Factors influencing reading achievement in Germany and Spain: Evidence from PISA 2000

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This article examines the factors fostering and inhibiting student achievement in Germany and Spain at the 15-year-old level in the OECD Programme on International Student Assessment (PISA) in 2000. Both countries performed significantly below the OECD average not only in Reading but also in Mathematics and Science on this occasion. Since the two countries are similar in average levels of student achievement, it is of interest to consider whether similar patterns exist in the ways in which factors operate to influence student achievement in these two countries. Preliminary analyses were carried out with PLSPATH and subsequent two-level models were analysed separately using Hierarchical Linear Modelling (HLM) software. Some similar factors influenced reading achievement in the two countries, but substantial differences in explaining reading achievement were also found. Much of the difference between the two systems arise from the large components of variance in Germany at the school level and in Spain at the between student within school level. Thus efforts to improve reading achievement should focus in Germany on low performing schools, whereas, in Spain remedial programs should be directed towards increased assistance at the individual student level in many of the schools.

Hierarchical linear modelling, reading achievement, secondary school level,
cross-national comparisons

INTRODUCTION

In 2000, the Organisation for Economic Co-operation and Development (OECD) spearheaded a new approach to collect, on a regular basis, achievement data from students among its member states.

The primary aim of the OECD Programme on International Student Assessment (PISA) was to compare students at a given level of schooling in key subjects, such as Mathematics, Reading and Science across countries. The information gained from these educational indicators, it was reasoned, would allow for a direct comparison of student performance between OECD countries. Moreover, if collected at regular intervals (currently set to three years), the educational indicators may be related to economic and social indicators and are, thus, an important instrument for economic forecasting and planning.

While these principal objectives have certainly been the main drive behind the establishment of PISA, another, equally important set of questions arises from the student achievement data themselves: which are the reasons why students do perform as they do, namely average or below or above average?

In order to answer these questions background data are required to explain student achievement. Such background data typically encompass information about students' home environment, their attitudes or expectations as well as teacher- and school-related factors. For cross-national comparisons it may also be helpful to include country-level data, for example, the percentage of GDP spent on education, which usually does not vary within a country but which can contribute to explaining differences in student achievement between countries.

The PISA study was designed not so much to focus on the factors leading to student performance but, rather, to measure and compare student performance itself. Still, the international data sets released by the OECD from the year 2000 data collection contain a number of student and school level background variables and scales which can be used to address the issue of why students in a particular country performed at a particular level.

This article takes a closer look at factors fostering or inhibiting student achievement in Reading in Germany and Spain at the 15-year-old level, the PISA target population. According to the PISA results (OECD 2001, 2003b; Adams and Wu, 2002), both countries performed significantly below the OECD average of 500 with Germany achieving at 484 and Spain at 493 in Reading, putting them between ranks 17 and 25 of 32 countries. Likewise, both countries performed significantly below the OECD average in Mathematics (Germany: 490; Spain: 476) and Science (Germany: 487; Spain: 491). As the two countries are similar in average student performance, it is of interest to examine whether or not patterns of the way in which factors operate to influence student achievement in the two countries are also similar.

THE DATA

The data used to examine ways in which background factors operate to influence student achievement in Germany and Spain have been taken from the publicly available PISA website (www.pisa.oecd.org). As the study did not obtain data from teachers, it was possible to investigate variables only at two levels, namely the student and school level. Table 1 lists the number of cases in the international PISA data sets for Germany and Spain.

Table 1. Number of cases for Germany and Spain

Germany		Spain	
Student level	School level	Student level	School level
5073	219	6214	185

THE ANALYSES

Based on results from previous analyses of student and school factors influencing student achievement in reading (Elley, 1994; Lundberg and Linnakylä, 1993; Lietz, 1996; Purves, 1973), factors and scales which were assumed to have an effect on reading achievement were extracted from the student and school data sets for the two countries. Another criterion for selecting variables for analysis was that the main aim of the analysis was to compare patterns of effects of factors influencing reading achievement in Germany and Spain rather than to optimise explained variance within each country. Thus, variables considered for inclusion in the analysis had to be available in both countries.

As a first step, descriptive statistics were run across the selected variables to check for missing data and to examine the frequency distributions. As the next step, single level path models, separately for Germany and Spain and separately for the student and school level, were hypothesised based on prior research on school achievement (Keeves, 1991; Kotte, 1992; Lietz, 1996) and analysed using partial least squares (PLS) analysis. For these preliminary analyses PLSPATH (Sellin, 1990) was used.

These exploratory PLS analyses served two purposes. First, they examined which of the hypothesised relationships between the predicting constructs as well as between the predictors and reading achievement in each country emerged in the two data sets. Second, using PLSPATH it was possible to identify to what degree a construct operated directly and indirectly to affect reading achievement in each country. Only those relationships between constructs with a direct effect of |0.10| on any other construct in the model were considered sufficiently substantial to be retained in the subsequent hierarchical analyses. Table 2 lists the student- and school-level constructs that were retained for the subsequent analyses.

A two level hierarchical linear model was then specified on the basis of these preliminary results. This two-level model was analysed separately for Germany and for Spain using Hierarchical Linear Modeling (HLM) software (HLM-5: Raudenbush, Bryk, Cheong and Congdon, 2000).

Using common cut-off criteria (Kotte, 1992; Lietz, 1996; Lietz and Kotte, 2000) final HLM models were estimated for the two countries (for a more detailed discussion on the statistical algorithms of HLM-5, see Raudenbush and Bryk, 2002). Any fixed effect with $\gamma<|0.05|$ was omitted from the final model. In addition, fixed effects with a p-value >0.05 were generally discarded as being not meaningful.

RESULTS

In this section, results of the two-level HLM analyses of the two data sets are reported, first for Germany and followed by Spain. In the last part of this section, results for the two countries are compared.

Two-level HLM model of reading achievement for Germany

Figure 1 illustrates the direct effects that emerge from the HLM analyses in terms of the direct effects of student and school level constructs on reading achievement in Germany. As can be seen, a number of factors operate at the student level while others operate at the school level.

Thus, reading achievement (READACH) is influenced directly at the student level by CLSSIZE (γ=0.16), GRADE (γ=0.13), SELF (γ=0.11), READINT (γ=0.07), POSS (γ=0.07), SES (γ=0.06) and MISS (γ=−0.06).

At the school level, eight different factors have an effect on READACH, namely ASSESS (γ=0.24), SCHCLIM (γ=−0.22), PRIMARY (γ=−0.17), PARTTIME (γ=0.17), RATCOMP (γ=−0.14), ACCESS (γ=0.13), IMPACH (γ=−0.10) and SCMATEDU (γ=−0.09). Table 3 displays the final estimation of fixed and interaction effects for the two-level HLM model for Germany.

At the student level, class size emerges as the strongest predictor of reading achievement (γ=0.16), while the grade a student is enrolled at (γ=0.13) and a student's self-perception (γ=0.11) show similar effect sizes. Smaller effects are observed with respect to home possessions (γ=0.07), the student's interest in reading (γ=0.07), the socio-economic status (γ=0.06) and absenteeism from school (γ=-0.06). With the exception of absenteeism, all effects have a positive impact on reading achievement. In other words, students:

- in larger classes;
- who are enrolled in a higher grade (ie, non-repeaters);
- who exhibit higher self-concept;
- who show more interest in reading;
- who come from homes with a higher socio-economic status; and
- who attend school more regularly than others,

can be expected, overall, to read better in Germany.

Table 2. Student and school-level constructs extracted for further analyses using PLSPATH

Student-level constructs		
Construct	**Variable(s) used to form construct (PISA variable name)**	**Coding/comment**
GRADE	Grade student is enrolled at (ST02Q01)	8=Grade 8, 9=Grade 9, 10=Grade 10
MISS	In the previous two school weeks, how many times student: Absent from school (ST29Q01) Late for school (ST29Q03), Time spent on homework (HMWKTIME*)	Scale/factor score based on the three variables; high value denotes high degree of absenteeism/low commitment
POSS	PISA index of home educational resources based on student reports on availability and number of the following in their home: dictionary, quiet place to study, own desk, text books, calculators (HEDRES*)	Rasch scaled index which is a weighted maximum likelihood estimate whereby a high value denotes availability/greater number of these resources*
READINT	PISA index denoting engagement in reading based on responses to 9 questions ranging from *I read only if I have to* to *Reading is one of my favourite hobbies* (JOYREAD*) PISA index denoting interest in reading based on responses to 3 questions ranging from, *I read in my spare time,* to *When I read I sometimes get totally absorbed* (INTREA*)	Scale/factor score based on the two indexes; high value denotes high interest in reading
CLSSIZE	Students' reports of the number of students in each of their Language, Maths and Science classes (ST28Q01-ST28Q03)	Higher values denote more students
SELF	Verbal self-concept (SCVERB), general academic ability (SCACAD), control strategies (CSTRAT), elaboration activities (ELAB), perceived self-efficacy (SELFEF)	Scale/factor score based on the 5 indexes; high value means high degree of self-concept/learning strategies
SES	Mother's main job (BMMJ) Father's main job (BFMJ) Educational level of mother (MISCED) and father (FISCED) Number of books at home (ST37Q01)	Scale/factor score based on five variables; high value denotes high socio-economic status
SEX	Student gender (ST03Q01)	1=female, 2=male
READACH	Reading achievement (PV1READ)	Rasch scaled reading score: Range: 0-1000, midpoint 500

School-level constructs		
ACCESS	Access to reading resources	Scale/factor score; high value denotes good access to reading resources
ASSESS	Assessment policy (school emphasises assessing students)	Scale/factor score; high value denotes strong emph. on assessm. by the school
IMPACH	Importance attached to achievement as reflected in principal's perception of frequency of student assessment through assignments/projects/ homework, freq. of performance reports to parents, teacher valuing academic achievement	Scale/factor score; high value denotes high importance attached to achievement by the school
LESSON	Number of lessons of instruction per week	
PARTTIME	Number of part-time teachers at school	
PRIMARY	School contains primary section	0=school without primary section; 1=school with primary (Grades 1-4)
PUBLIC	Public/private school	Dummy variable: 0=not public, 1=public
RATCOMP	Ratio of computers per student	
SCHCLIM	Principal's perception of a) extent to which student learning is hindered by lack of parental support, b) students coming from poor home environments, c) absenteeism and d) lack of respect	Scale/factor score; high value denotes poor school climate with bullying of students, high absenteeism, and principals concern reg. teacher-related variables hindering student performance
SCHSEX	Proportion of male/female students	
SCHSIZE	Size of school	Number of students enrolled in school
SCMATEDU	Instructional resources	Scale/factor score; high value denotes higher quality of instr. resources in school
TCHPARTI	Teacher participation in school affairs	Scale/factor score; high value denotes intensive teacher particip. in school

Notes: All variables were standardised with a mean of 0 and a standard deviation of 1; Data on variables forming "SELF" not collected in Spain; * for further details see Adams and Wu (2002).
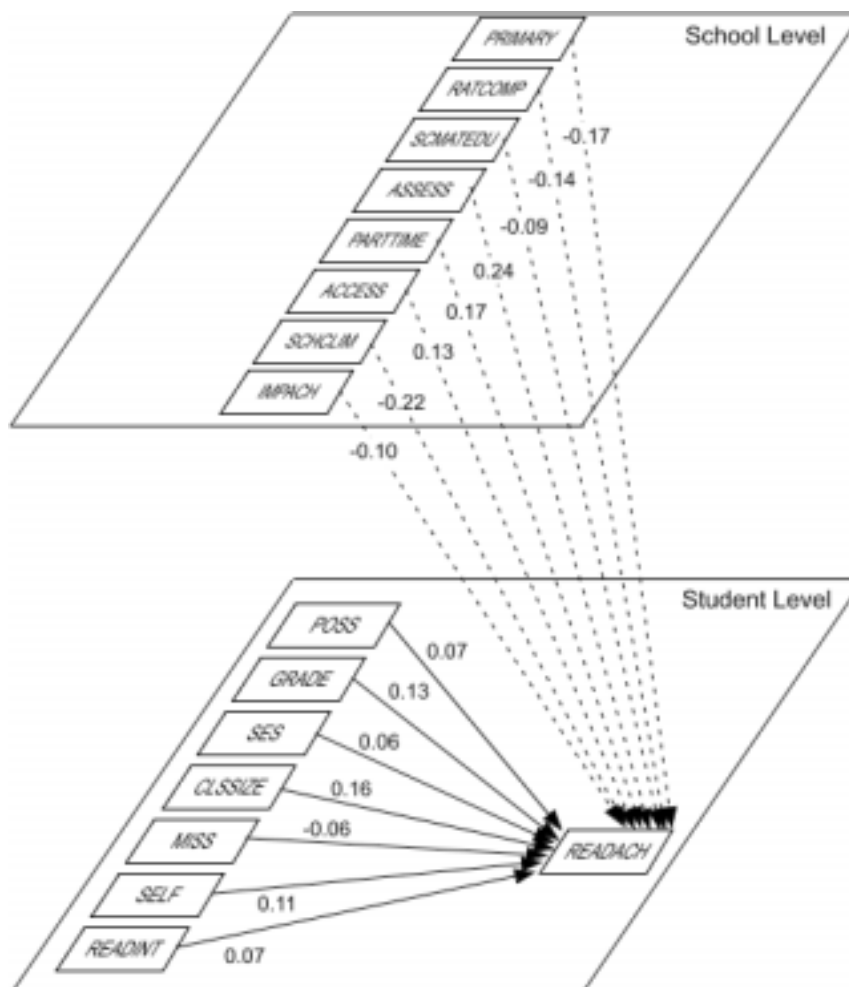
Note: For reasons of clarity, only direct effects are displayed. For interaction effects, please refer to Table 3.

Figure 1. Final two-level HLM model for Germany for reading achievement

It may be somewhat surprising that socio-economic status which includes the number of books in the home and the educational level of parents does not have a stronger influence on reading achievement. However, this effect has to be viewed in conjunction with the effect of POSS, that is the possessions in the home, on achievement. Taken together, these factors reflect the important impact of the wealth and educational human and material resources of the home on reading achievement.

It should be noted that the variables, Class size and Grade are disaggregated from the class to the student level where they have significant effects that would be lost if these variables were aggregated to the school level or ignored. This is less than optimal in the construction of the model.

It is interesting to find that the class size matters when it comes to reading achievement. Prior research on the issue has been inconclusive, with some studies showing higher performance for students in larger classes (Larkin and Keeves, 1984) and *vice versa* (Glass and Smith, 1978). Results of the two-level HLM analysis for Germany provide supportive evidence for the fact that 15-year-old students in larger classes perform at a higher level in reading, once other important factors at the student and school levels, such as home background, reading interest and school selection procedures and staffing levels have been taken into account. Moreover, this may reflect the fact that, in Germany, students of lower academic performance are placed in smaller instructional groups in order to enable teachers to address the special needs of those students.

Table 3. Final estimation of fixed and interaction effects; two-level HLM model for Germany for reading achievement

Fixed Effects on READACH	γ-coefficient	Standard error	t-ratio	p-value
Level 1/Student-level effects				
POSS	0.07	0.01	8.87	0.000
GRADE	0.13	0.01	13.28	0.000
SES	0.06	0.01	5.50	0.000
CLSSIZE	0.16	0.01	12.34	0.000
MISS	-0.06	0.01	-6.54	0.000
>> by PRIMARY on MISS	0.03	0.01	3.56	0.001
>> by TCHPARTI on MISS	0.03	0.01	2.92	0.004
>> by SCHCLIM on MISS	0.03	0.01	3.73	0.000
>> by IMPACH on MISS	-0.03	0.01	-3.08	0.003
SELF	0.11	0.01	11.24	0.000
>> by PUBLIC on SELF	-0.08	0.01	-9.97	0.000
>> by SCHSEX on SELF	0.03	0.01	6.03	0.000
>> by RATCOMP on SELF	-0.06	0.01	-5.73	0.000
>> by ACCESS on SELF	-0.03	0.01	-2.84	0.005
READINT	0.07	0.01	6.52	0.000
>> by PUBLIC on READINT	0.15	0.01	17.33	0.000
>> by RATCOMP on READINT	0.03	0.01	5.18	0.000
>> by PARTTIME on READINT	0.04	0.01	3.55	0.001
>> by SCHCLIM on READINT	-0.04	0.01	-3.54	0.001
Level 2/School-level effects				
PRIMARY	-0.17	0.04	-4.39	0.000
RATCOMP	-0.14	0.04	-3.20	0.002
SCMATEDU	-0.09	0.04	-2.19	0.028
ASSESS	0.24	0.04	5.66	0.000
PARTTIME	0.17	0.04	4.43	0.000
ACCESS	0.13	0.04	3.21	0.002
SCHCLIM	-0.22	0.04	-5.08	0.000
IMPACH	-0.10	0.04	-2.42	0.016

Notes: for further information see Raudenbush and Bryk (2002)
        >> Interaction effect

With regards to school effects, the two strongest predictors of reading achievement include clearly the extent to which assessments are used for instructional purposes (γ=0.24) and the school climate (γ=-0.22). The negative effect of school climate indicates that students in schools with more helpful home environments and more supportive teachers perform at a higher level in reading.

Results appear to indicate that schools which comprise primary grades perform lower in reading than those without primary grades (that is, Grade 1 to 4; γ=-0.17). This, however, seems to be an artefact for the type of school. Typically, academically oriented schools in Germany (Gymnasien) do not include primary grades while this, often, is the case for secondary schools that prepare students for a more general or vocational education (that is, Hauptschulen/ Realschulen).

Further to this, the number of part-time teachers in a school has a positive impact on reading (γ=0.16). Generally, a secondary school in Germany would contain a high number of part-time staff if the enrolment of students is high, since the student-teacher ratio is pre-defined by the school authorities and budgetary constraints. Still, there is no ready explanation why the presence of part-time staff plays a positive role for reading achievement. It may be hypothesised that part-time staff – often hired among recent graduates who are unable to obtain desired employment due to rigid bureaucracy – are still unaffected by teaching routines of day-to-day schooling and are

more flexible to experiment with different tasks and exercises intended at raising student reading interest and reading performance.

Factors with less pronounced effects on reading achievement at the school level cover the ratio of computers per students in a school (γ=-0.14), the access to reading resources (γ=0.13), and the quality of a school's educational resources, though negatively (γ=-0.09). Thus, while the availability of reading resources stimulates reading achievement, PCs and other educational resources may not be so favourable in the context of developing reading comprehension. Computers at school, it may be argued, are more likely to form a distraction and draw the attention of students to anything else but reading. Instead of using PCs for instructional purposes students might be tempted to play games, use chat rooms or surf the internet.

The importance teachers place on achievement at school seemingly has a small negative effect on students' performance in reading (γ=-0.10). In other words, the extent to which principals say that teachers in their schools value assessment, monitor students through assignments, projects and homework and inform parents about student performance appears to influence achievement negatively. While this effect seems counter-intuitive, it must be noted that it emerges after the positive effect of using assessment for instructional purposes has been taken into account.

As can be seen from Table 3, the two-level model for reading achievement also contains several so-called 'interaction effects'. In the framework of this research project such effects indicate a possible causal relationship of a particular school-level variable on the relationship between a student-level variable and the outcome variable. As an example, the effect of a construct operating at the student-level (say, READINT) on READACH is itself influenced by, for example, PUBLIC, a school-level factor. Indeed, this interaction effect PUBLIC>>READINT emerged as remarkably strong with γ=0.15: Whether students took an interest in reading and, thus, performed at a higher level was positively affected when the students were enrolled in a private school.

Due to their strengths (γ>0.05), two other interaction effects are worth noting here. Both interaction effects are found to operate negatively on SELF, namely PUBLIC>>SELF (γ=-0.08) and RATCOMP>>SELF (γ=-0.06). The positive effect self-perception has on reading achievement is lessened for students enrolled in schools that are (a) private; and (b) have a higher ratio of computers. For reasons of clarity it should be added that, overall, the German secondary education systems only comprised a relatively small number of private schools (less than five per cent).

In summary, students in Germany can expect a higher score in reading achievement when their school:

- uses assessment for instructional purposes;
- is not hindered by poor home environments or lack of parental support;
- is academically oriented (Gymnasien);
- has a larger number of part-time teaching staff; and
- offers ready access to books and magazines.

Two-level HLM model of reading achievement for Spain

As was the case for Germany, a two-level HLM model was analysed using the international data set for Spain obtained as part of the PISA 2000 data collection. Table 4 lists the different factors influencing reading achievement at the student and school level.

As illustrated in Figure 2, five factors, namely GRADE, SES, READINT, MISS and SEX influence directly reading achievement at the student level. Of these, three path coefficients are relatively strong: GRADE (γ=0.31), SES (γ=0.24) and READINT (γ=0.21). In addition, MISS

shows a negative effect on READACH (γ=-0.11) while the small negative gender effect (γ=-0.07) indicates that girls performed at a higher level than boys (female=1; male=2), once other factors such as reading interest, grade level and home background are taken into consideration.
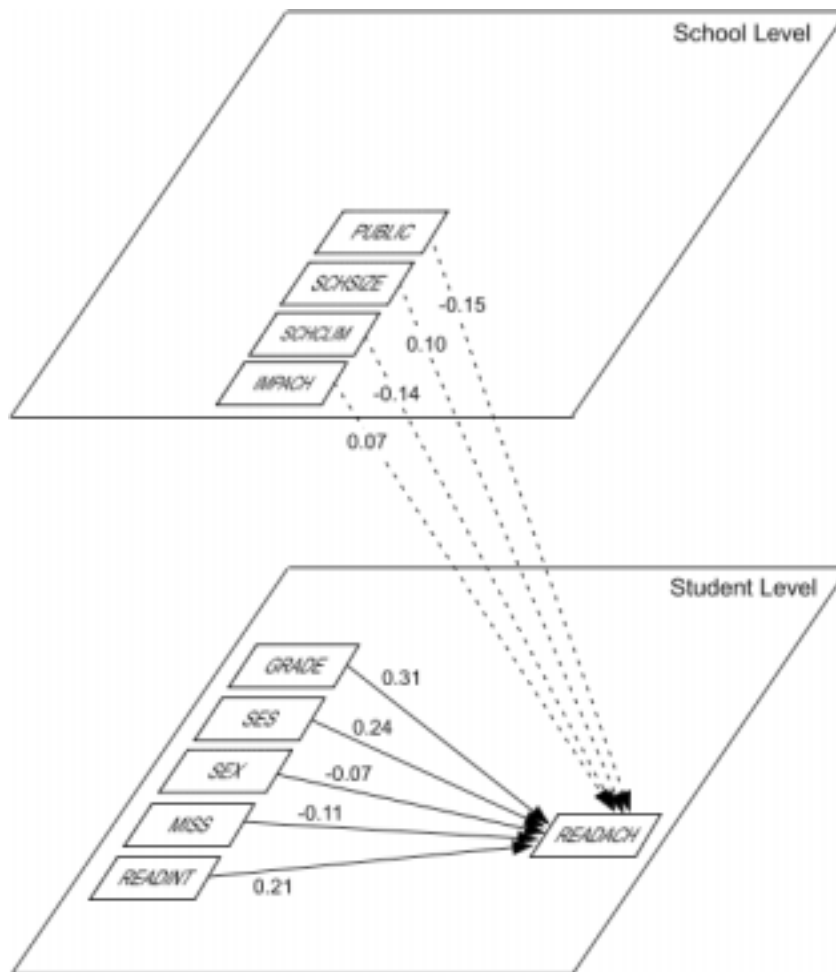
Note: For reasons of clarity, direct effects only are displayed. For interaction effects refer to Table 4.

Figure 2. Final two-level HLM model for Spain for reading achievement

The grade a student is enrolled at (γ=0.31) has, by far, the most influential effect on reading achievement. According to the Spanish educational legislation, effective until the academic year 2002-03, students are to repeat a grade during secondary education only as a result of the joint decision of all teachers and the subsequent parents' authorisation. For this reason, repeaters are generally those students involved in a nearly irreversible dissociation process from the education system.

Socio-economic status (γ=0.24) and interest and enjoyment in reading (γ=0.21) have a considerable influence on reading. In relation to socio-economic status it is interesting to add that among OECD countries Spain shows a high heterogeneity with respect to occupation (ILO 2003) and educational levels (OECD 2003a).

The two lowest predictors of reading achievement at the student level include MISS (γ=-0.11) and SEX (γ=-0.07). The negative effect of MISS indicates that students who are not attending class, being late for school or not doing homework, perform lower in reading. In relation to gender, the result means that girls obtain a noticeably higher score than boys, once other important factors have been taken into account.

Table 4. Final estimation of fixed and interaction effects; two-level HLM model for Spain for reading achievement

Fixed Effects on READACH	γ-coefficient	Standard error	t-ratio	p-value
Level 1/Student-level effects				
SEX	-0.07	0.01	6.94	0.000
GRADE	0.31	0.01	27.46	0.000
READINT	0.21	0.01	18.34	0.000
by SCHSIZE on READINT	0.03	0.01	2.80	0.005
SES	0.24	0.01	20.14	0.000
MISS	-0.11	0.01	-9.64	0.000
>> by PRIMARY on MISS	-0.03	0.01	-2.41	0.016
>> by LESSON on MISS	0.03	0.01	2.36	0.018
>> by RATCOMP on MISS	0.04	0.01	2.87	0.005
>> by PARTTIME on MISS	-0.03	0.01	-2.76	0.006
>> by SCHCLIM on MISS	-0.03	0.01	-2.48	0.013
>> by IMPACH on MISS	0.03	0.01	2.64	0.009
Level 2/School-level effects				
PUBLIC	-0.15	0.03	-4.42	0.000
SCHSIZE	0.10	0.03	3.18	0.002
SCHCLIM	-0.14	0.03	-4.21	0.000
IMPACH	0.07	0.03	2.10	0.036

Notes: for further information see Raudenbush and Bryk (2002)
>> Interaction effect

These findings at the student-level can be summarised by stating that Spanish students perform at a higher level in reading when they:

- are enrolled in higher grades (that is, if they are non-repeaters);
- come from homes with higher socio-economic status;
- demonstrate a greater interest in reading; and
- do not miss school.

At the school level, only four of the factors tested remain in the model to influence reading achievement. While, PUBLIC (γ=-0.15) and SCHCLIM (γ=-0.14) have a negative impact on the reading score, SCHSIZE (γ=0.10) and IMPACH (γ=0.07) show a positive effect.

Factors with more pronounced effects on reading achievement are the school type (γ=-0.15) and school climate (γ=-0.14), both showing negative effects. Overall, private schools perform better than public ones in reading achievement. It should be pointed out that private schools play an important role in Spanish secondary education as 37 per cent of all schools are private. What is more, their average socio-economic status is considerably higher than that of public schools (INCE, 1998). Thus, what mainly defines public and private schools is the different socio-economic status of the parents who enrol their children in either school type. In the case of school climate its negative effect indicates that students in schools with more helpful home environments and more supportive teachers perform at a higher level in reading.

It is interesting to observe that school size (γ=0.10) has a positive effect on reading achievement. Until now, studies carried out in Spain on the topics of 'school organisation' and 'school effectiveness' have not led to any final conclusion. On one hand, these studies suggest that school size lacks any kind of significant effect on student achievement (Garín Sallán and Antúnez Marcos, 1993) and on the other, though indirectly only, that this effect becomes negative (CIDE, 2000). According to the results from Table 4, 15-year-old students in larger schools perform at a higher level in reading achievement. It may be hypothesised that school size is an artifact for a school's geographic location, as large schools, typically, are found in urban or metropolitan areas.

In fact, most cultural resources and infrastructures, private schools and families with higher socio-economic status are found in the larger cities.

The importance attached to achievement (γ=0.07) is a less pronounced school effect. Its positive sign indicates that a higher frequency of student assessment seems to lead to better achievement in reading.

Thus, for students in Spain to achieve well in reading it is advantageous to be enrolled in a:

- private school;
- larger school ;
- school with a better school climate; and
- school which places importance on achievement.

Though it should not be overlooked that six interaction effects appeared to operate on MISS, their γ-coefficients turned out to be only small. Still, it is interesting to note that quite a complex network of factors is in place which impact on the relationship between regular school attendance and reading literacy. For instance, the differentiating effect that being absent from school has on the achievement levels of higher and lower performers in reading is greater in schools that (a) have a larger ratio of computers per student (>>RATCOMP on MISS γ=0.04); (b) assign greater importance to achievement (>>IMPACH on MISS γ=0.03); and (c) have more class periods per school week (>>LESSON on MISS γ=0.03).

Comparison of results for Germany and Spain

A comparison of the results of the two-level HLM analysis of factors influencing reading achievement in Germany and Spain reveals both, similarities and differences. Thus, GRADE, SES and READINT influence reading achievement positively whereas MISS has a negative effect on reading achievement. In other words, students who are non-repeaters, have a greater reading interest, are absent from school less frequently, and come from homes with higher socio-economic status, perform at higher levels in reading in both countries.

Likewise, school climate operates similarly in both countries, in that students attending schools for which principals report a more supportive home environment, more respectful students and more supportive teachers perform at a higher level in reading.

In contrast, albeit only weakly in both countries, importance placed on achievement in terms of frequency of reports to parents on student performance or teachers valuing academic achievement operates differently in the two countries. While this factor influences achievement positively in Spain, the reverse seems to apply in Germany.

As indicators of the appropriateness of the HLM models for the two countries, the respective variance proportions for each level have been calculated. In Table 5 the variance estimates for the unconditional models and the final models are presented, together with the proportions of the variance available at each level and the variance explained at each level.

Table 5. Estimation of variance components and explained variance: two-level HLM models for Germany and Spain

	GERMANY		SPAIN	
	Students ($\hat{\sigma}^2$)	Schools ($\hat{\tau}_\pi$)	Students ($\hat{\sigma}^2$)	Schools ($\hat{\tau}_\pi$)
Number of cases	5073	219	6214	185
Fully unconditional HLM model	0.55	0.64	0.99	0.19
Final two-level HLM model	0.40	0.26	0.70	0.12
Variance at each level (between)	0.46	0.54	0.84	0.16
Proportion of variance explained	0.27	0.59	0.29	0.37

When looking at the variance proportions for the unconditional model it becomes evident that in Spain more of the variance is associated with the student level (84%) whereas in Germany most of the variance is associated with the school level (54%). This finding – which is in line with previous results of German and Spanish school achievement data (OECD 1998) – is of key importance if remedial steps are to be taken to improve reading achievement in either country. But this finding also underlines, especially in Germany, the importance of school- and teacher or teaching-related factors for student performance in reading. In contrast and despite the segregation into private and public institutions, the Spanish education system appears to be more homogeneous and less prone to perpetuating differential levels of reading achievement. Indeed, the Spanish education system features one common path for students up to the end of lower secondary schooling. Here, remedial efforts would seem to have to focus on the individual student level if performance in reading is to be improved.

Both final HLM models show fairly similar proportions of explained variance at the student level (Germany: 27%; Spain: 29%), while there remain sizeable differences at the school level (Germany: 59%; Spain: 37%).

CONCLUSION

As could be shown using hierarchical linear modelling, a range of factors contributed positively or negatively to reading achievement among students that had been assessed as part of the OECD's PISA project. While the two-level HLM models identified some commonalities between the way in which reading achievement is influenced in Germany and Spain, substantial differences in explaining reading achievement in the two countries remain.

GRADE, which may be perceived here as a substitute for scholastic aptitude in that it reflects whether of not a student had repeated a grade, READINT, SES and MISS were identified as factors common to both countries at the student level. School climate and importance assigned to achievement by teachers were the two factors that operated at the school level both in Germany and in Spain. A home environment with higher parental education and occupation, students' greater interest in reading and a greater commitment to school as illustrated through fewer instances of being absent from or late for school tended to foster reading achievement in both countries.

Much of the differences between the two education systems apparently stemmed from the fact that in Germany much of the variance was associated with the school level whereas most of the differences in performance between students in Spain was associated with the student level. Thus, efforts to improve reading achievement in Germany would have to focus on supporting schools whereas in Spain remedial action would revolve around providing increased assistance at the individual student level.

In order to provide more detailed recommendations, further investigation could focus on introducing teacher and instructional variables into the model to examine the way in which such factors contribute to explaining differences in student performance. Whereas PISA-2000 data collection did not include such variables, recent efforts to develop this assessment program further appear to be aimed at addressing these issues.

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