Teacher structure as a predictor of student' perceived competence and autonomous motivation : The moderating role of differentiated instruction

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Abstract

Background. An important pedagogical practice is the provision of structure (Farkas &Grolnick, 2010, Motiv. Emot., 34, 266). According to self-determination theory (SDT; Deci& Ryan, 1985, Intrinsic motivation and self-determination in human behavior, Plenum, NewYork, NY), structure allows students to develop perceived competence in differentschool subjects, which in turn facilitates the development of autonomous motivationtowards these subjects and limits the development of controlled motivation.

Aims. In this study, we test a mediated moderation model that posits that teacherstructure has a stronger positive effect on students' autonomous motivation (and anegative effect on controlled motivation) in French class when differentiated instruction isused, and that this moderation effect is mediated by perceived competence.

Sample. To test this model, we used a sample of 27 elementary school teachers and 422students from Quebec, a province of Canada.

Methods. Data for teachers and students were collected with self-report measures. The method used was a correlational one with a single measurement time.

Results. Results revealed that (1) the effect of teacher structure on students'autonomous motivation was positive only when differentiated instruction strategieswere frequently used, and this moderated effect was partially mediated by perceivedcompetence, and (2) teacher structure was negatively associated with students'controlled motivation only when differentiated instruction was provided infrequently, and this moderated effect was not explained by perceived competence.

Conclusions. These findings are discussed in the light of the literature on SDT and ondifferentiated instruction.

Background

An important pedagogical practice is the provision of structure (Farkas & Grolnick, 2010). Structure allows students to develop perceived competence in different school subjects, which in turn facilitates the development of autonomous motivation towards these subjects and limits the development of controlled motivation. In this study, we test a model that posits that teacher structure has a positive effect on students' autonomous motivation (and a negative effect on controlled motivation) in French class

when differentiated instruction is used, and that this moderation effect is mediated by perceived competence.

Teacher structure

Structure refers to the provision of explicit rules, direction, and guidance in the classroom. Providing structure involves making the learning environment consistent and predictable such that students know what is expected from them and the consequences of meeting or ignoring these expectations (Skinner & Belmont, 1993). Because the provision of structure allows students to self-regulate their behaviour, remain engaged in a task, and better know how to succeed and avoid failure (Skinner & Belmont, 1993), it is expected to foster perceived competence in a given school subject, that is, a feeling of being effective and capable of attaining desired goals (Connell & Wellborn, 1991; Deci & Ryan, 2000). Some research corroborates this hypothesis by showing a positive relationship between teacher structure and students' perceived competence in various school subjects (Mouratidis, Vansteenkiste, Michou, & Lens, 2012).

According to self-determination theory (SDT; Deci & Ryan, 2002), students' perceived competence facilitates autonomous motivation towards learning (Deci & Ryan, 2002). Thus, when students feel competent and effective, they tend to engage in school activities more autonomously. Autonomously motivated individuals experience volition and self-endorsement in their actions (Deci & Ryan, 2008). More precisely, autonomous motivation occurs when students perform a task because (1) they identify with its value or importance (i.e., identified regulation), (2) they have integrated the task into their sense of self (i.e., integrated regulation), or (3) they feel inherent satisfaction and pleasure when doing the task (i.e., intrinsic motivation). In contrast, when students are guided by controlled motivation, they are under pressure to behave in certain ways. For example, they may perform a task to avoid negative feelings such as shame (i.e., introjected regulation), obtain an external reward, or evade punishment (i.e., external regulation). In the school context, autonomous motivation is associated with academic achievement (Guay, Ratelle, Roy, & Litalien, 2010) and long-term educational adjustment (Otis, Grouzet, & Pelletier, 2005), whereas controlled motivation leads to anxiety and school dropout (Hardre & Reeve, 2003; Vallerand & Bissonnette, 1992).

Taken together, past studies indicate that teacher structure is positively related to students' perceived competence, which in turn facilitates their autonomous motivation towards learning. Because structure provides a starting point for this motivational process, it is important to identify school conditions that can optimize the potential positive effect of this pedagogical practice on students' perceived competence. Recently, researchers have focused on variables that could moderate the effect of teacher structure on a range of student outcomes (e.g., learning, educational adjustment, grades). Most have focused on autonomy support as a moderator. Autonomy support refers to what an individual says and does to enhance another individual's internal perceived locus of causality, volition, and sense of choice during action (Reeve, Nix, & Hamm, 2003). In a school setting, this involves offering students various options and meaningful rationales, acknowledging negative feelings, and avoiding the use of controlling language (Su & Reeve, 2010).

Sierens, Vansteenkiste, Goossens, Soenens, and Dochy (2009) studied a sample of students to determine whether autonomy support moderates the relationship between teacher structure and self-regulated learning. They found that providing structure was associated with more self-regulated learning under conditions of moderate and high autonomy support. Similarly, Jang, Reeve, and Deci (2010) showed that teacher structure should be provided in an autonomy-supportive manner to facilitate students' engagement in learning activities. Moreover, Vansteenkiste *et al*. (2012) performed cluster analyses of four groups of students characterized by different levels of teacher structure and autonomy support. Their results indicated that children in the high autonomy support/high structure cluster reported higher degrees of autonomous motivation, more time management, concentration, and persistence, and fewer behaviour problems than the three other groups, which combined different levels of structure and autonomy support (also see Trouilloud, Sarrazin, Bressoux, & Bois, 2006).

As mentioned above, researchers have focused largely on the moderation effect of autonomy support in the relationship between teacher structure and students' outcomes (Vansteenkiste *et al*., 2012). However, it is possible that other pedagogical practices act as moderators. The identification of these practices would provide further insights into which strategies can optimize the positive effect of teacher structure on students' perceived competence. In addition to autonomy support, we hypothesized that differentiated instruction is a promising moderator of the relationship between teacher structure and students' perceived competence.

Differentiated instruction

In Western societies, there is a growing educational trend towards full inclusion, meaning that every child, disabled or not, should be taught in a regular classroom (Ferguson, 2008; Kavale, 2002). Consequently, general education teachers find it increasingly challenging to address students' various learning needs (McLeskey & Waldron, 2011). The need to provide school environments that respond to individual differences has been a long-standing concern (Ainscow, Booth, & Dyson, 2006; Glaser, 1977) in many countries. Consequently, teachers are impelled to implement instruction strategies that allow both advanced and weaker learners to succeed (Corno, 2008). Differentiated instruction has been recognized as a promising practice. It can be defined as an approach by which teaching is varied and adapted to match students' abilities using systematic procedures for academic progress monitoring and data-based decision-making (Roy, Guay, & Valois, 2013).

Instructional adaptations have been recognized as key to academic success for all learners in regular classrooms (Fuchs & Fuchs, 1998; McLeskey & Waldron, 2002). Through instructional adaptations, teachers can provide students with a variety of learning options (Randi & Corno, 2005; Scott, Vitale, & Masten, 1998). They formulate judgements about children's abilities and adjust their instruction accordingly to facilitate optimal learning. Possible adaptation strategies include (1) altering the curriculum (e.g., modify goals and expectations), (2) varying assignments and assessment methods (e.g., vary the

complexity of tasks), and (3) providing alternative materials (e.g., use books below and beyond grade level) to match students' abilities.

Both structure and differentiated instruction relate to students' perceived competence. Although not explicitly addressed in SDT, differentiated instruction is in line with this framework. In a recent study, Deci (2009) proposed that providing optimal challenges through differentiated instruction strategies would foster students' perceived competence and autonomous motivation towards learning and school activities. Therefore, combining teacher structure and differentiated instruction, which we believe could act in synergy to produce higher perceived competence, appears to be a fruitful avenue to explore. In fact, explicit rules, direction, and guidance allow children to stay engaged in school activities and attain desired goals, so that they feel competent (Grolnick, Friendly, & Bellas, 2009). However, if students are to stay on task, they need to pursue challenges that are suited to their abilities, which is the major purpose of differentiated instruction. Whereas a task that is too easy can lead to boredom and lack of interest, one that is too difficult may generate anxiety. In both cases, students are likely to disengage from these activities (Csikszentmihalyi, Rathunde, & Whalen, 1993). Therefore, we argue that teacher structure would lead to higher autonomous motivation in students when differentiated instruction is also used, because the synergy between these pedagogical practices would increase students' perceived competence.

The present study

Because more and more educational policies across the globe encourage the use of differentiated instruction, discovering how this pedagogical practice might moderate the effect of other pedagogical practices on students' motivation appears promising. The aim of this study was thus to investigate whether differentiated instruction strategies in French class increase the positive effect of teacher structure on students' perceived competence, which in turn facilitates autonomous motivation. French was selected because literacy is at the heart of basic education, and most students who have weaker academic abilities have reading problems (Connor, Jakobsons, Crowe, & Meadows, 2009). Moreover, in the French-speaking education system in the province of Quebec, Canada, elementary school students spend more time studying French (e.g., reading, writing) than any other subject (Quebec Education Act, 2013). Consistent with the above-presented theoretical framework, we posited a mediated moderation model (see Figure 1; Muller, Judd, & Yzerbyt, 2005). Mediated moderation occurs when the interaction between an independent variable (e.g., teacher structure) and a moderating variable (e.g., differentiated instruction) affects a mediating variable (students' perceived competence in French), which in turn affects an outcome variable (students' autonomous and controlled motivation in French). In other words, we hypothesized that (1) the overall effect of teacher structure on students' motivations (autonomous and controlled) would be moderated by differentiated instruction such that (a) the positive effect of teacher structure on students' autonomous motivation in French class is stronger when differentiated instruction strategies are used, (b) the negative effect of teacher structure on controlled motivation is more pronounced when differentiated instruction is used, and (2) these interaction effects would be at least partially mediated by students' perceived competence. These predictions were verified while controlling for

gender differences among students. Indeed, some studies have shown that there were some gender differences on autonomous motivation, especially in the French school subject where girls have higher scores on this variable than boys (Guay, Chanal, *et al*., 2010).

Method

Participants and procedure

Data for this study were obtained from a larger research project conducted to understand the role of differentiated instruction in students' academic achievement and educational adjustment (Roy *et al*., 2013). In the public educational system of Quebec, there are 72 school districts including 1,725 elementary schools and 423 high schools. A total of 27 elementary school teachers (83% female) agreed to participate in this project. With their parents' approval, children from all participating classrooms were administered a questionnaire during school time. The questionnaire took about 30 min to complete. We also asked teachers to fill out a questionnaire to self-report their provision of structure and differentiated instruction strategies. This resulted in a final sample of 422 students (47% female; third grade = 72, fourth grade = 105, fifth grade = 174, sixth grade = 71) from 27 classrooms, with at least 10 students per classroom. Teachers' mean age was 40 (*SD* = 9.27) and teaching experience ranged from 1 to 32 years (*M* = 14.67, *SD* = 8.97). To recruit teachers, we first call school principals to organize a meeting with elementary school teachers working in their schools. Once these meetings were organized, we explained to teachers the goals of the project. A total of 27 teachers have accepted to participate to this project. The 27 teachers worked in 15 different public schools located in three different school districts (five schools were located in the first district, nine in the second one and one in the third one). Teachers were the primary teacher for all school subjects (except for the English school subject who is taught by another teacher) and were all knowledgeable about differentiated instruction because this pedagogical practice is encouraged by the official educational programme. All elementary classes comprised students of different ability levels (mixed-ability classes). Unfortunately, we did not collect any data on the participation rate of teachers and students. Consequently, we are unable to compare this sample with a non-participating one on characteristics such as age, years of experience, gender, and teaching grade level.

Measures

Motivation

Autonomous and controlled motivations in French class were assessed using the Elementary School Motivation Scale developed by Guay, Chanal, *et al*. (2010). In this study, the six items assessing intrinsic motivation and identified regulation were aggregated to compute a total score for autonomous motivation, and the three items assessing a combination of external and introjected regulations were used to compute a total score for controlled motivation. Sample items, rated on a three-point ordinal scale (1 = not true, 2 = sort of true, 3 = very true), are as follows: 'I like French class (reading/writing)', 'I learn many useful things in French class (reading/writing)' (autonomous motivation, $\alpha = .70$); and 'I read/write to get a nice reward', and 'I read/write to please my parents or my teacher' (controlled regulation, $\alpha = .71$). Descriptive statistics for each item appear in Table 1.

Perceived competence

Perceived competence in French class was assessed with a shortened 3-item scale translated and adapted from the Academic Self-Description Questionnaire I developed by Marsh (1990, 1993) to measure self-perceived competence in elementary school children. Items, rated on a three-point ordinal scale (1 = not true, 2 = sort of true, 3 = very true), are the following: 'I have always done well in French class', 'The work in French class is easy for me', and 'I learn things quickly in French class'. All items were aggregated to compute a total score. Cronbach's alpha for this measure was .84. Descriptive statistics for each item appear in Table 1.

Structure

The scale to assess teacher structure was adapted from existing instruments (Su & Reeve, 2010; Williams & Deci, 1996). It included four items rated on a 5-point ordinal scale (1 = never, 5 = very frequently). Sample items are as follows: 'I provide my students with clear rules and expectations' and 'I provide consistent consequences and contingencies for actions' (α = .76). Teachers provided answers to these items in general. Specifically, items for the structure dimension were not specific to the French school subject. Descriptive statistics for each item appear in Table 1.

Differentiated instruction

Teachers' differentiated instruction strategies were reported on the Differentiated Instruction Scale developed by Roy *et al*. (2013) to assess instructional adaptations and academic progress monitoring procedures in regular classrooms. For purposes of this study, we used the eight items assessing teachers' use of instructional adaptation strategies. Sample items, rated on a 5-point ordinal scale (1 = never, 5 = very frequently), are as follows: 'I vary the complexity of assignments to match students' abilities' and 'I use alternative materials (e.g., books below and beyond grade level) to match students' abilities'. Cronbach's alpha was .86. Items for differentiated instruction were not specific to the French school subject, but more general. Descriptive statistics for each item appears in Table 1.

Statistical analysis

Multilevel design

Students were nested within classrooms. This hierarchical structure involves two levels of analysis and thus requires multilevel linear modelling (Raudenbush & Bryk, 2002). Therefore, we tested our hypotheses using the mixed procedure in SAS 9.2, which is suitable for fitting multilevel models (Singer, 1998; Tabachnick & Fidell, 2007). This procedure takes into account the dependence among students from a same classroom (i.e., because of shared school experiences) by estimating the variability associated with group differences. However, given the fact that we had only 15 schools, we have decided not to test a multilevel with three levels. Indeed, with such a few groups, the parameters estimated might be biased (Maas & Hox, 2005).

Mediated moderation

To test our hypotheses, we built two separate mediated moderation models (see Figure 1). Model 1 included autonomous motivation as an outcome variable, and Model 2

included controlled motivation. Three regression equations were tested for each model (see Muller *et al*., 2005). Equation (1) allows the overall effect of the independent variable to be moderated. The outcome (*Y*: autonomous or controlled motivation) was thus regressed on the independent variable (*X*: structure), the moderator (Mo: differentiated instruction), and the level-2 interaction between the independent variable and the moderator. Equation (2) allows the effect of the independent variable on the mediator to be moderated. The mediator (Me: perceived competence) was thus regressed on the independent variable (*X*: structure), the moderator (Mo: differentiated instruction), and the level-2 interaction between the independent variable and the moderator. Finally, equation (3) allows both the mediator's effect and the residual effect of the independent variable on the outcome (controlling for the mediator) to be moderated. Therefore, the outcome (*Y*: autonomous or controlled motivation) was regressed on the independent variable (*X*: structure), the moderator (Mo: differentiated instruction), the level-2 interaction between the independent variable and the moderator (*X*Mo), the mediator (Me: perceived competence), and the cross-level interaction between the mediator and the moderator (MeMo). In sum, the three equations that were tested for each hypothesized model were the following:

$$\mathbf{Y} = \beta_{10} + \beta_{11}X + \beta_{12}\mathbf{Mo} + \beta_{13}X\mathbf{Mo} + \varepsilon_1 \quad (1)$$

$$\mathbf{Me} = \beta_{20} + \beta_{21}X + \beta_{22}\mathbf{Mo} + \beta_{23}X\mathbf{Mo} + \varepsilon_2 \quad (2)$$

$$\mathbf{Y} = \beta_{30} + \beta_{31}X + \beta_{32}\mathbf{Mo} + \beta_{33}X\mathbf{Mo} + \beta_{34}\mathbf{Me} + \beta_{35}\mathbf{MeMo} + \varepsilon_3 \quad (3)$$

According to Muller *et al*. (2005), thee criteria must be met to demonstrate mediated moderation: (1) in equation (1), the interaction between the independent variable and the moderator (β_{13}) should be significant, indicating an overall moderation; (2) in equations (2) and (3), both β_{23} and β_{34} are significant (i.e., the independent variable's effect on the mediator depends on the moderator, and this is found in conjunction with a mediator effect on the outcome variable), and/or both β_{21} and β_{35} are significant (i.e., the mediator's effect on the outcome variable depends on the moderator, and this is found in conjunction with an independent variable's effect on the mediator); and (3) in equation (3), the moderation of the independent variable's effect (β_{33}) should be reduced in magnitude compared to the overall moderated effect found in equation (1) (β_{13}). These predictions were verified for each tested mediated moderation model (Model 1 and Model 2), while controlling for gender differences among students. In addition, the variables were centred ($M = 0$, $SD = 1$) to facilitate the interpretation of the multilevel regression coefficients. Cross-products were created to test each moderated effect. Finally, to interpret interaction effects, we rearranged the equation terms and computed the predicted line between the independent variable and the dependent variable at three levels of the moderating variable (low = −1, moderate = 0, high = 1; Aiken & West, 1991).

Missing values

The percentage of missing values is presented in Table 2. No missing values were observed for teachers. For students, missing values ranged between 0.5% and 1.43%. Several researchers have demonstrated that listwise and pairwise procedures and other *ad hoc* methods, such as replacing missing values with a variable mean, are inadequate (Peugh

& Enders, 2004). In this study, we used a multiple imputation procedure (Rubin, 1987). Twenty-five multiple imputation data sets were generated, and each missing value was replaced with an estimated value. Consequently, analyses were based on a total sample of 27 classrooms and 422 students.

Results

Model 1: Autonomous motivation

Model 1 included autonomous motivation as an outcome variable. Correlations among variables are presented in Table 2 and the multilevel regression results for the mediated moderation model in Table 3. According to criterion 1 for mediated moderation, the interaction between the independent variable (teacher structure) and the moderator (differentiated instruction; β_{13}) should be significant, indicating an overall moderation (see equation (1) and path c1 in Figure 2). Consistent with criterion 1, the interaction between teacher structure and differentiated instruction was significant. These results indicate that (1) when teachers use differentiated instruction infrequently, teacher structure has a significant and negative effect on students' autonomous motivation in French class ($\beta = -.26$, $p = .0009$), (2) when teachers use differentiated instruction moderately, the effect of structure is not significant ($\beta = .04$, $p = .43$), and (3) structure has a significant and positive effect on students' autonomous motivation when teachers use differentiated instruction strategies frequently ($\beta = .35$, $p = .005$).

According to criterion 2 for mediated moderation, both β_{23} and β_{34} should be significant and/or both β_{21} and β_{35} should be significant. Consistent with this criterion, we found that both β_{23} and β_{34} were significant, indicating that the effect of teacher structure on students' perceived competence depends on their use of differentiated instruction, and this was found in conjunction with a significant effect of perceived competence on students' autonomous motivation. First, the interaction between teacher structure and differentiated instruction indicates that (1) the effect of teacher structure on students' perceived competence in French class is not significant when differentiated instruction strategies are used infrequently ($\beta = -.07$, $p = .35$), (2) the effect of teacher structure on perceived competence is significant and positive when teachers' use differentiated instruction moderately ($\beta = .17$, $p = .0095$), and (3) the positive effect of structure on students' perceived competence is more pronounced when teachers use differentiated instruction strategies frequently ($\beta = .41$, $p = .0019$). These findings suggest that teacher structure is associated with more positive perceived competence in students when accompanied by differentiated instruction.

Second, perceived competence was significantly and positively associated with students' autonomous motivation while controlling for the moderated effect in equation (3) (β_{33}), suggesting that the interaction effect of teacher structure and differentiated instruction on students' autonomous motivation is mediated by perceived competence. According to criterion 3, the moderation of the independent variable's effect

(β_{33}) should be reduced in magnitude compared to the overall moderated effect found in equation (1) (β_{13}), which the pattern of results confirmed.

Taken together, these findings supported a mediated moderation model for autonomous motivation, although most β were small to moderate in magnitude (Ferguson, 2009). When accompanied by differentiated instruction strategies, teacher structure facilitates students' autonomous motivation through perceived competence. Finally, Model 1 also revealed gender effects such that girls tended to be more autonomously motivated and to feel more competent than boys in French class.

Model 2: Controlled motivation

The hypothesized model is presented in Figure 1 (see Model 2), and the multilevel regression results in Table 3. We predicted that the negative effect of teacher structure on students' controlled motivation would be more pronounced when differentiated instruction is used (Hypothesis 1), and that this moderated effect would be at least partially mediated by students' perceived competence (Hypothesis 2). Using controlled motivation as an outcome variable, we tested the same three equations as in Model 1 to verify the hypotheses. First, the interaction between the independent variable (teacher structure) and the moderator (differentiated instruction; β13) was significant, suggesting an overall moderation. The results indicate that the relationship between teacher structure and controlled motivation was negative only when differentiated instruction strategies were used infrequently ($\beta = -.32$, $p = .0517$). The effect was positive (although not significant) when these strategies were used moderately ($\beta = .04$, $p = .73$) and frequently ($\beta = .40$, $p = .13$). Second, the effect of teacher structure on students' perceived competence depended on the level of differentiated instruction, but this moderation was not found in conjunction with a significant effect of perceived competence on students' controlled motivation. Therefore, these results did not provide support for a mediated moderation model.

Discussion

Using a mediated moderation model, we tested the following hypotheses: (1) the overall effect of teacher structure on students' motivation would be moderated by differentiated instruction such that (a) the positive effect of teacher structure on students' autonomous motivation in French class is stronger when differentiated instruction strategies are used, and (b) the negative effect of teacher structure on controlled motivation is more pronounced when differentiated instruction is used; and (2) these moderated effects would be at least partially mediated by students' perceived competence. Overall, the results provided partial support for these predictions. First, we found that the effect of teacher structure on students' autonomous motivation was positive only when differentiated instruction strategies were frequently used and that this moderated effect was partially mediated by perceived competence (Model 1). Second, teacher structure was negatively associated with students' controlled motivation only when differentiated instruction was provided infrequently, but this moderated effect was not explained by perceived competence (Model 2).

Autonomous motivation

Results from the first equation of Model 1 revealed that teacher structure had a positive effect on students' autonomous motivation only when differentiated instruction strategies were frequently used, which is consistent with our predictions. Interestingly, the effect was not significant when differentiated instruction strategies were used moderately, and it was negative when these strategies were used infrequently. These results suggest that teacher structure can have different effects on students' autonomous motivation depending on the level of differentiated instruction. In fact, structure provides students with the know-how to self-regulate their behaviour and accomplish goals (Sierens *et al*., 2009), but it may not be sufficient to stay engaged. To be autonomously motivated, students need to pursue optimal challenges that are suited to their abilities. Otherwise, if they are assigned activities that are too difficult for them, they may feel pressured to achieve specific outcomes that seem unrealistic. In that case, students could perceive teacher structure as controlling and hence feel lower autonomous motivation. This interpretation is in line with the findings of Assor, Kaplan, Kanat-Maymon, and Roth (2005), who suggest that controlling teaching practices such as interfering with students' preferred pace of learning and giving frequent directives can induce anxiety, which may produce lower autonomous motivation. Lastly, the findings from equation (1) revealed gender effects such that girls tend to be more autonomously motivated than boys in French class, which is consistent with past research (Ratelle, Guay, Vallerand, Larose, & Senécal, 2007).

Results from the second equation of Model 1 indicated that the effect of teacher structure on students' perceived competence was positive when differentiated instruction strategies were frequently provided, which is consistent with the findings from the first equation. However, when these strategies were used moderately, the effect remained positive but smaller, and teacher structure was not associated with perceived competence when differentiated instruction strategies were used infrequently. Whereas these results differ only slightly from those for equation (1), they additionally suggest that the effect of teacher structure on perceived competence is more positive when combined with greater use of differentiated instruction. As mentioned above, differentiated instruction strategies allow students to accomplish tasks that match their abilities, which helps them achieve goals and feel competent. These findings should be replicated and the relationships investigated more deeply. In addition, we found that girls tended to feel more competent than boys in French class, which is consistent with past studies (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Marsh, Chessor, Craven, & Roche, 1995; Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2006).

Finally, the third equation of Model 1 confirmed that when combined with greater use of differentiated instruction, teacher structure had a positive effect on students' perceived competence, which in turn facilitated autonomous motivation in French class. This finding is consistent with SDT (Deci & Ryan, 2000). Although the findings from Model 1 require further investigation, they have important theoretical and practical implications. Theoretically, the results provide further insight into which pedagogical practices enhance the positive effect of teacher structure on students' autonomous motivation. In addition to autonomy support (Jang *et al*., 2010; Sierens *et al*., 2009; Vansteenkiste *et al*., 2012),

differentiated instruction was identified as a promising classroom condition. Indeed, this study showed that teacher structure is more likely to produce higher perceived competence and autonomous motivation when differentiated instruction strategies are frequently used. In practical terms, teachers should pay attention to the manner in which they provide rules, expectations and guidance in their classroom and ensure that students pursue optimal challenges that are suited to their capabilities.

Controlled motivation

Results from the first equation of Model 2 revealed that teacher structure had a negative effect on students' controlled motivation, but only when differentiated instruction strategies were used infrequently. Moreover, although these findings were not significant, teacher structure had no effect on controlled motivation when differentiated instruction strategies were used moderately, and a positive effect when these strategies were frequently used. Therefore, whereas these results should be interpreted with caution, it is possible that the combination of teacher structure and differentiated instruction leads to positive effects on both autonomous and controlled motivations. When used together, these two pedagogical practices may be associated with the quantity (or amount) of motivation rather than its quality. In other words, when accompanied by differentiated instruction strategies, teacher structure would facilitate higher student motivation, regardless of the motivation type (i.e., autonomous or controlled). One possible explanation is that teacher structure and differentiated instruction should also be accompanied by autonomy support to decrease controlled motivation. In this respect, some research has suggested that teacher structure leads to higher autonomous motivation when accompanied by autonomy support (Vansteenkiste *et al*., 2012). However, this interpretation is speculative, and the issue should be investigated in future studies. Finally, results from Model 2 revealed that the moderated effect on students' controlled motivation was not mediated by perceived competence. This finding also merits further examination.

Limitations and directions for further research

This study had some limitations. First, teachers might have self-reported their practices in a favourable light. Our hypotheses would have been more stringently tested if we had included other measures of teacher structure and differentiated instruction (e.g., observational data; see Pianta & Hamre, 2009; for a valid observational measure). Second, the present findings should be replicated in larger samples and using longitudinal designs to determine the effects of combining teacher structure and differentiated instruction strategies on students' perceived competence, autonomous motivation and relatedness over a longer time frame. Third, it would be useful to test this mediated moderation model in other core academic subjects, such as mathematics. Fourth, most regression coefficients were small to moderate in magnitude (Ferguson, 2009). Thus, we need to be careful about the practical significance of these results.

Conclusion

This study suggests that teacher structure may produce different effects on students' autonomous motivation, depending on the use of differentiated instruction. Specifically, teacher structure was positively associated with autonomous motivation only when differentiated instruction strategies were frequently used. Moreover, this moderated effect was explained by students' perceived competence. Taken together, our findings provide further insight into how teacher structure should be used to enhance students' perceived competence and autonomous motivation. However, the findings are limited to the present study, and more research is needed to more clearly define the moderating role of differentiated instruction.

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Figure 1. Hypothesized models.

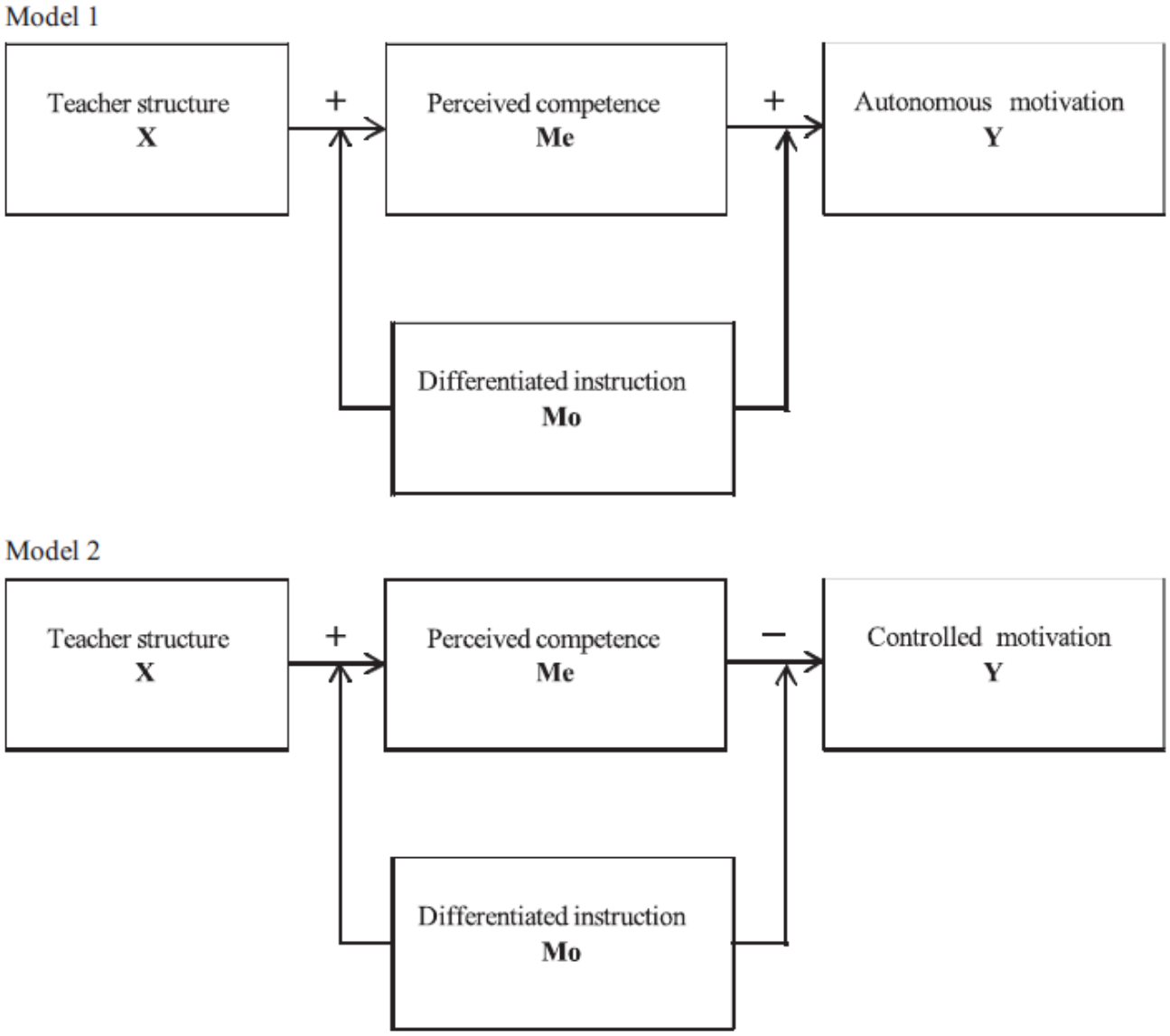

Figure 2. Models illustrating the overall moderation effect and the mediated moderation effect.

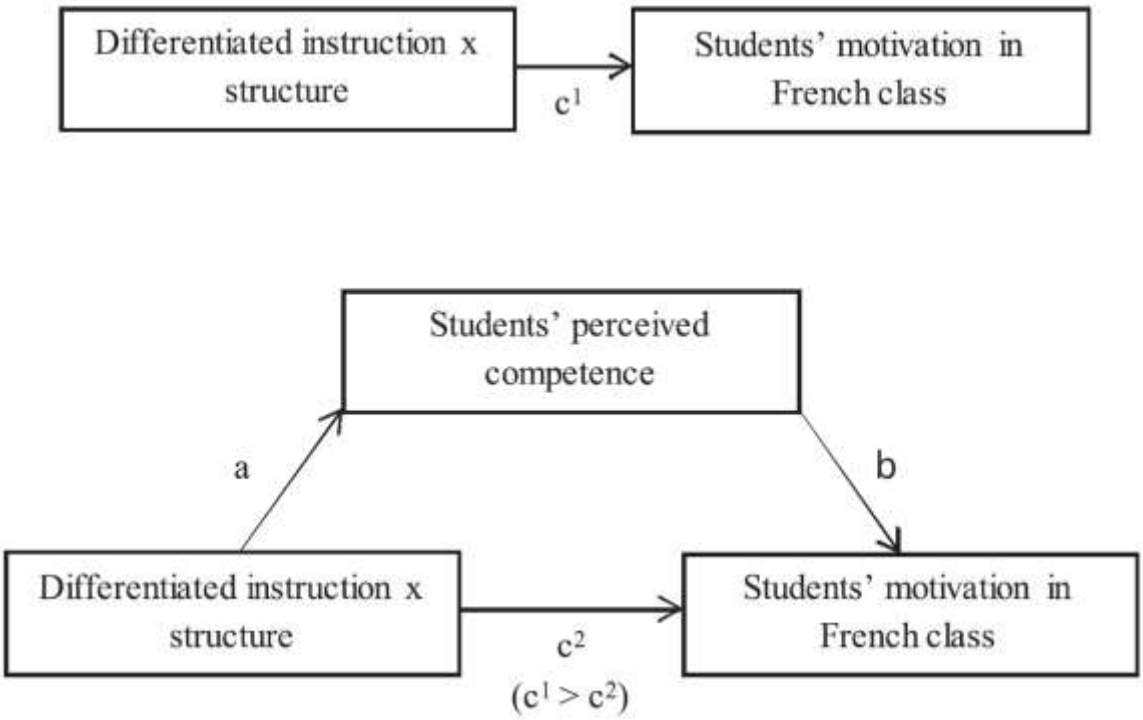

Table 1. Percentage of missing values, means, standard deviations, and frequencies for all items

Variables list	% of missing	Means	SD	Never (%)	Rarely (%)	Sometimes (%)	Frequent (%)	Very frequent (%)
Teachers (n = 27)								
Structure 1	0.00	4.85	0.36	–	–	–	15	85
Structure 2	0.00	3.89	0.80	4	–	15	67	15
Structure 3	0.00	4.59	0.57	–	–	4	33	63
Structure 4	0.00	4.59	0.64	–	–	7	26	67
Adaptation 1	0.00	2.63	1.08	19	22	41	15	4
Adaptation 2	0.00	3.19	0.69	–	11	63	22	4
Adaptation 3	0.00	3.52	0.94	–	19	22	48	11
Adaptation 4	0.00	2.93	1.27	15	30	11	37	7
Adaptation 5	0.00	3.59	0.89	–	11	33	41	15
Adaptation 6	0.00	3.26	0.86	–	22	33	41	4
Adaptation 7	0.00	2.63	1.12	19	26	33	19	4
Adaptation 8	0.00	2.26	1.13	30	33	22	11	4
Students (n = 422)								
Intrinsic 1	0.71	2.51	0.60					
Intrinsic 2	0.47	2.35	0.67					
Intrinsic 3	1.42	2.38	0.71					
Identified 1	0.24	2.77	0.46					
Identified 2	0.71	2.59	0.57					
Identified 3	0.71	2.97	0.21					
Controlled 1	0.47	1.75	0.80					
Controlled 2	0.95	1.81	0.80					
Controlled 3	0.24	2.09	0.77					
Competence 1	0.95	2.07	0.69					
Competence 2	0.95	2.07	0.69					
Competence 3	0.95	2.32	0.70					

Table 2. Single-level correlations among the variables of the study

Variables	1	2	3	4	5	6
1. Gender	–					
2. Autonomous motivation	−.24***	–				
3. Controlled motivation	.01	.06	–			
4. Perceived competence	−.22***	.48***	.13**	–		
5. Differentiated instruction	.03	−.04	.00	.01	–	
6. Structure	.04	−.08	−.07	.08	.22	–
Mean		2.59	1.88	2.15	3.00	4.43
SD		0.35	0.63	0.60	0.63	0.40

Note. $^{**}p < .01$; $^{***}p < .001$.

Table 3. Mediated moderation model 1 and 2: Multilevel regression coefficients relating autonomous motivation (model 1) or controlled motivation (model 2) in French class to perceived competence, differentiated instruction, and teacher structure

	Equation (1)			Equation (2)			Equation (3)		
	Autonomous motivation			Perceived competence			Autonomous motivation		
	β	*SE*	Sig.	β	*SE*	Sig.	β	*SE*	Sig.
Model 1									
Gender (G)	−.44	.09	.0001	−.43	.09	.0001	−.24	.09	.0045
Perceived competence (PC)							.45	.04	.0001
Differentiated instruction (DI)	.01	.05	.8000	.03	.06	.6000	.00	.05	.9600
Structure (S)	.04	.05	.4300	.17	.06	.0095	−.03	.05	.5700
DI × S	.31	.08	.0005	.24	.09	.0061	.20	.07	.0062
DI × PC							.02	.05	.6400
	Controlled motivation			**Perceived competence**			**Controlled motivation**		
Model 2									
Gender (G)	.08	.09	.3500	−.43	.09	.0100	.12	.09	.1900
Perceived competence (PC)							.08	.05	.1000
Differentiated instruction (DI)	.05	.10	.6100	.03	.06	.6000	.05	.10	.6100
Structure (S)	.04	.12	.7300	.17	.06	.0100	.03	.12	.7800
DI × S	.36	.17	.0435	.24	.09	.0100	.34	.16	.0373
DI × PC							−.03	.05	.5600

Note. *SE* = standard error.
N = 422. Standardized regression coefficients (*b*).