Does the school composition effect matter ? Some methodological and conceptual considerations

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LES CAHIERS DE RECHERCHE EN EDUCATION ET FORMATION

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Some Methodological and Conceptual Considerations

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Abstract

In recent years, several authors have described the school composition effect as a methodological artefact, suggesting that it results from two major categories of methodological bias: model under-specification and predictor unreliability. The main purpose of this article is to discuss these methodological considerations and test empirically the impact of model specification on the magnitude of the school composition effect, based on reading performance at primary school in French-speaking Belgium. The results show that the school composition effect remains significant even after controlling for pupils' initial performance, socio-cultural capital and non-cognitive dispositions, although the effect size vary greatly when these individual parameters are successively introduced. The second objective is to examine covariance between school composition and several organizational variables and their joint effect on school performance. The second set of analyses is intended to question the conceptual nature of the school composition effect, establishing whether it is direct or indirect.

Key words: school composition effect, methodology, model specification, mediation

Introduction

The school composition or school mix effect has always had particular status within Educational Effectiveness Research (*EER*) literature. More generally speaking, Thrupp (1995) even talks about the effect as an enduring problem within educational research. The school composition effect can be defined as the impact of pupils' aggregated characteristics (SES, sociocultural capital, prior achievements, etc.) when these variables have been taken into account at the individual level. The effect is ascertained by testing the impact of aggregated characteristics measured at level-1 (i.e. the pupils) at a broader level, i.e. the class or school.

In his well-known report, Coleman (1966) was one of the first to dissociate the individual effects of pupils' characteristics from the collective, and to suggest that both have a significant effect (mainly on achievement, motivation, aspirations and attitudes towards education). He also demonstrated that most internal school variables make little difference to school outcomes over and above the influence of students' backgrounds. In the seventies, several methodological critiques (e.g. Jencks, 1972) of the Coleman report came to preclude that even the school composition could have an impact on school outcomes, so that 'research into school performance was at an impasse' (Thrupp, 1995, p. 188). *EER* was developed in the eighties precisely to refute the conclusions that internal school processes have no (or only a marginal) effect on school achievement. The emphasis had now shifted from the effect of the social context to the study of internal processes within schools and classes.

However, despite this change in perspective, the school composition effect was still very much part of the educational debate. Firstly, some early *EER* studies (e.g. Rutter & al., 1979) continued to incorporate schools' 'balance of intake' in their research. Secondly, and more importantly, Willms

and Raudenbush (1989) proposed to make a distinction between Type A and Type B school effects, so as to acknowledge the potential effect of school composition. Type A effects refers to the impact a school appears to have on pupils' achievements after controlling for their individual characteristics (e.g. prior achievements, socio-cultural capital, etc.), while Type B effects explicitly incorporates the question of school composition and seeks to ascertain how well a school is performing given its specific circumstances, including the student body attending the school. In the most noteworthy *EER* studies, composition variables came to be considered as co-variables (Scheerens, 1997) or as control variables (Raudenbush and Willms, 1995).

In recent years, several educational effectiveness researchers have taken the debate a step further, denouncing the school composition effect as a methodological artefact. In so doing, they have cast doubt on the usefulness and relevance of distinguishing between Type A and Type B effects. For them, most studies demonstrating a significant school composition effect suffer from a methodological flaw, such as model under-specification and/or predictor unreliability (mainly the pupils' prior cognitive performances). These authors were undoubtedly right in concluding that inconsistency between different studies on the school composition effect could be associated with inconsistency regarding the methodological and statistical framework used to estimate that effect. And it is true that certain methodological pitfalls warrant denunciation.

However, we think that i) these methodological bias need to be considered in more depth and more extensively before any strong conclusions can be made as to their impact on assessing the school composition effect, and ii) that the conceptual nature of school composition also has to be regarded as a fundamental question in educational effectiveness research.

The purpose of this article is precisely to tackle these two facets of the school composition effect. The first section deals with the key methodological critiques which challenge the validity of the school composition effect, and provides evidence concerning the impact of model specification on the magnitude of the effect. The second section focuses on the conceptual and theoretical arguments around the issue of school composition and explores the potential organizational covariates of its effect.

1. Challenging the Validity of the School Composition Effect

1.1 Some methodological critiques

As mentioned above, several authors (Gorard, 2006; Nash, 2003; Harker & Tymms, 2004) denounced methodological pitfalls in school effect studies exploring the concept of the compositional effect. Harker and Tymms (2004) defined two main problem areas: model (under-)specification and predictors' (un)reliability. Model specification (at a given level) defined the number and prediction qualities of parameters entered into the model, so as to predict the outcome. The idea here is that a level-1 model is under-specified when the predictors entered at that level did not account for as much variance (within and between schools) as it could if well-established (in the literature) outcome predictors are entered in the model. Consequently, the less between-school variance is explained by level-1 predictors, the more it could by upper-level variables, such as compositional factors.

To illustrate the potential problem, the researchers used data from New Zealand National School Certificate Examinations in three subjects (maths, English and science) and compared three models for estimating the magnitude of the school composition effect. Each of the three models is a two-level model defined by a level-1 predictor (SES, prior achievement and ethnicity) and the same predictor aggregated at school level (school mean SES, school mean of prior achievement and the percentage of pupils from ethnic minorities – Maori, in this case). The results reveal that the school composition effect is stronger (and significant across all three subjects) when it is estimated by SES school mean, while it appears to be marginal when using the ethnic indicator and even unsignificant with the prior achievement school mean. This confirms that the validity of the school composition effect is closely linked to model specification, since the difference between the SES and prior achievement models could be explained by (among others) the greater proportion of variance (specifically the between schools variance) explained by prior achievement than by SES. The authors also draw attention to the positive relationship between unreliable level-1 predictor(s) and the magnitude of the school composition effect. By simulating variation in the reliability of prior achievement scores, they reveal that the less reliably the predictor is constructed, the more the between-school variance explained by the aggregated unreliable predictor(s) become important.

Taking a different point of view, Nash (2003) also challenges the importance of model specification, pointing out that 'the school composition effect is sometimes an artefact caused by "unmeasured" within-SES school selection for noncognitive dispositions and variable family resources within social classes' (Nash, 2003, p.441). In other words, some pupils' characteristics, like non-cognitive dispositions (e.g. self-concept, interest in school) or their cultural capital, are imperfectly correlated with SES and prior achievement, but significantly associated with educational progress. So the school composition effect could be due to inadequate controls for intake characteristics, thereby reflecting an effect of school selection. Working on the UK 2000 PISA database, Nash shows that the proportion of low-SES students from homes with 0-50 books at low SES schools is almost twice than in high SES schools, and maintains that 'students from low SES families are differentially being selected for education at high-SES schools on the basis of their cultural capital' (Nash, 2003, p.450).

All in all, it seems that methodological bias can have important implications for the estimation of the magnitude of the school composition effect. Some authors (Nash, for instance) even argue that the few studies which do take such factors into consideration still fail to show the impact of school composition on pupils' results. Nevertheless, it would seem premature to draw such conclusions at this point, for at least two reasons.

The first is that it is possible to review several recent studies[1] – even if they are scarce – which through their pertinent analytical approach and design[2] have indeed identified a school composition effect[3]. In New Zealand, Lauder and his colleagues (1999) found that differences between schools accounted for an

[1] The intention here is not to be exhaustive, but to present only some studies with a solid design and analysis model. Note also that studies measuring group composition at class level have not been considered either.
[2] For a discussion on methodological conditions for estimating the school composition effect, see Thrupp, Lauder & Robinson (2002).
[3] Obviously, studies which failed to find any effects related to school composition, or only very weak ones after controlling for individual prior achievement, could also be consulted (e.g. Gray, Jesson & Syne, 1990; Thomas & Mortimore, 1996).

average 16 % of variance in students' national exam results in maths, science and English, and that school-level variables – mainly a wide array of compositional variables – accounted for more than 40 % of between-school variance over and above that accounted for by the individual-level variables. Likewise, Opdenakker and Van Damme (2001, 2006) also identified a significant school composition effect. Their analyses on a sample of Flemish secondary schools revealed that composition and process variables have important net and joint effects on achievement independently of initial ability. They also found that the addition of school composition variables to models with school process variables caused a decline in the effect of significant school process variables. Finally, Rumberger and Palardy's study can also be cited (2005). By means of a longitudinal study (data from the National Education Longitudinal Survey of 1988), they made multilevel estimations of achievement growth between 8th and 12th Grade in mathematics, science, reading and history, over a sample of 14,217 students attending a representative sample of 913 U.S. high schools. The study found that the average socio-economic level of students' schools had as much impact on their achievement growth as their own socio-economic status, net of other background factors.

The second reason is to do with the fact that not enough is known about the scope of these methodological bias. That is, until now, no studies have yet explored the impact of the critiques made by Nash simultaneously with those proposed by Harker and Tymms, despite both critiques drawing attention to the same issue: model specification. In the next paragraph, Belgian data are used to illustrate variation in the magnitude of the school composition effect according to specification variation in the level-1 model.

1.2 Model specification and the extent of the school composition effect

To expand on the estimation made by Harker and Tymms, we propose to estimate variation in the magnitude of the school composition effect's size after varying the specification of the level-1 model and incorporating the level-1 model more than the level-1 variables aggregated at school level. Following the same idea, Nash's critique shall also be incorporated by adding the non-cognitive dispositions as level-1 variables in the final analysis model.

Analysis

Since students are nested within schools, a multi-level analysis has been applied (HLM 6.2, Raudenbush, Bryk & Congdon). First of all, a null model (without explanatory variables) is fitted to provide estimates of variance components at each level. Then an estimation of the impact of model specification on the magnitude of the school composition effect is computed on the basis of two similar sets of multi-level models. Given that both compositional variables (mean prior achievement and mean socio-cultural index) are closely correlated (r = 0.744), and to prevent any co-linearity, the analysis is carried out in two stages. In the first set of analyses, the variable used for school composition is mean prior achievement, while in the second set, it is processed by a mean socio-cultural index.

After analysing the null model, only the composition variable is entered into the model as a level-2 variable. Next, individual variables are added to the school composition variable successively: prior achievement, socio-cultural capital and non-cognitive dispositions. For each model, the total and between-school variance explained by a net effect of the school composition is computed[4]. In order to facilitate computation and interpretation, all explanatory variables are centered around their grand mean.

[4] The net effect of the school composition is computed as follows : Total or between-school variance explained by the school composition and individual variable(s) - Total or between-school variance explained by the school composition only.

Sample

The sample consisted of 2528 students nested in 52 schools from the French-speaking community of Belgium. All sixth-grade students – the final year of primary school in French-speaking Belgium's education system – in all 52 schools took part in the study. The schools were sampled using a two-stage procedure. Firstly, as the purpose of this study is to explore the effect of school composition, quintiles of the distribution of school composition in the population were calculated[5]. Secondly, 24 schools were selected randomly in each quintile and asked to take part in the research. Finally, 52 schools agreed to participate. This sample appears to be representative of school composition distribution in the school population. Neither the mean (Z = 0.36, p = 0.64) nor the variance (Chi-square = 59.46, p = [0.75; 0.90]) of the sample differ from the mean and the variance of the school composition in the school population of French-speaking Belgium. Given the free choice of school for Belgian parents, the dispersion of the schools' intake is rather strong. The sample defined above is therefore appropriate for examining and estimating the school composition effect, since it also includes schools with very unbalanced intakes.

Variables

Students performed two language-achievement tests (one test during the third week of the school year and one test at the end of the year) and answered a self-reported questionnaire on their backgrounds, well-being and perceptions of teaching practices. At the same time as the students (in March), all the teachers (n = 817) of the 52 schools answered a self-reported questionnaire on the principal's leadership, school culture and teacher collegiality within their school. The average number of teachers per school is averagely 15 (M=15,13; SD=5,36). Finally, the students' parents were asked to answer a self-reported questionnaire on the socio-cultural capital of their family.

Level-1 variables

Cognitive performance

Language-achievement tests had to be constructed, as there are no standardised exams in French-speaking Belgium in 6th grade. Both tests were devised by a team comprising two teaching specialists (with thorough knowledge of the curriculum in French-speaking Belgium) and two researchers. Each test was composed of curriculum-relevant open-answered questions, together with multiple-choice items. Each test was pre-tested in order to select the final questions ensuring a continuum of difficulty throughout. The final scores (see Table 1) from both tests were converted into IRT-scores using a one-parameter model, in order to situate both students and test scores on two latent scales (one for measuring prior achievement and one for performance in the final language test).

Table 1 – Criteria: Language performance and prior achievement (IRT scores)

	Mean	SD	Min	Max
Language performance	-.119	1.218	-4.410	3.880
Prior	.850	1.004	-3.105	4.698

[5] The composition index used to define our sample was an individual variable aggregated at school level. The individual level variable combined several measures of the socio-economic and socio-cultural resources of the students' families. This index is also used in politics as a tool for compensatory policies in French-speaking Belgium.

Prior achievement (pre-test)

The prior-achievement test covered reading performance (23 items), grammar (28 items) and spelling (15 items), and was highly reliable (internal consistency = 0.90).

Language performance (post-test)

The language-performance test covered the same three subjects: reading performance (19 items), grammar (39 items) and spelling (23 items). The reliability of the test is very high (internal consistency = 0.94), as is inter-rater agreement (Cohen's k[6]= .95). It would thus appear that the important requirement, underlined by Harker and Tymms (2004), of ensuring the reliability of test scores when estimating the effect of school composition, has been entirely fulfilled in this study.

Sociocultural capital index

In order to obtain a convincing indicator of pupils' socio-cultural capital, a principal components analysis (PCA) was applied to three indexes. Descriptions of these three indexes can be found in Table 2. All three indexes came from the questionnaire distributed to the pupils' parents[7]. The first two items are the mother and father's highest educational levels reported on a five-point scale (1 = primary school; 2 = lower-secondary school; 3 = upper-secondary school; 4 = non-university tertiary education; 5 = university). The last one is the number of books at the pupil's home (also measured on a five-point scale with 1 = [0-10]; 2 = [11-25]; 3 = [26-100]; 4 = [101-200]; 5 = [201-500]). The PCA yielded a one-factorial solution that explains 62 % of total variation among the three items. The scale's internal consistency is less high, but above the .70 limit (α = 0.72).

Table 2 - Criteria: pupils' socio-cultural capital

	Frequency
Father's highest level of education	
Primary school or no diploma	9.8
Lower-secondary school	18.1
Upper-secondary school	26
Tertiary level (not university)	22.8
Tertiary level (university)	23
Mother's highest level of education	
Primary school or no diploma	10.1
Lower-secondary school	17.8
Upper-secondary school	26
Tertiary level (not university)	30.8
Tertiary level (university)	15.1
Number of books at home	
0-10 books	4.5
11-25 books	8.8
26-100 books	26.4
101-200 books	22.8
201-500 books	37.3

[6] The Cohen's *k* is computed on the basis of three judges.

[7] Since pupils were only 11 or 12 years of age, their parents were asked to provide this information so that a reliable index could be computed.

Language self-concept

Language self-concept is assessed by means of a subscale – measuring self-concept in terms of language ability – taken from a translated French version of the Self-Description Questionnaire (SDQ – II; Guérin, Marsh & Famose, 2003). Students answered on a Lickert scale with six options. A PCA applied to the 5 items on the subscale (e.g. "I learn things quickly in French classes" or "I get good marks in French") yielded a one-factorial solution which accounts for 76 % of total variation among the five items. The scale's internal consistency is highly satisfactory (α = 0.91).

Achievement motivation

The achievement-motivation scale is made up of four items (e.g. "In class, I work as hard as possible"). Students answered on a Lickert scale with six options. A PCA was applied to the 4 items. One factor explains 67 % of total variation among the four items. The internal consistency of the scale is satisfactory (α = 0.83).

Table 3 - Correlations between individual parameters

	Language performance	Prior achievement	Socio-cultural capital	Language self-concept	Achievement motivation
Language performance	1	.744**	.420**	.243**	.113**
Prior achievement	.744**	1	.354**	.229**	.107**
Socio-cultural capital	.420**	.354**	1	.085**	.028
Language self-concept	.243**	.229**	.085**	1	.314**
Achievement motivation	.113**	.107**	.028	.314**	1

* < .05 ; ** < .01

Level-2 variables – composition variables

School means are calculated for the prior achievement score and the socio-cultural capital index. The two scores were then standardised to a mean of 0 and a standard deviation of 1.

Results

Null model

The purpose of the empty model was to dissociate the proportion of total variance in language achievement attributable to schools. The analysis (see Table 4) of the empty model reveals that the proportion of variance in language performance at school level represents 26 % of total variance. The proportion of variance at school level is somewhat greater than that reported by Bosker and Witziers in their meta-analysis (1996). This can be explained by the criterion-scores' high reliability, but also by certain characteristics of the education system in French-speaking Belgium, such as its tradition of decentralisation and free choice of school.

Table 4 - Null model

	Empty model	
	Estimate	S.E.
FIXED		
Intercept	-0.088	(0.074)
RANDOM		
Variance components		
School level	26.7 %	
Student level	73.3%	
Explained		
DEVIANCE	6443.177	

Model specification and the extent of the school composition effect

Firstly, it becomes apparent that when the school composition variables are entered into the model as the only predictor, they effectively act as an "omnibus" and account for a considerable proportion of between-school variance (see Table 5). Academic composition accounts for 79 % of between-school variance and 21 % of total language-achievement-score variance; while composition measured as a proxy of the collective socio-cultural capital accounts for 72 % of between-school variance and 19 % of total score variation.

Table 5 - Percentage of total and between-school variance accounted for by net effect of school composition

	Model with compositional variables only		Model with compositional variables and prior achievement		Model with compositional variables, prior achievement and socio-cultural capital		Model with compositional variables, prior achievement, socio-cultural capital and non-cognitive dispositions	
	BSV	TV	BSV	TV	BSV	TV	BSV	TV
Academic composition	79.8	21.3	8.7	2.3	8	2.1	10.2	2.7
Socio-cultural composition	72.3	19.9	16.8	4.5	12.4	3.3	15.3	4.1

Key:
BSV = Between-school variance accounted for
TV = Total variance accounted for

However, more interestingly, and as predicted, the results show that the magnitude of the school composition effect varies greatly according to the introduction of the individual variables. The main decrease in the effect is linked to the introduction of the first individual parameter: prior achievement. Academic composition is then associated with only 8.7 % of between-school variance and the socio-cultural-composition index with 16.8 % of the same variance. This corresponds to a respective decrease of 71 % in terms of academic composition and 55 % as regards socio-cultural composition. The decrease is even more significant after the socio-cultural capital is introduced as an individual parameter, since explained between-school variance associated with school composition is no more than 8 and 12.4 % for academic and socio-cultural composition respectively. It is pertinent to mention that there is a slight increase (in terms of the proportion of explained between-school variance) when controlling for the non-cognitive dispositions additively.

Importantly, nonetheless, it also becomes apparent that the school effect remains significant ($p < .001$) after having introduced all the individual parameters (see Tables 6 and 7), even when variables covariating less with prior achievement are entered into the analysis, such as pupils' non-cognitive dispositions or their socio-cultural capital. This last result challenges Harker and Tymms's findings (2004), as well as the critique made by Nash (2003). Firstly, they show that considering prior achievement alone did not remove the academic composition effect. Secondly, they demonstrate that even when analysing a fully specified level-1 model, the school composition effect is still not compromised. It can therefore be concluded that the composition effect is not inherently artificial (at least in these data), since it clearly helps to explain schools' achievements, even under the most stringent conditions of analysis.

So how can the differences between our results and those of Harker and Tymms, for example, be accounted for? One explanation is certainly linked with the educational policies in Belgium, like decentralization and school free choice, that make the distribution range of school composition broader in French-speaking Belgium. Another reason might be the level of education studied. This study focuses on primary school (6th Grade), while Harker and Tymms's is based on National Certificate Examinations, which are taken in the 11th Grade. Indeed, Lauder et al. (1999) posed the hypothesis that school outcome effects at secondary school are highly predictable in terms of prior achievement, since the losses or gains from the types of school attended could be cumulative. Following this hypothesis, the estimation of the school composition effect should therefore be greater in primary school than secondary school.

Table 6 - Mean prior achievement fixed effects

	Model with compositional variables only		Model with compositional variables and prior achievement		Model with compositional variables, prior achievement and socio-cultural capital		Model with compositional variables, prior achievement, socio-cultural capital and non-cognitive dispositions	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
FIXED								
Intercept	-0.092	0.035	-0.046	0.035	-0.014	0.035	-0.092	0.037
Student variables								
Prior achievement			0.676***	0.013	0.639***	0.035	0.596***	0.041
Socio-cultural capital					0.128***	0.024	0.127***	0.023
Language self-concept							0.089***	0.017
Achievement motivation							0.023	0.017
School composition								
Mean prior achievement	0.474***	0.036	0.165***	0.039	0.156***	0.037	0.176***	0.041
RANDOM								
Variance components								
Student level	73.3 %		35.7 %		35.4 %		34.3 %	
School level	5.3 %		6.6 %		5.3 %		5.9 %	
Total variance accounted for	21.4 %		57.7 %		59.3 %		59.8 %	
DEVIANCE	6375.454		4584.498		3689.311		3439.433	

* < .05 ; ** < .01 ; *** < .001

Table 7—Mean socio-cultural capital fixed effects

	Model with compositional variables only		Model with compositional variables and prior achievement		Model with compositional variables, prior achievement and socio-cultural capital		Model with compositional variables, prior achievement, socio-cultural capital and non-cognitive dispositions	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Intercept	-0.094	0.043	-0.047	0.032	-0.015	0.031	-0.013	0.033
Student variables								
Prior achievement			0.676***	0.029	0.642***	0.035	0.599***	0.041
Socio-cultural capital					0.122***	0.024	0.121***	0.023
Language self-concept							0.088***	0.017
Achievement motivation							0.024	0.016
School composition								
Mean socio-cultural capital	0.464***	0.043	0.228***	0.034	0.198***	0.035	0.218***	0.036
RANDOM								
Variance components								
Student level	73.3 %		35.7 %		35.4 %		34.2 %	
School level	7.3 %		4.5 %		4.2 %		4.6 %	
Total variance accounted for	19.4 %		59.8 %		60.4 %		61.2 %	
DEVIANCE	6387.782		4567.977		3678.904		3429.057	

* < .05 ; ** < .01 ; *** < .001

2. Defining the School Composition Effect

2.1. A conceptual critique

However, if school composition is regarded as a factor that has to be taken into account to explain between-school variance, then how can the nature of its effect be clearly understood? Or, to put it differently, is school composition a direct effect, or does it operate through process variables, such as the principal's leadership and the organizational culture of the school, or the quality of teaching and experiences within the classroom?

If the direct-effect hypothesis is adopted, one of the mechanisms which could explain the compositional effect is the peer effect (see, for example, Willms, 1986). The peer effect suggests that students 'who make up a school, or class, or group create a setting that facilitates or impedes learning above and beyond what would be expected on the basis of the individual characteristics of students' (Wilkinson, 2000, p.12). Dreeben and Barr (1988) also presented a model with two paths linked to the effects of peers. The first, called normative, suggests that peer effects arise because individual students internalise the norms of educational settings to guide their learning and behaviour. The second, comparative explanation, maintains that peer effects occur because students use the educational setting as a reference group to make comparisons in terms of performance and to develop academic self-perceptions. In more general terms, therefore, peer effects could be defined as the impact on students from everyday student-to-student exchanges in schools and classrooms.

Nonetheless, several other studies made a different assumption about the mechanisms associated with the compositional effect and empirically tested the idea that group composition operates through class and school covariates differently than peer mechanisms. Some qualitative studies (Thrupp, 1999; Lupton, 2004) illustrated the extent to which the composition of a class or school is connected to pedagogical and managerial processes, such as curriculum coverage, teacher qualifications and motivation, management routines and principal leadership. It would appear from these studies that the quality and quantity of teaching are linked to pupils' aspirations and academic levels, and that school management in disadvantaged schools is hindered by a lack of resources and difficulty in instigating efficient daily routines.

In the same line of research, several quantitative studies (see, for example, Weinert, Schrader & Helmke, 1989) also measured covariance between composition and pedagogical and managerial processes, calling the combined effect of the latter the 'joint effect'. Using the TIMMS 2003 8th grade database, Dumay and Dupriez (in press) found that classes made up of students who, on average, had access to extensive educational resources and whose parents' educations and academic aspirations were high, tend to learn in a class climate that is less disrupted, to cover a wider curriculum and receive more mathematics homework than other students. They also demonstrated that differences between classes could be explained by the net[8] effect of group composition and processes, as well as by their joint effect. Some studies, like that of Opdenakker, Van Damme and Minnaert (2005), have even attempted to specify the ways in which group composition affects pupils' performances. They found that group composition at class level seems to affect classroom practices in respect of both the learning environment and the class climate, thus implying the existence of unequal opportunities between classes (and schools). Classes with favourable group composition characteristics are better integrated, receive more

[8] The net effect of group composition and processes could be defined as their impact on class achievement, independently of covariance between group composition and processes.

teaching support, have greater learning opportunities, a better relationship with the mathematics teacher and a more favourable learning climate, which in turn leads to greater effort being made during the school year and a higher level of mathematics achievement, among others benefits.

It is also interesting to note that very few quantitative studies have explored the organizational or school covariates of the school composition effect. The only one to speak of is Opdenakker and Van Damme's (2001), cited below. They discovered that cooperation among teaching staff has a significant positive relationship with mean ability and the mean father's educational level. Unfortunately, however, the main variables used in the study concerned class processes aggregated at school level, such as learning environments, approaches to discipline and learning, and focused on students' differences and development. It is therefore difficult to attain a clear picture of potential associations between school composition and school processes, like the principal's leadership or school culture and values. The next paragraph aims to tackle precisely that, exploring the matter further with the same sample and data as in our first analysis.

2.2. A direct or indirect effect? Empirical evidence

Analyses

To begin, correlations between composition and organizational process variables are computed. Then a new set of multi-level analyses is analyzed, in order to extract and calculate the net and joint effects of school composition and school processes. The new set of models comprised a model with all the process variables and a full model with all the process variables as well as composition. A model rotation is finally applied in order to estimate the net and joint effects of both factors.

Variables (organizational)

Transformational leadership

24 items (scales on charisma, consideration for individuals and intellectual stimulation) from the multifactor leadership questionnaire (5X – short; Bass & Avolio, 1997) are used to measure transformational leadership constructs. All the teachers from each school answered on a Lickert scale with six options. Although this instrument aims to measure three underlying constructs, a PCA applied to this set of items reveals a two-factorial solution with loadings which do not fit the expected underlying factorial structure. For this reason, and since the scale is highly reliable when conceptualised as a one-factorial solution (α = 0.97), the transformational leadership score is obtained by summing (and then standardising) the scores of all 24 items. The aggregated properties of the scale are also examined in order to ensure that the aggregated measure is reliable and represents something actually shared at school level. The intra-class correlation (ICC[9]; see Glick, 1985) of a one-way ANOVA for this scale is in excess of .60 (ICC = 0.88), thus making aggregation possible.

Organizational culture

The organizational culture construct was chosen over the organizational climate construct, as it captures the beliefs and meanings adhered to by individual teachers vis-à-vis their schools and work, rather than just collective perceptions of them (Van Houtte, 2005). Four aspects of organizational culture are measured, using the same introductory question: 'Do you believe that, in your school, […]'. All the teachers from each school answered on a Lickert scale with six options.

The first element (6 items; α = 0.92) refers to the status of innovation within schools (e.g. 'teachers are

[9] ICC is calculated as follows: ICC = (between mean square – within mean square)/between mean square.

enthusiastic when trying out new teaching methods'). The second element measures cultural values in terms of teacher collaboration and collegiality (7 items; α = 0.89; e.g. 'teacher collaboration is highly valued'). The third element (4 items; α = 0.62) is an indicator of how much emphasis was placed on academic achievement (e.g. 'teachers have high expectations for their pupils' academic performance'). Finally, 5 items measures the status of disciplinary guidelines (α = 0.72; e.g. 'It is essential and a prerequisite for good teaching that pupils abide by school rules'). The items from each cultural scale are summed and then standardised.

When ICC is applied to all four scales, it reveals that they could all be aggregated reasonably at school level (Innovation, ICC = 0.79; Cooperation, ICC = 0.83; Academic emphasis, ICC = 0.72; Discipline, ICC = 0.82).

Collegial decision-making (class and school matters)

To construct collegial decision-making indexes, the teachers were asked who had the greatest influence over a number of school and class decisions. The following response categories were proposed: the school principal, the teaching staff as a whole, or individual teachers. Collegial decision-making indexes are then computed according to the number of times each teacher answered 'the teaching staff as a whole'. The first index (4 items) refers to decisions about class or pedagogical matters (e.g. chosen teaching methods, definitions of assessment criteria, etc.). The second index describes decisions concerning non-teaching matters, such as timetabling or disciplinary decisions. The first score varied from 0 to 4 and the second from 0 to 8. They are then standardised.

The ICC value for the scale of collegial decision-making on school matters appears to be over .60. It was thus possible to aggregate it at school level (ICC = 0.68). However, the ICC for collegial decision-making on class matters (ICC = 0.48) reveals that perceptions of teaching-related collegiality vary considerably from one teacher to another, within the same school.

Results

Correlations between composition and organizational (process) variables

Exploring correlations between school composition and organizational processes reveals that the links are very weak (see Table 8). Only the cultural scale measuring academic emphasis has a significant positive relationship with both school composition variables, revealing that the higher a school's mean ability or socio-cultural composition, the greater its emphasis on academic achievement. This result confirms the idea that teachers' expectations are higher in schools with more advantaged students. It would also appear that schools with lower mean academic achievement levels tend to make more collective decisions ($r = -0.26$, $p < .05$) as regards teaching methods and pedagogical matters[10] than those with higher average academic success rates. Indeed, this tendency is confirmed by the weak, but negative, relationships between the scale of collective decision-making on school matters and mean prior achievement ($r = -0.23$; $p < .10$) and the school's socio-cultural composition ($r = -0.20$; $p < .10$). However, it must be noted that this finding contradicts the conclusions reached by Opdenakker and Van Damme (2001), who showed a positive relationship between school composition and co-operation among teaching staff. Although Opdenakker and Van Damme's analysis was based on secondary schools, while this study focuses on primary education, it has still proven difficult to reach a decision on the two sets of results. There is no doubt that new empirical evidence is needed before any definitive conclusions can be made.

[10] A degree of caution is required when interpreting this result, as the ICC regarding the scale of collective decision-making on teaching matters is under .60, meaning that there is considerable intra-school variability.

Table 8 - Correlations between school processes and school composition

	Mean prior achievement	Mean socio-cultural capital	Transformational leadership	Co-operation	Discipline	Innovation	Academic emphasis	Collegial decision making (class)	Collegial decision making (school)
Mean prior achievement	1	.768	**.011**	**.051**	**.014**	**-.027**	**.484****	**-.265***	**-.236**
Mean socio-cultural capital	.768	1	**-.207**	**.032**	**-.172**	**-.032**	**.321****	**-.092**	**-.200**
Transformational leadership	.011	-.207	1	.231	.561**	.344*	.194	.076	.106
Co-operation	.051	.032	.231	1	.529**	.844**	.210	.366**	.152
Discipline	.014	-.172	.561**	.529**	1	.585**	.371**	.221	.079
Innovation	-.027	-.032	.344*	.844**	.585**	1	.309*	.582**	.179
Academic emphasis	.484**	.321**	.194	.210	.371**	.309*	1	.112	-.081
Collegial decision making (class)	-.265*	-.092	.076	.366**	.221	.582**	.112	1	.436**
Collegial decision making (school)	-.236	-.200	.106	.152	.079	.179	-.081	.436**	1

* < .05 ; ** < .01

Net and joint effects of school composition and processes

The purpose of the next analysis is to decompose between-school variance into the net and joint effects of school composition and school processes. Only the results of the full model (with composition and process variables entered into the analysis simultaneously) are presented, since the aim is not to understand the precise nature of the impact of organizational variables on mean academic achievement, but to establish whether (weak) covariance between organizational processes and school composition accounts for a significant proportion of between-school variance or not.

After model rotation, the results indicate (see Table 11) that the joint effect of process variables (organizational variables) and group composition accounts for 5.4 and 6.1 % of between-school variance respectively, when using mean academic achievement and socio-cultural composition as school composition variables. This equates to 1.4 and 1.6 % of total variance in language achievement scores. Such a finding upholds the idea that the articulated effect of organizational variables and school composition is indeed a convincing way to predict between-school variance in primary schools. That said, the direct effect of school composition was even more noteworthy. The direct effect of mean academic achievement accounts for nearly 5 % of between-school variance (and 1.3 % of total variance), while socio-cultural composition accounts for 9.2 % (2.5 % of total variance). We can thus put forward the hypothesis[11] that a considerable proportion of the school composition effect is attributable to peer mechanisms, even though it is modelised at school level.

Surprisingly, however, the net effect of organizational processes transpired to be null. In this respect, it is interesting to note that when organizational process and school composition variables are entered simultaneously into the analysis, the organizational process effect is quasi-null (see Tables 9 and 10). Only the disciplinary scale – using mean academic achievement as the composition variable – has a negative impact on mean academic achievement, meaning that the less emphasis teachers placed on discipline at a given school, the better the pupils from that school performed in the language test. This result can probably be understood considering there is less need for teachers to focus on disciplinary guidelines, when already working in an orderly environment.

The very weak (net) effect of the organizational processes could certainly be explained by the fact that a proportion of between-school variance is associated with a joint effect of organizational processes and school composition, but also by the difficulty in developing full-proof ways of measuring such processes in a questionnaire. It should also be mentioned that these findings confirm previous results, for example those obtained by Miller and Rowan (2006) in their study on the effects of organic management (defined as a combination of staff cooperation and collegiality, teachers' participation in school decision-making and supportive leadership by school principals) on student achievement. They found that organic forms of management are indeed not particularly powerful determinants in understanding student achievement rates at primary or secondary school.

[11] This suggestion can only act as a hypothesis, since the hypothesis that composition co-varies with unmeasured organizational variables could also be made.

Table 9 - Full model (with mean prior achievement as composition variable)

	Full model	
Intercept	-0.008	0.035
Student variables		
Prior achievement	0.596***	0.041
Socio-cultural capital	0.125***	0.023
Language self-concept	0.090***	0.017
Achievement motivation	0.023	0.017
School composition variables		
Mean prior achievement	0.145**	0.046
Organizational variables		
Transformational leadership	0.011	0.056
Co-operation values	0.023	0.050
Discipline values	-0.095*	0.040
Innovation values	-0.026	0.052
Academic emphasis	0.050	0.043
Collegial decision-making (class)	0.024	0.047
Collegial decision-making (school)	0.08	0.034
RANDOM		
Variance components		
Student level	34.2 %	
School level	6.1 %	
Total variance accounted for	59.7 %	
DEVIANCE		

* < .05 ; ** < .01 ; *** < .001

Table 10 - Full model (with mean socio-cultural capital as composition variable)

	Full model	
	Estimate	S.E.
Intercept	-0.012	0.033
Student variables		
Prior achievement	0.598***	0.041
Socio-cultural capital	0.121***	0.023
Language self-concept	0.089***	0.017
Achievement motivation	0.024	0.016
School composition variables		
Mean socio-cultural capital	0.188***	0.044
Organizational variables		
Transformational leadership	0.035	0.057
Co-operation values	0.023	0.043
Discipline values	-0.062	0.040
Innovation values	-0.035	0.049
Academic emphasis	0.050	0.036
Collegial decision-making (class)	0.01 0.041	
Collegial decision-making (school)	0.19 0.029	
RANDOM		
Variance components		
Student level	34.2 %	
School level	4.9 %	
Total variance accounted for	60.9 %	
DEVIANCE	3455.009	

* < .05 ; ** < .01 ; *** < .001

Table 11 - Percentage of total and between-school variance accounted for by the net effect of school composition, the net effect of school processes and the joint effect

	Full model (with mean prior achievement)		Full model (with mean socio-cultural capital)	
	BSV	TV	BSV	TV
School composition net effect	4.8	1.3	9.2	2.5
School processes net effect	0	0	0	0
Joint effect	5.4	1.4	6.1	1.6

Key:
BSV = Between-school variance accounted for
TV = Total variance accounted for

3. Discussion

The school composition effect has recently been accused of being a methodological artefact by several EER researchers. The primary aim of this article was to challenge that idea and test the impact of level-1 model specification on the magnitude of the composition effect. Using language achievement in primary schools in French-speaking Belgium, model specification was revealed to have a great impact on the extent of the school composition effect, but the effect remained significant after controlling for prior achievement, pupils' socio-cultural capital and their non-cognitive dispositions, and accounted for a non-negligible proportion of between-school variance. Indeed, it appeared, on average, that 12 % of between-school variance in language achievement was due to school composition, over and above that accounted for by individual variables.

The second objective of the paper was to increase understanding of the nature of the school composition effect and the ways in which it affects pupils' results. The findings demonstrated that school composition appeared to be associated very little with school process variables. Only teachers' collective emphasis on academic performance (positively) and their collective decision-making on school matters (negatively) were revealed to be associated with school composition. The decomposition of between-school variance into net and joint effects showed that school composition could also be considered as a joint effect. This confirmed the results of previous studies (Weinert, Schrader & Helmke, 1989; Opdenakker, Van Damme and Minnaert, 2005; Dumay and Dupriez, in press) exploring the joint effect of group composition and processes in the classroom.

The results underlined the importance of the methodological and statistical frameworks used to estimate compositional effects. They specifically emphasised the role of prior achievement as an important and necessary control variable when estimating compositional effects, and challenged, as a corollary, other studies not incorporating it in their strategy. Nevertheless, it is important to draw the reader's attention to the meaning of 'prior achievement'. Indeed, one could put forward the

hypothesis that a given child's prior achievements partially represent the impact of the classes and schools s/he has previously attended, and that the school (composition) effect is underestimated if you fail to consider the cumulative effect of school (composition) throughout a student's academic career. In this respect, it is necessary to take a longitudinal approach to assess the cumulative effect of composition on pupils' development more reliably.

Even when comparing studies with equally solid strategies and analysis – namely the results of this study and those of Harker and Tymms – several significant and persistent differences in the findings come to light. Yet, it is precisely by challenging such differences that the debate around the composition effect can be carried forward. Over and above the impact of methodology and analysis, it is important that variation in the degree of the composition effect be understood, as well as understanding which conditions (i.e. school segregation and academic levels, education system structure, education policies) influence it. Such questioning will prevent the debate from becoming polarised and pave the way for reflection on the contextualisation mechanisms at play in the compositional effect.

At this stage, it is only possible to make assumptions and develop hypotheses for future research. Potential moderators as regards the composition effect could be categorised into system-, school- and class-level moderators. At the system level, the composition effect appears to be more important in school systems which have a tendency for greater between-school segregation. This was highlighted by Dumay and Dupriez (2006), who, using the PISA 2000 database, demonstrated that the degree of academic (between-school) segregation was largely associated with the age at which different tracks or separate educational pathways were first introduced in each education system, meaning that school systems which adopted a differentiation approach (characterised by early tracking) tended to result in more academic segregation and a potentially greater school composition effect. Following the same train of thought, it could also be maintained that those educational systems which make use of setting and streaming to manage pupils' mixed abilities create favourable conditions for the emergence of a group composition effect at class level. As regards schools, it might be suggested that a collective vision and shared goals are particularly important in disadvantaged institutions, whose students need structure, order and clearly defined expectations. Finally, in respect of classes, it seems that structured teaching and an orderly environment in the classroom would diminish the effects of covariance between group composition and class processes, even if the conditions for implementing such teaching practices are more difficult to fulfil among disadvantaged classes.

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