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Context factors and student achievement in the IEA studies: evidence from TIMSS

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article

Abstract

Background: The present study investigates what factors related to the school context influence student achievement on TIMSS mathematics tests across countries. A systematic review of the literature on PIRLS, TIMSS, and ICCS was conducted upstream to identify those school, teacher, and classroom factors shown to be useful predictors of student performance in previous IEA studies. Data of student samples representative of grade 8 students from 28 countries who participated in TIMSS 2011 were analysed. The main aim of the present study is to verify what school and teacher characteristics are positively associated with students' mathematics achievement, mainly focusing on disadvantaged schools. Furthermore, it aims at identifying how school context variables contribute to explaining the performance of students in disadvantaged schools in comparison with more advantaged schools.

Methods: A separate analysis was carried out for each considered country, and the same multilevel regression model was used on the sampled schools as a whole and treating schools with high (highest tertile) and low (lowest tertile) socio-economic backgrounds as distinct groups.

Results: The results confirmed that a high socio-economic status has a significant and positive effect on student achievement: compared with students from socio-economic disadvantaged schools, students from advantaged schools performed better in mathematics achievement. This difference is more evident in countries where the gap between rich and poor people as measured by the Gini coefficient, which measures how much an economy deviates from perfect equality, is wider. However, this difference is restricted in countries with a smaller gap between rich and poor people.

Conclusions: According to the literature in the field, the results show significant differences across countries in relation to the school and teacher characteristics that have an impact on mathematics achievement of students from low and high SES schools. Different patterns were also found within countries for low and high SES schools.

Keywords: TIMSS, PIRLS, ICCS, School factors, Contextual questionnaires

Background

A review of the literature on how school-level factors were, and still are, used to predict and interpret student performance in some of the IEA studies—i.e., PIRLS, TIMSS, and ICCS—showed that it is quite difficult to find strong associations between school-level

factors and students' results at a country level, based on data of the type collected in comparative studies, and that wide differences are found across participating countries. Such results suggest the need for more in-depth analyses. The multi-level model for an analysis of TIMSS 2011 results presented below—intended to explore whether the impact of those factors on student achievement varies in relation to the schools' socio-economic status—originally stemmed from that review.

School-level variables in the IEA studies

From the beginning, IEA international comparative studies have included background questionnaires to collect data on contextual factors to be linked to students' cognitive outcomes (Postlethwaite 1967; Peaker 1975; Walker 1976). Participating students, their teachers and the principals of their schools respond to background questionnaires. These questionnaires are central to the analysis of results in terms of a range of student and school characteristics—from students' economic, social and cultural capital to context of instruction, including schools' human and material resources, as well as school and classroom conditions and processes (IEA 1998). The school-level variables used for the development of the questionnaire address school context (e.g., urban/rural, community resources), school characteristics (e.g., school type, school size, and instructional time), school resources (e.g., teaching materials and equipment), school initiatives in the field of specific interest to each survey, school management (e.g., funding, decision-making processes, staffing practices and teacher evaluation, curricular emphasis, and parental involvement), teachers' characteristics and activities, teaching practices, and classroom activities (Postlethwaite and Ross 1992).

Data collected through background questionnaires are central to both international reports and secondary analyses, as they allow to better contextualise student results in the cognitive tests and help identify the school and classroom factors that have a direct or indirect impact on student performance.

International reports show that the school variables associated with student achievement are mainly those related to school context, school characteristics and resources and class characteristics (Walker 1976; Postlethwaite and Ross 1992; Schulz et al. 2010; Mullis et al. 2012a, b). CIVED and ICCS 2009 found that an open classroom climate for discussion was a positive predictor of student civic knowledge in several countries, although data about that particular school characteristic were collected through the student questionnaire and not the school questionnaire (Schulz et al. 2010; Torney-Purta et al. 2001).

However, it is exceedingly difficult to draw causal inferences, such as concluding that a particular process-related school variable is directly associated with student achievement, and wide differences across and within countries are usually reported.

Several studies indicated that teacher-related factors have effects of various magnitudes on student achievement in mathematics (e.g., Rivkin et al. 2005; Akiba et al. 2007; Akyüz and Berberoglu 2010; Tsai and Yang 2015; Winnaar et al. 2015). For example, De Witte and Van Klaveren (2014), using data from Dutch students participating in TIMSS 2003, found that high test scores are associated with teaching styles that emphasize problem solving and homework.

Furthermore, several studies used the TIMSS data for secondary analyses at individual country level.

Lee and Huh (2014) investigated the impact of teachers' instructional strategies on student learning in mathematics and what instructional strategies are positively associated with student learning outcome in the United States. Eighth grade students' mathematics data from TIMSS 2007 were used. Teachers' instructional strategies were found to explain approximately 17 % at the teacher level of the learning outcome.

Nilsen and Gustafsson (2014) showed that school emphasis on academic success contributed to explaining the increased science performance in Norway between TIMSS 2007 and 2011.

However, other studies found limited evidence of this impact on student achievement in both mathematics (Luschei and Chudgar 2011; Sturman and Lin 2011; Dodeen and Hilal 2012) and reading literacy (e.g., Van Daal et al. 2006; Schagen and Twist 2008). Recently, Gao (2014) investigated whether inquiry-based instruction is more effective in influencing student science achievement than traditional teaching methods. Using the TIMSS 2011 8th grade dataset from Singapore, Chinese Taipei and the US, the author did not find a clear and positive relation between the type of instruction and student achievement.

Moreover, research has still not been able to clearly identify a pool of teacher characteristics and classroom practices that consistently improve student learning across countries (Goe 2007). In a recent review of TIMSS research literature, Drent et al. (2013) outlined the existence of wide differences across countries. Phan (2008) found that different variables are associated with mathematics achievement in different countries. In her studies, she tested three different models: (1) the instructional practices model, (2) the teacher background model and (3) a full model, including all of the variables considered in the previous models. The author found that the first model was the best for the United States; the second model served as the most efficient for predicting math achievement in Egypt, and the third model performed the best in Canada and South Africa.

Martin et al. (2000) conducted an analysis on school effectiveness using TIMSS 1995 data in countries with a large between-school variance. The authors identified several characteristics that distinguished low- from high-achieving schools and then examined school factors using hierarchical linear modelling. After controlling for student socioeconomic status, the factors considered did not show a strong relationship with mathematics achievement across all countries. Only a few school characteristics, such as school climate, instructional activities and teacher characteristics were found to be associated with school achievement in some countries.

Recently, a multilevel model related to TIMSS and PIRLS 2011 was developed by Martin et al. (2013) to verify what characteristics of effective schools and of specific home backgrounds are associated with higher student achievement in reading, mathematics, and science at grade 4. The results showed that the 'Home Resources for Learning' variable was the strongest predictor of student achievement, with significant effects on both between and within school variance in almost every country. After controlling for the 'Home Background' variable, the strength of the relationship between school environment and instruction and student achievement was considerably reduced across

countries. The variable 'Schools Are Safe and Orderly' maintained a significant effect in at least one subject after controlling for 'Home Resources' in 15 countries, while 'Schools Support Academic Success' had a positive impact on student achievement in at least one subject in 10 countries. In general, this study found considerable differences across countries in the ways school variables are related to student achievement, with similar results for reading, mathematics and science.

Analyses conducted on ICCS 2009 data have shown a limited impact of school factors on student civic knowledge, except for the open classroom climate (Fraillon et al. 2011). Attempts have also been made to explore the relationships between school factors and non-cognitive students' outcomes for ICCS 2009. Controlling for student and school SES, the impact of school variables was shown to be negligible (Caponera and Losito 2011; Caponera et al. 2012).

Apparently, these results confirm that SES is the most important contextual factor affecting student learning outcomes (Coleman et al. 1966; Coleman 1975; OECD 2005).

The literature review carried out for this study showed a relevant impact of SES at the school level: the analysis of the influence of student socio-economic status on student achievement seemed to confirm that variables such as parent educational level and the amount of resources available at home are strongly associated with student achievement (Chiu and Xihua 2008; Ismail and Awang 2008). In some studies, an index of the overall socio-economic status for each individual school was calculated as an average of student socio-economic background, and different studies showed the relevance of this variable in explaining student achievement (e.g., McConney and Perry 2010). Furthermore, in several studies, only few variables were found to have a significant effect on mathematics achievement once the socioeconomic level of schools and students was taken into account (Wiberg et al. 2013; Wiberg and Rolfsman 2013). Recently, some studies tried to better understand whether and the extent to which school variables contribute to improving student achievement in disadvantaged schools (Baird 2008; Shepherd 2013).

Sandoval-Hernández et al. (2014) used data from TIMMS 2011 (fourth grade) to compute an HLM analysis using school factors for two sub-samples: disadvantaged students and non-disadvantaged students. They compared the results across ten European countries and found that the school factors considered in the analysis have a stronger relation with non-disadvantaged student achievement in most countries.

Based on the review of the existing literature on IEA studies' results and with particular attention to secondary analyses derived from the TIMSS Survey, the present study aims at investigating whether and the extent to which those results may help to clarify what factors related to the school context influence student achievement on the TIMSS mathematics tests across countries. On the basis of the evidence discussed so far, the aim of the present study is to verify what school and teacher characteristics are positively associated with students' mathematics achievement, mainly focusing on disadvantaged schools. Furthermore, it aims at identifying how school context variables contribute to explaining the performance of students in disadvantaged schools in comparison with more advantaged schools.

A separate analysis was carried out for each considered country, and the same multi-level regression model was used on the sampled schools as a whole and on schools with high (highest tertile) and low (lowest tertile) socio-economic backgrounds as distinct

groups. To verify whether the impact of specific school and teacher characteristics may be different in relation to the schools' socio-economic characteristics (average student SES at school level), a hierarchical multilevel analysis of TIMSS 2011 data was conducted. The multilevel approach adopted allows for data analysis with a hierarchical structure—where the individual units (students) are "nested" within the aggregated school level. Thus, this technique makes it possible to investigate simultaneously variables measured at student level (the first level of the multilevel analysis) and the impact of some relevant school characteristics on student achievement (second level of the multilevel analysis).

Methods

Participants

The analyses presented in this paper were conducted on the TIMSS 2011 data for Grade 8 students. TIMSS used a two-stage sampling design (for a detailed description, see Martin and Mullis 2012). The overall sample consisted of 149,788 students from all participating countries, from 5177 schools.

Countries with poor reliability[1] on the achievement scale were excluded from our analyses, as well as cases with missing values in one or more explanatory variables.

Measures

For the sake of brevity, only the measures that are directly relevant to the study's aims and hypotheses will be described (for a detailed description see Martin and Mullis 2012).

Mathematics achievement scale. The scale was developed by the research group of the TIMSS project (for a detailed description of the scale, see Martin and Mullis 2012) and consisted of multiple-choice and constructed-response items. The eighth grade mathematics content domains included number, algebra, geometry, and data and chance. The cognitive domains measured were knowing, applying and reasoning. The whole item pool consisted of 217 questions. In TIMSS 2011, various combinations of the assessment items were compiled into 14 booklets while maintaining the distribution of items across content and cognitive domains. Using IRT estimates, a score of mathematics achievement was calculated for each student. The scale used to measure mathematics achievement has high internal consistency (Cronbach's alpha international median 0.87). To take into account measurement errors, a range of five plausible values of scores in mathematics test was provided for each student (for a detailed description, see Martin and Mullis 2012). In the present study, the proficiency score for overall mathematics achievement drawn from the five plausible values obtained through the IRT methodology was used in the analyses.

The following variables derived from student, teacher and school questionnaires were used in the analyses; they are found in the literature to be good indicators of student performance in mathematics. All of the scales were constructed using IRT scaling

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[1] In *TIMSS 2011 International Results in Mathematics*, students were considered to have an achievement too low for estimation if their performance on the assessment was no better than that they could achieve by simply guessing on the multiple choice assessment items. However, such students were assigned scale scores (plausible values) by the achievement scaling procedure, despite concerns about their reliability. We excluded countries with reservations about reliability of average achievement because the percentage of students with achievement too low for estimation exceeds 15 % (Mullis et al. 2012a, p 456).

methods, specifically the Rasch partial credit model. Using IRT partial credit scaling, student responses were placed on a scale constructed so that the mean scale score across all countries was 10, and the standard deviation was 2 (for detailed description, see Martin and Mullis 2012).

At the *student level,* we used the following variables derived from the Student Questionnaire and included in the TIMSS database.

Socio-economic status (SES; indicated in the International report as Home educational resources). Based on the answers in the Student Questionnaire (for a detailed description of these scales, see Martin and Mullis 2012), a general index of each student's socio-economic status was created. The Student Questionnaire collected information about (1) student home environments, including the parents' educational level, (2) the number of resources for study available at home, and 3) how many books there are in the home.

Mathematics self-concept (St_SCM). Students were asked to answer nine questions related to their perceived ability to study and learn mathematics, such as "I learn things quickly in mathematics".

Students like learning mathematics (St_SLM). The scale consisted of five questions concerning the student's interest and positive attitude towards mathematics, such as "I enjoy learning mathematics".

Students value mathematics (St_SVM). Students were asked to answer to six questions concerning the importance of studying mathematics to their lives, e.g., "I need to do well in mathematics to get the job I want".

Students engaged in mathematics lessons (St_EML). The scale was created based on students' level of agreement with five statements, such as "My teacher gives me interesting things to do".

Weekly time spent on math homework (St_HMW). The TIMSS 2011 teacher questionnaire collected information about the teachers of the students participating in the assessment. For the schools where more than one teacher per class or per school were selected, we computed the mean of the different scores. The following variables derived from the teacher questionnaire were used for the school level.

Safe and orderly school (Teach_SOS). The scale was created based on teachers' degree of agreement with five statements regarding a disciplined climate in their schools.

Teacher working conditions (Teach_WCN). The scale was created based on teachers' responses to five questions, such as "In your current school, how severe is each problem? Teachers do not have adequate workspace (e.g., for preparation, collaboration, or meeting with students)".

School emphasis on academic success (Teach_EAS).

Confidence in teaching mathematics (Teach_CTM). The scale was created based on teachers' responses to five questions, such as "In teaching mathematics to this class, how confident do you feel to adapt teaching to engage students' interest?"

Teacher career satisfaction (Teach_CST). The scale was created based on teachers' degree of agreement with six statements, such as "I am satisfied with being a teacher at this school".

Collaborate to improve teaching (Teach_CIT). The scale was created based on teachers' responses to five questions concerning the types of interactions with other teachers, such as "Collaborate in planning and preparing instructional materials".

Instruction to engage students in learning (Teach_IES). The scale was created based on teachers' responses to how often they used each of four instructional practices, such us "Use questioning to elicit reasons and explanations".

The variables derived from the school questionnaire and used for the school level are the following.

Instruction affected by mathematics resource shortages (Princ_MRS). The scale was created based on principals' responses concerning the availability of resources both at school and classroom levels, such as "How much is your school's capacity to provide instruction affected by a shortage or inadequacy of calculators for mathematics instruction?"

School emphasis on academic success—principal reports (Princ_EAS). The scale was created based on principals' responses (e.g., "How would you characterize each of the following within your school?" Teachers' degree of success in implementing the school's curriculum).

School discipline and safety (Princ_DAS). Principals were asked to answer 11 questions regarding different discipline problems among eighth grade students at school, such as "Physical injury to other students".

All of the variables described above, derived from both teacher and school questionnaires, are included in the TIMSS database.

In addition, the following scales were constructed ad hoc.

SES_school. The index was calculated at the school level and corresponds to the students' SES average in each school. This index was used at the school level to select students attending schools with low socio-economic status and students attending schools with high socio-economic status.

Sum of topic taught (Teach_STT). The scale was constructed to measure how much teachers taught 19 different topics related to mathematics during the year of the test.

Teacher preparedness (Teach_PRP). A second-order factor analysis was conducted on four indices measuring teacher beliefs regarding their preparation to teach number, algebra, geometry and data. The new index explains 69 % of the variance and has good internal consistency (0.76 median Cronbach alpha across countries).

Parental involvement (Princ_PIN). A factor analysis was conducted on 10 items derived from the school questionnaire, such as "Inform parents about the behaviour and well-being of their child at school". The index explains 69 % of the variance and has good internal consistency (0.76 median Cronbach alpha across countries).

Data analysis

The country-specific descriptive analyses were conducted using the software IEA IDB[2] Analyzer—a software developed by the IEA Data Processing and Research Center for analysing data from all IEA surveys—by means of adapted macros provided by IEA TIMSS (Foy et al. 2013).

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[2] The IDB Analyzer allows handling complex sample designs, using plausible value methodology and calculating correct standard errors when conducting analysis with large-scale surveys. The IDB Analyzer creates an SPSS code that can be used to conduct statistical analysis considering the complex sample and assessment structures of these databases. The software allows combining data from different countries for cross-country analysis and selecting specific subsets of variables. In addition, it provides several different procedures for analysis, such as the computation of means or percentages of any background variable of interest for a whole country or subgroup within a population (IEA 2012).

A two level hierarchical linear model was conducted by means of the software HLM 6.0 (Raudenbush et al. 2004a, b) to investigate the relationship between the school variables and student mathematics achievement, accounting for the socio-economic index. In HLM, the analysis of plausible values is done by multiple imputations.

At level 1—student level—we used the scales described earlier and derived from the student questionnaire; at level 2—school level—we used variables from both the teacher and school questionnaires described above.

In the multilevel analyses, the house weight (HOUSWGT) was used. The variable *total student weight* was normalized so that the sum of the weights was equal to the student sample size in the data. A proficiency score for overall mathematics achievement drawn from all five plausible values was used as dependent variable. The independent student-level variables were entered as group-mean centred student-level (level 1) variables; the independent school-level averages were entered as grand-mean centred school-level (level 2) variables.

Results and discussion

Descriptive statistics

Table 1 shows the description of participants[3] in TMSS 2011 divided by class and by school.

Depending on the average class size in the country, one class from each sampled school may be sufficient to achieve the desired student sample size. Some countries choose to sample more than one class per school, either to increase the size of the student sample or to provide a better estimate of school-level effects (for a more detailed description see Martin and Mullis 2012). As shown in Table 1, in most countries, only one class per school was selected.

Table 2 shows the descriptive statistics for mathematics across countries. The results are presented by country in alphabetic order.

Concerning mathematics achievement, the difference between students from schools with high and low socio-economic backgrounds varies across countries, from 26 in Slovenia to 138 in Malaysia.

Slovenia, Sweden, Norway and Finland showed less variation, whereas Malaysia, Australia, Chile, England, Honk Kong, SAR, Israel, Romania and Turkey showed a marked difference of more than one standard deviation.

Multilevel analyses

The TIMSS 2011 data were best described in two levels: student level (level-1), and school and teacher level (level-2). Level-1 was represented by student background and home resource variables that were unique across students and also by student characteristics such as self-efficacy and interest in mathematics. Level-2 was represented by instructional practices, teacher background and school background variables because each school had one mathematics class sampled. The analysis took place in three steps:

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[3] In this study, we only included the countries that had an adequate reliability concerning average achievement in mathematics and where all of the items used in the analyses were administered.

Table 1 Descriptive statistics: number of participants (*Source* TIMSS 2011 database—eight grade)

	Number of students	Number of classes	Number of schools
Armenia	5527	236	147
Australia	5492	368	230
Chile	5521	185	184
Chinese Taipei	4951	149	147
England	3406	159	110
Finland	4127	250	142
Georgia	4358	190	164
Hong Kong, SAR	3908	118	115
Hungary	5043	244	145
Israel	4230	166	149
Italy	3677	189	184
Japan	4362	137	137
Republic of Korea	4883	145	145
Lebanon	3763	177	141
Lithuania	4747	258	141
Malaysia	5628	177	177
New Zealand	4999	231	155
Norway	3746	165	133
Romania	5296	239	146
Singapore	5874	327	165
Slovenia	4144	220	181
Sweden	4683	240	145
Thailand	5831	164	164
United Arab Emirates	12,679	564	423
Tunisia	4772	193	193
Turkey	6674	232	231
Ukraine	3316	159	148
United States	8295	439	404

1. First, the variance between and within schools in relation to mathematics achievement was estimated (model 0, with no explanatory variables). This model provides estimates of the variance at each level (within and between schools) and is the reference point to determine how much variance is explained by subsequent models.
2. Second, the model was modified by introducing student-level variables (model 1, where the effects on student level were treated as fixed, assuming no variation across schools).
3. The following steps consisted of introducing school-level and class-level variables into the model (model 2). The model was then completed by adding the school's average index of socio-economic background (model 3).

Table 3 shows the total variance, the between variance and the percentage of variance explained by the full model divided by all students, students from schools with low SES and students from schools with high SES. In Table 4, the full model is presented.

As expected, after removing the influence of SES at school level, the between-school variance appeared reduced, except for Slovenia (as far as low SES schools were

Table 2 Descriptive statistics: mean and s.e. for mathematics achievement (*Source* TIMSS 2011 database—eight grade)

	All students	Students from schools with low SES	Students from schools with high SES
Armenia	467 (2.8)	442 (5.1)	491 (5.9)
Australia	507 (5.5)	455 (6.7)	561 (11.6)
Chile	418 (2.7)	381 (4.7)	483 (6.3)
Chinese Taipei	610 (3.2)	566 (4.9)	656 (6.5)
England	506 (5.8)	441 (6.6)	564 (8.3)
Finland	514 (2.5)	502 (3.6)	531 (2.8)
Georgia	432 (4.0)	403 (5.0)	491 (5.7)
Hong Kong, SAR	585 (3.8)	529 (9.2)	637 (6.4)
Hungary	504 (3.5)	462 (5.2)	552 (4.3)
Israel	520 (4.1)	460 (7.2)	569 (5.4)
Italy	499 (2.5)	476 (4.3)	526 (3.9)
Japan	570 (2.6)	545 (3.8)	592 (5.0)
Republic of Korea	613 (2.9)	590 (3.6)	641 (4.3)
Lebanon	450 (3.7)	407 (4.0)	506 (5.8)
Lithuania	502 (2.5)	475 (3.7)	542 (4.1)
Malaysia	440 (5.4)	373 (6.4)	512 (5.9)
New Zealand	488 (5.5)	434 (5.3)	526 (7.2)
Norway	475 (2.4)	459 (3.3)	493 (3.4)
Romania	458 (4.1)	425 (7.7)	526 (6.1)
Singapore	611 (3.8)	567 (8.0)	660 (4.1)
Slovenia	505 (2.1)	491 (3.3)	517 (2.9)
Sweden	485 (2.2)	467 (3.4)	506 (3.2)
Thailand	429 (4.4)	397 (5.0)	493 (8.7)
Tunisia	425 (3.0)	394 (3.5)	457 (5.9)
Turkey	453 (4.2)	401 (5.3)	508 (8.0)
Ukraine	479 (3.9)	449 (5.2)	523 (6.5)
United Arab Emirates	455 (2.2)	418 (3.1)	497 (4.6)
United States	512 (3.2)	467 (3.7)	561 (5.1)

() standard errors appear in parentheses

concerned) and Chile, Georgia, Japan, Republic of Korea, Thailand, Tunisia, Turkey, United Arab Emirates and the United States (as far as high SES schools were concerned).

School emphasis on academic success—principal reports is positively related to student achievement in 7 out of 28 countries (Georgia, Hungary, Australia, Finland, Lebanon, Lithuania, Republic of Korea).

Parental involvement is negatively related to student achievement in low SES schools in 4 out of 28 countries: Georgia, Hungary, New Zealand, and Malaysia.

Teacher preparedness was found to be positively associated with achievement in low SES schools in 5 countries (Turkey, Hong Kong, Hungary, New Zealand, Malaysia). *Instruction to engage students in learning* was found to be positively associated with achievement in low SES schools in 4 countries (Hungary, Republic of Korea, New Zealand, Tunisia) and negatively associated with it in 2 countries (Italy and Lithuania). *Confidence in teaching mathematics* was found to be positively associated with achievement in disadvantaged schools in 4 countries (England, Lebanon, Lithuania, Norway) and negatively in one country (Hungary).

Table 3 Total variance and explained variance in mathematics achievement across countries (*Source* TIMSS 2011 database—eight grade)

	All students				Students from schools with low SES level				Students from schools with high SES level			
	Variance without controls		% of variance explained by model		Variance without controls		% of variance explained by model		Variance without controls		% of variance explained by model	
	Total variance	% of variance between schools	Within schools	Between schools	Total variance	% of variance between schools	Within schools	Between schools	Total variance	% of variance between schools	Within schools	Between schools
Armenia	7867	23	22	13	8490	25	22	0	7460	23	20	18
Australia	7602	62	31	63	5799	43	30	38	7374	65	34	63
Chile	6536	44	34	73	4741	23	26	12	6572	45	42	68
Chinese Taipei	10,690	21	36	68	10,491	10	37	43	8458	16	36	44
England	7509	68	19	64	4773	32	24	50	4773	32	35	0
Finland	4131	13	43	20	4097	16	40	31	3711	5	44	0
Georgia	9701	27	32	47	8904	20	30	20	9414	29	37	52
Hong Kong, SAR	7620	64	25	61	6584	47	23	8	3850	38	27	50
Hungary	8925	42	43	74	9154	37	38	77	4912	10	48	0
Israel	8991	42	31	65	8991	42	31	65	5799	20	33	3
Italy	5461	26	38	32	5322	25	32	9	4678	15	36	0
Japan	6781	11	31	53	6602	5	30	18	6647	15	28	56
Republic of Korea	7865	9	43	73	7572	2	42	51	7385	10	43	48
Lebanon	5545	43	18	66	3790	17	17	28	3953	24	22	39
Lithuania	5988	23	39	68	6024	13	43	54	4952	15	37	41
Malaysia	8652	67	10	65	4947	42	10	21	4415	43	20	13
New Zealand	7519	37	36	65	5850	24	32	45	5343	13	39	72
Norway	3988	12	48	48	3949	8	43	15	3673	8	50	27
Romania	9659	32	33	46	8504	28	24	6	8367	21	39	74
Singapore	6697	44	20	66	6279	25	24	35	4172	44	20	50

Table 3 continued

	All students				Students from schools with low SES level				Students from schools with high SES level			
	Variance without controls		% of variance explained by model		Variance without controls		% of variance explained by model		Variance without controls		% of variance explained by model	
	Total vari-ance	% of variance between schools	Within schools	Between schools	Total vari-ance	% of variance between schools	Within schools	Between schools	Total vari-ance	% of variance between schools	Within schools	Between schools
Slovenia	4990	11	44	20	5064	15	42	45	4685	7	42	1
Sweden	4465	13	42	62	4753	10	41	62	4022	7	46	0
Thailand	6960	51	10	36	5813	34	6	0	6927	55	16	59
Tunisia	5816	30	20	61	4261	11	16	12	6343	36	32	54
Turkey	12,824	35	31	70	10,154	21	22	33	12,854	35	41	65
Ukraine	7373	23	28	36	6806	15	21	0	6393	18	32	40
United Arab Emirates	7705	39	100	100	6263	23	20	31	7470	36	34	46
United States	5568	58	21	51	4241	41	21	19	4673	57	25	28

() standard errors appear in parentheses

Because results are rounded to the nearest whole number, some total may appear inconsistent

Table 4 Multilevel regression results: estimated effects on TIMSS mathematics achievement—school level

		Intercept	SES_school	Princ_MRS	Princ_EAS	Princ_DAS	Princ_PIN	Teach_gender (female = 0)
Armenia	All schools	477 (4.0)	9 (7.9)	−2 (3.0)	7 (3.3)	−3 (3.0)	5 (6.3)	2 (20.3)
	Low SES	452 (6.6)	−44 (26.2)	−1 (9.5)	5 (8.6)	−9 (4.3)	18 (9.0)	−1 (28.6)
	High SES	490 (5.1)	46 (22.4)	−3 (4.1)	2 (4.5)	0 (4.0)	1 (8.9)	−56 (20.3)
Australia	All schools	508 (0.0)	64 (0.0)	−4 (0.0)	4 (0.0)	−5 (0.0)	−11 (0.0)	−1 (0.0)
	Low SES	454 (6.0)	40 (15.5)	4 (3.3)	9 (4.3)	1 (7.2)	−11 (10.1)	18 (11.8)
	High SES	559 (5.5)	98 (8.8)	−9 (3.1)	1 (3.2)	−2 (4.1)	−12 (7.8)	−14 (10.3)
Chile	All schools	431 (2.5)	33 (3.4)	−2 (1.2)	7 (1.3)	1 (2.2)	1 (2.4)	8 (5.7)
	Low SES	375 (4.0)	4 (13.0)	−1 (3.2)	7 (2.3)	−1 (3.4)	4 (5.9)	2 (13.3)
	High SES	487 (3.8)	49 (6.9)	−2 (2.5)	5 (2.5)	8 (4.9)	−4 (3.6)	0 (8.3)
Chinese Taipei	All schools	611 (2.5)	52 (4.1)	−1 (1.5)	1 (2.0)	−2 (1.6)	−4 (2.9)	11 (4.7)
	Low SES	572 (3.3)	90 (15.0)	2 (2.3)	−3 (3.0)	0 (2.3)	1 (4.5)	24 (8.1)
	High ES	653 (3.6)	52 (7.9)	−2 (1.3)	0 (3.3)	−4 (2.4)	−4 (4.8)	−7 (6.7)
England	All schools	502 (4.7)	51 (6.5)	−7 (2.6)	−1 (3.4)	9.6 (4.8)	−7.9 (5.1)	6 (9.4)
	Low SES	439 (4.6)	34 (17.2)	6 (4.6)	−0.1 (4.1)	7 (5.4)	13 (7.5)	−19 (12.5)
	High SES	565 (6.7)	47 (17.0)	−3 (5.5)	0.5 (5.7)	5 (5.0)	−34 (9.5)	28 (16.8)
Finland	All schools	512 (2.2)	21 (4.4)	2 (1.7)	4 (1.6)	1 (2.0)	−2 (2.5)	2 (4.5)
	Low SES	500 (0.0)	76 (0.0)	3 (0.0)	8 (0.0)	2 (0.0)	−9 (0.0)	−3 (0.0)
	High SES	528 (2.3)	12 (11.6)	3 (2.3)	7 (3.6)	0 (2.4)	6 (5.1)	−4 (5.7)
Georgia	All schools	450 (3.7)	19 (4.4)	−4 (2.9)	12 (3.0)	−2 (2.2)	−9 (4.6)	20 (13.7)
	Low SES	425 (5.5)	0 (12.5)	−16 (6.5)	24 (6.0)	−5 (2.4)	−27 (9.1)	42 (24.8)
	High SES	487 (5.3)	48 (16.0)	7 (4.4)	3 (4.3)	0 (4.7)	−6 (5.6)	5 (20.5)
Hong Kong, SAR	All schools	576 (4.0)	45 (7.0)	2 (2.2)	−2 (3.4)	14 (3.6)	−3 (5.7)	−8 (9.7)
	Low SES	519 (6.7)	96 (36.3)	0 (2.6)	−13 (7.3)	13 (10.9)	−8 (7.4)	64 (18.7)
	High SES	635 (3.2)	34 (7.9)	3 (2.6)	5 (2.3)	10 (4.1)	1 (4.9)	−3 (7.5)
Hungary	All schools	500 (3.1)	46 (5.4)	4 (2.4)	1 (2.6)	2 (2.5)	−3 (5.2)	1 (9.0)
	Low SES	454 (4.0)	52 (9.3)	8 (3.7)	10 (3.1)	0 (4.3)	−4 (6.0)	11 (12.0)
	High SES	550 (3.2)	21 (7.5)	−1 (1.9)	−8 (3.0)	3 (2.4)	11 (5.0)	17 (8.5)
Israel	All schools	526 (3.4)	38 (4.5)	3 (1.9)	1 (3.2)	3 (2.1)	−8 (3.8)	−10 (8.5)
	Low SES	526 (3.4)	38 (4.5)	3 (1.9)	1 (3.2)	3 (2.1)	−8 (3.8)	−10 (8.5)
	High SES	574 (4.3)	24 (10.5)	5 (3.6)	−1 (4.2)	−4 (5.2)	1 (4.3)	−10 (14.7)
Italy	All schools	498 (2.8)	27 (4.4)	2 (3.1)	0 (2.1)	2 (1.6)	0 (3.6)	−7 (7.6)
	Low SES	471 (4.8)	12 (12.2)	−4 (5.9)	7 (3.7)	−2 (2.9)	−7 (6.4)	−6 (11.5)
	High SES	525 (3.7)	20 (10.7)	1 (3.1)	−1 (3.8)	2 (2.2)	−7 (5.7)	−10 (9.3)
Japan	All schools	569 (1.8)	26 (4.7)	2 (1.4)	2 (1.5)	1 (0.8)	2 (2.2)	1 (5.3)
	Low SES	550 (2.3)	24 (11.2)	2 (2.3)	1 (1.6)	−2 (1.0)	3 (3.8)	−7 (7.5)
	High SES	589 (2.9)	39 (10.8)	−1 (2.9)	−2 (2.0)	8 (2.8)	9 (5.9)	8 (11.7)
Republic of Korea	All schools	616 (2.1)	35 (3.6)	−1 (0.7)	1 (1.0)	1 (0.8)	0 (1.9)	0 (3.9)
	Low SES	592 (1.8)	2 (10.8)	−2 (0.9)	3 (1.2)	1 (1.2)	−4 (3.1)	2 (5.8)
	High SES	640 (2.6)	4 (7.5)	0 (2.1)	3 (2.2)	−1 (1.7)	−1 (4.2)	5 (9.3)
Lebanon	All schools	455 (2.9)	29 (3.1)	4 (1.4)	4 (1.9)	2 (1.5)	−3 (3.3)	−2 (6.6)
	Low SES	406 (3.3)	25 (6.3)	3 (2.6)	9 (2.0)	1 (2.0)	−10 (4.0)	0 (12.2)
	High SES	500 (3.3)	18 (8.3)	5 (1.8)	3 (3.4)	4 (1.3)	−1 (5.4)	−6 (10.3)
Lithuania	All schools	503 (2.2)	42 (3.9)	−1 (2.1)	5 (2.5)	2 (2.3)	−1 (3.3)	−14 (17.0)
	Low SES	470 (2.8)	53 (14.4)	−1 (3.2)	12 (4.7)	1 (2.2)	−8 (5.1)	−26 (24.9)
	High SES	540 (3.0)	43 (6.9)	3 (3.7)	−1 (3.1)	−4 (4.6)	6 (5.2)	−2 (15.1)

Table 4 continued

		Intercept	SES_school	Princ_MRS	Princ_EAS	Princ_DAS	Princ_PIN	Teach_gender (female = 0)
Malaysia	All schools	437 (3.5)	*64* (4.5)	0 (1.9)	−3 (2.5)	7 (3.1)	0 (4.8)	−5 (10.0)
	Low SES	372 (4.6)	*39* (14.8)	1 (3.7)	−3 (4.1)	3 (5.2)	9 (8.9)	−5 (11.8)
	High SES	512 (4.7)	*23* (8.5)	5 (3.0)	0 (4.0)	−3 (4.3)	−1 (6.9)	−9 (17.0)
New Zealand	All schools	481 (3.0)	52 (4.9)	−2 (1.7)	*6* (2.2)	−8 (3.6)	3 (4.1)	−13 (6.5)
	Low SES	432 (3.9)	59 (7.8)	−3 (2.6)	*7* (2.9)	4 (4.7)	−3 (5.5)	10 (7.8)
	High SES	527 (2.0)	−2 (10.7)	−5 (1.7)	*9* (2.2)	−5 (2.4)	*18* (5.7)	−7 (4.5)
Norway	All schools	478 (1.7)	25 (3.8)	−1 (1.4)	1 (1.4)	5 (1.5)	−5 (2.6)	−8 (3.9)
	Low SES	462 (2.3)	45 (11.3)	1 (4.4)	1 (2.4)	4 (2.3)	6 (4.5)	4 (6.2)
	High SES	495 (2.1)	33 (11.9)	0 (1.7)	1 (2.6)	6 (1.7)	−5 (3.9)	4 (6.8)
Romania	All schools	467 (3.9)	28 (3.9)	5 (3.8)	7 (3.1)	1 (2.8)	−2 (6.0)	−4 (10.9)
	Low SES	422 (6.3)	12 (18.1)	10 (8.1)	11 (5.5)	3 (4.9)	−5 (9.3)	−12 (19.6)
	High SES	512 (2.8)	*60* (5.6)	0 (3.3)	−5 (2.5)	1 (2.3)	4 (3.7)	−21 (6.2)
Singapore	All schools	612 (2.7)	*55* (4.5)	0 (0.9)	2 (1.3)	4 (2.2)	−11 (4.1)	2 (5.5)
	Low SES	574 (3.8)	*88* (14.9)	−1 (2.1)	4 (2.7)	0 (4.3)	−7 (6.5)	14 (10.0)
	High SES	661 (3.9)	*39* (10.7)	0 (1.3)	0 (2.9)	6 (3.3)	2 (4.3)	−19 (9.5)
Slovenia	All schools	503 (2.0)	24 (5.4)	−1 (1.2)	3 (1.3)	−1 (1.2)	−2 (2.7)	4 (5.1)
	Low SES	489 (2.9)	79 (18.6)	−4 (2.3)	4 (2.2)	5 (2.3)	−1 (4.4)	*21* (6.1)
	High SES	517 (2.5)	35 (8.7)	−3 (2.3)	4 (2.8)	4 (2.2)	6 (4.1)	−16 (6.7)
Sweden	All schools	487 (1.8)	*28* (4.2)	0 (1.3)	0 (1.2)	4 (2.0)	−4 (2.0)	3 (3.8)
	Low SES	467 (2.4)	30 (7.9)	−4 (2.1)	−3 (2.4)	7 (2.3)	0 (3.2)	4 (6.3)
	High SES	511 (2.9)	8 (10.8)	1 (3.4)	7 (3.0)	7 (3.4)	−5 (3.6)	−8 (5.5)
Thailand	All schools	438 (4.5)	*36* (5.4)	3 (2.6)	0 (3.1)	−4 (4.2)	−5 (7.7)	5 (10.6)
	Low SES	398 (6.4)	−25 (26.3)	−7 (4.7)	1 (5.3)	−8 (5.3)	−17 (9.4)	2 (15.8)
	High SES	502 (6.2)	*57* (6.1)	6 (4.5)	−1 (6.9)	−11 (7.0)	27 (10.6)	8 (15.2)
Tunisia	All schools	424 (2.5)	*28* (2.5)	−3 (2.3)	1 (1.3)	−1 (1.4)	0 (3.3)	9 (5.2)
	Low SES	399 (3.2)	*32* (6.6)	−7 (2.5)	−2 (1.5)	2 (3.1)	1 (3.2)	−7 (7.2)
	High SES	459 (4.6)	*46* (7.5)	−3 (4.5)	4 (3.0)	−5 (3.0)	3 (5.0)	3 (8.2)
Turkey	All schools	453 (2.8)	*31* (2.7)	1 (2.6)	6 (1.8)	2 (1.5)	−1 (3.2)	2 (5.8)
	Low SES	409 (4.5)	17 (7.4)	1 (3.8)	6 (3.1)	0 (3.2)	4 (6.8)	3 (10.0)
	High SES	507 (4.6)	*47* (8.7)	2 (3.5)	7 (3.2)	1 (2.4)	0 (7.0)	−1 (11.2)
Ukraine	All schools	486 (3.1)	*28* (5.0)	−1 (3.7)	1 (3.8)	4 (2.1)	−1 (5.5)	9 (9.4)
	Low SES	461 (4.8)	40 (14.9)	8 (7.7)	−5 (6.1)	−3 (3.6)	25 (14.2)	−3 (19.4)
	High SES	518 (4.3)	*51* (13.5)	1 (4.8)	7 (6.3)	7 (3.8)	3 (7.0)	*69* (34.4)
United Arab Emirates	All schools	497 (3.9)	*45* (8.7)	3 (1.9)	1 (2.6)	3 (2.5)	8 (5.6)	−1 (9.2)
	Low SES	420 (3.5)	*31* (9.1)	1 (2.0)	2 (1.8)	1 (1.4)	0 (3.8)	*−38* (9.1)
	High SES	497 (3.9)	*45* (8.7)	3 (1.9)	1 (2.6)	3 (2.5)	8 (5.6)	−1 (9.2)
United States	All schools	507 (2.4)	*40* (3.3)	2 (1.2)	1 (1.6)	−3 (2.0)	2 (2.6)	−6 (5.2)
	Low SES	473 (3.7)	*30* (8.6)	−1 (2.1)	2 (2.6)	−4 (4.1)	4 (3.7)	−11 (8.1)
	High SES	558 (4.5)	*46* (13.4)	2 (2.1)	0 (2.9)	−4 (4.0)	6 (5.1)	4 (9.8)

		Teach_WCN	Teach_EAS	Teach_SOS	Teach_CTM	Teach_CST	Teach_CIT	Teach_IES	Teach_PRP	Teach_STT
Armenia	All schools	3 (2.8)	3 (3.1)	2 (2.6)	5 (3.1)	−1 (2.7)	0 (2.5)	0 (2.1)	−20 (12.7)	0 (1.8)
	Low SES	6 (7.9)	4 (5.3)	−2 (5.1)	−2 (4.6)	−2 (4.7)	−7 (8.1)	3 (4.8)	−9 (20.0)	−1 (4.4)

Table 4 continued

		Teach_WCN	Teach_EAS	Teach_SOS	Teach_CTM	Teach_CST	Teach_CIT	Teach_IES	Teach_PRP	Teach_STT
Australia	High SES	3 (3.4)	1 (4.0)	−5 (3.9)	7 (4.8)	0 (3.7)	3 (2.1)	1 (3.2)	−8 (16.2)	2 (2.5)
	All schools	−1 (0.0)	4 (0.0)	−1 (0.0)	3 (0.0)	−2 (0.0)	3 (0.0)	−1 (0.0)	−6 (0.0)	−1 (0.0)
	Low SES	1 (3.7)	3 (3.8)	−2 (3.7)	1 (3.9)	1 (3.8)	4 (2.8)	3 (4.1)	−3 (7.3)	2 (1.7)
Chile	High SES	−4 (3.8)	8 (4.4)	−5 (5.9)	*9 (2.8)*	−3 (2.7)	0 (3.9)	−4 (4.3)	−7 (18.7)	−4 (1.9)
	All schools	0 (1.4)	0 (1.6)	2 (1.2)	−1 (1.8)	4 (1.6)	1 (1.2)	−2 (1.6)	2 (2.9)	1 (1.0)
	Low SES	−1 (2.6)	−6 (2.8)	0 (2.4)	0 (5.2)	*9 (2.8)*	3 (3.6)	3 (4.1)	1 (6.8)	2 (1.9)
Chinese Taipei	High SES	3 (2.5)	0 (2.2)	1 (3.1)	−4 (3.9)	−1 (3.1)	0 (1.6)	−1 (2.0)	−2 (18.9)	1 (1.3)
	All schools	0 (1.8)	1 (1.7)	1 (1.4)	−1 (1.3)	−3 (1.9)	−1 (1.2)	1 (1.0)	2 (2.7)	−2 (1.2)
	Low SES	0 (2.4)	0 (3.1)	0 (3.2)	2 (2.2)	−6 (3.3)	0 (2.0)	2 (1.8)	4 (5.6)	2 (1.5)
England	High SES	3 (2.9)	1 (2.5)	0 (2.4)	2 (2.0)	−1 (3.3)	*−6 (2.3)*	0 (1.7)	2 (3.3)	−4 (2.4)
	All schools	−5 (3.2)	1 (3.2)	4 (3.3)	0 (3.7)	3 (2.5)	−2 (2.4)	−1 (2.2)	−6 (7.6)	1 (6.0)
	Low SES	0 (4.6)	1 (3.5)	−9 (3.9)	13 (6.0)	7 (3.6)	−6 (3.0)	−3 (3.1)	18 (12.6)	5 (19.0)
Finland	High SES	−2 (3.4)	−2 (6.2)	3 (5.6)	0 (5.0)	2 (2.4)	4 (4.5)	3 (4.6)	−5 (12.0)	−5 (28.0)
	All schools	−2 (2.0)	−1 (1.7)	2 (1.8)	0 (1.3)	−1 (1.5)	−2 (1.4)	1 (1.1)	4 (4.5)	0 (1.2)
	Low SES	−2 (0.0)	−3 (0.0)	5 (0.0)	−2 (0.0)	*−6 (0.0)*	−5 (0.0)	0 (0.0)	−11 (0.0)	*4 (0.0)*
Georgia	High SES	−2 (2.6)	0 (3.1)	−3 (2.3)	−2 (2.2)	3 (2.2)	2 (1.8)	−1 (1.7)	−2 (7.6)	4 (2.7)
	All schools	0 (2.0)	*10 (2.7)*	2 (3.0)	−1 (2.1)	−2 (2.3)	4 (2.2)	1 (2.2)	6 (6.2)	3 (2.0)
	Low SES	6 (4.8)	3 (6.0)	−4 (5.1)	1 (3.7)	−9 (5.6)	*11 (2.6)*	3 (4.0)	−6 (7.9)	4 (2.8)
Hong Kong, SAR	High SES	−2 (3.5)	*7 (3.3)*	3 (4.3)	−4 (5.0)	−1 (2.9)	−4 (7.1)	5 (3.8)	*35 (21.1)*	−4 (4.2)
	All schools	−3 (3.5)	2 (3.7)	3 (3.1)	−1 (2.7)	2 (2.6)	0 (2.6)	0 (2.3)	8 (6.4)	−4 (1.8)
	Low SES	*−17 (7.4)*	2 (6.5)	2 (6.4)	−2 (4.4)	*−19 (6.8)*	3 (3.9)	1 (4.2)	*25 (7.5)*	−6 (3.4)
Hungary	High SES	0 (2.7)	−6 (4.7)	8 (2.7)	3 (2.9)	−2 (2.5)	−5 (2.3)	*−8 (1.7)*	*−16 (3.7)*	−3 (4.6)
	All schools	−1 (1.7)	0 (2.8)	1 (2.1)	−4 (3.0)	−4 (1.9)	−2 (2.6)	3 (2.3)	7 (3.9)	−8 (2.8)
	Low SES	1 (2.0)	0 (4.0)	2 (3.1)	*−20 (5.7)*	−1 (2.4)	−6 (3.8)	*10 (4.0)*	*14 (5.0)*	−8 (3.3)
Israel	High SES	−4 (2.2)	4 (2.4)	−1 (2.6)	2 (2.1)	−3 (2.8)	1 (4.2)	0 (2.2)	−1 (2.4)	−3 (2.4)
	All schools	−7 (2.3)	3 (2.0)	5 (2.2)	0 (1.8)	2 (2.1)	−1 (2.0)	1 (2.2)	4 (4.2)	0 (1.6)
	Low SES	−7 (2.3)	3 (2.0)	5 (2.2)	0 (1.8)	2 (2.1)	−1 (2.0)	1 (2.2)	4 (4.2)	0 (1.6)
Italy	High SES	−7 (4.7)	2 (3.2)	8 (4.4)	−2 (3.6)	2 (2.8)	0 (3.7)	−4 (4.7)	11 (7.8)	−2 (1.8)
	All schools	0 (1.8)	4 (2.3)	1 (1.8)	1 (1.5)	−1 (1.8)	−2 (1.6)	*−3 (1.6)*	0 (2.5)	−1 (1.7)
	Low SES	1 (3.3)	5 (4.6)	4 (3.7)	4 (2.7)	−1 (2.9)	2 (3.8)	*−10 (2.9)*	−5 (4.4)	2 (3.3)
Japan	High SES	0 (3.3)	3 (3.4)	−5 (2.7)	−1 (2.9)	0 (3.9)	1 (2.5)	−3 (2.7)	−5 (5.6)	3 (2.9)
	All schools	1 (1.0)	3 (1.0)	0 (1.3)	0 (1.1)	1 (1.1)	0 (0.9)	0 (1.2)	1 (1.8)	2 (1.1)
	Low SES	2 (1.5)	3 (1.5)	5 (3.2)	1 (1.4)	1 (1.4)	−5 (2.3)	0 (1.8)	−1 (2.3)	2 (2.0)
Republic of Korea	High SES	0 (1.7)	*4 (1.8)*	−3 (3.4)	−5 (1.9)	7 (2.5)	2 (1.6)	−3 (2.1)	*14 (4.1)*	−3 (2.9)
	All schools	1 (1.1)	*3 (1.1)*	−1 (1.5)	*−2 (0.7)*	0 (1.2)	1 (0.8)	0 (1.0)	−2 (1.7)	0 (0.5)
	Low SES	0 (1.2)	2 (1.6)	−1 (1.8)	−2 (1.0)	2 (1.5)	*3 (1.0)*	*3 (1.2)*	−3 (2.1)	0 (0.8)
	High SES	0 (1.4)	2 (2.0)	−1 (2.3)	−1 (1.3)	−3 (2.0)	0 (2.4)	0 (2.4)	0 (3.9)	−1 (1.1)

Table 4 continued

		Teach_WCN	Teach_EAS	Teach_SOS	Teach_CTM	Teach_CST	Teach_CIT	Teach_IES	Teach_PRP	Teach_STT
Lebanon	All schools	1 (1.5)	1 (1.8)	1 (1.9)	2 (1.5)	−1 (1.5)	2 (1.5)	−1 (1.9)	−1 (3.6)	1 (1.1)
	Low SES	−6 (2.9)	6 (2.8)	−3 (1.6)	7 (2.5)	6 (1.9)	1 (1.8)	−1 (2.5)	−7 (5.1)	4 (1.8)
	High SES	1 (2.5)	0 (2.5)	2 (3.7)	−2 (2.7)	−2 (1.9)	−1 (1.8)	7 (2.8)	−8 (4.8)	−3 (1.4)
Lithuania	All schools	−1 (1.4)	0 (1.5)	0 (2.0)	2 (2.0)	0 (1.6)	−1 (1.7)	−3 (1.9)	−3 (7.6)	−1 (1.6)
	Low SES	0 (1.8)	3 (2.6)	0 (3.1)	9 (2.5)	−2 (2.5)	−1 (2.7)	−6 (2.6)	−11 (10.7)	0 (2.2)
	High SES	0 (2.4)	2 (2.7)	0 (2.4)	−6 (2.4)	1 (1.7)	−3 (2.2)	4 (2.8)	2 (11.2)	4 (2.5)
Malaysia	All schools	−5 (2.5)	2 (2.0)	−1 (2.4)	−1 (1.9)	1 (2.5)	−3 (2.7)	2 (1.9)	9 (4.0)	−1 (1.2)
	Low SES	−1 (3.0)	−1 (3.2)	−8 (3.6)	−1 (2.5)	10 (4.9)	−3 (3.7)	1 (2.6)	12 (5.2)	−1 (1.5)
	High SES	−1 (6.1)	5 (2.6)	0 (4.2)	2 (3.1)	−2 (3.3)	−1 (4.9)	3 (2.4)	2 (9.4)	0 (1.9)
New Zealand	All schools	−2 (1.4)	0 (2.3)	4 (2.0)	−4 (1.7)	0 (1.6)	0 (1.9)	2 (2.1)	7 (3.6)	−1 (1.2)
	Low SES	−4 (2.4)	−3 (3.1)	4 (3.7)	−4 (2.3)	4 (2.4)	1 (2.2)	5 (2.3)	10 (4.3)	−4 (1.7)
	High SES	0 (2.3)	4 (2.1)	5 (2.3)	−2 (2.2)	−4 (2.4)	0 (2.1)	0 (1.9)	13 (2.6)	2 (1.4)
Norway	All schools	−1 (1.3)	3 (1.8)	0 (1.4)	1 (1.2)	0 (1.1)	3 (1.0)	0 (1.3)	−6 (2.4)	1 (0.7)
	Low SES	1 (1.8)	−1 (3.8)	−1 (3.1)	4 (2.0)	−1 (1.8)	4 (2.0)	1 (2.2)	−6 (4.1)	−1 (1.5)
	High SES	−6 (2.6)	10 (3.2)	−2 (2.3)	1 (1.4)	2 (2.4)	1 (1.8)	2 (1.3)	−6 (2.4)	−1 (1.3)
Romania	All schools	−1 (2.4)	0 (2.4)	1 (3.3)	3 (4.1)	−2 (1.8)	0 (3.5)	4 (2.7)	8 (8.2)	−3 (2.1)
	Low SES	1 (4.2)	−1 (4.6)	1 (4.7)	4 (6.8)	−3 (3.9)	−3 (5.1)	7 (5.4)	11 (12.6)	−3 (4.1)
	High SES	−2 (2.4)	7 (2.2)	−2 (2.2)	−5 (3.9)	−2 (1.6)	0 (2.2)	4 (3.1)	27 (17.5)	2 (1.4)
Singapore	All schools	−2 (1.6)	1 (1.5)	0 (1.9)	1 (1.8)	1 (1.6)	3 (1.3)	2 (1.9)	1 (5.0)	−1 (1.1)
	Low SES	−3 (3.4)	−4 (2.3)	−3 (2.8)	1 (3.8)	6 (3.1)	0 (3.4)	4 (2.6)	3 (5.8)	0 (1.3)
	High SES	−1 (2.8)	3 (3.3)	5 (3.8)	−4 (2.1)	−1 (2.9)	2 (2.8)	6 (2.9)	10 (9.2)	−3 (1.5)
Slovenia	All schools	−1 (1.1)	3 (1.5)	−2 (1.5)	1 (1.5)	−1 (1.6)	2 (1.3)	−1 (1.1)	−8 (3.7)	2 (1.4)
	Low SES	0 (2.3)	8 (3.3)	0 (2.3)	0 (2.5)	−3 (2.1)	1 (1.5)	−3 (2.2)	−12 (3.6)	3 (2.2)
	High SES	1 (1.3)	0 (2.6)	−7 (2.8)	6 (2.6)	2 (1.9)	3 (2.0)	−2 (1.4)	−16 (4.3)	0 (1.6)
Sweden	All schools	2 (1.2)	3 (1.4)	−1 (1.5)	−1 (1.4)	1 (1.0)	1 (0.9)	−1 (1.1)	1 (3.0)	0 (0.5)
	Low SES	0 (1.4)	3 (3.3)	4 (2.7)	−5 (2.8)	3 (2.4)	1 (1.8)	0 (1.3)	12 (6.6)	1 (1.0)
	High SES	5 (3.2)	1 (2.2)	2 (1.8)	−1 (2.4)	0 (1.3)	4 (1.2)	−3 (2.9)	5 (4.8)	−1 (1.0)
Thailand	All schools	−1 (3.7)	1 (2.8)	−2 (2.7)	2 (2.2)	0 (5.0)	−2 (2.2)	2 (2.8)	−5 (4.3)	1 (1.2)
	Low SES	1 (4.8)	4 (5.2)	0 (3.2)	4 (3.8)	−17 (15.7)	1 (3.9)	−5 (4.5)	−7 (6.2)	−1 (1.8)
	High SES	4 (8.1)	5 (3.9)	6 (5.1)	7 (3.6)	−2 (4.9)	−5 (2.2)	3 (4.5)	2 (5.9)	−3 (2.2)
Tunisia	All schools	−4 (1.7)	3 (1.5)	2 (1.4)	−3 (1.6)	0 (1.3)	0 (1.0)	2 (1.3)	−3 (3.2)	1 (0.8)
	Low SES	−3 (3.2)	0 (2.0)	5 (2.1)	−3 (2.2)	−2 (1.9)	0 (1.8)	3 (1.7)	5 (3.3)	0 (1.5)
	High SES	−3 (4.1)	1 (3.2)	−4 (3.4)	−2 (3.0)	1 (3.3)	−1 (2.5)	7 (3.0)	−11 (7.0)	3 (1.4)
Turkey	All schools	−5 (1.7)	−2 (1.7)	8 (1.9)	2 (1.5)	0 (1.3)	−2 (1.6)	2 (1.6)	6 (3.1)	2 (1.5)
	Low SES	−4 (2.1)	−4 (2.8)	8 (2.9)	3 (2.6)	1 (1.7)	−5 (2.4)	5 (2.6)	14 (6.3)	3 (2.0)
	High SES	−5 (2.7)	−3 (3.1)	8 (3.8)	0 (2.9)	−3 (2.7)	0 (2.9)	2 (3.1)	10 (5.2)	1 (2.0)

Table 4 continued

		Teach_WCN	Teach_EAS	Teach_SOS	Teach_CTM	Teach_CST	Teach_CIT	Teach_IES	Teach_PRP	Teach_STT
Ukraine	All schools	0 (2.7)	1 (3.3)	0 (2.9)	−1 (4.1)	1 (2.8)	0 (3.6)	1 (2.6)	−3 (3.7)	*6* (2.6)
	Low SES	−2 (4.6)	*−11* (4.5)	−7 (4.5)	−9 (7.8)	6 (5.1)	−4 (6.9)	−2 (3.8)	−3 (6.2)	4 (6.7)
	High SES	−2 (4.1)	−4 (6.4)	−3 (4.3)	15 (8.5)	3 (4.0)	1 (4.5)	1 (3.9)	0 (6.9)	4 (3.2)
United Arab Emirates	All schools	−2 (1.8)	*6* (2.7)	2 (3.8)	−2 (2.8)	*6* (2.7)	−4 (2.2)	−1 (3.2)	10 (5.4)	3 (1.7)
	Low SES	0 (2.2)	3 (2.5)	5 (2.6)	−1 (2.0)	0 (2.2)	−6 (3.1)	1 (2.5)	−5 (5.1)	1 (1.1)
	High SES	−2 (1.8)	6 (2.7)	2 (3.8)	−2 (2.8)	6 (2.7)	−4 (2.2)	−1 (3.2)	10 (5.4)	3 (1.7)
United States	All schools	0 (1.2)	0 (1.5)	−2 (1.6)	1 (1.7)	−2 (1.4)	0 (1.0)	0 (1.8)	2 (4.4)	*−3* (0.9)
	Low SES	−1 (1.9)	1 (2.1)	0 (2.1)	2 (2.8)	−6 (2.4)	0 (1.6)	−1 (3.4)	−3 (5.8)	−2 (1.3)
	High SES	5 (2.2)	0 (2.9)	−6 (3.7)	2 (3.3)	−3 (2.4)	1 (1.7)	−1 (3.2)	−6 (6.5)	−5 (2.3)

		Student_gender (female = 0)	SES_student	St_SLM	St_SVM	St_SCM	St_EML	St_HMW
Armenia	All schools	−9 (2.6)	5 (1.0)	5 (1.0)	−2 (0.8)	16 (1.1)	0 (0.8)	−8 (1.9)
	Low SES	*−11* (5.1)	*5* (1.3)	5 (1.6)	*−5* (1.3)	*18* (1.1)	1 (1.7)	*−15* (4.4)
	High SES	*−8* (3.7)	4 (1.6)	4 (1.5)	0 (1.0)	13 (1.6)	0 (1.3)	−5 (3.0)
Australia	All schools	−2 (3.8)	6 (1.3)	2 (1.1)	−1 (1.2)	14 (1.2)	−2 (1.1)	0 (2.4)
	Low SES	−5 (5.1)	7 (1.3)	1 (1.6)	−1 (1.3)	14 (1.1)	−1 (1.7)	−1 (4.4)
	High SES	−4 (5.3)	6 (1.3)	1 (1.3)	0 (1.0)	14 (1.3)	−2 (1.2)	0 (2.8)
Chile	All schools	*10* (3.4)	4 (0.7)	0 (1.0)	0 (0.8)	17 (0.8)	−3 (0.9)	1 (2.2)
	Low SES	6 (4.3)	5 (1.5)	2 (1.5)	−1 (1.2)	16 (1.4)	−3 (1.1)	−3 (4.0)
	High SES	*13* (3.0)	2 (1.3)	−1 (1.0)	2 (1.0)	17 (0.8)	−4 (0.8)	3 (2.8)
Chinese Taipei	All schools	*−15* (2.1)	12 (0.8)	5 (1.0)	2 (0.9)	17 (0.9)	−2 (0.9)	*−10* (2.7)
	Low SES	*−12* (3.8)	12 (1.7)	*7* (2.0)	2 (1.9)	16 (1.3)	−1 (1.9)	*−10* (4.4)
	High SES	*−22* (3.5)	10 (1.2)	4 (1.8)	4 (1.3)	16 (1.5)	−1 (1.5)	*−10* (2.9)
England	All schools	−5 (2.4)	8 (1.1)	−1 (1.2)	0 (1.0)	*11* (0.9)	0 (1.0)	−2 (2.5)
	Low SES	−5 (4.7)	*10* (2.1)	−4 (2.8)	1 (2.0)	*14* (1.9)	2 (1.8)	−1 (5.7)
	High SES	−5 (3.7)	7 (1.5)	0 (1.4)	−1 (1.2)	*11* (1.2)	−1 (1.4)	−3 (3.7)
Finland	All schools	−9 (2.3)	8 (0.7)	2 (1.0)	1 (0.9)	17 (1.2)	−5 (1.0)	8 (1.4)
	Low SES	−7 (3.7)	7 (1.7)	2 (2.1)	1 (1.4)	17 (1.2)	−7 (1.6)	9 (3.3)
	High SES	*−14* (3.9)	6 (1.3)	1 (1.7)	1 (0.9)	16 (1.2)	−3 (2.3)	6 (6.0)
Georgia	All schools	−1 (3.9)	8 (1.3)	*3* (1.3)	−4 (1.1)	*21* (1.7)	0 (1.3)	*−12* (2.1)
	Low SES	5 (8.7)	15 (2.8)	1 (2.1)	−1 (2.4)	*21* (2.8)	−2 (2.6)	*−10* (3.7)
	High SES	−2 (3.8)	5 (1.8)	2 (1.4)	−6 (1.3)	*21* (1.5)	1 (1.2)	*−18* (3.5)
Hong Kong, SAR	All schools	*9* (2.4)	0 (0.7)	*3* (0.9)	*1* (0.8)	9 (0.8)	0 (1.4)	−2 (2.6)
	Low SES	*12* (3.4)	0 (1.3)	3 (1.5)	2 (1.2)	*11* (1.5)	−1 (1.3)	1 (3.2)
	High SES	*6* (2.8)	1 (1.2)	4 (1.3)	2 (0.9)	8 (0.9)	1 (1.1)	−1 (2.2)
Hungary	All schools	−3 (2.3)	12 (1.0)	−2 (1.2)	0 (0.9)	19 (0.8)	−2 (0.9)	4 (1.7)
	Low SES	−5 (5.1)	16 (1.7)	−2 (2.7)	0 (2.3)	20 (1.7)	−1 (1.6)	1 (3.4)
	High SES	−1 (2.5)	8 (1.2)	0 (0.9)	0 (0.8)	18 (0.9)	−3 (1.2)	5 (2.2)
Israel	All schools	−4 (0.0)	9 (0.0)	−1 (0.0)	*2* (0.0)	17 (0.0)	−4 (0.0)	*−7* (0.0)
	Low SES	−4 (3.4)	9 (0.7)	−1 (1.0)	2 (0.8)	17 (0.8)	−4 (0.9)	*−7* (2.2)
	High SES	3 (6.1)	9 (1.4)	1 (1.3)	0 (1.3)	15 (1.3)	−4 (1.6)	−6 (4.2)
Italy	All schools	1 (0.0)	8 (0.0)	0 (0.0)	*−3* (0.0)	19 (0.0)	*−2* (0.0)	3 (0.0)
	Low SES	1 (5.0)	9 (1.6)	2 (2.3)	−2 (1.8)	17 (1.7)	−3 (2.1)	5 (3.7)

Table 4 continued

		Student_gender (female = 0)	SES_student	St_SLM	St_SVM	St_SCM	St_EML	St_HMW
	High SES	1 (4.7)	8 (1.1)	−1 (1.9)	0 (1.8)	19 (1.5)	−4 (1.9)	2 (3.0)
Japan	All schools	−9 (0.0)	11 (0.0)	2 (0.0)	4 (0.0)	19 (0.0)	−2 (0.0)	10 (0.0)
	Low SES	−13 (4.0)	12 (1.4)	2 (2.4)	3 (1.9)	20 (1.9)	−2 (2.1)	2 (5.4)
	High SES	−7 (3.0)	11 (1.6)	1 (1.4)	4 (1.6)	18 (1.9)	1 (1.2)	9 (4.3)
Republic of Korea	All schools	−4 (0.0)	13 (0.0)	3 (0.0)	6 (0.0)	22 (0.0)	0 (0.0)	3 (0.0)
	Low SES	−3 (5.1)	12 (1.5)	2 (2.0)	8 (1.5)	24 (1.6)	−1 (1.3)	3 (4.2)
	High SES	−8 (3.3)	15 (1.2)	4 (1.6)	6 (1.2)	19 (1.5)	0 (1.4)	3 (3.8)
Lebanon	All schools	4 (0.0)	2 (0.0)	2 (0.0)	0 (0.0)	11 (0.0)	−1 (0.0)	−2 (0.0)
	Low SES	−1 (7.2)	0 (1.5)	5 (1.7)	1 (1.4)	8 (1.4)	0 (1.2)	−7 (3.4)
	High SES	3 (3.4)	2 (1.0)	0 (1.1)	−1 (0.9)	13 (1.2)	−1 (1.3)	0 (2.4)
Lithuania	All schools	−12 (0.0)	11 (0.0)	1 (0.0)	−1 (0.0)	21 (0.0)	−7 (0.0)	4 (0.0)
	Low SES	−16 (5.9)	14 (2.3)	1 (2.4)	1 (1.9)	25 (2.1)	−10 (2.3)	1 (3.6)
	High SES	−10 (3.7)	8 (1.3)	0 (1.3)	0 (1.0)	19 (0.9)	−5 (1.3)	7 (2.6)
Malaysia	All schools	−2 (0.0)	3 (0.0)	8 (0.0)	0 (0.0)	9 (0.0)	−6 (0.0)	4 (0.0)
	Low SES	−3 (3.2)	2 (0.9)	9 (1.1)	2 (0.9)	3 (1.6)	−5 (1.1)	2 (2.0)
	High SES	−5 (2.7)	1 (0.8)	5 (1.0)	1 (0.8)	10 (1.2)	−7 (0.8)	5 (1.9)
New Zealand	All schools	−2 (0.0)	9 (0.0)	1 (0.0)	−1 (0.0)	19 (0.0)	−5 (0.0)	−3 (0.0)
	Low SES	8 (4.5)	10 (2.2)	−1 (1.7)	1 (1.4)	19 (1.5)	−8 (1.2)	6 (4.3)
	High SES	−6 (4.3)	10 (1.5)	1 (1.4)	−2 (1.5)	19 (1.2)	−2 (1.8)	−1 (4.8)
Norway	All schools	−6 (0.0)	8 (0.0)	1 (0.0)	−2 (0.0)	17 (0.0)	−3 (0.0)	2 (0.0)
	Low SES	−12 (5.3)	11 (1.4)	3 (2.3)	−4 (1.3)	15 (2.2)	−5 (1.4)	−5 (3.4)
	High SES	−3 (2.7)	9 (0.8)	−1 (1.3)	−2 (1.1)	17 (0.9)	0 (1.0)	4 (3.1)
Romania	All schools	−3 (0.0)	14 (0.0)	2 (0.0)	−3 (0.0)	18 (0.0)	−2 (0.0)	−16 (0.0)
	Low SES	3 (3.2)	12 (1.5)	4 (1.3)	−3 (1.1)	16 (1.3)	−3 (1.6)	−18 (3.9)
	High SES	−7 (3.4)	13 (1.3)	1 (1.4)	−1 (1.1)	20 (1.0)	−5 (1.4)	−13 (2.4)
Singapore	All schools	−3 (0.0)	5 (0.0)	3 (0.0)	0 (0.0)	12 (0.0)	−5 (0.0)	−15 (0.0)
	Low SES	−5 (4.7)	7 (1.3)	2 (1.6)	−1 (1.5)	14 (1.4)	−7 (2.0)	−25 (4.0)
	High SES	4 (3.4)	1 (1.3)	4 (0.9)	0 (0.8)	9 (0.9)	−2 (1.0)	−3 (2.0)
Slovenia	All schools	−2 (0.0)	12 (0.0)	0 (0.0)	−1 (0.0)	2 (0.0)	−8 (0.0)	−4 (0.0)
	Low SES	−3 (4.0)	11 (1.7)	−3 (1.3)	0 (1.3)	26 (1.2)	−5 (1.9)	2 (2.9)
	High SES	2 (4.0)	11 (1.3)	1 (1.4)	−3 (1.3)	21 (1.9)	−6 (1.3)	−8 (2.4)
Sweden	All schools	−9 (0.0)	8 (0.0)	2 (0.0)	−2 (0.0)	18 (0.0)	−2 (0.0)	6 (0.0)
	Low SES	−8 (5.6)	9 (1.8)	3 (2.4)	−3 (1.7)	19 (2.7)	0 (1.6)	11 (4.1)
	High SES	−13 (4.4)	8 (1.2)	2 (1.9)	−2 (1.5)	18 (1.3)	−3 (2.1)	4 (4.0)
Thailand	All schools	−4 (0.0)	2 (0.0)	9 (0.0)	3 (0.0)	7 (0.0)	−6 (0.0)	−2 (0.0)
	Low SES	−8 (4.3)	−1 (1.7)	8 (1.8)	6 (2.0)	3 (3.2)	−5 (2.3)	0 (2.8)
	High SES	0 (2.9)	1 (1.0)	10 (1.2)	1 (1.0)	8 (1.5)	−6 (1.1)	−2 (2.7)
Tunisia	All schools	12 (0.0)	3 (0.0)	2 (0.0)	0 (0.0)	14 (0.0)	−3 (0.0)	3 (0.0)
	Low SES	14 (2.8)	−2 (1.1)	1 (1.2)	−1 (1.2)	13 (1.3)	−3 (1.2)	1 (2.1)
	High SES	9 (3.6)	6 (1.5)	0 (1.5)	1 (0.9)	15 (1.7)	−2 (1.1)	3 (2.4)
Turkey	All schools	−9 (0.0)	9 (0.0)	−1 (0.0)	1 (0.0)	22 (0.0)	−1 (0.0)	4 (0.0)
	Low SES	−9 (5.5)	5 (1.4)	1 (1.6)	2 (1.4)	19 (1.5)	2 (1.5)	1 (3.6)
	High SES	−11 (3.3)	9 (1.3)	−1 (1.5)	0 (1.3)	23 (1.1)	−4 (1.3)	9 (3.4)
Ukraine	All schools	2 (0.0)	10 (0.0)	−1 (0.0)	0 (0.0)	28 (0.0)	−3 (0.0)	1 (0.0)
	Low SES	−3 (8.0)	18 (3.1)	2 (2.8)	1 (2.3)	26 (4.4)	−3 (2.6)	0 (3.6)
	High SES	10 (3.5)	7 (1.3)	1 (1.5)	−2 (1.2)	28 (1.5)	−4 (1.4)	6 (2.7)

Table 4 continued

		Student_gender (female = 0)	SES_student	St_SLM	St_SVM	St_SCM	St_EML	St_HMW
United Arab Emirates	All schools	−5 (0.0)	*5* (0.0)	*3* (0.0)	−1 (0.0)	*18* (0.0)	−5 (0.0)	2 (0.0)
	Low SES	−16 (10.3)	*5* (0.9)	2 (1.4)	−2 (0.9)	*18* (1.2)	−3 (1.0)	1 (2.7)
	High SES	−5 (4.4)	*5* (1.2)	*3* (1.1)	−1 (0.8)	*18* (0.8)	−5 (1.1)	2 (2.7)
United States	All schools	*4* (0.0)	*4* (0.0)	0 (0.0)	0 (0.0)	*11* (0.0)	−3 (0.0)	−1 (0.0)
	Low SES	4 (2.7)	*2* (0.8)	1 (0.9)	−1 (0.8)	*11* (0.7)	−4 (0.8)	−2 (1.8)
	High SES	1 (2.2)	*3* (0.7)	2 (0.9)	0 (0.6)	*9* (0.7)	−3 (0.7)	1 (2.1)

() standard errors appear in parentheses; statistically significant ($p < 0.05$) coefficient in italics

The results exhibited a different impact of the considered variables on the analyses of different countries. For example, in New Zealand, Thailand and Ukraine, the full model of high SES schools explained a higher proportion of between-school variance, while parental involvement, school emphasis on academic success (principal reports) and safe and orderly school (teacher report) had a significant impact on mathematics achievement compared with low SES schools.

Conclusion

The main aim of the present study was to evaluate the impact of context factors on mathematics achievement, focusing on students attending socio-economic disadvantaged schools across countries participating in TIMSS 2011. Context factors reflecting the availability/non-availability of economic and cultural resources within the family context play a relevant role in determining student performance. As expected and according to previous studies (see, e.g., Sirin 2005; Chiu and Xihua 2008; Ismail and Awang 2008; Levpušček et al. 2013), our analyses showed that a high socio-economic status has a significant and positive effect on student achievement: compared with students from socio-economically disadvantaged schools, students from advantaged schools performed better in mathematics achievement. This difference is more evident in countries where the gap between rich and poor people as measured by the Gini coefficient, which measures how much an economy deviates from perfect equality, is wider.[4] Those countries are Chile, England, Turkey, Malaysia and Israel. However, this difference is restricted in countries with the smallest gap between rich and poor people, namely in northern European countries, such as Finland, Norway and Sweden, and in Slovenia. Two exceptions are represented by Japan and Australia. In Japan, although it has a large gap between rich and poor, the difference in mathematics achievement is about half of a standard deviation. In Australia, the gap between rich and poor people is not so high, but the difference in mathematics achievement is around one standard deviation.

Moreover, according to the literature (Martin and Mullis 2013; Drent et al. 2013; Phan 2008), the results show significant differences across countries in relation to the school and teacher characteristics that have an impact on mathematics achievement of students

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[4] See https://www.cia.gov/library/publications/the-world-factbook/rankorder/2172rank.html.

from low and high SES schools. Different patterns were also found within countries for low and high SES schools.

As for other variables considered in this study, such as *parental involvement*, other studies showed discordant results (e.g., McNeal 1999). It is possible that this difference is due to schools' attempts to have more direct and stronger relationships with the parents of students with learning problems. Furthermore, in advantaged schools, parental involvement and emphasis on academic success have an impact in a small group of countries, although this association has different directions in different countries.

Some limitations to this study should be noted. First, to gain a deeper understanding of the present findings, it is necessary to consider the large differences in teaching mathematics across countries (Mullis et al. 2012). A second limitation is that the data used in this study are related to only one school year. As a consequence, generalizations about the influence of context factors on student mathematics achievement should be taken with some degree of caution. Analyses on more than one dataset are needed for a clearer picture of what school factors are associated with mathematics achievement.

Additionally, a more general methodological issue should be investigated. The type of constructs and variables used in the questionnaire development, the way these constructs and variables are operationally defined, the self-reported nature of the collected data, and the type of data analyses carried out all may contribute to explaining the difficulty of finding strong associations between students' performance and process-related school variables. Additionally, the construction of indicators of teaching processes may require a different approach, namely a systematic observation of classroom practices (Postlethwaite and Ross 1992). Furthermore, the results suggest that even more advanced and "complex" analytical methods and designs of analysis should be tried to address some of the issues outlined here, in an effort to extricate the effect of SES from that of other variables.

Despite these limitations, the present study investigated the relationship between context factors and student achievement across countries on a large and representative sample of students, assessed by a well-established international standardized test. It should be noted that such standardized tests have been used increasingly in recent years by educational and political decision makers to improve teaching and learning in mathematics and the quality of education systems. The results of the present study suggest the opportuneness of using school-level factors not only for cross-country comparisons but also for an in-depth investigation into the differences existing within individual countries. Moreover, as already shown by other studies (Sandoval-Hernández et al. 2014), the results of the international comparative studies could be used to study the impact of school factors in disparate school contexts. Different school factors seem to play a different role in different school contexts within each individual country.

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