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Intrinsic, identified, and controlled types of motivation for school subjects in young elementary school children

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Background. There are two approaches to the differential examination of school motivation. The first is to examine motivation towards specific school subjects (between school subject differentiation). The second is to examine school motivation as a multidimensional concept that varies in terms of not only intensity but also quality (within school subject differentiation). These two differential approaches have led to important discoveries and provided a better understanding of student motivational dynamics. However, little research has combined these two approaches.

Aims. This study examines young elementary students' motivations across school subjects (writing, reading, and maths) from the stance of self-determination theory. First, we tested whether children self-report different levels of intrinsic, identified, and controlled motivation towards specific school subjects. Second, we verified whether children self-report differentiated types of motivation across school subjects.

Sample. Participants were 425 French-Canadian children (225 girls, 200 boys) from three elementary schools. Children were in Grades 1 ($N = 121$), 2 ($N = 126$), and 3 ($N = 178$).

Results. Results show that, for a given school subject, young elementary students self-report different levels of intrinsic, identified, and controlled motivation. Results also indicate that children self-report different levels of motivation types across school subjects. Our findings also show that most differentiation effects increase across grades. Some gender effects were also observed.

Conclusion. These results highlight the importance of distinguishing among types of school motivation towards specific school subjects in the early elementary years.

Educational researchers and practitioners recognize that school motivation is vital for academic achievement and persistence (Pintrich, 2003). This has opened the way to a recent series of intervention programmes specifically designed to improve student

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motivation at school (Wigfield & Wentzel, 2007). When examining the role of student motivation, we may consider it as either a general construct (i.e., student motivation towards school in general) or specific to school subjects (e.g., student motivation towards maths). Both foci are important to consider in understanding general as well as specific academic outcomes (Bandura, 1997; Elliot, 2005; Green, Martin, & Marsh, 2007; Pintrich, 2003). Here, we focus our attention on specific school motivations.

There are two approaches to the differential examination of school motivation. The first is to examine motivation towards specific school subjects. This has been done from several theoretical standpoints (e.g., goal theory, self-efficacy theory, self-concept, and the expectancy-value model), and has focused primarily on disciplines such as writing, reading, and maths. We refer to this motivational differentiation as *between school subject differentiation*. Another approach is to examine school motivation as a multidimensional concept that varies in terms of not only intensity but also quality. An example of this approach is self-determination theory (SDT; Ryan & Deci, 2002), which distinguishes among types of motivation. We refer to this motivational differentiation as *within school subject differentiation*. These two differentiation types (within and between school subjects) have led to important discoveries and provided a better understanding of student motivational dynamics and the associated outcomes. However, little research has combined these two approaches, which is the focus of the present study. In addition, we examine whether these differentiations vary across age groups. For example, are older children better able than younger children to differentiate types of motivation for a given school subject (within school subject differentiation) and a given motivational construct across school subjects (between school subject differentiation)? It is important to find the answer to this question, because it may inform us on how motivation develops during formative years that are important for later school adjustment.

A differentiated approach to conceptualizing school motivation: SDT

Motivation is defined under SDT (Ryan & Deci, 2002) as the reasons that underlie behaviour. Applied to education, it refers to the reasons that students engage in different school activities (Ryan & Deci, 2000). SDT distinguishes among different types of motivation, which vary in terms of self-determination (i.e., the extent to which behaviour originates from the self). *Intrinsic motivation* refers to engaging in an activity for its own sake, for the pleasure and satisfaction derived from participating in it (Ryan & Deci, 2000). *Extrinsic motivation* refers to engaging in an activity for instrumental reasons rather than for the intrinsic qualities of the activity. According to SDT, there are different types of extrinsic motivation that vary in terms of self-determination. From low to high self-determination, these are external regulation, introjected regulation, identified regulation, and integrated regulation (Ryan & Deci, 2000).

External regulation occurs when behaviour is motivated by the desire to obtain a reward or avoid punishment. *Introjected regulation* refers to behaviours performed in response to internal pressures such as obligation or guilt: the individual somewhat endorses the reasons for doing something, but in a controlled way. In our study, we assessed introjected and external regulation jointly under the construct of *controlled regulation* (see Shahar, Henrich, Blatt, Ryan, & Little, 2003) in order to reduce the number of items for which young children would have to provide responses. Identified regulation is observed when individuals identify with the reasons for performing a behaviour, or when they personally find it important. This is a self-determined form of extrinsic motivation, because the behaviour originates from the self in a non-contingent way. Integrated regulation occurs when the identified regulation is congruent with other values and needs. The behaviour is therefore performed because it is part of who the person is. However, this form of regulation requires that the individual has formed an identity (Deci, Ryan, & Williams, 1996), such that he or she can identify with the importance of a behaviour and reciprocally assimilate that identification with other aspects of the coherent sense of self. According to Harter (1999), this hierarchical organization of the self is developed only by the end of adolescence or during early adulthood, which is why we did not assess integrated regulation in this study.

These types of motivation have been associated with school outcomes. For example, students who endorse autonomous types of motivation (intrinsic and identified regulation) are more persistent and cognitively involved in their tasks, experience more positive emotions and have better grades, whereas students who are motivated in a controlled fashion are less persistent, more distracted, experience more negative emotions (anxiety), and obtain lower grades (see Guay, Ratelle, & Chanal, 2008). These findings underscore the importance of developing autonomous motivations (intrinsic, identified) in contrast to controlled motivation during the early school years.

According to SDT, motivation types can be ordered along a self-determination continuum. Motivation types are therefore expected to relate to each other in a simplex-like pattern, with stronger positive correlations between adjacent than distant motivations. For example, identified regulation and intrinsic motivation should be positively and moderately correlated, and this correlation should be higher than the correlation between intrinsic motivation and controlled regulation. Previous research has supported the self-determination continuum for motivation types towards school in general (see Otis, Grouzet, & Pelletier, 2005; Ryan & Connell, 1989; Vallerand, Blais, Brière, & Pelletier, 1989; Vallerand *et al.*, 1992, 1993). The present study focuses on motivation types towards specific school subjects (i.e., reading, writing, and maths), where we expected the self-determination continuum to be replicated within each school subject.

> *Hypothesis 1:* For each school subject (i.e., reading, writing, and maths), correlations among motivation types will follow a simplex pattern (*within school subject differentiation*), where $r_{(\text{intrinsic, identified})} > r_{(\text{intrinsic, controlled})}$, and $r_{(\text{identified, controlled})} > r_{(\text{intrinsic, controlled})}$.

A differentiated approach to assessing school motivations: School versus subject-specific motivations

As mentioned earlier, school motivation can be examined globally or in a differentiated way within school subjects. Traditionally, motivation researchers have evaluated variations in motivation across different school subjects (see Elliot, 2005; Green *et al.*, 2007; Pintrich, 2003). To date, however, research from the stance of SDT has not examined types of school motivation towards different school subjects. Some support has been obtained for between school subject differentiation effects with respect to intrinsic motivation towards reading, maths, social studies, and science (Gottfried, 1985). Students' ability to differentiate intrinsic motivation across school subjects is evidenced by correlational patterns, whereby intrinsic motivation for a given school subject is more strongly associated with other motivational constructs within that school subject than with motivational constructs for other school subjects (also see Eccles, Wigfield, Harold, & Blumenfeld, 1993; Gottfried, 1990).

In this study, we wanted to replicate the *between school subject differentiation* effect obtained for intrinsic motivation and extend our focus to identified and controlled regulations. Because these regulations are phenomenologically distinct from intrinsic motivation, we postulated that differentiation effects would be obtained for all types of motivation, but that intensity would differ. We therefore expected between school subject differentiation to be stronger at the higher end of the self-determination continuum (intrinsic motivation) and lower as self-determination declines. We believe that intrinsic motivation should be more differentiated than extrinsic motivation, because intrinsic motivation is not instrumentally focused. Instead, it originates autotelically, arising from the inherent satisfaction in the action, whereas extrinsic motivation relies on contingent outcomes that are separable from the action. Specifically, children engage in various activities offered at school to give them an opportunity to discover at a relatively early age which activities they enjoy and which they do not. Identified regulation should be less differentiated than intrinsic motivation, because this regulatory process is less tied to the inherent characteristics of the activity and more governed by the endorsement of cultural values (Deci & Ryan, 1985). In fact, children may understand relatively early that reading, writing, and maths are important for their development as an individual, even though they may identify with one subject more than another. Finally, we posited that controlled regulation would not be differentiated among school subjects, because it involves managing internal and external impetuses that may be operative across school subjects. For example, a teacher that uses external contingencies to motivate children will do so not only in maths, but in other subjects as well. This hypothesis is in line with previous findings obtained in adults that correlations among intrinsic motivation towards different work tasks are weaker than correlations among identified regulation, which are in turn weaker than correlations among introjected and external regulation (Fernet, Senécal, Guay, Marsh, & Dowson, 2008).

> *Hypothesis 2:* An *amplified differentiation effect* will be observed, in which the differentiation of motivations across school subjects will be amplified as motivations become more self-determined (i.e., $\text{Differentiation}_{\text{intrinsic}} > \text{Differentiation}_{\text{identified}} > \text{Differentiation}_{\text{controlled}}$).

Differentiation effects across grades

An important aspect that has not been thoroughly addressed in the research on school motivation that focused on within and between school subjects is the possible fluctuation across school grades. With increased experience of the school system, will young children become increasingly able to differentiate motivation types for different school subjects? In this study, three age groups were examined: 6 years old (Grade 1), 7 years old (Grade 2), and 8 years old (Grade 3). This grouping by grade is consistent with previous studies (see Wigfield *et al.*, 1997). According to Harter (1999), self-descriptions of children aged between 5 and 7 are typically undifferentiated (see also Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006), because this age is characterized by an all-or-nothing kind of thinking. That is, children at this age believe that they are good at everything or bad at everything, although they usually have a very positive image of themselves. In contrast, children aged between 8 and 11 years have a more differentiated self-perception, such that they can better understand and integrate evaluative feedback, which leads to more accurate self-perceptions. They can therefore better differentiate among their self-perceptions across school subjects

(Eccles *et al.*, 1993). Furthermore, by this age, children have been exposed to more learning experiences, which in turn enables them to more accurately report on their motivational states (Bandura, 1997; Deci & Ryan, 1985). These children also use more social comparisons and are therefore more aware of their status with respect to their schoolmates in each discipline. Their degrees of success in specific disciplines can then lead to different perceptions of motivation across school subjects.

With respect to *within school subject differentiation*, no study to date has examined grade effects, such that there is no empirical evidence for students' developing an ability to differentiate among motivation types towards specific school subjects. Generally, researchers have tested the factorial structure of SDT motivational types in a given age group, without investigating the moderating effect of age (Ryan & Connell, 1989; Vallerand *et al.*, 1989, 1992, 1993). Since developmental research suggests that children's abilities to differentiate self-representations increase across school years (especially in Grade 3), we expected similar effects on their ability to differentiate among motivation types.

Hypothesis 3: For each school discipline, the simplex pattern of correlations among types of motivation should become clearer as students progress through the grades.

With respect to *between school subject differentiations*, there is theoretical and empirical support for grade effects. According to SDT, self-reports of intrinsic motivation become more differentiated with age: 'At the beginning interests are relatively undifferentiated, and gradually through accumulated experiences they become more differentiated' (Deci & Ryan, 1985, p. 127). This was corroborated by Wigfield *et al.* (1997), who showed that interest (a concept similar to intrinsic motivation) in reading and maths correlates more positively with children's competence beliefs in these subjects (i.e., convergent correlations) as children grow older. However, based on the results of Wigfield and his colleagues, it is difficult to verify whether age effects for between school subject differentiation of intrinsic motivation are fully supported, because correlations among measures of interest for different school subjects were not reported. Examining a concept akin to identified regulation, Eccles *et al.* (1993) found that subjective task values (i.e., importance) for maths, reading, and sports form distinct factors in Grades 1, 2, and 4. This suggests that even young elementary school students can develop differentiated beliefs about what they value most in school. However, the extent to which differentiation takes place remains unclear, because correlations among the subjective values for the different school subject were not reported. We argue that intrinsic motivation may develop before identified regulation, because children are involved in a variety of tasks, becoming more interested in some and less interested in others (see also Wigfield, Tonks, & Lutz Klauda, 2009). However, identified regulation implies that children find the activity important for themselves. Given this definition, it is likely that the development of identified regulation occurs when children have a better understanding of the relevance of the activity for themselves and greater capacity to integrate evaluative feedback.

While the research suggests possible grade effects for between school subject differentiation of intrinsic motivation and identified regulation, no study to date has examined these effects for controlled regulation. Nevertheless, consistent with our amplified differentiation hypothesis, which posits no differentiation effect for controlled regulation, we did not expect any developmental trends for this variable. Consequently, we proposed the following hypothesis:

Hypothesis 4: The expected pattern of results for Hypothesis 2 (i.e., $\text{Differentiation}_{\text{intrinsic}} > \text{Differentiation}_{\text{identified}} > \text{Differentiation}_{\text{controlled}}$) will be clearer as children progress through grades.

In sum, the present study aimed to examine young elementary school students' motivation in a differentiated way by estimating both within and between school subject differentiation effects. Another goal was to examine differentiation effects across grades. It is important to note that the between school subject differentiation effects proposed in Hypotheses 2 and 4 is tested using academic self-concept in three school subjects, because Marsh and colleagues have shown in numerous studies that academic self-concept is differentiated across school subjects (Marsh, 2007), and because this construct is expected to correlate with motivation types (Deci & Ryan, 2000). Finally, we explore the effects of gender on the components, as previous studies have shown that females are more autonomously motivated towards school than males (Guay & Vallerand, 1997).

Method

Participants

Participants were 425 French-Canadian children (225 girls, 200 boys; mean age = 7 years, range 6–10 years) attending three elementary schools in Quebec City, Canada. Children were in Grade 1 ($N = 121$), Grade 2 ($N = 126$), and Grade 3 ($N = 178$). In all, 26 classrooms containing approximately 20 students each were involved. Participation required parental consent and the parental participation rate was over 84%.

Procedure

Questionnaires were administered in the classroom by a team of three trained research assistants. The following instructions were given to all children: 'This is a chance to help me find out how you feel. It is not a test. There are no right or wrong answers and everyone will have different answers. I will ask you a question and then ask you to write how you feel about it by writing "yes" in the questionnaire if the sentence says how you feel, and "no" if it doesn't. Make sure your answers show how you feel about yourself. We will not show your answers to anyone else. If you do not understand a sentence or a word in a sentence, please tell us'.

Measures

Academic motivations

For the purposes of this study, we created the Elementary School Motivation Scale (ESMS) by adapting 27 items from the elementary school version of the Academic Motivation Scale (Vallerand *et al.*, 1989), a validated instrument used with older children. An expert committee of three professors and three doctoral students adapted the items for young elementary schoolchildren. For each school subject (i.e., reading, writing, and maths), three items were adapted to assess intrinsic motivation, three to assess identified regulation, and three to assess controlled regulation. Children were asked to indicate the extent to which each item applied to them, according to the following scale (see Marsh, Craven, & Debus, 1998): (1) 'always no',

(2) 'sometimes no', (3) 'I don't know', (4) 'sometimes yes', and (5) 'always yes'. Note that we used a double-binary (two part) response format. We asked children to select between 'yes' and 'no' and to indicate whether it was 'always yes', 'sometimes yes', 'always no', or 'sometimes no', The middle category ('I don't know') was presented only when children really did not know what to answer, and was used infrequently. Specifically, the descriptive statistics indicate that the average number of values for the 'I don't know' category was 3% for intrinsic items, 3.4% for identified items, and 5.3% for controlled items. This indicates that the children adequately understood most items. However, it is possible that they understood some questions less well than others, leading to a higher response rate for the 'I don't know' category. It is also possible that younger students were more prone to use this answer option than older students. To assess whether the proportion of 'I don't know' answers varied across *questions* and *grades*, we performed a repeated measures logistic model. A compound symmetry dependence structure is assumed among questions. Type 3 tests show no significant effect of *grade* but a significant effect of *question*. Multiple comparisons of the estimated probability of answering 'I don't know' show 127 significant effects ($p < .05$) out of 630 possible comparisons. However, none of these comparisons remain significant when a step-down Bonferroni correction is applied (all $p > .09$). This analysis reveals two important findings. First, even though students in Grade 1 were relatively young and their language ability varied significantly, they were not more prone to use the 'I don't know' category than older children. Second, although the frequency of the 'I don't know' category varies significantly across questions, these apparent differences do not hold when a step-down Bonferroni correction is applied.

The scale is presented in Appendix A. The content validity and wording of the 27 items were reviewed by six independent experts who had not initially participated in adapting the items. These experts confirmed the adequacy of the content validity, wording, and response format.

Because the ESMS has not been used in any studies to date, we decided to perform a confirmatory factor analysis (CFA) to test the adequacy of the nine-factor solution of the scale for the total sample and for each cohort (Grades 1–3). The findings provide reasonable support for the factorial structure of the ESMS when using the total sample ($\chi^2[261, N = 425] = 518.59$; $\chi^2/df = 1.99$, root mean square error of approximation (RMSEA) = .048 [.042, .054]; see the 'Statistical analysis' section for more information on statistical analyses). However, when the sample was examined by grade, the fit indices differed across grades, with best fitting solutions found in Grade 3 ($\chi^2[261, N = 178] = 396.99$; $\chi^2/df = 1.52$, *RMSEA = .054* [.043, .065]), followed by Grade 2 ($\chi^2[261, N = 126] = 516.72$; $\chi^2/df = 1.98$, RMSEA = .089 [.077, .099]), and Grade 1 ($\chi^2[261, N = 121] = 486.10$; $\chi^2/df = 1.86$, RMSEA = .085 [.073, .096]). Cronbach's alphas for each subscale are presented in Appendix B.

Academic self-concept

Nine items were selected from the Academic Self-Description Questionnaire (Marsh, 1990) to assess academic self-concept in maths (3 items), reading (3 items), and writing (3 items). The wording of the three items is the same for each school subject (1: 'I have always done well in reading (writing, maths)', 2: 'Reading (writing, maths) is easy for me', and 3: 'I learn things quickly in reading (writing, maths)'). Children were asked to rate each item according to the following scale: (1) 'always no',

(2) 'sometimes no', (3) 'I don't know', (4) 'sometimes yes', and (5) 'always yes'. Cronbach's alphas are presented in Appendix B.

Statistical analysis

Missing data

Less than 7% of the data were missing (approximately 17, 4, and 1% for Grades 1, 2, and 3, respectively). Most missing values were not random – some teachers were unable to give extra time to the research team after 30 min of class time. Despite the low amount of missing data, it would be highly inappropriate to disregard missing values by using listwise deletion of cases (see Peugh & Enders, 2004). In the present study, we performed an full information maximum-likelihood (FIML) estimation using LISREL (version 8.80) to approximate the missing values.

Confirmatory factor analyses

We assessed the adequacy of the models by structural equation modelling using LISREL (version 8.80). All models were tested with maximum-likelihood estimation. To ascertain model fit, we used the RMSEA and the chi-square/degrees of freedom (χ^2/df) ratio. According to Browne and Cudeck (1993), RMSEA values less than .05 are considered a good fit, values between .05 and .08 an adequate fit and values between .08 and .10 a mediocre fit, while values $>.10$ are unacceptable. The chi-square/degrees of freedom (χ^2/df) ratio is a function of model misfit (χ^2) compared to model parsimony, as indicated by the model's degrees of freedom (df). Smaller χ^2/df ratios occur when model misfit is lower than model parsimony. In general, a χ^2/df ratio of less than 2 indicates a relatively good model fit (Kline, 2005). In the present study, other key indices such as the CFI and the NNFI were not used, because LISREL does not provide these fit indices with the FIML missing values estimation procedure.

Correlated errors or uniquenesses of parallel items

Correlated uniquenesses of parallel items were freely estimated, because the ESMS and the academic self-concept measure target the same three school subjects. The uniquenesses associated with corresponding items are therefore likely to be correlated (a method effect; see Marsh & Hau, 1996). When substantially correlated uniquenesses are not included in a model, the model's fit indices are weaker, and more importantly, results yield positively biased estimates of relations among parallel constructs reflecting different school subjects.

Multiple group tests of invariance

Using parallel data from more than one group, it is possible to test the invariance of the solution by constraining estimates to be equal across groups. The minimum condition for factorial invariance is invariance of the factor loadings. In the present study, separate tests were run to determine the invariance of factor loadings and factor correlations. If the addition of invariance constraints results in little or no change in chi-square values, then there is support for the invariance of the factor structure across age groups.

Results

Before testing our hypotheses, we began by assessing the 12-factor model, which includes motivation types and self-concepts for the three school subjects. Fit indices are presented in Table 1 under models M1 to M4. They indicate adequate factor solutions for the total sample and the older cohort (Grade 3). However, although the χ^2/df ratio is acceptable, RMSEA values are poor for Grades 1 and 2, which is consistent with Hypotheses 3 and 4 that posit greater differentiation of motivational components in older children.

We further tested for potential gender effects using a structural equation model. Fit indices of this model are adequate ($\chi^2[540, N = 425] = 1,095.7626$, $\chi^2/df = 2.0$, RMSEA $= .049$ [.045, 053]). Gender has four significant effects, namely on the three intrinsic motivation dimensions (reading, writing, and maths) and on identified regulation towards writing. Specifically, girls have higher intrinsic motivation for writing and reading as well as higher identified regulation for writing than boys. In contrast, boys have higher intrinsic motivation for maths than girls.

Testing within school subject differentiation

Our first hypothesis states that the correlation between intrinsic motivation and identified regulation should be higher than that between identified and controlled regulations. Moreover, the correlation between identified and controlled regulations should be higher than that between intrinsic motivation and controlled regulation ($r_{(\text{intrinsic, identified})} > r_{(\text{intrinsic, controlled})}$; $r_{(\text{identified, controlled})} > r_{(\text{intrinsic, controlled})}$). Correlations among motivation types for the total sample *within* each school subject are presented in Table 2 (obtained from M1). To test Hypothesis 1, we constrained two set of correlations to equality: $r_{(\text{intrinsic, identified})} = r_{(\text{intrinsic, controlled})}$, and $r_{(\text{identified, controlled})} = r_{(\text{intrinsic, controlled})}$ within each school subject. This yielded three models: M5 (reading), M6 (writing), and M7 (maths). If the chi-square values of the constrained models M5, M6, and M7 differ from the chi-square value of the unconstrained M1, this would indicate that the correlations are different, supporting Hypothesis 1. Results for these models are presented in Table 1. Under the 'comparison' column, we have indicated which models are compared. Results of M5 to M7 indicate that the correlations differ statistically for reading and maths, but not for writing. The simplex pattern of correlations is therefore supported for reading, but less so for maths, where the correlation between controlled regulation and intrinsic motivation is higher than that between identified and controlled regulations. In addition, despite the fact that the correlations appear to support the simplex pattern for writing, these apparent differences in correlations do not reach significance. These findings therefore indicate that Hypothesis 1 is supported only for reading.

Testing between school subject differentiation

Our second hypothesis states that children's self-reports of intrinsic motivation should be more differentiated across school subjects than self-reports of identified regulation, and that children's self-reports of identified regulation should be more differentiated across school subjects than self-reports of controlled regulation. These effects should be reflected by (1) correlations among types of motivation across school subjects where $rs_{\text{intrinsic}} < rs_{\text{identified}} < rs_{\text{controlled}}$ and (2) correlations between types of motivation and measures of self-concept where the difference between convergent correlations

Table 1. CFAs: Model fit statistics

Model	Description	χ^2	*df*	χ^2/df	RMSEA	CI RMSEA	Comparison	Δdf	$\Delta\chi^2$
CFA models									
M1	Total sample CFA	867.52	492	1.76	.042	[.038, .047]	–	–	–
M2	Grade 1 CFA	881.56	492	1.79	.081	[.072, .090]	–	–	–
M3	Grade 2 CFA	915.06	492	1.86	.083	[.074, .091]	–	–	–
M4	Grade 3 CFA	744.51	492	1.51	.054	[.046, .061]	–	–	–
Models testing H1									
M5	Reading	880.52	494	1.78	.043	[.038, .048]	M5 vs. M1	2	13.00*
M6	Writing	870.29	494	1.76	.042	[.038, .047]	M6 vs. M1	2	2.77*
M7	Maths	890.63	494	1.80	.043	[.039, .048]	M7 vs. M1	2	23.11*
Models testing H2									
M8	IM vs. IR	893.05	495	1.80	.043	[.039, .048]	M8 vs. M1	3	25.53*
M9	IR vs. CR	954.43	495	1.93	.047	[.042, .051]	M9 vs. M1	3	86.91*
M10	IM convergent = divergent	1,120.59	498	2.25	.054	[.050, .059]	M10 vs. M1	6	253.07*
M11	IR convergent = divergent	927.16	498	1.86	.045	[.041, .050]	M11 vs. M1	6	59.6*
M12	CR convergent = divergent	907.41	498	1.82	.044	[.039, .049]	M12 vs. M1	6	39.89*
Invariance models									
M13	Totally non-invariant	2,541.13	1,476	1.72	.072	[.067, .076]			
M14	FL invariant	2,616.03	1,524	1.72	.071	[.067, .076]	M14 vs. M13	48	74.90*
M15	FL + FC invariant	2,879.19	1,656	1.74	.072	[.068, .077]	M15 vs. M14	132	263.16*
Models testing H3									
M16	Maths	2,626.93	1,530	1.72	.071	[.067, .076]	M16 vs. M14	6	10.90*
M17	Reading	2,638.84	1,530	1.72	.072	[.067, .076]	M17 vs. M14	6	22.81*
M18	Writing	2,630.61	1,530	1.72	.071	[.067, .076]	M18 vs. M14	6	14.58*
Models testing H4									
M19	IM	2,634.91	1,530	1.72	.071	[.067, .076]	M19 vs. M14	6	18.88*
M20	IR	2,620.19	1,530	1.71	.071	[.067, .076]	M20 vs. M14	6	4.16*
M21	CR	2,620.20	1,530	1.71	.071	[.067, .076]	M21 vs. M14	6	4.17*

Table 1. (*Continued*)

Model	Description	χ^2	*df*	χ^2/df	RMSEA	CI RMSEA	Comparison	Δdf	$\Delta\chi^2$
Grade 1									
M22	IM	914.74	498	1.84	.083	[.075, .092]	M22 vs. M2	6	33.18*
M23	IR	905.39	498	1.82	.082	[.074, .091]	M23 vs. M2	6	23.83*
M24	CR	904.91	498	1.82	.082	[.074, .091]	M24 vs. M2	6	23.35*
Grade 2									
M25	IM	991.62	498	1.99	.089	[.081, .097]	M25 vs. M3	6	76.56*
M26	IR	942.51	498	1.89	.084	[.076, .092]	M26 vs. M3	6	27.45*
M27	CR	944.04	498	1.90	.084	[.076, .093]	M27 vs. M3	6	28.98*
Grade 3									
M28	IM	884.25	498	1.78	.066	[.059, .073]	M28 vs. M4	6	139.74*
M29	IR	767.66	498	1.54	.055	[.047, .063]	M29 vs. M4	6	23.15*
M30	CR	749.90	498	1.51	.053	[.045, .061]	M30 vs. M4	6	5.39*

Note. All models were estimated using FIML (LISREL); FL, factor loadings; FC, factor correlations; IM, intrinsic motivation; IR, identified regulation; CR, controlled regulation; $*p < .01$.

Table 2. Correlations among motivations: Within school subjects (Hypotheses 1 and 3)

	Total sample ($N = 425$)			Grade 1 ($N = 121$)			Grade 2 ($N = 126$)			Grade 3 ($N = 178$)		
	1	2	3	1	2	3	1	2	3	1	2	3
Reading												
1. Intrinsic	–			–			–			–		
2. Identified	.64*	–		.71*	–		.71*	–		.51*	–	
3. Controlled	.16*	.43*	–	.60*	.73*	–	.16*	.39*	–	−.12*	.30*	–
Writing												
1. Intrinsic	–			–			–			–		
2. Identified	.66*			.69*	–		.74*	–		.59*	–	
3. Controlled	.25*	.48*	–	.57*	.69*	–	.33*	.52*	–	−.02	.29*	–
Maths												
1. Intrinsic	–			–			–			–		
2. Identified	.58*	–		.57*	–		.67*	–		.54*	–	
3. Controlled	.45*	.35*	–	.82*	.61*	–	.44*	.40*	–	.27*	.22*	–
Mean												
1. Intrinsic	–			–			–			–		
2. Identified	.62	–		.66	–		.71	–		.55	–	
3. Controlled	.29	.42	–	.66	.68	–	.31	.44	–	.04	.27	–

Note. All correlations are corrected for measurement error; $*p < .05$.

(i.e., correlations between motivations and self-concept within a school subject) and divergent correlations (i.e., correlations between motivations and self-concept for different school domains) should be greater for self-determined types of motivation. That is, the difference between convergent and divergent correlations should be greater for intrinsic motivation than for identified regulation, whereas this difference should be greater for identified regulation than controlled regulation.

Correlations among motivation types for each school subject are presented in Table 3 (first column). As expected, the average correlation for intrinsic motivation across the three school subjects (mean $r = .36$) is lower than the average correlation for identified regulation (mean $r = .76$), which is in turn lower than the average correlation for controlled regulation (mean $r = .86$). To test these differences, we constrained two sets of correlations to equality across school subjects. In M8, we constrained $r_{(\text{intrinsic reading, intrinsic writing})} = r_{(\text{identified reading, identified writing})}$, $r_{(\text{intrinsic reading, intrinsic maths})} = r_{(\text{identified reading, identified maths})}$, and $r_{(\text{intrinsic maths, intrinsic writing})}) = r_{(\text{identified maths, identified writing})}$. In M9, we constrained $r_{(\text{identified reading, identified writing})} = r_{(\text{controlled reading, controlled writing})}$, $r_{(\text{identified reading, identified maths})} = r_{(\text{controlled reading, controlled maths})}$, and $r_{(\text{identified maths, identified writing})} = r_{(\text{controlled maths, controlled writing})}$. If the chi-square values of the constrained models M8 and M9 differ from the chi-square value of the unconstrained M1, this would indicate that the correlations are different, supporting Hypothesis 2. Results presented in Table 1 show that both M8 and M9 differ significantly from M1, revealing poorer fits when correlations are constrained to equality. These findings therefore support Hypothesis 2.

Second, correlations between motivation types and self-concepts are presented in Table 4. Convergent correlations are presented in bold and divergent correlations are presented in italics. Convergent correlations connect motivations to self-concept within a same school subject, whereas divergent correlations relate motivations to self-concept

Table 3. Correlations among motivations: Between school subjects (Hypotheses 2 and 4)

	Total sample (N = 425)			Grade 1 (N = 121)			Grade 2 (N = 126)			Grade 3 (N = 178)		
	1	2	3	1	2	3	1	2	3	1	2	3
Intrinsic motivation												
1. Reading	–			–			–			–		
2. Writing	.56*	–		.78*	–		.68*	–		.36*	–	
3. Maths	.22*	.30*	–	.49*	.80*	–	.22*	.36*	–	.08	.09	–
		Mean = .36			Mean = .69			Mean = .42			Mean = .18	
Identified regulation												
1. Reading	–			–			–			–		
2. Writing	.85*	–		.82*	–		.96*	–		.86*	–	
3. Maths	.71*	.72*	–	.79*	.78*	–	.67*	.74*	–	.71*	.73*	–
		Mean = .76			Mean = .80			Mean = .79			Mean = .77	
Controlled regulation												
1. Reading	–			–			–			–		
2. Writing	.93*	–		1.00	–		.97*	–		.84*	–	
3. Maths	.79*	.87*	–	.71*	.80*	–	.81*	.92*	–	.78*	.85*	–
		Mean = .86			Mean = .84			Mean = .90			Mean = .82	

Note. All correlations are corrected for measurement error; $*p < .05$.

Table 4. Correlations between motivations and self-concept (Hypotheses 2 and 4)

	Self-concepts											
	Total sample ($N = 425$)			Grade 1 ($N = 121$)			Grade 2 ($N = 126$)			Grade 3 ($N = 178$)		
	R	W	M	R	W	M	R	W	M	R	W	M
Intrinsic motivation												
1. Reading	**.61***	.43*	.24*	**.76***	.60*	.58*	**.38***	.55*	.19	**.56***	.25*	.15
2. Writing	.27*	**.67***	.21*	.44*	**.63***	.60*	.25*	**.72***	.19	.17	**.68***	.08
3. Maths	.09	.22*	**.73***	.40*	.32*	**.71***	− .10	.32	**.79***	.10	.13	**.73***
Mean of convergent r		.67			.70			.63			.66	
Mean of divergent r		.24			.49			.43			.15	
Identified motivation												
1. Reading	**.37***	.45*	.30*	**.70***	.67*	.65*	**.16**	.55*	.21	**.19**	.23*	.30*
2. Writing	.21*	**.48***	.26*	.41*	**.48***	.32*	.16	**.62***	.31*	.14	**.42***	.24*
3. Maths	.09	.21*	**.42***	.17	.18	**.56***	.01	.37*	**.50**	.03	.12	**.38***
Mean of convergent r		.42			.58			.43			.33	
Mean of divergent r		.25			.40			.27			.18	
Controlled motivation												
1. Reading	**.06**	.21*	.06	**.65***	.53*	.21	**− .07**	.15	− .05	**− .15**	.06	.07
2. Writing	− .03	**.25***	.05	.37*	**.49***	.14	− .15	**.24***	− .07	− .11	**.15**	.09
3. Maths	− .07	.13*	**.18***	.23	.20	**.38***	− .15	.16	**.13**	− .14	.03	**.13**
Mean of convergent r		.16			.51			.10			.04	
Mean of divergent r		.06			.28			−.02			.01	

Note. All correlations are corrected for measurement error; R, reading; W, writing; M, maths; correlations in bold are convergent correlations; correlations in italics are divergent correlations; convergent, correlations connecting a motivation type for a given school subject to self-concept in the same subject; divergent, correlations connecting a motivation type in a given school subject to self-concept in other school subjects; $*p < .05$.

across different school subjects. Results show that the average convergent correlation is significantly higher than the average divergent correlations for intrinsic motivation (.67 vs. .24, respectively) and identified regulation (.42 vs. .25, respectively), but not for controlled regulation (.16 vs. .06, respectively). To verify whether these differences were significant, we constrained convergent and divergent correlations to equality for each motivation type in three models: M10, M11, and M12 (one model per motivation type). For example, in M10, convergent correlations for intrinsic motivation (i.e., correlations between intrinsic motivations and self-concept within the same school subject) were constrained to equality with divergent correlations (i.e., correlations between motivations and self-concept for different school subjects) for the total sample. The same procedure was used for M11 and M12, in which we constrained to equality divergent and convergent correlations for identified (M11) and controlled regulations (M12). Again, if the chi-square values of the constrained M10, M11, and M12 differ from the chi-square value of the unconstrained M1, this would indicate that the correlations differ, supporting Hypothesis 2. Results show that convergent and divergent correlations differ for each motivation type. However, we obtained a more marked chi-square difference for intrinsic motivation (253.07) than for identified (59.60) and controlled regulations (39.89; see also χ^2/df ratio and RMSEA values), which is consistent with Hypothesis 2, because we expected greater differentiation for intrinsic and identified regulation than for controlled regulation.

Testing grade effects

To test Hypotheses 3 and 4, we performed a 12-factor CFA using a model that included motivations and self-concepts towards the three school subjects. We evaluated the invariance of the factor loadings and factor correlations across grades (see Marsh *et al.*, 1998). Fit indices are presented in Table 1 (models M13 to M15). From these results, we concluded that factor correlations are not completely invariant across grades, given the difference in chi-square values between M14 and M15. We therefore selected M14 as the best model and based our interpretations on it. The correlation matrices obtained for the three groups are presented separately in Tables 2–4. Importantly, factor loadings are invariant across grades, suggesting that increased experience with schooling does not affect the factorial structure of motivation subscales.

Grade effects on within school subject differentiation

Hypothesis 3 states that the simplex pattern of correlations among the three motivational components should be clearer as children progress though grades. In Table 2, correlations among types of motivation *within* each school subject are presented separately for each grade. Overall, correlations among motivation types for the three school subjects reflect a clearer simplex pattern for Grade 3 than Grade 1 children (i.e., $r_{(\text{intrinsic, identified})} > r_{(\text{identified, controlled})} > r_{(\text{intrinsic, controlled})}$). For each school subject, correlations among types of motivation for Grade 1 appear similar, suggesting no differentiation among types of motivation. Grade 2 students show increased differentiation, with lower correlations between distal motivations (intrinsic motivation and controlled regulation) than between intrinsic motivation and identified regulation. In Grade 3, all correlations appear to differ for reading and writing, with lower correlations between distal motivations (intrinsic motivation and controlled regulation) than proximal motivations. This pattern is not replicated exactly for maths, where the correlation between intrinsic motivation and controlled regulation appears to be higher than the correlation between identified and controlled regulations. To provide stronger support for Hypothesis 3, we tested, for each school subject, whether the three correlations ($r_{(\text{intrinsic, identified})}$, $r_{(\text{intrinsic, controlled})}$, and $r_{(\text{identified, controlled})}$) were equivalent across grades. We then ran three models to test the three pairs of correlation for maths (M16), reading (M17), and writing (M18). For example, in M16, the following three sets of correlations for maths were constrained to equality (see Table 2): (1) the correlation between intrinsic and identified regulation in maths observed in Grade 1 (.57), Grade 2 (.67), and Grade 3 (.54); (2) the correlation between intrinsic and controlled regulations in maths observed in Grade 1 (.82), Grade 2 (.44), and Grade 3 (.27); and (3) the correlation between identified and controlled regulations in maths observed in Grade 1 (.61), Grade 2 (.40), and Grade 3 (.22). The same procedure was used for reading (M17) and writing (M18). If the chi-square values of the constrained models M16, M17, and M18 differ from the chi-square value of the unconstrained M14, this would indicate that the correlations differ, supporting Hypothesis 3. Results of the chi-square difference test show significant differences in correlation across grades for reading, whereas the differences for writing approach statistical significance and the correlations for maths do not. Hence, our findings suggest that differentiation among motivation types within school subjects increases across grades for reading, which only partially supports our third hypothesis.

Grade effects on between school subject differentiation

Our fourth hypothesis posits that elementary school students would be able to more clearly differentiate among their different types of motivation between school subjects as they progress through grades. Three sets of results are presented in support of Hypothesis 4. First, we found that the average correlations among intrinsic motivations diminish across grades (.69, .42, and .18 for Grades 1, 2, and 3, respectively; see Table 3), indicating a much more pronounced intrinsic motivation differentiation as children progress through the grades. Average correlations across grades are relatively high and stable for identified regulations (.80, .79, and .77) and controlled regulation (.84, .90, and .82), indicating no grade effects on between school subject differentiation for these types of regulation. In fact, a perfect correlation was obtained between controlled regulation towards reading and writing, although such correlations are more common in complex CFA analyses (see Marsh, Martin, & Debus, 2001). To further explain these differences, we constrained correlations among different school subjects to equality for a single type of motivation across grades (e.g., $r_{\text{intrinsic for reading}} = r_{\text{intrinsic for writing}}$). Results are presented in Table 1 under M19 (correlations for intrinsic motivation), M20 (correlations for identified regulation), and M21 (correlations for controlled regulation). For example, in M19, the following three sets of correlations were constrained to equality (see Table 3): (1) correlations between intrinsic motivation for reading and intrinsic motivation for writing observed in Grade 1 (.78), Grade 2 (.68), and Grade 3 (.36); (2) correlations between intrinsic motivation for reading and intrinsic motivation for maths observed in Grade 1 (.49), Grade 2 (.22), and Grade 3 (.08); and (3) correlations between intrinsic motivation for writing and intrinsic motivation for maths observed in Grade 1 (.80), Grade 2 (.36), and Grade 3 (.09). The same procedure was applied for identified (M20) and controlled regulation (M21). If the chi-square values of the constrained M19, M20, and M21 differ from the chi-square value of the unconstrained M14, this would indicate that the correlations differ, supporting

Hypothesis 4. Results of the chi-square difference test reveal a significant reduction in model fit for intrinsic motivation, but not for identified or controlled regulation, which suggests greater differentiation of intrinsic motivation as students progress through grades. This provides only partial support for Hypothesis 4.

Second, we examined correlations between motivation types and self-concept for each grade (see Table 4). As expected, greater differences were found between convergent and divergent correlations for intrinsic motivation in older than younger children (difference = .21, .20, and .51 for Grades 1, 2, and 3, respectively). For identified regulation, the differences between convergent and divergent correlations also appear more pronounced for older children. For controlled regulation, however, these differences are less marked. To further investigate these differences, we constrained convergent and divergent correlations to equality for each motivation type and grade in 9 models (3 school subjects × 3 grades; M22 to M30). For example, convergent correlations for intrinsic motivation (i.e., correlations between intrinsic motivations and self-concept within the same school subject) were constrained to equality with divergent correlations (i.e., correlations between motivations and self-concept for different school subjects) for children in Grade 1 (M22), Grade 2 (M25), and Grade 3 (M28). For other structural models, the same procedure was used to test differences between divergent and convergent correlations for identified (M23, M26, and M29) and controlled regulations (M24, M27, and M30). If the chi-square values of the constrained M22 to M30 differ from chi-square values of the unconstrained models (M2, M3, or M4) this would indicate that the convergent and divergent correlations are different, supporting Hypothesis 4.

Results for intrinsic motivation show differing convergent and divergent correlations at all grades, and these differences are greater in older than younger cohorts (i.e., greater chi-square difference). Significant differences between convergent and divergent correlations were also obtained for identified and controlled regulations, although they are weaker and do not vary substantially across grades. In Grade 3, no significant differences were found between convergent and divergent correlations for controlled regulation.

Discussion

The primary goal of this study was to examine young elementary school students' motivation in a differentiated way by distinguishing among types of motivation (*within school subject differentiation*) as well as among motivations towards different school subjects (*between school subject differentiation*). Our findings suggest that students differentiate among intrinsic motivation, identified regulation, and controlled in reading. Correlations between proximal motivations (intrinsic and identified regulation; identified and controlled regulations) are generally stronger than correlations between distal motivations (intrinsic motivation and controlled regulation) for reading. There is less support for the self-determination continuum in maths or writing (i.e., the effect is close to significance for writing). Furthermore, students differentiate among types of motivation across school subjects. For instance, their ability to differentiate among types of motivation across school subjects is more developed for more self-determined forms of motivation (intrinsic motivation > identified regulation > controlled regulation). In addition, students' motivations towards a specific discipline are more strongly related to another motivational construct (i.e., self-concept) within that same discipline than to motivations towards another discipline. A second goal of this study was to examine within and between school subject differentiation effects as a function of grade. Our findings suggest that (1) within school subject differentiation is more marked for older than younger elementary schoolchildren, especially for reading and (2) between school subject differentiation is clearer for older students, and as expected, this is especially true for intrinsic motivation. These findings either partially or fully support our research hypotheses. Finally, gender differences were observed on some motivational components.

Implications for research on within school subject differentiation

Our findings have important implications for theories and research efforts that differentiate among types of school motivation. First, they support the importance of considering the quality of school motivation at the subcontextual level, which has not been examined to date. According to SDT, motivation is not a global, undifferentiated concept that is synonymous with effort. Rather, it is a multidimensional concept that varies in terms of quality, in which high-quality student motivation is based primarily on intrinsic motivation and identified regulation, and poor quality student motivation is based on controlled regulation. Whereas most studies have addressed motivation types towards school in general, our findings suggest that these motivations can also be examined within school disciplines to provide a more general than situational perspective (e.g., motivation to do this morning's exercise on multiplication tables), but more specific than a contextual perspective (e.g., motivation for going to school; see Vallerand, 1997).

The self-determination continuum proposed by Deci and Ryan (1985) illustrates the notion of motivational quality. Consistent with research in older students (Miserandino, 1996; Ryan & Connell, 1989; Vallerand *et al.*, 1989), our findings provide reasonable support for the self-determination continuum during the early elementary school years for reading. However, as mentioned previously, the continuum becomes clearer with age, which has implications for researchers studying motivation types in young children. In Grade 1, children may not have fully developed their capacities for mastering external demands and identifying with them (Deci & Ryan, 1985), and may therefore be unable to distinguish between what they truly like to do and what they do because others ask them to, for example, in reading. Because this ability to self-reflect on their different motivations is in development, the differentiation and predictive validity of school motivations might also improve as students become more experienced with school subjects that involve reading and their demands. This interpretation is consistent with Harter's (1999) suggestion that greater differentiation among self-perceptions occurs around 8 years old.

However, our findings suggest that the self-determination continuum is not fully supported in writing or in maths. For writing, however, it should be noted that, despite the non-significant differences, the simplex pattern of correlation becomes clearer with age. For example, in Grade 3, the correlation between intrinsic motivation and controlled regulation is $-.02$, whereas the correlation between intrinsic motivation and identified regulation is .59 and the correlation between identified and controlled regulations is .29. The absence of significant differences in correlation patterns across grades may therefore be explained by a lack of statistical power to reveal differences that are less marked. For maths, the correlation between intrinsic and controlled regulation is higher than the correlation between controlled and identified regulation for all age cohorts. This means that when students develop intrinsic motivation towards this discipline, they also develop controlled regulation. Thus, they might report liking maths, but at the same time would perform maths to obtain a positive outcome such as a reward, or to avoid a negative outcome such as punishment. This phenomenon is consistent with Lepper, Corpus Henderlong, and Iyengar's (2005) contention that 'From a functional perspective, this makes perfect sense. In fact, it may be quite adaptive for students to seek out activities that they find inherently pleasurable while simultaneously paying attention to the extrinsic consequences of those activities in any specific context' (p. 191). In addition, goal theory could be relevant to explain the observed findings. In some studies (see Barron & Harackiewicz, 2001), a mixture of both a performance approach (wanting to outperform others) and a mastery approach (wanting to increase one's competence) to achieving goals has been linked to positive outcomes. Because children usually perceive maths as difficult (Eccles, Roeser, Wigfield, & Freedman-Doan, 1999), it could be more adaptive for them to develop both types of regulation (autonomous and controlled) to succeed in maths.

It should be noted that the pattern of results observed for maths does not necessarily differ sharply from patterns observed in other studies conducted with elementary school children (Ryan & Connell, 1989). For example, using a general motivation measure towards school, Ryan and Connell (1989) obtained a positive correlation of .25 (sample 3 in their study) between intrinsic motivation and controlled regulation (specifically, introjection). Thus, more research is needed to understand why the simplex pattern is supported in some studies and not in others.

Implications for research on between school subject differentiation

Traditionally, researchers have investigated whether motivational constructs are specific for school subjects or global for school (Bandura, 1997; Elliot, 2005; Green *et al.*, 2007; Pintrich, 2003). Their findings highlight the importance of considering subject-specific motivation to accurately predict school outcomes. Our findings contribute to this line of research, first by replicating some of these effects, and second by providing a more comprehensive conceptualization of motivation from a self-determination perspective. Overall, our results suggest that it is essential to assess intrinsic motivation towards specific school subjects, and that this becomes even more important as children progress to Grades 2 and 3 (Harter, 1999), where the observed correlations among intrinsic motivation components are lower than in Grade 1. In addition, the difference between convergent and divergent intrinsic motivation correlations is greater for children in Grades 2 and 3. Hence, in Grades 2 and 3, young children's intrinsic motivation is sensitive to school subjects, which is consistent with the findings of Gottfried and colleagues (Gottfried, 1985, 1990; Gottfried, Fleming, & Gottfried, 2001) and Harter and Jackson (1992). Our findings and those of previous studies indicate that children in Grades 2 and 3 who enjoy maths may not necessarily enjoy reading or writing, and vice versa. We believe that the reason for the more differentiated intrinsic motivation across age groups is that intrinsic motivation is not instrumentally focused. Instead, it originates autotelically from the satisfaction inherent in performing actions, such that children who engage in various school activities will discover as they grow up which activities they enjoy and which they do not. Another explanation for this effect is the contribution of self-concept to student motivation. As noted in this and other studies, intrinsic motivation is positively related to self-concept (or perceived competence; Vallerand *et al.*, 1989) such that the more that students perceive themselves as competent, the more intrinsically motivated they become. Because student self-concept is differentiated across school subjects (see Marsh, 1990) and this differentiation increases with age (Harter, 1999), the intrinsic motivation observed for students in Grades 2 and 3 becomes increasingly differentiated.

The need to consider subject specificity also applies to identified regulation, albeit to a lesser extent, but not to controlled regulation. Our findings therefore support the postulated *amplified differentiation effect*, whereby motivations become more differentiated across school subjects as self-determination increases. As we argued in the introduction, identified regulation is less differentiated than intrinsic motivation because this regulatory process is not tied to the enjoyable nature of the activity, but is rather governed by the endorsement of values (Deci & Ryan, 1985). Children may understand relatively early that these three school subjects are important for their optimal development, although they may identify somewhat more with one school subject than another. Concerning the lack of differentiation in controlled regulation in various grades, we believe that this can be explained by the fact that teachers who use external contingencies such as incentives or punishments would do so across school disciplines (i.e., in the Quebec educational system the same teachers are involved across school subjects), thereby contributing to students' high levels of controlled regulation in all school subjects. Alternatively, controlled regulation might not be affected by teachers' practices, but might result instead from a personality trait developed in the family environment. For example, some parents may place greater emphasis on rewards and punishment, thereby promoting in their children an overall controlled orientation that they would use to regulate their behaviour. If this interpretation holds in future studies, it would imply that preventive efforts to reduce controlled regulation at school should focus on the family, and should take place even before children enter elementary school.

Another implication of the present study is that empirical support has been obtained for a new instrument (the ESMS) designed to assess motivation in elementary school children. Psychometrically, our results demonstrate that the factor structure underlying responses to the ESMS is relatively robust and generalizes across age (i.e., factor loadings were found to be invariant across age groups). On the other hand, an important finding was that not all motivational components are differentiated in Grade 1, or to some extent in Grade 2. Specifically, intrinsic motivation, identified regulation, and controlled motivation are not necessarily subject specific at this age, and most motivational components are undifferentiated within each school subject. This suggests that the ESMS is not suitable for children in Grades 1 and 2. However, before reaching a definitive conclusion on this, other studies are needed to validate the constructs of the ESMS, including a consideration of criterion variables such as achievement and learning strategies. If future studies reveal that there is no differentiation in Grades 1 and 2 (i.e., all motivation components are associated with achievement in an undifferentiated way), than an undifferentiated motivation score computed by aggregating ESMS motivation types across school subjects could be used.

Gender effects

Four effects of gender on motivational components were observed in this study. Girls are more intrinsically motivated towards reading and writing and are more regulated by identification towards writing than boys. In contrast, boys are more intrinsically motivated towards maths than girls. These results parallel those of other studies (Eccles *et al.*, 1993), and indicate that gender stereotypes may affect motivation processes in the early grades.

Limitations and directions for further research

This study has several strengths, including the use of a large sample of young elementary schoolchildren at various grades, sophisticated analyses, and innovative hypotheses. It also has some shortcomings that must be considered when interpreting the findings. A first limitation is that approximately 7% of the values were missing from our study, which might have affected our results. However, we used a sophisticated approach (FIML) to resolve the problem. We therefore believe that the missing data did not compromise the validity of our findings. A second limitation pertains to our use of academic self-concept as a criterion variable to establish between school subject differentiation. Because self-concept and motivation are self-reported, the correlations observed between these measures could be inflated due to shared-method variance. Future research should therefore use more objective criterion measures (e.g., achievement) for each school subject. Third, we used a classroom administration procedure instead of individual interviews. According to Marsh *et al.* (1998), our procedure could have increased the measurement error. However, in a recent large-scale, nationally representative study with over 1,400 Grade 2 elementary schoolchildren (ELDEQ study, 1998–2007), we administrated the intrinsic motivation subscale of the ESMS and self-concept scale in individual interviews. Results of this large-scale study parallel those obtained in the present study, with nearly identical reliabilities and correlations between intrinsic and self-concept dimensions. A fourth limitation involves the model fit indices, which are low for some of the models tested.

An important avenue for future research would be to better understand why intrinsic motivation is more differentiated than other types of motivation, as well as the mechanisms underlying age effects. We have put forward some hypotheses to explain these effects, but these speculations need to be formally tested.

In sum, researchers have pointed out the need to investigate motivation towards specific school subjects rather than globally. Our findings make a contribution in that they demonstrate that some motivation types proposed by SDT are specific to school subjects, and that these effects might develop with children's increased exposure to learning experiences and contexts. This can have important implications in practice by allowing more targeted interventions. For example, a motivational intervention could be more effective if it targeted a specific school subject.

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Appendix A. The Elementary School Motivation Scale

English version	French version
Reading	
Intrinsic motivation	
I like reading	J'aime lire
Reading interests me a lot	La lecture m'intéresse beaucoup
I read even when I don't have to	Je lis même lorsque je ne suis pas obligé de le faire
Identified regulation	
I can learn many useful things by reading	Lire va me permettre d'apprendre beaucoup de choses utiles
I choose to read to learn many things	J'ai choisi de lire pour apprendre plein de choses
In life, it's important to learn how to read	Dans la vie, il est important d'apprendre à lire
Controlled regulation	
I read to get a nice reward	Je lis pour obtenir une belle récompense
I read to please my parents or my teacher	Je lis pour faire plaisir à mes parents ou à mon enseignant
I read to show others how good I am	Je lis pour montrer aux autres que je suis bon
Writing	
Intrinsic motivation	
I like writing	J'aime écrire
Writing interests me a lot	L'écriture m'intéresse beaucoup
I write even when I don't have to	J'écris même lorsque je ne suis pas obligé de le faire
Identified regulation	
I can learn many useful things by writing	Écrire va me permettre d'apprendre beaucoup de choses utiles
I choose to write to learn many things	J'ai choisi d'écrire pour apprendre plein de choses
In life, it's important to learn how to write	Dans la vie, il est important d'apprendre à écrire
Controlled regulation	
I write to get a nice reward	J'écris pour obtenir une belle récompense
I write to please my parents or my teacher	J'écris pour faire plaisir à mes parents ou à mon enseignant
I write to show others how good I am	J'écris pour montrer aux autres que je suis bon

Appendix A. (*Continued*)

English version	French version
Maths	
Intrinsic motivation	
I like maths	J'aime les mathématiques
Maths interests me a lot	Les mathématiques m'intéressent beaucoup
I do maths even when I don't have to	Je fais des mathématiques même lorsque je ne suis pas obligé d'en faire
Identified regulation	
I can learn many useful things by doing maths	Les mathématiques vont me permettre d'apprendre beaucoup de choses utiles
I choose to do maths to learn many things	J'ai choisi de faire des mathématiques pour apprendre plein de choses
In life, it's important to learn how to do maths	Dans la vie, il est important d'apprendre à faire des mathématiques
Controlled regulation	
I do maths to get a nice reward	Je fais des mathématiques pour obtenir une belle récompense
I do maths to please my parents or my teacher	Je fais des mathématiques pour faire plaisir à mes parents ou à mon enseignant
I do maths to show others how good I am	Je fais des mathématiques pour montrer aux autres que je suis bon

Note. The scale was administered in French; the items have been translated into English for purposes of this article.

Appendix B. Scale reliabilities (based on FIML procedures for missing data)

Scale	Grade 1 ($N = 121$)	Grade 2 ($N = 126$)	Grade 3 ($N = 178$)	Total sample ($N = 425$)
Reading				
Intrinsic motivation	.77	.69	.80	.76
Identified regulation	.74	.75	.60	.70
Controlled regulation	.68	.76	.67	.73
Academic self-concept	.72	.77	.82	.77
Writing				
Intrinsic motivation	.81	.75	.78	.78
Identified regulation	.88	.78	.75	.79
Controlled regulation	.79	.80	.75	.80
Academic self-concept	.78	.78	.71	.75
Maths				
Intrinsic motivation	.75	.80	.81	.80
Identified regulation	.79	.83	.80	.81
Controlled regulation	.91	.92	.87	.90
Academic self-concept	.71	.84	.82	.81