Why 15-year old pupils in the Netherlands and Flanders have such high scores in international comparisons of educational outcomes?
A first analysis with one German educational system.

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Why 15-year old pupils in the Netherlands and Flanders have such high scores in international comparisons of educational outcomes? A first analysis with one German educational system.[1]

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Introduction

The 15-years old pupils in the Netherlands have relatively high scores in the international comparisons made by the *Program for International Student Assessment* [PISA]. Since 2000, 15-year-old pupils living in a large number of OECD member states are taking this test every three years. The purpose of this test is to map the competences in the fields of mathematics, physics and reading at the end of the period of compulsory education (at the age of 15 or 16 in most Western countries). Although a lot of attention was given to the high score of the Finnish pupils in the three PISA waves, the pupils in the Netherlands and Flanders (the schools in the Belgium data where Dutch was the official language) scored also quite high on reading and math, at least compared with Austria, Germany and Switzerland.[4]

The aim of this paper is to explain this high score of 15-years old pupils in the Netherlands and Flanders, *by comparing them with countries with comparable educational systems and welfare state regimes*. This restriction in the planned comparison is deliberate. We try to avoid comparisons with societies and educational systems, which deviate so strongly that there hardly can be policy lessons learned from the comparison[5]. Therefore, we compare only the educational systems of the following countries with the Netherlands and Flanders: Wallonia, German Länder (in this paper still undivided), German-Swiss cantons, and Austria.

All these countries have: 1) a vocational education tradition (next to general education), which influences already the early stages of secondary education, 2) they have all more or less religious private schools, subsidized by the state and 3) they all most all have a conservative welfare regime. In addition, their educational systems have influenced each other deeply (most by the German example) and the same holds for their welfare regimes. In order to have enough statistical power at the educational system level it is necessary to be able to differentiate between the pupils and schools in the various German Länder[6] (in this

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[4] On average the pupils in the German cantons score higher on math and reading (see table 3) than the pupils in the French cantons [Genève (532/511), Jura (552/497), Neuchatel (533/499); Vaud (541/511), Valais (543/507)] and the Italian canton (Ticino 535/507). However the mixed German/French cantons Bern (543/501) and Fribourg (569/524) score higher. As a consequence, the average score of all Swiss pupils (550/515) is lower that that of the pupils in Flanders (553/533) and the Netherlands (545/521).

[5] Because it is nearly impossible to change a whole society with only educational aims

[6] In Germany the responsibility for educational policies is in the hands of the *Bundes Länder*, and not on the level of federal state. The same is true for Switzerland, where cantons have this role and Belgium, where Flemish and Walloon can be treated independently. In addition, German länder, Swiss cantons and Belgian regions have each their own educational system.

paper still undivided), the German-Swiss cantons and Wallonia. Our aim is not to compare publicly the educational outcomes of the German Länder and German-Swiss cantons with each other.

Educational systems, school characteristics and educational outcome.

There exists since recently (Kerckhoff, 2001; Shavit & Muller, 1998; Hanuushek & Wössmann, 2005; Horn, 2009; Dunne, 2010) an agreement among scholars that the educational outcomes of pupils in different educational systems vary systematically, but also that the effects of parental background on these educational outcomes vary between educational systems. However, there is less agreement among scholars about the interpretation and explanation of these variations between educational systems.

An important reason for these interpretation and explanation problems of the effects of educational systems might be the omission of an important determinant of educational achievement namely school characteristics. The latter transmits educational system features into constrains and opportunities for pupils to learn and for teachers to teach.

This does not mean that there has been a lack of research on the school effectiveness. Since Coleman (1966) the study of the effects of school characteristics on educational outcome has flowered. Scheerens & Bosker (1997) have summarized most prominent studies on this topic. The research has so far shown that the most important significant school characteristics are social composition of the pupil population; grade or curriculum-level, curriculum-type, time-on-task of teachers and pupils, quality of the teachers and school-climate.

However, all these school characteristics are not independent of the educational systems, in which they operate, but heavily conditioned by them. For instance, the differences in the social composition of secondary schools are much larger in a highly differentiated educational system (like the Dutch or German system), compared with a hard differentiated system (like the Norwegian or the Swedish). Consequently, the effects of the social composition of the school on educational outcome might be quite different between educational systems (Dunne, 2010).

Surprisingly, until very recently the in-between-level of school was fully ignored by the study of the effects of educational systems on educational outcome. However Dunne (2010) and Dronkers (2010) showed independently that school characteristics like school composition and ethnic and social-cultural diversity in schools have substantial different effects and implications in different educational systems for educational achievement. Dronkers, van der Velden & Dunne (2011) add the curriculum level as one of the omitted school characteristics. Their results highlight the importance of including track-level and school-level factors in the debate of educational inequality of opportunity for students in different education contexts. The findings clearly indicate that the effects of educational system characteristics are flawed if the analysis uses only a country and a student level and ignores the track- and school-level characteristics. Moreover the inclusion of the track-level is necessary to avoid overestimation of the school-composition effect, especially in stratified educational systems with a stronger differentiation of curricula. From a policy perspective, the most important finding is that educational systems are not uniformly ‘good’ or ‘bad’, but they have different consequences for different groups. Some groups are better off in comprehensive systems, while other groups are better off in moderately or highly stratified systems.

Therefore, this project will incorporate these new insights and investigate the educational outcome of 15-year old in different educational systems of developed societies with a five level perspective: *nation states* (either a unitary state or the federation); *educational systems* (either the unitary state or the cantons, Länder or language community); *schools* with different constrains and opportunities to teach and learn as a consequence of their characteristics; *curricula* as measure of learning environments; *pupils* with different social and cultural background and learning histories. This five-level perspective is also useful to overcome the current interpretation and explanation problems related with a two-level approach (see Dronkers, van der Velden & Dunne, 2011).

It is evident that the inclusion of the curriculum-level in the study of educational systems can be very useful for policy-makers. The change of an educational system might also imply the change of some school features, which might not be possible within the context of Dutch educational system and laws or might not be non-advisable because of the negative side-effects of such changes.

Data

Since 2000, the OECD has tri-annually conducted large-scale tests among 15-year-olds living in its member states and partner states in order to assess students' mathematical, reading, and scientific literacy, the so-called PISA data. The purpose of this test is to map the competences in the fields of mathematics, physics and reading at the end of the period of compulsory education (at the age of 15 or 16 in most Western countries). We make use of the 2006 wave for the Netherlands, Belgium, Germany and the German-Swiss canton. The data of the German-Swiss cantons were obtained from the Swiss Federal Statistical Office (EDK).[7] The PISA data for the other countries were obtained from the OECD/PISA webpage. The PISA data for each participating country constitute a representative sample of the schools that teach 15-year-old students. We selected only the native born students from these datasets, using the PISA definition of immigrant student.[8] Each school that has been selected tests a sample of all 15-year-olds, irrespective of their track or grade. In addition to educational performance, PISA also supplies information on a large number of individual background characteristics and school characteristics. The school principals provide details on a variety of school characteristics, such as student-teacher ratio, teacher shortages and the location of the school. In the student questionnaires, students are asked for information on such things as the educational level of their parents.

Schools and tracks-within-schools as separate units of analysis

The PISA data contain two cross-national indicators of the track the students are attending. The student is asked whether he or she is currently enrolled in a certain track of a certain level. This was later recoded in the international format distinguishing between general and vocational tracks on the one hand and between lower and higher tracks on the other hand. This recoding by the National PISA data managers probably reflects the official national policy regarding the placement of different tracks into the International classification. In Germany all students with a general track were coded at the lower level. But the national specific program code in the PISA data for Germany allowed us to distinguish between those

[7] Swiss dataset of the IX-grade students PISA 2006 – FSO/EDK

[8] The student and/or both parents are born outside the country of test.

students of general lower education with and without access to higher secondary education and between lower and higher vocational education.

Schools are the sampling unit in the PISA survey. But these schools often contain both general and vocational education and both levels within secondary education. The school-level therefore reflects more the administrative unit of the educational institution, while the combined two track characteristics reflect more the daily reality of the teaching and learning environment, and also of the social intercourse between students and teachers. This daily life unit is a better indicator of the actual school environment of teaching and learning than the administrative unit. We call this the curriculum-level. We compute this level per educational system for each student by combining his or her school identification number, the kind of track he or she is following (vocational or general), and the track-level (low, medium or Gymnasium) (ask the first author for an explanation of our choices in the coding of the various programs and curricula).

Dependent variable: linguistic or math performance

The dependent variable in this study is *linguistic or math performance*. To measure linguistic or math skills accurately would make the test too long to be feasible. Hence a large number of very similar, but shorter tests were created. As such different tests can never have exactly the same degree of difficulty, *Item Response Modelling* (IRM) was used to achieve comparable results between students who made different tests. In this analysis, we averaged the five plausible values that were obtained from the IRM. The linguistic or math skills scores were standardised for the OECD countries using an average of 500 and a standard deviation of 100.

Individual level variables of all students

Parental ESCS. The Index of economic, social and cultural status of the parents (ESCS) is a composite index created in the PISA dataset of the occupational status of the parents measured with the ISEI scale (Ganzeboom, De Graaf, Treiman & De Leeuw, 1992), the educational level of the parents measured with the ISCED classification (UNESCO, 2006), and the presence of any material or cultural resources at the students' homes.[9] This combination of the parents' occupational status and educational level, together with the resources at home, produces the strongest indicator of the parental environment. We set the average of parental ESCS for each destination country to zero, to ensure that the comparisons for this item show the result for the average student in these countries.

Grade. Since not all students attend the same grade, we have included a variable to account for this. As a result of between-country variance in the way grades are constructed, we have standardized the grade around the modal grade in a country.

Female. We control for gender effects by using a dummy variable indicating whether a student is female (1) or male (0).

Variables measured at the curriculum level

[9] The measure consists of the presence of a desk, a private room, a quiet place to study, a computer, educational software, Internet, literature or poetry, art, books that may be of use when doing schoolwork, a dictionary, a dishwasher, and the presence of more than 100 books in the house.

Vocational. A dummy variable indicates whether a student is currently enrolled in a (pre-) and low vocational (1) or medium and higher secondary education (0) type of education (ISCED classification).

Higher secondary. This dummy distinguishes the current *track-level* within secondary education as gymnasium (=giving entrance rights to university education) (1) or medium, which contains both medium or mixed vocational or general education (0).

ESCS diversity. In a similar way, we calculated the socio-cultural diversity of the tracks-within-schools. Using the ESCS scores of the parents we divided these parental scores in 5 categories; the group with the lowest 10% scores, the 10-30% group; the 30-70% group; the 70-90% group and the group with the highest 10% scores.[10] On the basis of these 5 categories we calculated the Herfindahl index of socio-cultural diversity (varying between 0 and 1).[11] The index should be interpreted as follows: a value 0 means that there is no diversity, because all parents of all students at that particular curriculum are in the same ESCS category. A value approaching 1 indicates a very high level of diversity, indicating that the students are equally recruited from the five ESCS categories. As this Herfindahl index of socio-cultural diversity is "level-blind" and therefore insensitive to the average parental educational level, we have also added the average ESCS of a curriculum to the analysis (see below).

Percentage of native students. The Dutch PISA data 2006 did not contained the country of birth of the student and parents, because the Dutch Minister of Education did not want to know that important variable (see Dronkers, 2005). Therefore we cannot distinguish between immigrants from different origin countries. In this case this omission is less serious than in a OECD-wide comparison, because the countries of origin of the immigrants in Austria, Belgium, Germany and the Netherlands are more or less comparable (see Dronkers, van der Velden & Dunne, 2011).

Average ESCS. We also calculated the average parental ESCS per curriculum.

Variables measured at the school-level

Selective admittance of students to the school is a scale in the PISA data based on the answers of the principals indicating whether admittance to their school was based on academic record and/or on recommendation. We divided the scale in three dummies: selective admittance, some selection and no selection. Although these dummies are measured at the school-level, we use them to control the amount of entrance selectivity at the track-level.

Teacher shortage. The degree in which schools suffer a shortage of teachers is an index in the PISA data which indicates according to the principals to what extent education is hampered by the following items: a lack of qualified physics teachers, a lack of qualified mathematics teachers, a lack of qualified language teachers and a lack of qualified teachers for the other subjects. This index is based on the answers given by the school principals. The average of this index for teacher shortage was set to zero for all destination countries and all

[10] The groups are defined as follows: 1. Less than 10%: ESCS < -1.1; 2. 10-30%: -1.0 < ESCS <-0.4; 3. 30-70%: -0.3 < ESCS < 0.6; 4. 70-90%: 0.7 < ESCS < 1.2; 5. more than 90%: ESCS > 1.3.

[11] The Herfindahl index of socio-cultural diversity was calculated as follows: 1-((percentage of parents from ESCS group 1) ^{2} + (percentage of parents from ESCS group 2) ^{2} + … + (percentage of parents from ESCS group 5) ^{2}).

students, to ensure that the comparisons for this item show the result for the student in schools with an average shortage of teachers.

Number of curricula within schools. This variable is based on information on the amount of curricula (track levels) present within schools seen as administrative units. The maximum amount of curricula per school is 3, meaning that within one administrative unit of a school, pupils are enrolled either 1) in vocational training, 2) medium level general education or 3) high level general education. The minimum number is 1, meaning that entire school offers training only at one-track level.

Student-staff ratio. The student-staff ratio (the number of students per member of staff per school) is based on the answer given by the school principals. The average for this ratio was set to zero for all destination countries and all students, to ensure that the comparisons for this item show the result for the students in schools with an average student-staff ratio.

Urbanisation. Two dummies were constructed to indicate whether a school is located in (large) *city* or in a *rural area*. Schools in an urbanized countryside or in (small) towns serve as the reference category.

School size. Number of students in the school.

Private public. Educational systems differ in the shares of public and private schools and in the degree of state grants for these private scores. Two dummies were constructed to separate private dependent and private independent schools from public schools. These variables control for these system differences and effectiveness of these school-types (Dronkers & Avram, 2010a & 2010b).

Analysis

Tables 1, 2, and 3 give the summary statistics for all relevant variables, both together and for the different educational systems separately. [12]

Tables 4 and 5 give the multi-level analyses for reading and math scores respectively. They are made in the same way. Model 0 includes only dummies for the Netherlands and Flanders and thus gives the degree in which the scores of the Dutch and Flemish students are higher than the average scores of the Austrian, German and Swiss pupils. Model 1 includes the Dutch and Flemish dummies and the individual characteristics, while model 2 also includes the grade of the pupil. In model 3 to 9 we included separately the curriculum and school features in model 2. These models give an impression of the importance of these curriculum and school features in explaining the higher scores of the Dutch and Flemish students. Model 10 combines all individual, curriculum and school variables, together with the dummies for the Netherlands and Flanders.

Table 6 analyses whether the effects of a number of school features are different for the Netherlands and Flanders compared to the effects of these school features in Austrian, Germany, German-Swiss cantons and Wallonia by adding the relevant interaction variables.

Reading score

Model 0 of table 4 shows that the pupils in Flanders and the Netherlands have significant higher scores than the average score of the pupils of Austrian, Germany, German-Swiss cantons and Wallonia (+41; +34). Adding the individual characteristics and the grade of the pupils hardly change this higher scores of Flanders and the Netherlands (+42; +33). This

[12] Not yet divided in the different educational systems of the German Länder.

means that the causes of these higher scores cannot be explained by the social composition of the pupils in Flanders and the Netherlands.

The dummy for the Netherlands becomes both insignificant and not longer substantive in model 3 (+9), where the school features average ESCS, Herfindalindex of ESCS and the % native pupils are added to the equation, in model 8 (0), where the school size is added to the equation. Although this dummy also becomes insignificant in model 6 (private dependent and independent schools) and model 9 (the curriculum attended by the pupil), but the size of the coefficient of this dummy is still substantive (+29; +43). In the final model 10 with all variables included, the dummy for the Netherlands is insignificant and hardly substantive (+15).

The dummy for Flanders becomes never insignificant, but the size of the coefficient becomes substantively smaller in model 3 (+33; school features average ESCS, Herfindalindex of ESCS and the % native pupils), model 4 (+22, level of selectivity of the school) and model 7 (+27; teacher shortage). In the final model 10 with all variables included, the dummy for Flanders is significant and substantive (+33).

Math score

Model 0 of table 5 shows that the pupils in Flanders and the Netherlands have on average significantly higher scores than the pupils of Austria, Germany, German-Swiss cantons and Wallonia (+45; +48). Adding the individual characteristics and the grade of the pupils hardly change this higher scores of Flanders and the Netherlands (+44; +46). This means that the causes of these higher scores cannot be explained by the social composition of the pupils in Flanders and the Netherlands.

The dummy for the Netherlands becomes both insignificant and not longer substantive in model 3 (+14), where the school features average ESCS, Herfindalindex of ESCS and the % native pupils are added to the equation, in model 4 (+19), where the level of selectivity of the school is added to the equation, in model 8 (+10), where the school size is added to the equation. Although this dummy also becomes insignificant in model 6 (private dependent and independent schools) and model 9 (the curriculum attended by the pupil), but the size of the coefficient of this dummy is still substantive (+39; +46). In the final model 10 with all variables included, the dummy for the Netherlands is insignificant but still substantive (+20).

The dummy for Flanders becomes insignificant in model 4 (+10), where the level of selectivity of the school is added to the equation. The size of the coefficient becomes substantively smaller in model 3 (+30; school features average ESCS, Herfindalindex of ESCS and the % native pupils) and model 7 (+32; teacher shortage). In the final model 10 with all variables included, the dummy for Flanders is insignificant but substantive (+32).

Large school size as explanation of the high Dutch score

The school size seems to be the best predictor of the higher score on reading and math by Dutch pupils compared with the average score of the pupils of Austrian, Germany, German-Swiss cantons and Wallonia. Table 3 shows that the Netherlands has the highest school size of the compared educational systems 1063 pupils, but also the largest standard deviation 538. Wallonia and Wallis have the next highest school sizes 797 and 795 (standard deviation 285 and 479. Flanders has an average school (661; compared tables 1 and 3). Given that the effects of school size on the reading and math scores are positive in model 8 (0.0624 for reading; 0.0591 for math),

the high school size of Dutch school seems to be a sufficient explanation of the higher score on reading and math by Dutch pupils. However, model 4 of table 6 shows that the effect of school size in the Netherlands and Flanders is less strong than in the other educational systems (for the Netherlands 0.0476 and Flanders 0.0463 in stead of 0.0771 for the other educational systems). But the effect of school size is still positive in the Netherlands and the insignificant dummy for the Netherlands in model 4 of table 6 (+25) still supports this school size explanation. This higher school size thus is an explanation of the high Dutch score.

Curriculum composition as explanation of the high Dutch score

The curriculum features, average ESCS, Herfindalindex of ESCS and the % native pupils seems also to explain at least partly the higher score on reading and math by Dutch pupils compared with the average score of the pupils of Austrian, Germany, German-Swiss cantons and Wallonia. However the average score for the Netherlands on two[13] of the three curriculum features (table 3: 0.322; 0.665; 91.346) do not deviate strongly from the analogous averages for all educational systems (table 1: 0.238; 0.651; 89.111): However, the curriculum average ESCS is the higher in the Netherlands (although the German school average ESCS is higher: 0.360).[14] Also the standard deviations of these Dutch curriculum features do not deviate from those of all educational systems (0.401/ 0.427; 0.063/ 0.077; 10.903/12.60). The models 1, 2 and 3 of table 6 do not show significantly different effects of these three curriculum features for the Netherlands.

Thus the most plausible explanation of the effect of curriculum composition on the high Dutch score is the relatively high ECSC score, both on the individual level and on the curriculum level. Thus, the occupational status and the educational level of the parents and the presence of material or cultural resources at the students' homes (a desk, a private room, a quiet place to study, a computer, educational software, Internet, literature or poetry, art, books that may be of use when doing schoolwork, a dictionary, a dishwasher, and the presence of more than 100 books in the house) is higher in Germany and the Netherlands than in Austria, both parts of Belgium, and the German-speaking part of Switzerland. This higher economic, social and cultural status of the parents thus is also an explanation of the high Dutch score.

The deviant effect of a high level of selectivity in Flanders

The negative and significant effect of the interaction between the Flemish dummy and high selectivity in model 6 of table 6 shows that a high level of selectivity at the school entrance has no positive effect on reading and math in Flanders, in contrast with the other compared educational systems. It has a small negative and probably significant effect on the reading score (-7.35=30.87-38.22).

Conclusion

The higher school size of Dutch schools seems to be the best explanation of the higher Dutch scores on the reading and math tests of PISA. Compared to the other educational systems the Netherlands has the highest school size, but also the largest variation in school sizes, as reflected by the large standard deviation. This larger Dutch school size is the consequence of the powerful drive in Dutch education of the ’80 and the ’90 to fusion of smaller stand-alone schools in larger,

[13] Namely for Herfindalindex of ESCS and the % native pupils

[14] This is also true for the individual ESCS score. German pupils has the highest (0.431), followed by the Dutch pupils (0.381), while the average for all pupils in the compared nations is 0.290.

more efficient, multi-track schools.[15] If this interpretation is correct, the higher scores for the Dutch pupils can be claimed as a consequence of Dutch educational policy, because this fusion a smaller schools to larger more efficient, multi-track schools has been a goal of Dutch ministers of education from the '80's and '90's. However, there are limits to the benefits of larger school sizes. We found that the effect of school size was less strong in the Netherlands, which might be an indication of a smaller effect of school size if the average school size is already large.

A second explanation is the high score of Dutch parents on the index of economic, social and cultural status of the parents (ESCS), both on the individual and curriculum level. The amount of resources available for Dutch pupils is relatively high. They have disproportional more often a desk, a private room, a quiet place to study, a computer, educational software, Internet, literature or poetry, art, books that may be of use when doing schoolwork, a dictionary, a dishwasher, and the presence of more than 100 books in the house. The native Dutchmen and women have many resources to their disposal, at least compared with Austria, Belgium and German-Switzerland. Only the German pupils have even more resources at home.

We were less successful in explaining the high score of the pupils of Flanders. Only with a high level of selectivity at the school entrance we could explain (a part of) this high score. We found that a high level of selectivity at the school entrance has not a positive but a negative effect on the scores, but only in Flanders. The explanation might be that of the compared educational systems, Flanders and Wallonia have a moderate differentiated system, while the other educational systems are highly differentiated systems with selection at an early age and with different school-types, located in different buildings and institutions. The more moderate differentiated educational system of both parts of Belgium allows for larger institutions, which contains multiple school-types. Selection at the entrance of the school is therefore less relevant than in other more differentiated systems.

An important caveat is that we still have to split up Germany in the various Länder, each with his own educational system. The addition of these German Länder will give us enough educational systems to make multi-level analysis possible. That will allow us to control for various aspects of these educational system, like the age of first selection, the percentage private-dependent and private-independent schools, the level of central standardisation of the final exams, the size of the vocational education. These macro-indicators would allow us to test hypotheses like:

1. The effect of standardization of curriculum and examination-procedures within an educational system on the level of educational outcome is positive and largest for pupils with lower parental background and for pupils attending lower scaled school types and curricula, because they are at risk of lowering educational standards.
2. The existence of a vocational stream or type in an educational system improves the cognitive skills of the lowest achieving 25% part of the 15-year pupils, because such a vocational stream is a clear incentive of educational performance.
3. The existence of at least 25% private government-dependent schools within an educational system increases the competition for pupils and the general effectiveness of all private and public schools, provided that the private government-dependent schools function under conditions equal to those of public schools. Therefore in such educational systems the educational outcomes of all pupils will be higher. A private government-independent school-sector however has a negative effect on average

[15] School size is measured in PISA at the institutional level, not at the location level.

educational outcomes, because it only creams-off the more able or richer children without giving more incentives for public funded schools to improve their teaching.

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Table 1: The Summery statistics of individual, curriculum level and school level characteristics and reading & math scores of native pupils in Austria, Belgium, Germany, the German-speaking parts of Switzerland and the Netherlands

Variable	Nr of observations	Mean	Standard deviation	Minimum	Maximum
Individual level					
Reading performance	26195	517.4101	90.65584	39.18326	777.7534
Math performance	26195	539.0514	87.21479	150.0935	851.2151
Student ESCS	26195	.2902728	.8266278	-3.6771	2.9945
Gender (1=female, 0=male)	26195	.4868486	.4998366	0	1
Grade	26195	.0272549	.5769979	-2.735699	2.516328
Curricula					
Vocational track	26195	.2779156	.4479801	0	1
Gymnasium (ref. medium)	26195	.3457912	.4756346	0	1
Curriculum level					
Average ESCS	26195	.2384817	.4268344	-2.24772	1.682575
Percentage of natives	26195	89.11086	12.59641	4.545455	100
Herfindahlindex ESCS	26195	.6514729	.0772384	0	.7860422
School level					
Nr of curricula	26195	1.519259	.6559072	1	3
Low selection	26195	.2023669	.4017719	0	1
High selection	26195	.3651842	.481491	0	1
Private Government independent	26195	.0159954	.1254598	0	1
Private Government Dependent	26195	.3259019	.4687198	0	1
Public	26195	.6581027	.4743544	0	1
Teachers shortage	26195	.0569244	.9368627	-1.0568	3.6194
Percentage of certified teachers	26195	.8762071	.2277905	0	1
School size	26195	661.8684	431.5072	18	2639
Student teacher ratio	26195	12.61457	4.983077	1.302	38.667
Teacher shortage	26195	-.024809	.8354682	-2.145467	3.987695
Rural area	26195	.4153083	.4927845	0	1
City	26195	.1625119	.3689268	0	1

Source: PISA 2006

Table 2: Summery statistics of reading and mathematics scores per educational system[16]

Nation-states	Educational systems	Mean of Reading score	Standard deviation	Mean of Mathematics scores	Standard deviation	Observations
Switzerland	Aargon	522.9	(72.93)	557.8	(79.84)	817
	Bern (German)	519.3	(72.91)	544.2	(75.58)	970
	Basel	516.4	(80.76)	541.9	(81.64)	684
	St Gallen	526.1	(72.31)	564.4	(75.92)	851
	Schaffhausen	537.2	(72.76)	577.7	(84.78)	665
	Thurgau	522	(74.56)	560.5	(75.15)	938
	Zurich	524.7	(76.49)	560.7	(80.00)	764
	Wallis	524.6	(67.45)	551.6	(74.77)	717
Germany	Germany	513.4	(99.90)	521.2	(90.25)	3827
Austria	Austria	502.7	(97.24)	519.9	(86.63)	4232
Belgium	Flemish region	532.8	(93.59)	553.3	(89.47)	4642
	Walloon region	499.2	(96.55)	518.9	(92.02)	2834
Netherlands	Netherlands	521.3	(86.27)	544.9	(81.54)	4254

Source: PISA 2006

[16] Not yet divided in the different educational systems of the German Länder.

Table 3: Summery statistics for each of the countries, un-weighted means and their standard deviations[17]

	ESCS	Female	Grade	Vocational orientation	Higher general	Average ESCS	% Natives	Teacher shortage	Herfindahl index of ESCS	Nr of curricula
Aargau	0.252	0.483	0.026	0.152	0.454	0.148	82.622	-0.119	0.651	1.482
(n=817)	(0.783)	(0.500)	(0.662)	(0.359)	(0.498)	(0.416)	(14.716)	(0.908)	(0.085)	(0.500)
Bern (German)	0.134	0.506	-0.131	0.343	0.243	0.094	90.280	0.008	0.624	2.102
(n=970)	(0.816)	(0.500)	(0.567)	(0.475)	(0.429)	(0.460)	(12.773)	(0.692)	(0.084)	(0.747)
Basel-Landschaft	0.271	0.501	-0.016	0.265	0.338	0.211	84.575	-0.184	0.629	2.680
(n=684)	(0.77)	(0.50)	(0.61)	(0.44)	(0.47)	(0.40)	(13.10)	(0.79)	(0.09)	(0.63)
St Gallen	0.086	0.492	0.003	0.303	0.149	0.017	81.131	-0.381	0.658	1.716
(n=851)	(0.830)	(0.500)	(0.661)	(0.460)	(0.357)	(0.391)	(13.542)	(0.703)	(0.078)	(0.451)
Schaffhausen	0.285	0.490	0.012	0.311	0.217	0.218	82.536	-0.522	0.638	1.471
(n=665)	(0.745)	(0.500)	(0.681)	(0.463)	(0.412)	(0.364)	(13.486)	(0.609)	(0.085)	(0.500)
Thurgau	0.090	0.488	-0.045	0.366	0.084	0.039	86.109	-0.472	0.645	1.751
(n=938)	(0.774)	(0.500)	(0.629)	(0.482)	(0.278)	(0.346)	(12.794)	(0.820)	(0.067)	(0.433)
Zurich	0.298	0.514	-0.096	0.297	0.257	0.192	78.468	-0.149	0.618	1.737
(n=764)	(0.765)	(0.500)	(0.609)	(0.457)	(0.437)	(0.427)	(17.361)	(0.769)	(0.102)	(0.441)
Wallis	0.064	0.491	0.011	0.303	0.432	0.020	89.226	0.365	0.630	1.967
(n=717)	(0.737)	(0.500)	(0.427)	(0.460)	(0.496)	(0.310)	(8.507)	(0.762)	(0.097)	(0.778)
Germany	0.431	0.485	0.059	0.179	0.376	0.360	88.518	0.283	0.657	1.093
(n=3827)	(0.872)	(0.500)	(0.655)	(0.383)	(0.484)	(0.392)	(12.218)	(0.911)	(0.073)	(0.291)
Austria	0.274	0.496	0.035	0.238	0.238	0.222	90.395	-0.374	0.636	1.013
(n=4232)	(0.778)	(0.500)	(0.546)	(0.426)	(0.426)	(0.394)	(10.572)	(0.752)	(0.072)	(0.137)
Flemish region	0.274	0.464	0.034	0.215	0.475	0.253	94.692	-0.030	0.664	1.735
(n=4642)	(0.851)	(0.499)	(0.471)	(0.411)	(0.499)	(0.461)	(8.950)	(0.877)	(0.082)	(0.673)
Walloon region	0.270	0.490	0.090	0.151	0.591	0.237	85.835	1.067	0.660	1.855
(n=2834)	(0.857)	(0.500)	(0.594)	(0.358)	(0.492)	(0.473)	(15.015)	(0.863)	(0.070)	(0.760)
The Netherlands	0.381	0.489	0.033	0.533	0.244	0.322	91.346	0.067	0.665	1.437
(n=4254)	(0.816)	(0.500)	(0.562)	(0.499)	(0.430)	(0.401)	(10.903)	(0.880)	(0.063)	(0.521)

Source: PISA 2006

[17] Not yet divided in the different educational systems of the German Länder.

Table 3 (continued)

	Low selection	High selection	Private Gov. Independent	Private Gov Dependent	Public	Size of school	Student teacher ratio	Teacher shortage	School rural area	School in a city
Aargau	0.027	0.831	0.000	0.000	1.000	354.088	13.716	-0.052	0.955	0.000
	(0.162)	(0.375)	(0.000)	(0.000)	(0.000)	(179.500)	(2.538)	(0.908)	(0.208)	(0.000)
Bern (German)	0.254	0.474	0.037	0.000	0.963	320.078	11.701	-0.034	0.669	0.096
	(0.435)	(0.500)	(0.189)	(0.000)	(0.189)	(216.541)	(1.479)	(0.692)	(0.471)	(0.295)
Basel-Landschaft	0.091	0.605	0.000	0.000	1.000	586.487	11.425	0.009	0.787	0.000
	(0.29)	(0.49)	(0.00)	(0.00)	(0.00)	(294.91)	(1.62)	(0.79)	(0.41)	(0.00)
St Gallen	0.226	0.511	0.000	0.000	1.000	353.724	11.539	-0.007	0.723	0.000
	(0.418)	(0.500)	(0.000)	(0.000)	(0.000)	(237.469)	(1.331)	(0.703)	(0.448)	(0.000)
Schaffhausen	0.080	0.531	0.000	0.000	1.000	321.753	10.626	-0.058	0.412	0.000
	(0.271)	(0.499)	(0.000)	(0.000)	(0.000)	(240.280)	(2.255)	(0.609)	(0.493)	(0.000)
Thurgau	0.237	0.384	0.000	0.009	0.991	254.359	12.343	-0.036	0.890	0.000
	(0.425)	(0.487)	(0.000)	(0.092)	(0.092)	(172.372)	(1.595)	(0.820)	(0.313)	(0.000)
Zurich	0.187	0.432	0.000	0.048	0.952	409.040	11.181	-0.001	0.513	0.213
	(0.390)	(0.496)	(0.000)	(0.215)	(0.215)	(268.882)	(2.047)	(0.769)	(0.500)	(0.410)
Wallis	0.346	0.402	0.000	0.000	1.000	795.298	12.939	-0.001	0.693	0.000
	(0.476)	(0.491)	(0.000)	(0.000)	(0.000)	(478.665)	(1.560)	(0.762)	(0.462)	(0.000)
Germany	0.174	0.254	0.002	0.089	0.909	661.678	17.222	-0.072	0.321	0.210
	(0.379)	(0.435)	(0.046)	(0.285)	(0.288)	(343.231)	(4.512)	(0.911)	(0.467)	(0.407)
Austria	0.216	0.497	0.000	0.079	0.921	547.861	11.776	-0.005	0.481	0.284
	(0.411)	(0.500)	(0.000)	(0.270)	(0.270)	(415.053)	(6.835)	(0.752)	(0.500)	(0.451)
Flemish region	0.308	0.146	0.067	0.691	0.241	661.637	8.829	-0.017	0.300	0.109
	(0.462)	(0.353)	(0.251)	(0.462)	(0.428)	(298.216)	(2.771)	(0.877)	(0.458)	(0.312)
Walloon region	0.372	0.062	0.022	0.586	0.392	796.510	10.066	-0.022	0.294	0.210
	(0.483)	(0.242)	(0.146)	(0.493)	(0.488)	(284.576)	(2.854)	(0.863)	(0.455)	(0.407)
The Netherlands	0.012	0.545	0.000	0.693	0.307	1062.763	16.109	-0.015	0.191	0.211
	(0.109)	(0.498)	(0.000)	(0.461)	(0.461)	(538.064)	(3.929)	(0.880)	(0.393)	(0.408)

Table 4: The effects of individual, curriculum level and school level characteristics on reading scores of native pupils (Nr of nation-states = 5; Nr educational systems=13, Nr of schools= 1095, Nr of curricula= 1576, Nr of students=26195)

	Model 0[18]		**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Constant	490.2***	(6.469)	479.1***	(6.521)	480.2***	(6.484)	411.9***	(15.72)	486.5***	(8.225)	477.9***	(5.248)
Educational systems dummies												
Dummy Flanders	41.22***	(7.859)	41.85***	(7.526)	42.25***	(7.084)	33.20***	(5.693)	42.20***	(7.085)	38.65***	(6.726)
Dummy Netherlands	34.32*	(14.38)	32.92*	(14.47)	32.79*	(14.40)	8.781	(19.67)	32.81*	(14.48)	22.11*	(10.61)
Individual characteristics												
ESCS			6.618***	(0.497)	5.973***	(0.487)	4.831***	(0.490)	5.968***	(0.487)	5.955***	(0.487)
Gender (ref. male)			20.56***	(0.774)	20.05***	(0.759)	20.04***	(0.756)	20.05***	(0.759)	20.02***	(0.758)
Grade					22.95***	(0.671)	22.90***	(0.668)	22.94***	(0.671)	22.97***	(0.671)
Track of pupil												
Vocational												
Higher general (ref. medium)												
Curriculum features												
Average ESCS							99.67***	(3.264)				
Herfindahlindex of ESCS							47.38**	(15.06)				
% natives							0.302***	(0.089)				
School features												
Nr of curricula									-4.156	(3.310)		
Low selection											-16.77***	(4.981)
High selection											22.68***	(4.419)
Private Gov. Independent												
Private Gov. Dependent												
Teacher shortage												
School size												
Rural												
City (ref. Town)												
Variation												
SD nation-state	11.77***	(4.545)	11.96***	(4.503)	12.00***	(4.442)	17.23***	(5.640)	12.08***	(4.414)	8.226***	(3.460)
SD educational system	0.00270	(0.152)	0.00405	(0.148)	0.00110	(0.0068)	0.00567	(0.204)	0.000960	(0.0066)	0.000188	(0.0011)
SD school	44.25***	(4.368)	41.51***	(4.321)	35.63***	(5.127)	30.80***	(2.314)	35.62***	(4.864)	35.41***	(4.380)
SD curriculum	60.17***	(2.734)	57.86***	(2.669)	57.71***	(2.841)	38.30***	(1.638)	57.67***	(2.720)	56.45***	(2.507)
SD pupils	56.99***	(0.257)	56.21***	(0.254)	55.06***	(0.248)	55.09***	(0.249)	55.06***	(0.248)	55.06***	(0.251)
="* p<0.05 ** p<0.01 *** p<0.001"												

Sources: PISA 2006

[18] Standard deviations are indicated in parenthesis.

Table 4 (continued)

	Model 6		**Model 7**		**Model 8**		**Model 9**		**Model 10**	
Constant	478.1***	(7.506)	483.8***	(4.476)	444.5***	(11.20)	489.2***	(10.33)	442.2***	(14.45)
Educational systems dummies										
Dummy Flanders	41.15***	(7.210)	27.20***	(6.859)	53.18***	(6.850)	47.19***	(11.56)	32.99*	(15.82)
Dummy Netherlands	28.67	(16.72)	30.74**	(9.826)	-0.0628	(24.36)	43.47	(23.27)	14.78	(23.35)
Individual characteristics										
ESCS	5.962***	(0.487)	5.964***	(0.487)	5.899***	(0.487)	5.291***	(0.486)	4.661***	(0.489)
Gender (1=female)	20.05***	(0.759)	20.02***	(0.758)	20.13***	(0.758)	19.88***	(0.752)	19.87***	(0.752)
Grade	22.95***	(0.671)	22.91***	(0.671)	22.86***	(0.671)	22.91***	(0.661)	22.84***	(0.661)
Track of pupil										
Vocational track							-72.31***	(1.678)	-56.45***	(2.042)
Higher general (ref. medium)							49.29***	(1.926)	39.34***	(2.138)
Curriculum features										
Average ESCS									32.30***	(3.128)
Herfindahl index ESCS									18.87	(10.27)
% Natives									0.197**	(0.0743)
School features										
Low selection									-9.102*	(3.563)
High selection									10.91***	(3.138)
Private Gov Independent	23.84	(16.86)							-6.184	(11.86)
Private Gov Dependent	9.483	(5.264)							2.243	(3.716)
Ref. Public										
Teacher's shortage			-13.18***	(2.088)					-5.231***	(1.529)
School size					0.0624***	(0.00488)			0.0217***	(0.00370)
School in rural area									5.015	(3.275)
School in a city (ref. Town)									-4.280	(3.744)
Variation										
SD nation-state	14.04***	(5.132)	7.492***	(3.258)	21.21***	(7.061)	19.21***	(6.808)	17.28***	(6.717)
SD educational system	0.00183	(0.140)	0.00235	(0.134)	0.00110	(0.00752)	7.302**	(4.552)	11.29***	(4.028)
SD school	35.25***	(4.935)	34.42***	(4.838)	30.63***	(4.551)	45.21***	(1.295)	38.36***	(1.284)
SD curriculum	57.75***	(2.736)	57.49***	(2.661)	56.23***	(2.394)	13.60***	(1.257)	15.18***	(1.330)
SD individual	55.06***	(0.248)	55.06***	(0.248)	55.06***	(0.249)	55.13***	(0.249)	55.13***	(0.249)

Table 5: The effects of individual, curriculum level and school level characteristics on mathematics scores of native pupils (Nr of nation-states = 5; Nr educational systems=13, Nr of schools= 1095, Nr of curricula = 1576, Nr of students=26195)

	Model 0		**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
Constant	508.5***	(9.147)	519.1***	(9.129)	520.5***	(8.999)	442.6***	(17.28)	534.0***	(93.40)	531.4***	(10.32)
Educational systems dummies												
Dummy Flanders	45.17***	(6.569)	44.25***	(6.463)	43.80***	(6.129)	29.73*	(12.18)	10.24	(0.60)	43.19***	(6.131)
Dummy Netherlands	47.98*	(20.39)	45.95*	(20.34)	44.84*	(20.05)	14.02	(27.63)	19.47	(1.14)	44.90*	(20.72)
Individual characteristics												
ESCS			7.465***	(0.470)	6.876***	(0.461)	5.778***	(0.464)	6.859***	(14.87)	6.871***	(0.461)
Gender (1=female)			-24.73***	(0.732)	-25.22***	(0.718)	-25.34***	(0.715)	-25.25***	(-35.19)	-25.21***	(0.718)
Grade					21.13***	(0.635)	21.01***	(0.632)	21.14***	(33.28)	21.11***	(0.635)
Track of pupil												
Vocational track												
Higher general (ref. medium)												
Curriculum features												
ECSC of curriculum							96.91***	(3.034)				
Herfindahl index of ESCS							61.39***	(14.21)				
% Natives							0.344***	(0.0832)				
School features												
Number of curricula											-6.934*	(2.856)
Private Gov Independent												
Private Gov Dependent												
Teacher shortage												
School size												
Low selection									-15.90***	(-3.66)		
High selection (ref:moderate)									20.05***	(5.12)		
Variation												
SD nation-state	17.70***	(5.924)	17.67***	(5.904)	17.46***	(5.799)	23.20***	(7.793)			18.08***	(5.969)
SD educational system	0.00001	(0.0015)	0.000005	(0.000)	0.0000**	(0.0000)	8.100***	(3.429)	2.751***[19]	(11.83)	0.000	(0.007)
SD school	6.246	(19.18)	11.09	(17.50)	0.001***	(0.0000)	20.36***	(2.765)	2.101	(0.92)	0.0316	(1.584)
SD curricula	67.48***	(2.381)	65.12***	(3.183)	63.27***	(1.215)	39.64***	(1.500)	4.120***	(93.36)	63.14***	(1.218)
SD pupils	54.61***	(0.246)	53.13***	(0.240)	52.12***	(0.235)	52.13***	(0.235)	3.954***	(876.56)	52.12***	(0.235)

Source: PISA 2006

[19] Due to computational time for this particular model we decided to leave out the highest level.

Table 5 (continued)

	Model 6		**Model 7**		**Model 8**		**Model 9**		**Model 10**	
Constant	517.8***	(10.11)	523.2***	(7.324)	488.0***	(13.41)	530.3***	(13.71)	470.3***	(16.57)
Educational systems dummies										
Dummy Flanders	42.00***	(6.168)	32.11***	(6.382)	48.72***	(12.73)	43.37*	(19.55)	32.47	(22.31)
Dummy Netherlands	39.24	(22.55)	43.09**	(16.26)	10.27	(29.83)	46.45	(31.44)	19.61	(32.07)
Individual characteristics										
ECSC	6.861***	(0.461)	6.865***	(0.461)	6.817***	(0.461)	6.286***	(0.459)	5.609***	(0.462)
Gender (1=female)	-25.22***	(0.718)	-25.25***	(0.718)	-25.15***	(0.717)	-25.56***	(0.711)	-25.65***	(0.709)
Grade	21.13***	(0.635)	21.08***	(0.635)	21.03***	(0.635)	21.06***	(0.625)	20.93***	(0.623)
Track of pupil										
Vocational orientation							-73.23***	(1.655)	-57.61***	(1.918)
Higher general (ref: medium)							59.49***	(1.856)	48.98***	(2.016)
Curriculum features										
Average ESCS									29.33***	(2.773)
Herfindahl index ESCS									28.77**	(9.500)
% Natives									0.259***	(0.0654)
School features										
Nr if curricula within school										
Private Gov Independent	29.99*	(14.39)							-0.304	(9.092)
Private Gov Dep (ref. Public)	12.47**	(4.594)							5.479	(2.874)
Teacher shortage			-9.739***	(1.876)					-2.039	(1.187)
School size					0.0591***	(0.00436)			0.0196***	(0.00290)
Low selection									-7.690**	(2.749)
High selection (ref: moderate)									10.48***	(2.427)
School in rural area									8.586***	(2.538)
School in the city (ref. town)									-6.431*	(2.918)
Variation										
SD nation-states	19.66***	(6.522)	13.96***	(4.753)	25.04***	(8.548)	24.32***	(8.986)	23.45***	(9.099)
SD educational system	0.0000*	(0.00000)	0.00000*	(0.0000)	8.227***	(4.547)	14.22***	(4.316)	16.67***	(4.499)
SD School	0.0001***	(0.0000)	0.0017***	(0.00133)	0.0166***	(0.0127)	33.24***	(1.169)	26.79***	(1.206)
SD Curriculum	63.02***	(1.211)	62.77***	(1.206)	59.56***	(1.155)	15.60***	(1.218)	16.69***	(1.242)
SD Individual	52.12***	(0.235)	52.12***	(0.235)	52.12***	(0.235)	52.16***	(0.235)	52.14***	(0.235)

Table 6: Multi level analysis with interaction terms, Reading performance, N=26195. (T-values in parentheses).

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	414.5***	411.0***	411.5***	436.2***	475.5***
	(23.93)	(25.46)	(26.05)	(34.98)	(91.95)
Curriculum features[20]					
Average ESCS	99.74***	99.70***	101.8***		
	(30.41)	(30.49)	(25.66)		
% Native students	0.300***	0.312**	0.294**		
	(3.34)	(3.17)	(3.27)		
Herfindahlindex of ESCS	43.48*	47.47**	48.48**		
	(2.35)	(3.15)	(3.20)		
School level					
High selection					30.87***
					(5.68)
Low selection					-16.84**
					(-2.87)
School size				0.0771***	
				(11.35)	
Country dummies					
Dummy NL	-4.115	12.44	9.066	24.86	31.94**
	(-0.10)	(0.42)	(0.45)	(0.88)	(2.80)
Dummy VLA	27.97	38.11	34.45***	75.13***	41.15***
	(1.21)	(1.41)	(5.94)	(6.20)	(4.92)
Interactions					
Dummy VLA*Average ESCS			-8.395		
			(-1.14)		
Dummy NL*Average ESCS			-2.073		
			(-0.24)		
Dummy VLA* Herfindahlindex	8.100				
	(0.23)				
Dummy NL*Herfindahlindex	19.54				
	(0.37)				
Dummy VLA*%native students		-0.0541			
		(-0.19)			
Dummy NL* % native students		-0.0417			
		(-0.16)			
Dummy VLA*Low selection					7.571
					(0.65)
Dummy NL*Low selection					-78.85
					(-1.63)
Dummy VLA*school size				-0.0308*	
				(-2.05)	
Dummy NL* School size				-0.0295**	
				(-2.79)	
Dummy NL*High selection					-20.08
					(-1.88)
Dummy VLA*High selection					-38.22**
					(-2.64)

[20] In these models we also control for individual characteristics, namely for ESCS, Grade and Gender

Table 6 (continued)

Variation					
Log SD nation-states	2.845***	2.847***	2.855***	3.148***	2.000***
	(8.69)	(8.70)	(8.72)	(9.51)	(4.52)
Log SD educational systems	-5.640	-5.092	-7.660	-8.800	-6.220
	(-0.10)	(-0.16)	(-1.12)	(-1.40)	(-0.07)
Log SD Schools	3.427***	3.428***	3.430***	3.411***	3.574***
	(45.50)	(45.62)	(45.46)	(22.57)	(30.36)
Log SD curricula	3.645***	3.645***	3.643***	4.028***	4.025***
	(85.06)	(85.17)	(84.32)	(94.43)	(92.36)
Log SD individuals	4.009***	4.009***	4.009***	4.008***	4.009***
	(887.93)	(887.94)	(887.71)	(888.41)	(888.21)

T statistics in parenthesis $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$; Source: PISA 2006