study still relies on cross-sectional data. Consequently, the directionality of the effects found remains elusive. Teacher practices may have an effect on student engagement as well as student engagement may influence teacher willingness to provide autonomy support or structure (Skinner, Kindermann, Connell, & Wellborn, 2009). A third variable, not measured in the study, may also explain the associations found between variables in correlational studies. For instance, the academic composition of the class may influence teacher practices (e.g. teachers may adapt their expectancies and practices according to the class mean level of achievement; see Dumay & Dupriez, 2007). Some elements of classroom composition were taken into account in the present study (including the ratio of retained students, a proxy for academic composition), but this cannot rule out completely this kind of issue. To overcome these limits, longitudinal and experimental studies are needed. Using longitudinal design, the effects of autonomy support and structure at a specific time could be more accurately evaluated by controlling for previous engagement level. Such design makes it possible to test reciprocal effects between autonomy support/structure and engagement (Skinner & Belmont, 1993). Experimental design makes it possible to determine the causality of some relationships (West, Cham, & Liu, 2014).

Given the limited sample of the current study, school level was not investigated. This could be considered in analyses although school effects were found to be less influential than class effects on student engagement (Vezeau et al., 2010). As we focused on students' perceptions, using teachers' reports could provide a complementary approach in assessing the effects of the learning environment.

Contextual variables, which have a significant effect, may differ depending on the emotion investigated (Frenzel et al., 2007). As emotional engagement was measured through global measures of positive and negative emotions, further studies may investigate the effects of autonomy support and structure on discrete emotions.

To better understand the role of structure on engagement, the mediation effects of students' needs-satisfaction could be investigated. Structure could be important since it may contribute to fulfilling not only the need for competence but other needs as well, or since the need for competence is more critical for engagement (Dupont et al., 2014). The fulfillment of some needs may be more crucial depending on students' characteristics (e.g., prior highly engaged students, see Opdenakker & Minnaert, 2014). These considerations could supply more precision in the formulation of SDT regarding the importance or the balance of different needs in different conditions (Sheldon & Niemiec, 2006).

Further studies carried out in SDT should include contextual aspects other than autonomy support, such as structure. A third aspect of teaching – involvement – should be included as, according to SDT, it also plays a role in students' engagement (Vansteenkiste et al., 2012). The specific and combined effects of different aspects of teaching should also be given more attention in SDT to better determine the most efficient way to enhance students' engagement, and academic success. In terms of getting a clearer picture of the way classroom context impacts engagement, the results of the present study suggest that the components of engagement should be distinguished, as results could differ from one component to another.

Regarding practical implications, these results suggest that the learning environment shaped by the teacher at the class level really matters for students' engagement, beyond the effects of students' characteristics and class composition. They support the idea that providing students with structure is important to sustain their engagement. Autonomy support could be beneficial, especially regarding emotional engagement during lessons.

4.4. Conclusion

As postulated by SDT, the current study stresses the associations between classroom environment, especially teacher structure, and student behavioral, cognitive and emotional engagement. Autonomy support has a complementary role as it is associated with emotional and cognitive engagement. These results highlight the importance of not restricting further studies carried out within the SDT framework to autonomy support, and of including other dimensions of the social context. They underline the importance of using multilevel analyses to better assess the effects of the learning environment on students and to provide more precise guidance to teachers and educators regarding the most effective ways to enhance student engagement.

Acknowledgments

The authors wish to thank Noémie Baudoin, Arnaud Maréchal, and Sandra Robinet for their help in the data collection, and the three anonymous reviewers for their helpful comments. This research was supported by a grant of the National Fund for Scientific Research (F.R.S.-FNRS) of the Fédération Wallonie-Bruxelles awarded to the first author.

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