

Technical Appendix B

School Effectiveness Models and Analyses

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Overview

Many factors lead to variation in student achievement. Through data analysis we seek out those factors that can explain this variation. In the context of TIMSS and PIRLS, these factors can be at the student level (e.g., what happens at home) and at the school level (e.g., what happens in the school and the classroom). Effective schools analysis looks for factors that explain school-level variation, and a first step consists of determining how much of the total variation is at the student level and at the school level. The proportion of school-level variation will determine the scope for effective schools analyses.

In this study, presented in the *TIMSS and PIRLS 2011 Relationships Report* (Martin & Mullis, 2013), the analysis of effective schools was conducted by applying Hierarchical Linear Models (HLM)¹ to data from 34 countries and 3 benchmark participants (Quebec, Canada, and Abu Dhabi and Dubai, United Arab Emirates) that administered both TIMSS and PIRLS 2011 assessments to the same samples of fourth grade students (Botswana and Honduras administered the assessments at the sixth grade). For the purpose of this analysis, a special TIMSS and PIRLS 2011 Fourth Grade Combined International Database (Foy, 2013) was created, which includes only students assessed in reading, mathematics, and science and their achievement scores in all three subjects estimated on a multidimensional scaling of these subjects together. Two-level models—students and schools—were developed and applied to the data provided by the students, their parents, their school principals, and their teachers. These models served to estimate the relationship between effective school factors and achievement in reading, mathematics, and science.

Some of the school variance may be due to home factors (i.e., what students and their home background bring to the school), thus it was necessary to account for this source of variation in the modeling such that effective school variables were free of this influence. For this purpose, two analytical constructs derived from the student and parent background questionnaires were used:

¹ All HLM analyses were conducted using the HLM7 software (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011).

a socio-economic factor, and literacy and numeracy skills acquired before primary schooling. The use of these two student-level factors provided control for home factors in order to properly isolate the contribution of the effective school factors on student achievement.

National Samples of Students and Schools

The national samples drawn for TIMSS and PIRLS are known generally as two-stage stratified cluster samples. Typically for the 2011 assessments, 150 schools were drawn using a systematic sampling approach and with probabilities proportional to size—that is, larger schools had larger selection probabilities. Within selected schools, generally one or two classrooms were sampled with all students in selected classrooms taking part in the two assessments, resulting in national samples of about 150 schools and 4,000 students.

The multi-stage nature of the TIMSS and PIRLS sample design lends itself well to analyses with hierarchical linear models. When at least two classrooms are sampled per school, the resulting national samples of students are amenable to proper two-level analyses of students and schools. This was the case for most of the participating countries and benchmarking participants.

Exhibit 1 presents the actual samples sizes drawn in each participating country in terms of students, classrooms, and schools. This exhibit also shows the number of schools where one, two, and three or more classrooms were sampled. It is worthwhile to note that among the schools where one classroom was sampled, a good number of these schools had only one available classroom. As can be seen, Botswana, Chinese Taipei, Germany, Hong Kong SAR, Iran, Italy, Morocco, Oman, Qatar, the Russian Federation, Saudi Arabia, the United Arab Emirates, the Canadian province of Quebec, and the Emirate of Abu Dhabi predominantly sampled only one classroom per school. Thus, the student samples within schools were representative of their respective schools to the extent that the one classroom sampled was comparable to the other classrooms in their respective schools.

Exhibit B.1: Sample Sizes for the TIMSS and PIRLS 2011 Effective Schools Analysis

Country	Students	Classrooms	Schools	Schools with . . .		
				One Classroom Sampled	Two Classrooms Sampled	Three or More Classrooms Sampled
Australia	5,943	438	280	142	120	18
Austria	4,587	276	158	48	105	5
Azerbaijan	4,871	283	169	55	114	0
Chinese Taipei	4,265	155	150	145	5	0
Croatia	4,545	295	152	44	78	30
Czech Republic	4,433	235	177	121	54	2
Finland	4,541	267	145	47	75	23
Georgia	4,774	232	173	114	59	0
Germany	3,928	205	197	193	2	2
Hong Kong SAR	3,802	133	132	131	1	0
Hungary	5,149	249	149	50	98	1
Iran, Islamic Rep. of	5,734	245	244	243	1	0
Ireland	4,383	220	150	80	70	0
Italy	4,125	239	202	165	37	0
Lithuania	4,584	277	154	33	119	2
Malta	3,492	197	96	41	25	30
Morocco	7,614	292	284	280	1	3
Northern Ireland	3,469	160	136	112	24	0
Norway	3,054	197	119	47	66	6
Oman	10,237	412	327	254	69	4
Poland	4,962	257	150	43	107	0
Portugal	3,991	240	147	66	72	9
Qatar	4,104	185	166	147	19	0
Romania	4,643	246	148	58	82	8
Russian Federation	4,450	209	202	195	7	0
Saudi Arabia	4,470	197	171	145	26	0
Singapore	6,208	351	176	1	175	0
Slovak Republic	5,561	314	197	86	105	6
Slovenia	4,433	243	195	147	48	0
Spain	4,105	200	151	102	49	0
Sweden	4,482	251	152	79	49	24
United Arab Emirates	14,377	621	458	297	159	2
Sixth Grade Countries						
Botswana	4,165	150	149	148	1	0
Honduras	3,830	164	147	131	15	1
Benchmarking Participants						
Quebec, Canada	4,142	220	190	161	28	1
Abu Dhabi, UAE	4,100	180	164	148	16	0
Dubai, UAE	5,922	261	138	17	119	2

Achievement Scales

For the purpose of analyzing the relationships across reading, mathematics, and science, achievement scores in the three subjects were estimated using a multi-dimensional IRT model. This approach preserved the correlation structure across the three subjects. The item parameters were taken from the concurrent calibration of the PIRLS 2011 reading assessment and the concurrent calibration of the TIMSS 2011 mathematics and science assessments.² The achievement scores across the three subjects were estimated simultaneously as three separate sets of plausible values by the process of conditioning whereby all available student-level contextual data were included to improve the overall reliability of the achievement scales. Each achievement scale—reading, mathematics, and science—was then put on its own metric with an international mean of 500 (based on the 32 countries that administered the two assessments at the fourth grade) and standard deviation of 100. Although these achievement scores are not identical to those reported separately in the *TIMSS 2011 and PIRLS 2011 International Reports*, these scores convey the same information about the student achievement distributions in reading, mathematics, and science.

Sampling Weights

All effective schools analyses used the sampling weights provided with the TIMSS and PIRLS 2011 Combined International Database. These analyses relied on the overall student sampling weights specified at the student level, making it unnecessary to provide sampling weights at the school level. Specifically, the analyses used the house weight (HOUWGT), which sums up to the national student sample size (Foy, 2013).

The house weight also was used for conducting the principal components analyses needed for imputing missing data and for creating the aggregated explanatory and control variables incorporated into the HLM models.

Analysis Variables

The effective schools analyses relied on a number of variables extracted from the TIMSS and PIRLS 2011 Combined International Database obtained from responses to questions asked of the students, their parents, their school principals, and their teachers. The variables then were combined into measures of school effectiveness or home background for the types of analyses required. Exhibit 2 lists and describes the source variables used in our effective schools analysis. All source variables were contextual scales derived from responses to specific sets of questions using the Rasch partial credit model and included the following: seven student-level variables (either from the students, their parents, or both), four school-level variables, and three teacher-level variables. The exhibit also describes in which explanatory variable each of these source variables was used.

² The item parameters are presented in the scaling section of *Methods and Procedures in TIMSS and PIRLS 2011* (Martin & Mullis, 2012).

Exhibit B.2: Source Variables for the TIMSS and PIRLS 2011 Effective Schools Analysis

Student-Level Variables

Name	Label	Use
ASBHELT	Early Literacy Tasks	Control Variables ASBHAVG and ASBCAVG
ASBHENT	Early Numeracy Tasks	Control Variables ASBHAVG and ASBCAVG
ASBGHRL	Home Resources for Learning	Control Variables ASBGHRL and ASBCHRL
ASBGERL	Students Engaged in Reading Lessons	School Explanatory Variable ASBCEAL
ASBGEML	Students Engaged in Mathematics Lessons	School Explanatory Variable ASBCEAL
ASBGESL	Students Engaged in Science Lessons	School Explanatory Variable ASBCEAL
ASBGSBS	Students Bullied at School	School Explanatory Variable ACBMSOS

School-Level Variables

Name	Label	Use
ACBGARS	Instruction Affected by Any Resource Shortages	School Explanatory Variable ACBMSRS
ACBGDAS	School Discipline and Safety	School Explanatory Variable ACBMSOS
ACBGEAS	School Emphasis on Academic Success - Principal Reports	School Explanatory Variable ACBMEAS
ACBGRSS	Emphasis in Early Grades on Reading Skills and Strategies	School Explanatory Variable ACBGRSS (Unchanged)

Teacher-Level Variables

Name	Label	Use
ATBGTWC	Teacher Working Conditions	School Explanatory Variable ACBMSRS
ATBGSOS	Safe and Orderly School	School Explanatory Variable ACBMSOS
ATBGEAS	School Emphasis on Academic Success - Teacher Reports	School Explanatory Variable ACBMEAS

The contextual scales are described in the context questionnaire scales section of *Methods and Procedures in TIMSS and PIRLS 2011* (Martin & Mullis, 2012). For the purposes of the relationships report, all contextual scales were re-scaled in order to reflect the specific pool of countries and their data included in the TIMSS and PIRLS 2011 Combined International Database. The primary objective was to put these contextual scales on a common TIMSS and PIRLS metric rather than on either the TIMSS 2011 metric or the PIRLS 2011 metric found in their respective databases. Also, the Instruction Affected by Any Resource Shortages scale (ACBGARS) was created specifically for this relational analysis by combining all component variables of the individual resource shortages scales from TIMSS 2011 (ACBGMRS and ACBGSRS) and PIRLS 2011 (ACBGRRS).

Exhibit 3 describes the explanatory and control variables included in the HLM models. In general, these variables are averages of the source variables presented in Exhibit 2 and are divided into two major groups. The first group contains the school explanatory variables, which are further categorized as either school environment or school instruction explanatory variables. The second major group contains the home background control variables that are further divided into two sub-groups: the first consisting of the two student-level variables (students within schools), and the second consisting of the two school-level variables (between schools).

Exhibit B.3: School Explanatory Variables and Home Background Control Variables for the TIMSS and PIRLS 2011 Effective Schools Analysis

School Explanatory Variables

School Environment

Name	Label	Derivation
ACBMSOS	Schools Are Safe and Orderly	Average of Three School-level Variables: School Average of ASBGSBS; ACBGDAS; and School Average of ATBGSOS
ACBMEAS	Schools Support Academic Success	Average of Two School-level Variables: ACBGEAS and School Average of ATBGEAS
ACBMSRS	Adequate Environment and Resources	Average of Two School-level Variables: ACBGARS and School Average of ATBGTWC

School Instruction

Name	Label	Derivation
ACBGRSS	Early Emphasis on Reading Skills	ACBGRSS (Unchanged)
ASBCEAL	Students Engaged in Reading, Mathematics, and Science Lessons	Average of Three School-level Variables: School Average of ASBGERL; School Average of ASBGEML; and School Average of ASBGESL

Home Background Control Variables

Students within Schools

Name	Label	Derivation
ASBGHRL	Home Resources for Learning	ASBGHRL (Unchanged)
ASBHAVG	Early Literacy/Numeracy Tasks	Average of ASBHELT and ASBHENT

Between Schools

Name	Label	Derivation
ASBCHRL	School Average of Home Resources for Learning	School Average of ASBGHRL
ASBCAVG	School Average of Early Literacy/Numeracy Tasks	School Average of ASBHAVG

All school explanatory variables and the two school-level control variables were defined at the school level, regardless of whether their source variables were at the student level, school level, or teacher level. Student-level variables were averaged at the school level using the house weight. Teacher-level variables also were averaged at the school level using the house weight, but taking into account the special relationship between the students and their teachers as characterized in the student-teacher linkage files in the database. The three teacher weights present in these files—the reading teacher weight (REAWGT), the mathematics teacher weight (MATWGT), and the science teacher weight (SCIWGT)—were summed and the result recalibrated to sum up to the national student sample size, much like the house weight.

School Explanatory Variables

The school explanatory variables were divided into two categories. The first category consisted of three variables related to school environment (the school environment variables). The second category consisted of two variables related to school instruction (the school instruction variables).

School Environment Variables

The first variable, Schools Are Safe and Orderly, took into account the safe school environment perceptions of students, their school principals, and their teachers. This was done by using the

following three variables: the student variable Students Bullied at School (ASBGSBS), averaged at the school level; the teacher variable Safe and Orderly Schools (ATBGSOS), also averaged at the school level; and the school variable School Discipline and Safety (ACBGDAS). These three school-level variables were then averaged for each school.

The second school environment variable, Schools Support Academic Success, combined the teachers' and the school principals' reports on how much their schools emphasize academic success. The teachers' report (ATBGEAS) was averaged at the school level and then averaged with the school principals' report (ACBGEAS) for each school.

The third school environment variable, Adequate Environment and Resources, combined the school variable Instruction Affected by Any Resource Shortages (ACBGARS) with the teacher variable Teacher Working Conditions (ATBGTWC) averaged at the school level. These two components then were averaged for each school.

School Instruction Variables

The first school instruction variable, Early Emphasis on Reading Skills, was simply the school-level contextual scale Emphasis in Early Grades on Reading Skills and Strategies (ACBGRSS).

The second school instruction variable, Students Engaged in Reading, Mathematics, and Science Lessons, was the school-level average of the PIRLS 2011 student-level contextual scale Students Engaged in Reading Lessons (ASBGERL) and the two TIMSS 2011 student-level contextual scales Students Engaged in Mathematics Lessons (ASBGEML) and Students Engaged in Science Lessons (ASBGESL). It was calculated by first computing the average of the three student-level scales for each student and then averaging that student-level result for each school.

Home Background Control Variables

Measuring effective schools required that the effects of the factors that the schools bring to bear on student achievement be separated from the effects of the factors that the students bring to the schools. To that end, a control model was developed to account for the effects of student home environment.

From the data available from the TIMSS and PIRLS 2011 background questionnaires, Home Resources for Learning and Early Literacy/Numeracy Tasks were identified as the two analytical constructs for the control model. Home Resources for Learning (ASBGHRL) is a contextual scale described in the *TIMSS 2011 and PIRLS 2011 International Reports*. Early Literacy/Numeracy Tasks (ASBHAVG) is the average of two contextual scales, Early Literacy Tasks (ASBHELT), and Early Numeracy Tasks (ASBHENT), also described in the TIMSS 2011 and PIRLS 2011 International Reports.

The control model also differentiated how these two variables (ASBGHRL and ASBHAVG) could contribute at the student level and at the school level. Not only did the students themselves bring these factors to the schools for their own benefit, but their schoolmates also contributed as what is termed peer, or compositional, effects. Thus, these two variables were included as

student-level variables and school-level averages. In HLM terms, the student-level variables (ASBGHRL and ASBHAVG) were entered as group-mean centered student-level (level 1) variables; the school-level averages (ASBCHRL and ASBCAVG) were entered as grand-mean centered school-level (level 2) variables.

Dealing with Missing Data

Missing data occur in all national data files and at all levels: students, parents, schools, and teachers. The presence of missing data complicates the application of sophisticated statistical models such as HLM when it comes to maintaining constant sample sizes and degrees of freedom as variables are added or removed from the models. The missing data rates, therefore, can be different depending on the variables included in an analytical model, because a record will be dropped from analysis as soon as one of the variables included is missing. To address the matter of missing data, we applied single imputation models to complete the national datasets.³ Exhibit 4 presents the student and school sample sizes and student response rates by explanatory model prior to imputation. These numbers also reflect the presence of the home background control variables. Response rates are generally high, with a few notable exceptions.

³ Multiple imputations were considered, but the very small imputation variance present across all countries and data sources (students, parents, schools, and teachers) did not warrant the added complexity and computational burden.

Exhibit B.4: Sample Sizes and Student Response Rates for the TIMSS and PIRLS 2011 Effective Schools Analysis

Country	Sample Size After Imputation		Sample Sizes Prior to Imputation									
	Students	Schools	School Environment			School Instruction			School Environment and Instruction			
			Students	Schools	Student Response Rate	Students	Schools	Student Response Rate	Students	Schools	Student Response Rate	
Australia	5,943	280	3,109	276	54 s	2,991	265	52 s	2,991	265	52 s	
Austria	4,587	158	4,287	158	94	4,260	157	93	4,260	157	93	
Azerbaijan	4,871	169	4,352	169	90	4,245	162	88	4,245	162	88	
Chinese Taipei	4,265	150	4,171	150	98	4,171	150	98	4,171	150	98	
Croatia	4,545	152	4,484	152	99	4,484	152	99	4,484	152	99	
Czech Republic	4,433	177	4,274	176	96	4,126	169	93	4,126	169	93	
Finland	4,541	145	4,304	145	95	4,065	137	91	4,065	137	91	
Georgia	4,774	173	4,448	173	93	4,379	171	92	4,379	171	92	
Germany	3,928	197	2,934	196	75 r	2,740	182	70 r	2,740	182	70 r	
Hong Kong SAR	3,802	132	3,474	130	91	3,280	122	86	3,280	122	86	
Hungary	5,149	149	4,729	148	92	4,573	143	89	4,573	143	89	
Iran, Islamic Rep. of	5,734	244	5,559	244	97	5,527	243	97	5,527	243	97	
Ireland	4,383	150	4,091	150	94	3,888	143	90	3,888	143	90	
Italy	4,125	202	3,741	200	91	3,683	197	90	3,683	197	90	
Lithuania	4,584	154	4,309	154	94	4,187	149	91	4,187	149	91	
Malta	3,492	96	3,016	96	86	2,782	90	80 r	2,782	90	80 r	
Morocco	7,614	284	5,332	271	68 s	5,143	258	65 s	5,143	258	65 s	
Northern Ireland	3,469	136	1,861	125	52 s	1,707	115	49 t	1,707	115	49 t	
Norway	3,054	119	2,758	118	90	2,611	112	85	2,611	112	85	
Oman	10,237	327	8,498	318	87	7,360	281	76 r	7,338	280	76 r	
Poland	4,962	150	4,814	148	96	4,752	146	95	4,752	146	95	
Portugal	3,991	147	3,735	146	93	3,735	146	93	3,735	146	93	
Qatar	4,104	166	3,430	166	84 r	3,352	161	83 r	3,352	161	83 r	
Romania	4,643	148	4,451	146	96	4,392	144	95	4,392	144	95	
Russian Federation	4,450	202	4,380	202	98	4,380	202	98	4,380	202	98	
Saudi Arabia	4,470	171	4,170	171	93	4,105	168	91	4,105	168	91	
Singapore	6,208	176	5,962	175	96	5,928	174	95	5,928	174	95	
Slovak Republic	5,561	197	5,355	196	97	5,304	194	95	5,304	194	95	
Slovenia	4,433	195	4,251	195	96	4,075	187	93	4,075	187	93	
Spain	4,105	151	3,681	149	89	3,539	142	85	3,539	142	85	
Sweden	4,482	152	3,727	149	85	3,121	124	70 r	3,121	124	70 r	
United Arab Emirates	14,377	458	12,403	450	87	11,362	415	79 r	11,362	415	79 r	
Sixth Grade Countries												
Botswana	4,165	149	2,889	143	70 r	2,862	142	69 s	2,862	142	69 s	
Honduras	3,830	147	2,436	144	66 s	2,352	140	64 s	2,352	140	64 s	
Benchmarking Participants												
Quebec, Canada	4,142	190	3,596	187	88	3,541	182	86	3,541	182	86	
Abu Dhabi, UAE	4,100	164	3,588	161	87	3,432	153	80 r	3,432	153	80 r	
Dubai, UAE	5,922	138	4,980	136	87	4,602	126	79 r	4,602	126	79 r	

An “r” indicates data are available for at least 70% but less than 85% of the students. An “s” indicates data are available for at least 50% but less than 70% of the students. A “t” indicates data are available for less than 50% of the students.

The single imputation procedure in SPSS uses a regression model with a maximum likelihood estimation method. The dependent variables were the source variables of Exhibit 2 and the independent variables were all of the background questionnaire variables summarized by a principal component analysis that retained 75% of total variance. Thus, three imputation models, each with its set of dependent variables and principal components, were applied for each country: a student-level, a school-level, and a teacher-level imputation model. The student-level imputation model used background data from both the student questionnaire and the parent questionnaire.

The final result was a database with no missing data. Exhibit 5 shows the weighted national means and standard deviations of all the school explanatory variables and home background control variables included in the effective schools analysis. Exhibit 6 shows the same national means and standard deviations prior to imputation. As a general rule, the means, with or without imputation, are nearly identical. The standard deviations tend to show some attenuation after imputation, typically in countries with lower response rates.

Exhibit B.5: Means and Standard Deviations for the TIMSS and PIRLS 2011 Effective Schools Analysis

Country	School Explanatory Variables									
	School Environment						School Instruction			
	Schools are Safe and Orderly		Schools Support Academic Success		Adequate Environment and Resources		Early Emphasis on Reading Skills		Students Engaged in Reading, Mathematics and Science Lessons	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Australia	10.2	1.00	11.0	1.69	10.6	1.52	12.9	2.06	9.8	0.66
Austria	9.8	0.81	10.4	1.28	10.4	1.38	10.6	1.40	9.7	0.55
Azerbaijan	10.6	1.21	9.3	1.34	9.2	1.12	9.9	1.64	10.3	0.59
Chinese Taipei	10.2	0.75	10.7	1.28	9.3	1.14	9.5	1.76	9.4	0.63
Croatia	10.6	0.82	11.0	1.28	10.3	1.38	10.6	1.63	9.8	0.61
Czech Republic	9.8	0.77	8.9	1.28	10.9	1.35	10.2	1.89	9.9	0.65
Finland	10.0	0.86	10.1	1.12	10.1	1.13	9.4	1.43	8.7	0.51
Georgia	10.9	0.94	9.3	1.24	10.1	1.35	10.1	1.63	10.5	0.51
Germany	9.7	0.85	9.6	1.13	9.9	1.28	10.7	1.49	9.8	0.58
Hong Kong SAR	10.4	0.77	9.6	1.22	9.0	0.74	9.7	1.61	9.3	0.56
Hungary	9.6	0.84	9.2	1.40	10.4	1.46	10.6	1.67	10.3	0.52
Iran, Islamic Rep. of	10.2	1.07	10.5	1.46	9.0	1.32	8.9	1.61	10.8	0.77
Ireland	11.0	1.07	11.7	1.56	10.4	1.38	10.8	1.72	10.0	0.69
Italy	9.3	0.84	9.3	1.09	9.6	1.05	9.6	1.48	9.8	0.55
Lithuania	10.0	0.78	10.1	1.11	10.3	0.99	10.3	1.57	10.1	0.54
Malta	9.9	0.85	10.8	1.31	10.0	1.06	9.7	1.59	10.5	0.53
Morocco	8.3	1.02	7.7	1.59	9.1	1.15	6.9	1.63	10.2	1.01
Northern Ireland	10.9	0.83	12.0	1.49	10.4	1.38	11.9	1.74	9.8	0.62
Norway	10.2	0.75	9.8	1.08	9.9	1.06	9.4	1.57	9.8	0.64
Oman	9.1	0.95	10.5	1.20	8.9	1.17	8.7	1.56	10.2	0.69
Poland	10.1	0.81	10.0	1.32	11.0	1.36	9.5	1.20	10.3	0.52
Portugal	10.0	1.01	9.9	1.43	9.3	1.31	10.5	1.27	10.4	0.70
Qatar	9.8	1.04	11.1	1.35	10.0	2.10	9.6	2.22	9.9	0.60
Romania	9.8	1.00	9.8	1.42	9.7	1.36	10.0	1.42	10.7	0.80
Russian Federation	9.9	0.86	9.2	1.16	10.0	1.51	11.4	1.51	10.5	0.83
Saudi Arabia	9.6	1.10	10.2	1.59	9.4	1.15	8.4	1.84	10.0	0.78
Singapore	10.2	0.81	9.9	1.40	10.5	1.37	11.1	1.86	9.5	0.44
Slovak Republic	9.7	0.80	8.9	1.21	10.2	1.13	10.3	1.50	9.7	0.68
Slovenia	9.6	0.91	9.6	1.12	10.9	1.32	9.1	1.52	10.0	0.62
Spain	10.0	1.12	9.6	1.47	10.6	1.36	10.6	1.59	10.0	0.72
Sweden	9.9	0.93	10.0	1.32	9.9	1.21	10.7	1.70	9.5	0.58
United Arab Emirates	10.0	1.02	11.0	1.39	10.2	1.53	8.9	2.21	10.3	0.72
International Avg.	10.0	1.06	10.0	1.59	10.0	1.43	10.0	1.98	10.0	0.78
Sixth Grade Countries										
Botswana	8.5	0.94	8.8	1.73	8.6	1.30	10.5	2.31	9.7	0.68
Honduras	9.6	1.21	10.2	1.70	9.2	1.78	9.3	1.84	10.1	0.55
Benchmarking Participants										
Quebec, Canada	9.8	0.92	10.2	1.27	10.5	1.22	10.0	1.76	9.7	0.56
Abu Dhabi, UAE	9.9	0.91	11.0	1.38	10.1	1.55	8.0	2.36	10.3	0.82
Dubai, UAE	10.4	0.98	11.6	1.55	10.6	1.80	10.5	2.29	10.3	0.55

Exhibit B.5: Means and Standard Deviations for the TIMSS and PIRLS 2011 Effective Schools Analysis (Cont.)

Country	Home Background Control Variables							
	School Control Variables				Student Control Variables			
	Home Resources for Learning		Early Literacy and Numeracy Tasks		Home Resources for Learning		Early Literacy and Numeracy Tasks	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Australia	11.6	0.60	9.5	0.31	11.6	1.27	9.5	1.19
Austria	10.4	0.70	9.3	0.39	10.4	1.54	9.3	1.60
Azerbaijan	8.4	0.67	9.5	0.97	8.4	1.42	9.5	1.93
Chinese Taipei	10.2	0.86	11.2	0.27	10.2	1.89	11.2	1.22
Croatia	9.7	0.76	10.5	0.34	9.7	1.45	10.5	1.48
Czech Republic	10.5	0.66	9.9	0.38	10.5	1.50	9.9	1.50
Finland	11.3	0.53	10.4	0.43	11.3	1.47	10.4	1.63
Georgia	9.8	1.07	9.8	0.63	9.8	1.71	9.8	1.81
Germany	10.7	0.72	9.5	0.38	10.7	1.57	9.5	1.38
Hong Kong SAR	9.7	1.06	11.3	0.37	9.7	1.74	11.3	1.17
Hungary	10.0	1.34	9.3	0.40	10.0	2.20	9.3	1.68
Iran, Islamic Rep. of	8.0	1.67	9.6	0.98	8.0	2.27	9.6	1.93
Ireland	10.8	0.84	9.4	0.45	10.8	1.76	9.4	1.57
Italy	9.6	0.71	9.2	0.43	9.6	1.50	9.2	1.53
Lithuania	9.8	0.91	10.1	0.48	9.8	1.62	10.1	1.45
Malta	10.3	0.62	10.2	0.34	10.3	1.36	10.2	1.49
Morocco	6.9	1.37	9.7	1.41	6.9	1.97	9.7	2.08
Northern Ireland	10.9	0.59	9.0	0.31	10.9	1.41	9.0	1.18
Norway	11.5	0.54	9.4	0.33	11.5	1.52	9.4	1.60
Oman	8.6	0.94	10.6	0.46	8.6	1.81	10.6	1.54
Poland	10.0	0.95	9.9	0.46	10.0	1.81	9.9	1.67
Portugal	9.9	1.11	9.4	0.51	9.9	1.88	9.4	1.50
Qatar	10.1	0.76	10.8	0.40	10.1	1.47	10.8	1.52
Romania	8.7	1.52	9.6	1.13	8.7	2.15	9.6	2.06
Russian Federation	10.4	0.87	10.2	0.85	10.4	1.49	10.2	1.70
Saudi Arabia	9.0	1.06	10.5	0.95	9.0	1.81	10.5	1.76
Singapore	10.7	0.77	11.3	0.44	10.7	1.60	11.3	1.33
Slovak Republic	9.9	1.10	9.0	0.70	9.9	1.77	9.0	1.70
Slovenia	10.4	0.56	9.3	0.42	10.4	1.43	9.3	1.72
Spain	10.2	0.98	10.6	0.48	10.2	1.74	10.6	1.54
Sweden	11.3	0.82	10.3	0.40	11.3	1.65	10.3	1.48
United Arab Emirates	9.9	1.00	10.4	0.45	9.9	1.59	10.4	1.59
International Avg.	10.0	1.38	10.0	0.89	10.0	1.96	10.0	1.72
Sixth Grade Countries								
Botswana	7.6	1.19	9.6	0.91	7.6	1.94	9.6	1.83
Honduras	6.9	1.23	10.7	0.62	6.9	1.97	10.7	1.57
Benchmarking Participants								
Quebec, Canada	11.1	0.61	9.5	0.36	11.1	1.34	9.5	1.50
Abu Dhabi, UAE	9.7	0.97	10.5	0.47	9.7	1.58	10.5	1.59
Dubai, UAE	10.6	1.02	10.3	0.38	10.6	1.57	10.3	1.57

Exhibit B.6: Means and Standard Deviations for the TIMSS and PIRLS 2011 Effective Schools Analysis Prior to Imputation

Country	School Explanatory Variables									
	School Environment						School Instruction			
	Schools are Safe and Orderly		Schools Support Academic Success		Adequate Environment and Resources		Early Emphasis on Reading Skills		Students Engaged in Reading, Mathematics and Science Lessons	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Australia	10.2	1.05	10.7	1.85	10.7	1.59	12.9	2.09	9.8	0.66
Austria	9.8	0.81	10.4	1.28	10.4	1.39	10.6	1.41	9.7	0.55
Azerbaijan	10.7	1.22	9.3	1.36	9.2	1.14	9.9	1.65	10.4	0.61
Chinese Taipei	10.2	0.75	10.7	1.29	9.4	1.16	9.5	1.76	9.4	0.64
Croatia	10.6	0.82	11.0	1.28	10.3	1.43	10.6	1.63	9.8	0.62
Czech Republic	9.8	0.77	8.9	1.28	10.9	1.37	10.2	1.92	9.9	0.65
Finland	9.9	0.90	10.1	1.16	10.1	1.14	9.4	1.47	8.7	0.51
Georgia	10.9	0.96	9.3	1.24	10.1	1.36	10.1	1.63	10.6	0.53
Germany	9.7	0.89	9.5	1.22	9.9	1.37	10.6	1.54	9.8	0.67
Hong Kong SAR	10.4	0.78	9.7	1.23	9.0	0.93	9.7	1.66	9.3	0.57
Hungary	9.6	0.84	9.1	1.34	10.5	1.56	10.5	1.63	10.3	0.52
Iran, Islamic Rep. of	10.2	1.08	10.5	1.47	9.0	1.36	8.8	1.62	10.8	0.77
Ireland	11.0	1.07	11.6	1.60	10.4	1.38	10.8	1.71	10.0	0.69
Italy	9.3	0.86	9.3	1.10	9.6	1.08	9.6	1.49	9.8	0.55
Lithuania	10.0	0.78	10.0	1.11	10.3	0.97	10.3	1.59	10.1	0.54
Malta	9.9	0.85	10.8	1.32	10.0	1.09	9.6	1.54	10.5	0.53
Morocco	8.4	1.07	7.8	1.61	9.0	1.34	6.9	1.68	10.3	1.03
Northern Ireland	10.9	0.87	11.9	1.75	10.5	1.51	11.9	1.90	9.8	0.62
Norway	10.2	0.77	9.8	1.11	9.9	1.11	9.4	1.62	9.8	0.66
Oman	9.2	1.01	10.4	1.24	9.0	1.45	8.5	1.61	10.2	0.69
Poland	10.1	0.81	10.0	1.33	10.9	1.38	9.5	1.21	10.3	0.53
Portugal	9.9	1.00	9.9	1.46	9.4	1.34	10.5	1.28	10.4	0.70
Qatar	9.8	1.05	11.1	1.35	10.0	2.10	9.6	2.24	9.9	0.60
Romania	9.8	1.01	9.8	1.45	9.7	1.24	10.0	1.43	10.7	0.80
Russian Federation	9.9	0.86	9.2	1.16	10.0	1.56	11.4	1.51	10.5	0.83
Saudi Arabia	9.6	1.10	10.2	1.60	9.4	1.20	8.4	1.85	10.0	0.79
Singapore	10.2	0.81	9.9	1.40	10.5	1.38	11.2	1.83	9.5	0.44
Slovak Republic	9.7	0.81	8.9	1.19	10.2	1.13	10.3	1.51	9.7	0.68
Slovenia	9.6	0.92	9.6	1.10	10.8	1.35	9.1	1.55	10.0	0.62
Spain	10.0	1.14	9.6	1.53	10.6	1.39	10.5	1.60	10.0	0.73
Sweden	10.1	1.03	10.0	1.51	9.8	1.32	10.7	1.87	9.5	0.58
United Arab Emirates	10.0	1.06	11.0	1.53	10.4	1.68	8.9	2.34	10.3	0.72
International Avg.	10.0	1.07	10.0	1.60	10.0	1.47	10.0	2.00	10.0	0.79
Sixth Grade Countries										
Botswana	8.5	0.96	8.8	1.77	8.6	1.33	10.5	2.32	9.7	0.69
Honduras	9.6	1.21	10.1	1.73	9.2	1.78	9.2	1.87	10.1	0.55
Benchmarking Participants										
Quebec, Canada	9.8	0.95	10.2	1.34	10.5	1.24	10.0	1.77	9.7	0.57
Abu Dhabi, UAE	9.9	0.95	10.9	1.55	10.3	1.78	8.3	2.35	10.3	0.81
Dubai, UAE	10.4	1.03	11.3	1.73	10.9	1.74	10.2	2.19	10.3	0.56

Exhibit B.6: Means and Standard Deviations for the TIMSS and PIRLS 2011 Effective Schools Analysis Prior to Imputation (Cont.)

Country	Home Background Control Variables							
	School Control Variables				Student Control Variables			
	Home Resources for Learning		Early Literacy and Numeracy Tasks		Home Resources for Learning		Early Literacy and Numeracy Tasks	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Australia	11.5	0.96	9.5	0.60	11.6	1.64	9.5	1.62
Austria	10.5	0.72	9.3	0.41	10.5	1.56	9.3	1.64
Azerbaijan	8.5	0.69	9.6	1.01	8.5	1.45	9.5	2.02
Chinese Taipei	10.2	0.87	11.2	0.27	10.2	1.90	11.2	1.23
Croatia	9.7	0.77	10.5	0.34	9.7	1.46	10.5	1.50
Czech Republic	10.5	0.65	9.9	0.40	10.5	1.50	9.9	1.53
Finland	11.3	0.56	10.4	0.44	11.3	1.50	10.4	1.66
Georgia	9.9	1.10	9.8	0.67	9.9	1.75	9.8	1.85
Germany	10.7	0.94	9.5	0.49	10.7	1.76	9.5	1.55
Hong Kong SAR	9.7	1.10	11.4	0.37	9.8	1.78	11.4	1.20
Hungary	10.0	1.41	9.3	0.42	10.0	2.26	9.3	1.73
Iran, Islamic Rep. of	8.0	1.68	9.6	0.98	8.0	2.29	9.6	1.96
Ireland	10.8	0.85	9.4	0.47	10.9	1.78	9.4	1.62
Italy	9.7	0.77	9.2	0.46	9.7	1.54	9.2	1.59
Lithuania	9.8	0.94	10.1	0.50	9.8	1.65	10.1	1.48
Malta	10.3	0.69	10.3	0.38	10.4	1.43	10.3	1.56
Morocco	6.9	1.53	9.7	1.61	7.0	2.20	9.7	2.26
Northern Ireland	10.9	0.93	9.0	0.56	11.0	1.78	9.0	1.55
Norway	11.6	0.58	9.4	0.36	11.6	1.58	9.4	1.68
Oman	8.7	1.02	10.7	0.52	8.7	1.90	10.7	1.61
Poland	10.0	0.96	9.9	0.46	10.0	1.82	9.9	1.70
Portugal	9.9	1.14	9.5	0.52	9.9	1.92	9.4	1.55
Qatar	10.2	0.86	10.8	0.43	10.2	1.55	10.8	1.61
Romania	8.7	1.55	9.6	1.14	8.7	2.18	9.6	2.08
Russian Federation	10.4	0.88	10.2	0.85	10.4	1.49	10.2	1.71
Saudi Arabia	9.0	1.10	10.6	0.97	9.0	1.85	10.6	1.79
Singapore	10.7	0.78	11.3	0.44	10.7	1.62	11.3	1.34
Slovak Republic	9.9	1.12	9.0	0.72	10.0	1.78	9.0	1.74
Slovenia	10.5	0.58	9.3	0.44	10.4	1.45	9.3	1.75
Spain	10.3	1.06	10.7	0.51	10.3	1.79	10.7	1.60
Sweden	11.5	0.88	10.3	0.44	11.5	1.70	10.3	1.58
United Arab Emirates	10.0	1.09	10.4	0.47	9.9	1.65	10.5	1.66
International Avg.	10.0	1.42	10.0	0.92	10.0	2.00	10.0	1.80
Sixth Grade Countries								
Botswana	7.5	1.33	9.6	1.04	7.6	2.17	9.6	1.97
Honduras	6.9	1.41	10.7	0.67	6.9	2.22	10.7	1.66
Benchmarking Participants								
Quebec, Canada	11.1	0.67	9.5	0.42	11.1	1.41	9.5	1.59
Abu Dhabi, UAE	9.8	1.06	10.5	0.51	9.8	1.63	10.5	1.66
Dubai, UAE	10.6	1.12	10.3	0.42	10.6	1.63	10.3	1.65

Data Analysis

Hierarchical linear modeling was used to investigate how the characteristics of effective schools were associated with achievement in reading, mathematics, and science across countries.

In total, eight two-level regression models were formulated for each country to predict students' reading, mathematics, and science scores. Analyses for reading, mathematics, and science were conducted separately and all five plausible values were used. The following sections provide a description of the unconditional model that was used to partition the total variance in achievement into within- and between-school components, the general form of the two-level hierarchical linear model that included both student and school variables, and descriptions of the specific models that were formulated to investigate how the characteristics of effective schools were associated with achievement in reading, mathematics, and science.

The Unconditional Model

Before conducting the analyses for investigating how the characteristics of effective schools were associated with achievement, unconditional (or null) models were formulated. The purpose of these models was to partition the total variance in achievement into its within- and between-group components.

The unconditional model assumed a random sample of i students within j schools, such that the outcome Y_{ij} was predicted as follows:

$$Y_{ij} = \beta_{0j} + r_{ij}$$

With no predictors in the model, the level 1 intercept, β_{0j} , was the predicted mean achievement for each of the j schools, and r_{ij} was the student-level error. The error was assumed to be normally distributed with a mean of zero, and a variance σ^2 . At level 2, the level 1 intercept became an outcome variable and was predicted using the grand-mean achievement in the population, γ_{00} , and random school effect, u_{0j} :

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

The random school effect, u_{0j} , was assumed to be normally distributed with a mean of zero, and a variance τ_{00} .

The unconditional model provided an estimate of the grand mean achievement in the population, γ_{00} , and was used to partition the total variance in achievement into its within- and between-school components. The total variance in achievement, Y_{ij} , was the sum of the within- and between-school variance, as follows:

$$\text{Var}(Y_{ij}) = \text{Var}(r_{ij} + u_{0j}) = \sigma^2 + \tau_{00}$$

The proportion of the total variance in Y_{ij} between schools is referred to as the intraclass correlation coefficient (ICC), ρ , and was calculated as follows:

$$\rho = \frac{\tau_{00}}{\sigma^2 + \tau_{00}}$$

The ICCs for reading, mathematics, and science for each country are shown as the percentage of variance between schools in the Source of Variance panel of the summary tables for each country's results in the *TIMSS and PIRLS 2011 Relationships Report* (Exhibits 3.5 to 3.41). The unconditional variance components, σ^2 and τ_{00} , represented the variance available in the achievement measure to be explained with the addition of student and school predictors, and were used along with the conditional variance components from subsequent models to estimate the percentage of variance explained at the student level, at the school level, and in total.

School Explanatory Models

Subsequent to formulating the unconditional models, school explanatory models were formulated that included combinations of school explanatory predictors to explain some of the available variance in achievement between schools. The purpose of these models was to describe how the school explanatory variables were associated with achievement, without controlling for any home background information. The magnitude, direction, and significance of the regression coefficients indicated the relationship between each school explanatory variable and achievement, holding all other school explanatory variables in the model constant, and when compared to those from the unconditional model, the residual variance components indicated the percentage of variance in achievement between schools explained by the school explanatory variables.

In total, three school explanatory models were formulated: the first included the school environment variables, the second included the school instruction variables, and the final of the three included both the school environment and the school instruction variables. The models that included various combinations of the P school explanatory variables were as follows:⁴

$$Y_{ij} = \beta_{0j} + r_{ij}$$

$$\beta_{0j} = \gamma_{00} + \sum_{p=1}^P \gamma_{0p} (\text{School Explanatory Variables})_{pj} + u_{0j}$$

The regression coefficients in the school explanatory models, γ_{0p} , represented the predicted increase in Y_{ij} for every one unit increase in the associated p^{th} school explanatory variable, holding all other school explanatory variables in the model constant. The regression coefficients from the school explanatory models for reading, mathematics, and science can be found in the

⁴ In the school environment model, $P = 3$; in the school instruction model, $P = 2$; and in the combined school environment and instruction model, $P = 5$.

summary tables of the *TIMSS and PIRLS 2011 Relationships Report* (Exhibits 3.5 to 3.41). The coefficients also are presented in summary tables for each model in Exhibits B.8 through B.28).

In the absence of student variables, the individual error, r_{ij} , was the unconditional variance in Y_{ij} among students within schools, and was assumed to be normally distributed with a mean of zero and a variance σ^2 . The group error, u_{0j} , was the residual variance in Y_{ij} between schools after controlling for the P school explanatory variables included in the model and was assumed to be normally distributed with a mean of zero and a variance $\tau_{00\text{resid}}$. By comparing this residual variance to the unconditional variance between schools, τ_{00} , it was possible to estimate the percentage of variance explained by the school explanatory variables between schools, and in total. The variance components from the school explanatory models for reading, mathematics, and science for each country can be found in the summary tables of the *TIMSS and PIRLS 2011 Relationships Report* (Exhibits 3.5 to 3.41).

Home Background Control Model

To characterize how the home background control variables were associated with achievement in reading, mathematics, and science, the home background control model included two home background variables: Home Resources for Learning, and Early Literacy/Numeracy Tasks. The magnitude, direction, and significance of the regression coefficients indicated the relationship between each control variable and achievement, holding all other control variables in the model constant. Moreover, when compared to those from the unconditional model, the residual variance components indicated the percentage of variance in achievement within and between schools that was explained by the home background control variables.

At level 1, the home background control model included $K = 2$ student-level home background control variables, and took the following form:

$$Y_{ij} = \beta_{0j} + \sum_{k=1}^K \beta_{kj} (\text{Home Background Control Variables})_{kij} + r_{ij}$$

The K student-level home background control variables were group-mean centered and the K school averages were included as predictors at level 2. Group-mean centering at level 1 was deemed most appropriate because the analyses aimed to separate the between-school and within-school components from the total variation, and with the addition of school explanatory variables in subsequent models, allowed us to investigate how school explanatory variables were associated with individual achievement after controlling for the home background control variables.

With group-mean centering, the intercept, β_{0j} , was the predicted value of Y_{ij} for a student in school j who was at the mean on all K student control variables. Each β_{kj} regression coefficient was a student-level effect within schools, and represented the predicted increase in the value of Y_{ij} for every one unit increase in the associated k^{th} student control variable above the school

mean, holding all else in the model constant. The random student effect, r_{ij} , was the residual variance in Y_{ij} among students within schools after controlling for the K student control variables and was assumed to be normally distributed with a mean of zero and a variance σ^2_{resid} .

At level 2, the intercept, β_{0j} , became an outcome variable and was predicted by the $K = 2$ school averages of the home background control variables:

$$\beta_{0j} = \gamma_{00} + \sum_{k=1}^K \gamma_{0k} (\text{School Averages of Home Background Control Variables})_{kj} + u_{0j}$$

The intercept in the level 2 model, γ_{00} , was the predicted value of Y_{ij} when the K school averages of the home background control variables were equal to zero. Each γ_{0k} regression coefficient represented the predicted increase in Y_{ij} for every one unit increase in the associated k^{th} school control variable, holding all else in the model constant. Finally, the group error, u_{0j} , was the residual variance in Y_{ij} among schools after controlling for the K school control variables. It was assumed to be normally distributed with a mean of zero and a variance $\tau_{00\text{resid}}$.

The K level 1 regression coefficients, β_{kj} , associated with the student control variables became outcome variables at level 2. The models for these K regression coefficients were not constant across student control variables within countries, across countries, or across subject areas. Instead, the models varied according to whether they included a random effect. For each level 1 coefficient, the decision to include a random effect was based on two factors: (a) whether there was significant variation in the relationship between the student control variable and achievement across schools, and (b) whether that relationship was estimated reliably. These two criteria were applied separately for each student control variable, for each country, and for reading, mathematics, and science. In cases where there was no significant variation across schools in the relationship between the student control variable and achievement, the model was as follows:

$$\beta_{kj} = \gamma_{k0}$$

When there was significant variation in the relationship across schools, the reliability of the slope was evaluated. If the reliability was greater than 0.05 (Raudenbush & Bryk, 2002), the model included a random effect, as follows:

$$\beta_{kj} = \gamma_{k0} + u_{kj}$$

Because these were intercept-only models, no school-level predictors were included in the slope models to predict the variability in the relationships. Exhibit 7 shows which student control variables included a random effect in each country, and by subject area. The regression coefficients from the home background control models for reading, mathematics, and science can be found in the summary tables of the *TIMSS and PIRLS 2011 Relationships Report* (Exhibits 3.5 to 3.41).

Exhibit B.7: Random Effects for the Student-level Home Background Control Variables

Country	Reading		Mathematics		Science	
	ASBGHRL	ASBHAVG	ASBGHRL	ASBHAVG	ASBGHRL	ASBHAVG
Australia	No	Yes	Yes	Yes	Yes	Yes
Austria	Yes	No	Yes	Yes	Yes	No
Azerbaijan	No	No	Yes	Yes	Yes	Yes
Chinese Taipei	No	No	No	No	No	Yes
Croatia	No	No	No	Yes	Yes	Yes
Czech Republic	Yes	Yes	Yes	Yes	Yes	No
Finland	Yes	Yes	No	Yes	Yes	Yes
Georgia	Yes	Yes	Yes	Yes	Yes	Yes
Germany	No	No	Yes	No	Yes	No
Hong Kong SAR	No	Yes	No	Yes	No	Yes
Hungary	Yes	Yes	Yes	Yes	Yes	Yes
Iran, Islamic Rep. of	Yes	No	Yes	Yes	Yes	No
Ireland	Yes	Yes	Yes	Yes	Yes	Yes
Italy	Yes	Yes	Yes	Yes	Yes	Yes
Lithuania	Yes	No	Yes	No	Yes	Yes
Malta	No	No	No	No	No	No
Morocco	No	Yes	Yes	Yes	Yes	Yes
Northern Ireland	No	No	No	Yes	No	Yes
Norway	Yes	No	Yes	No	Yes	Yes
Oman	Yes	Yes	Yes	Yes	Yes	Yes
Poland	Yes	Yes	Yes	Yes	Yes	Yes
Portugal	Yes	Yes	Yes	Yes	Yes	Yes
Qatar	No	No	No	No	No	No
Romania	Yes	Yes	Yes	Yes	Yes	Yes
Russian Federation	Yes	Yes	Yes	Yes	Yes	Yes
Saudi Arabia	Yes	No	Yes	Yes	Yes	Yes
Singapore	No	Yes	No	Yes	No	Yes
Slovak Republic	Yes	Yes	Yes	Yes	Yes	Yes
Slovenia	Yes	No	Yes	Yes	Yes	Yes
Spain	Yes	Yes	Yes	Yes	Yes	Yes
Sweden	No	No	Yes	Yes	Yes	Yes
United Arab Emirates	Yes	Yes	Yes	Yes	Yes	Yes
Sixth Grade Countries						
Botswana	Yes	No	No	No	No	No
Honduras	Yes	Yes	Yes	Yes	Yes	Yes
Benchmarking Participants						
Quebec, Canada	No	No	No	No	No	No
Abu Dhabi, UAE	No	Yes	Yes	Yes	No	Yes
Dubai, UAE	No	No	No	No	No	No

By comparing the residual variances within and between schools (σ^2_{resid} and $\tau_{00\text{resid}}$, respectively) from the home background control model to the within and between school variance components from the unconditional model (σ^2 and τ_{00} , respectively), it was possible to estimate the percentage of variance explained by the home background control variables within schools, between schools, and in total. The variance components from the home background control model for reading, mathematics, and science for each country can be found in the summary tables of the *TIMSS and PIRLS 2011 Relationships Report* (Exhibits 3.5 to 3.41).

School Explanatory with Home Background Control Models

The final set of models, referred to as the school explanatory with home background control model, combined the previous two sets of models. The purpose of these models was to describe how the school explanatory variables were associated with achievement after controlling for the home background variables. The magnitude, direction, and significance of the regression coefficients associated with each school explanatory variable indicated the relationship between that school explanatory variable and achievement, holding all else constant in the model, including the home background control variables. Moreover, when compared to those from the unconditional model and the home background control model, the residual variance components indicated the percentage of variance in achievement between schools that was explained by the school explanatory variables over and above the variance explained within and between schools by the home background control variables.

The school explanatory with home background control models included $K = 2$ home background control variables at the student level, the $K = 2$ school averages of the home background control variables, and the P school explanatory variables. At level 1, achievement, Y_{ij} , was predicted by the two group-mean centered home background control variables and a random student effect:

$$Y_{ij} = \beta_{0j} + \sum_{k=1}^K \beta_{kj} (\text{Home Background Control Variables})_{kij} + r_{ij}$$

The intercept, β_{0j} , was the predicted value of Y_{ij} for a student in school j who was at the mean on both student control variables. Each β_{kj} regression coefficient was a student-level effect within schools, and represented the predicted increase in the value of Y_{ij} for every one unit increase in the k^{th} student control variable above the school mean, holding all else in the model constant. The random student effect, r_{ij} , was the residual variance in Y_{ij} among students within schools after controlling for the two student control variables and was assumed to be normally distributed with a mean of zero and a variance σ^2_{resid} .

At level 2, the intercept, β_{0j} , became an outcome variable predicted by a linear combination of the P school explanatory variables and the $K = 2$ school averages of the home background control variables:

$$\beta_{0j} = \gamma_{00} + \sum_{p=1}^P \gamma_{0p} (\text{School Explanatory Variables})_{pj} + \sum_{k=1}^K \gamma_{0k} (\text{School Averages of Home Background Control Variables})_{kj} + u_{0j}$$

Depending on the significance of the variation in the level 1 regression coefficients across schools and on the reliability of that variation, the level 2 slope models took one of two forms:

$$\beta_{kj} = \gamma_{k0}$$

or,

$$\beta_{kj} = \gamma_{k0} + u_{kj}$$

Again, because these were intercept-only models, no school-level predictors were included in the slope models to predict the variability in the relationships.

The intercept in the level 2 model, γ_{00} , was the predicted value of Y_{ij} when the P school explanatory variables and the $K = 2$ school control variables were equal to zero. The regression coefficients, γ_{0p} and γ_{0k} , represented the predicted increase in Y_{ij} for every one unit increase in the p^{th} school explanatory variable and k^{th} school control variable, respectively, holding all else in the model constant. The error term, u_{0j} , represented the residual variance in Y_{ij} among schools after controlling for the P school explanatory variables and the $K = 2$ school control variables, and was assumed to be normally distributed with a mean of zero and a variance $\tau_{00resid}$. By comparing the residual variance, $\tau_{00resid}$, to the unconditional variance between schools, τ_{00} , it was possible to estimate the percentage of variance explained by the school explanatory variables between schools, and in total. In addition, by comparing the residual variance in these models to the residual variance from the home background control model, it was possible to estimate the percentage of variance in achievement explained by the school explanatory variables above the variance explained by the home background control variables.

Exhibit B.8: HLM Regression Coefficients for School Environment Model – Reading Achievement

Country	School Explanatory Variables		
	School Environment		
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources
Australia	21 (3.5) ▲	6 (2.1) ▲	2 (2.5)
Austria	8 (3.3) ▲	5 (2.4) ▲	-2 (1.3)
Azerbaijan	11 (4.5) ▲	6 (3.6)	-1 (4.4)
Chinese Taipei	5 (3.8)	6 (2.4) ▲	0 (2.0)
Croatia	2 (2.8)	5 (1.9) ▲	-3 (1.5)
Czech Republic	2 (5.4)	2 (2.4)	-4 (2.9)
Finland	9 (3.2) ▲	5 (2.4) ▲	-2 (1.8)
Georgia	5 (4.2)	9 (3.8) ▲	-4 (3.8)
Germany	9 (3.3) ▲	16 (3.4) ▲	-1 (2.1)
Hong Kong SAR	7 (4.0)	0 (2.6)	-2 (3.8)
Hungary	11 (6.1)	16 (3.9) ▲	-2 (2.2)
Iran, Islamic Rep. of	0 (4.4)	14 (3.7) ▲	2 (3.7)
Ireland	11 (4.0) ▲	5 (2.2) ▲	-1 (2.1)
Italy	7 (2.6) ▲	-3 (2.5)	3 (2.4)
Lithuania	8 (6.0)	11 (2.8) ▲	-4 (3.9)
Malta	21 (5.7) ▲	21 (4.2) ▲	0 (4.6)
Morocco	5 (5.0)	18 (3.7) ▲	8 (3.7) ▼
Northern Ireland	14 (4.0) ▲	5 (2.2) ▲	2 (1.9)
Norway	7 (3.7)	6 (2.3) ▲	-5 (2.5)
Oman	7 (3.7)	12 (2.7) ▲	3 (2.9)
Poland	-7 (4.5)	9 (2.1) ▲	-3 (2.0)
Portugal	2 (3.5)	9 (2.8) ▲	-5 (2.6)
Qatar	25 (6.6) ▲	12 (4.2) ▲	8 (2.7) ▲
Romania	11 (7.5)	10 (4.8)	1 (4.3)
Russian Federation	3 (4.2)	3 (3.2)	3 (2.2)
Saudi Arabia	5 (4.1)	18 (3.2) ▲	5 (4.5)
Singapore	7 (4.8)	13 (2.8) ▲	-5 (2.5)
Slovak Republic	8 (3.8) ▲	9 (3.1) ▲	-2 (2.8)
Slovenia	1 (2.8)	3 (1.9)	0 (1.5)
Spain	5 (3.3)	8 (3.0) ▲	-2 (2.0)
Sweden	11 (2.7) ▲	2 (2.1)	3 (2.0)
United Arab Emirates	17 (3.6) ▲	12 (3.1) ▲	7 (2.4) ▲
Sixth Grade Countries			
Botswana	15 (4.8) ▲	19 (2.4) ▲	2 (3.3)
Honduras	7 (5.2)	-3 (3.7)	6 (4.1)
Benchmarking Participants			
Quebec, Canada	4 (2.4)	7 (1.9) ▲	1 (2.0)
Abu Dhabi, UAE	14 (5.8) ▲	15 (4.9) ▲	7 (3.5)
Dubai, UAE	27 (7.6) ▲	8 (4.7)	9 (3.9) ▼

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.9: HLM Regression Coefficients for School Environment Model – Mathematics Achievement

Country	School Explanatory Variables		
	School Environment		
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources
Australia	21 (4.1) ▲	6 (2.4) ▲	3 (2.5)
Austria	9 (4.1) ▲	5 (2.6) ▲	0 (1.7)
Azerbaijan	16 (5.6) ▲	5 (4.8)	5 (5.7)
Chinese Taipei	4 (3.5)	6 (2.3) ▲	0 (2.2)
Croatia	1 (3.2)	5 (2.1) ▲	-1 (1.7)
Czech Republic	1 (7.7)	3 (3.0)	-5 (3.8)
Finland	9 (3.1) ▲	5 (2.2) ▲	-1 (1.6)
Georgia	0 (5.8)	16 (5.9) ▲	-8 (4.9)
Germany	6 (3.1)	15 (3.2) ▲	-1 (1.9)
Hong Kong SAR	6 (3.9)	3 (2.6)	-2 (3.6)
Hungary	16 (5.5) ▲	18 (4.0) ▲	-3 (2.3)
Iran, Islamic Rep. of	-1 (4.8)	13 (3.9) ▲	2 (3.7)
Ireland	12 (3.8) ▲	5 (2.2) ▲	0 (2.5)
Italy	7 (4.4)	-1 (3.1)	6 (3.2) ▲
Lithuania	6 (6.5)	13 (3.4) ▲	-5 (4.6)
Malta	15 (3.6) ▲	12 (2.7) ▲	-1 (2.9)
Morocco	4 (5.0)	12 (4.1) ▲	10 (3.8) ▲
Northern Ireland	20 (5.5) ▲	4 (2.7)	1 (2.5)
Norway	10 (4.7) ▲	7 (3.4)	-4 (3.2)
Oman	8 (3.6) ▲	12 (2.7) ▲	-1 (2.9)
Poland	-8 (5.0)	8 (2.1) ▲	-3 (2.2)
Portugal	0 (5.6)	12 (4.3) ▲	-4 (3.8)
Qatar	18 (6.8) ▲	10 (4.6) ▲	11 (3.0) ▲
Romania	11 (9.9)	12 (6.4)	1 (5.0)
Russian Federation	6 (5.3)	0 (3.3)	1 (2.3)
Saudi Arabia	2 (5.1)	13 (4.7) ▲	0 (5.6)
Singapore	6 (4.4)	12 (2.7) ▲	-5 (2.2) ▼
Slovak Republic	14 (5.0) ▲	10 (4.3) ▲	-4 (3.2)
Slovenia	1 (2.4)	4 (1.7) ▲	0 (1.5)
Spain	7 (3.5) ▲	9 (2.7) ▲	-3 (2.0)
Sweden	9 (2.4) ▲	5 (1.7) ▲	1 (1.9)
United Arab Emirates	12 (3.5) ▲	10 (2.9) ▲	6 (2.2) ▲
Sixth Grade Countries			
Botswana	15 (3.7) ▲	14 (2.1) ▲	1 (2.7)
Honduras	4 (5.1)	-2 (3.9)	8 (4.0)
Benchmarking Participants			
Quebec, Canada	4 (2.6)	8 (1.9) ▲	1 (2.2)
Abu Dhabi, UAE	12 (6.0) ▲	13 (4.5) ▲	6 (3.3)
Dubai, UAE	23 (6.7) ▲	7 (4.2)	8 (3.6) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.10: HLM Regression Coefficients for School Environment Model – Science Achievement

Country	School Explanatory Variables		
	School Environment		
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources
Australia	20 (3.5) ▲	6 (2.0) ▲	2 (2.5)
Austria	10 (3.7) ▲	6 (2.4) ▲	-1 (1.5)
Azerbaijan	17 (5.8) ▲	7 (4.6)	0 (6.5)
Chinese Taipei	4 (3.5)	6 (2.2) ▲	0 (2.1)
Croatia	2 (2.9)	4 (1.7) ▲	-3 (1.5)
Czech Republic	3 (5.9)	3 (2.5)	-4 (3.2)
Finland	11 (2.6) ▲	6 (2.2) ▲	-3 (1.6)
Georgia	0 (5.1)	12 (4.8) ▲	-7 (4.6)
Germany	8 (3.4) ▲	17 (3.2) ▲	-1 (1.9)
Hong Kong SAR	5 (4.2)	2 (2.7)	-2 (4.2)
Hungary	13 (6.3) ▲	17 (4.2) ▲	-3 (2.3)
Iran, Islamic Rep. of	-2 (5.3)	15 (4.1) ▲	1 (4.3)
Ireland	11 (4.2) ▲	6 (2.4) ▲	0 (2.9)
Italy	9 (3.9) ▲	-2 (3.1)	4 (3.2)
Lithuania	8 (6.5)	10 (3.5) ▲	-5 (4.8)
Malta	16 (4.6) ▲	18 (3.8) ▲	2 (3.9)
Morocco	5 (5.9)	17 (4.6) ▲	10 (4.3) ▲
Northern Ireland	17 (5.4) ▲	6 (2.3) ▲	0 (2.5)
Norway	7 (3.8)	7 (2.4) ▲	-4 (2.4)
Oman	10 (4.3) ▲	15 (3.1) ▲	-2 (3.6)
Poland	-8 (4.8)	8 (2.2) ▲	-4 (2.2)
Portugal	0 (5.1)	12 (4.2) ▲	-5 (3.2)
Qatar	26 (7.9) ▲	12 (5.1) ▲	8 (3.2) ▲
Romania	13 (9.5)	12 (5.8) ▲	1 (4.8)
Russian Federation	5 (5.2)	2 (3.6)	3 (2.5)
Saudi Arabia	4 (4.8)	18 (4.1) ▲	4 (5.4)
Singapore	6 (4.8)	14 (2.9) ▲	-5 (2.4) ▼
Slovak Republic	12 (4.6) ▲	9 (4.0) ▲	-4 (3.4)
Slovenia	2 (2.9)	3 (2.0)	0 (1.7)
Spain	6 (3.6)	8 (2.9) ▲	-3 (2.2)
Sweden	14 (3.1) ▲	3 (2.1)	2 (2.1)
United Arab Emirates	14 (3.7) ▲	13 (3.1) ▲	6 (2.3) ▲
Sixth Grade Countries			
Botswana	20 (5.7) ▲	22 (2.8) ▲	2 (4.1)
Honduras	6 (5.3)	-2 (4.1)	6 (4.2)
Benchmarking Participants			
Quebec, Canada	3 (3.0)	8 (1.9) ▲	0 (1.9)
Abu Dhabi, UAE	13 (6.2) ▲	16 (4.7) ▲	6 (3.3)
Dubai, UAE	26 (7.5) ▲	8 (4.6)	8 (4.0) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.11: HLM Regression Coefficients for School Instruction Model – Reading Achievement

Country	School Explanatory Variables	
	School Instruction	
	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons
Australia	0 (1.8)	15 (5.2) ▲
Austria	-1 (1.7)	-4 (3.9)
Azerbaijan	1 (2.8)	34 (9.3) ▲
Chinese Taipei	-1 (1.5)	12 (3.5) ▲
Croatia	1 (1.5)	-7 (3.5) ▼
Czech Republic	0 (1.4)	-1 (4.7)
Finland	1 (1.9)	-4 (5.4)
Georgia	1 (3.1)	31 (9.2) ▲
Germany	8 (2.8) ▲	-4 (4.8)
Hong Kong SAR	3 (1.6) ▲	22 (4.3) ▲
Hungary	0 (3.5)	5 (11.6)
Iran, Islamic Rep. of	12 (2.6) ▲	3 (5.8)
Ireland	3 (1.7)	6 (4.4)
Italy	-1 (1.6)	4 (3.8)
Lithuania	5 (1.8) ▲	18 (6.1) ▲
Malta	-2 (3.2)	47 (9.7) ▲
Morocco	11 (3.2) ▲	30 (6.6) ▲
Northern Ireland	1 (2.4)	10 (4.7) ▲
Norway	-1 (1.7)	8 (4.3)
Oman	5 (2.0) ▲	22 (4.2) ▲
Poland	-1 (2.4)	-13 (6.1) ▼
Portugal	-4 (2.4)	21 (4.7) ▲
Qatar	7 (2.9) ▲	47 (8.5) ▲
Romania	3 (6.3)	19 (7.8) ▲
Russian Federation	-1 (1.7)	1 (3.4)
Saudi Arabia	3 (2.8)	41 (7.4) ▲
Singapore	0 (2.3)	9 (7.7)
Slovak Republic	1 (2.2)	0 (4.6)
Slovenia	-1 (1.2)	-3 (3.9)
Spain	-3 (1.6)	9 (4.6)
Sweden	1 (1.7)	-3 (4.6)
United Arab Emirates	13 (1.6) ▲	28 (5.6) ▲
Sixth Grade Countries		
Botswana	0 (2.2)	55 (7.6) ▲
Honduras	9 (4.0) ▲	-6 (8.2)
Benchmarking Participants		
Quebec, Canada	0 (1.1)	11 (3.9) ▲
Abu Dhabi, UAE	7 (2.8) ▲	26 (7.8) ▲
Dubai, UAE	17 (2.4) ▲	48 (13.4) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.12: HLM Regression Coefficients for School Instruction Model – Mathematics Achievement

Country	School Explanatory Variables	
	School Instruction	
	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons
Australia	1 (1.9)	16 (5.6) ▲
Austria	-2 (2.0)	-3 (5.1)
Azerbaijan	-4 (3.6)	57 (10.3) ▲
Chinese Taipei	0 (1.5)	12 (3.7) ▲
Croatia	2 (1.8)	-8 (4.3)
Czech Republic	0 (1.5)	-1 (5.5)
Finland	2 (2.5)	-3 (6.2)
Georgia	-2 (4.1)	40 (12.5) ▲
Germany	7 (2.7) ▲	-6 (4.5)
Hong Kong SAR	3 (1.5) ▲	22 (4.4) ▲
Hungary	0 (3.6)	7 (11.7)
Iran, Islamic Rep. of	9 (2.5) ▲	3 (5.8)
Ireland	1 (1.7)	10 (6.6)
Italy	0 (2.0)	6 (5.8)
Lithuania	4 (2.1) ▲	14 (6.3) ▲
Malta	-1 (2.2)	27 (6.8) ▲
Morocco	5 (3.3)	28 (7.0) ▲
Northern Ireland	-1 (3.0)	14 (5.4) ▲
Norway	0 (2.2)	8 (5.7)
Oman	4 (2.0) ▲	24 (4.2) ▲
Poland	-1 (2.5)	-16 (6.5) ▼
Portugal	-6 (3.9)	25 (6.6) ▲
Qatar	7 (3.1) ▲	36 (8.7) ▲
Romania	0 (7.2)	12 (9.8)
Russian Federation	-2 (2.4)	1 (4.2)
Saudi Arabia	1 (3.6)	21 (7.6) ▲
Singapore	0 (2.0)	10 (6.9)
Slovak Republic	2 (2.7)	4 (6.2)
Slovenia	-1 (1.4)	-5 (4.7)
Spain	-1 (1.5)	10 (4.3) ▲
Sweden	2 (1.4)	-5 (3.9)
United Arab Emirates	12 (1.5) ▲	20 (5.2) ▲
Sixth Grade Countries		
Botswana	0 (1.7)	47 (5.9) ▲
Honduras	6 (4.3)	-4 (9.3)
Benchmarking Participants		
Quebec, Canada	-1 (1.5)	5 (4.4)
Abu Dhabi, UAE	7 (2.5) ▲	17 (7.7) ▲
Dubai, UAE	15 (2.2) ▲	39 (12.2) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.13: HLM Regression Coefficients for School Instruction Model – Science Achievement

Country	School Explanatory Variables	
	School Instruction	
	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons
Australia	0 (1.7)	14 (5.2) ▲
Austria	-1 (2.0)	-5 (4.9)
Azerbaijan	0 (3.3)	59 (9.4) ▲
Chinese Taipei	0 (1.5)	11 (3.5) ▲
Croatia	1 (1.4)	-7 (3.4) ▼
Czech Republic	0 (1.4)	1 (4.2)
Finland	1 (2.0)	-6 (5.3)
Georgia	0 (3.5)	35 (11.6) ▲
Germany	7 (2.8) ▲	-6 (4.9)
Hong Kong SAR	3 (1.6) ▲	20 (4.4) ▲
Hungary	0 (3.7)	6 (12.6)
Iran, Islamic Rep. of	11 (2.9) ▲	0 (6.6)
Ireland	3 (1.8)	9 (6.4)
Italy	-1 (2.1)	4 (5.7)
Lithuania	3 (2.0)	18 (6.2) ▲
Malta	-1 (2.8)	36 (8.2) ▲
Morocco	7 (3.4) ▲	34 (7.7) ▲
Northern Ireland	-1 (2.9)	14 (5.5) ▲
Norway	-1 (1.5)	6 (4.4)
Oman	5 (2.3) ▲	34 (5.3) ▲
Poland	-1 (2.5)	-15 (6.0) ▼
Portugal	-6 (3.5)	26 (6.7) ▲
Qatar	5 (3.6)	49 (10.9) ▲
Romania	3 (7.0)	19 (9.7) ▲
Russian Federation	-1 (2.3)	2 (4.4)
Saudi Arabia	3 (3.3)	38 (7.1) ▲
Singapore	0 (2.3)	7 (7.6)
Slovak Republic	1 (2.6)	3 (5.2)
Slovenia	-1 (1.6)	-5 (4.5)
Spain	-2 (1.7)	8 (4.7)
Sweden	2 (1.8)	-5 (5.6)
United Arab Emirates	11 (1.6) ▲	30 (5.5) ▲
Sixth Grade Countries		
Botswana	0 (2.5)	75 (8.5) ▲
Honduras	8 (4.0)	-9 (9.2)
Benchmarking Participants		
Quebec, Canada	-1 (1.3)	10 (3.7) ▲
Abu Dhabi, UAE	7 (2.7) ▲	28 (7.8) ▲
Dubai, UAE	16 (2.4) ▲	50 (13.1) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.14: HLM Regression Coefficients for School Environment and Instruction Model – Reading Achievement

Country	School Explanatory Variables				
	School Environment			School Instruction	
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons
Australia	20 (3.5) ▲	6 (2.1) ▲	2 (2.5)	2 (1.5)	6 (4.2)
Austria	8 (3.3) ▲	5 (2.4) ▲	-2 (1.4)	-2 (1.6)	-4 (3.8)
Azerbaijan	8 (4.3)	6 (2.8) ▲	-1 (3.2)	1 (2.7)	31 (8.9) ▲
Chinese Taipei	4 (3.5)	6 (2.4) ▲	0 (2.0)	-1 (1.4)	10 (3.3) ▲
Croatia	3 (2.7)	5 (1.9) ▲	-2 (1.6)	0 (1.6)	-8 (3.6) ▼
Czech Republic	2 (5.5)	3 (2.4)	-5 (3.0)	-1 (1.3)	-2 (4.5)
Finland	9 (3.2) ▲	5 (2.5)	-2 (1.8)	0 (1.7)	-3 (5.2)
Georgia	3 (3.7)	7 (3.6)	-6 (3.7)	0 (3.3)	29 (9.5) ▲
Germany	9 (3.3) ▲	15 (3.0) ▲	-1 (2.0)	5 (2.3) ▲	-3 (3.7)
Hong Kong SAR	2 (3.9)	-4 (2.5)	-2 (3.5)	4 (1.6) ▲	23 (5.2) ▲
Hungary	10 (6.3)	16 (3.8) ▲	-3 (2.1)	-2 (2.7)	2 (9.3)
Iran, Islamic Rep. of	0 (4.3)	12 (3.6) ▲	3 (3.7)	10 (2.6) ▲	0 (5.9)
Ireland	11 (3.9) ▲	5 (2.2) ▲	-2 (2.1)	2 (1.8)	5 (4.4)
Italy	7 (2.6) ▲	-2 (2.6)	3 (2.5)	-1 (1.6)	3 (4.1)
Lithuania	7 (5.5)	9 (2.6) ▲	-4 (4.0)	4 (1.9) ▲	13 (5.0) ▲
Malta	18 (5.6) ▲	19 (4.1) ▲	-1 (4.5)	-3 (2.7)	22 (8.1) ▲
Morocco	1 (4.7)	12 (3.7) ▲	10 (3.5) ▲	7 (3.6)	26 (6.6) ▲
Northern Ireland	14 (3.6) ▲	5 (2.1) ▲	2 (1.9)	2 (2.1)	6 (4.3)
Norway	7 (3.9)	5 (2.4) ▲	-4 (2.5)	-1 (1.6)	4 (4.1)
Oman	5 (3.5)	9 (2.6) ▲	4 (2.8)	4 (1.9)	19 (4.3) ▲
Poland	-5 (4.4)	8 (2.1) ▲	-3 (2.0)	-2 (2.3)	-8 (5.5)
Portugal	-2 (3.4)	8 (2.6) ▲	-5 (2.4) ▼	-4 (2.3)	17 (5.1) ▲
Qatar	18 (6.4) ▲	10 (4.0) ▲	8 (2.5) ▲	3 (2.2)	30 (7.8) ▲
Romania	6 (8.0)	11 (5.2) ▲	1 (4.1)	5 (6.0)	15 (8.4)
Russian Federation	4 (4.5)	3 (3.3)	3 (2.3)	-2 (1.8)	0 (3.6)
Saudi Arabia	-1 (3.7)	15 (3.2) ▲	5 (3.8)	1 (2.4)	31 (7.4) ▲
Singapore	8 (4.7)	14 (2.8) ▲	-4 (2.4)	-2 (2.0)	12 (6.9)
Slovak Republic	8 (3.7) ▲	9 (3.2) ▲	-2 (2.8)	1 (1.9)	0 (4.1)
Slovenia	2 (3.0)	4 (1.8) ▲	0 (1.5)	-1 (1.3)	-4 (3.8)
Spain	5 (3.1)	8 (2.6) ▲	-2 (1.9)	-4 (1.6) ▼	7 (3.7)
Sweden	11 (2.8) ▲	2 (2.1)	3 (2.0)	0 (1.6)	-3 (3.7)
United Arab Emirates	10 (3.4) ▲	9 (2.9) ▲	6 (2.4) ▲	10 (1.6) ▲	20 (5.6) ▲
Sixth Grade Countries					
Botswana	7 (4.7)	15 (2.6) ▲	3 (2.6)	0 (1.9)	37 (6.5) ▲
Honduras	6 (5.0)	-5 (3.7)	5 (3.8)	8 (3.8) ▲	-8 (8.0)
Benchmarking Participants					
Quebec, Canada	3 (2.3)	7 (1.9) ▲	2 (1.9)	-1 (0.9)	8 (3.8) ▲
Abu Dhabi, UAE	7 (6.0)	16 (4.7) ▲	6 (3.8)	6 (2.5) ▲	21 (7.5) ▲
Dubai, UAE	17 (6.2) ▲	4 (4.4)	10 (3.3) ▲	15 (2.3) ▲	35 (10.0) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.15: HLM Regression Coefficients for School Environment and Instruction Model – Mathematics Achievement

Country	School Explanatory Variables				
	School Environment			School Instruction	
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons
Australia	21 (4.1) ▲	7 (2.4) ▲	3 (2.5)	2 (1.7)	6 (4.3)
Austria	9 (4.1) ▲	6 (2.6) ▲	0 (1.7)	-3 (1.7)	-2 (4.9)
Azerbaijan	9 (5.5)	6 (3.5)	5 (3.9)	-3 (3.4)	53 (10.0) ▲
Chinese Taipei	3 (3.3)	6 (2.2) ▲	1 (2.1)	-1 (1.3)	10 (3.7) ▲
Croatia	2 (3.0)	4 (2.0) ▲	0 (1.8)	1 (1.8)	-9 (4.6) ▼
Czech Republic	2 (7.8)	3 (2.9)	-5 (3.8)	-1 (1.5)	-2 (5.2)
Finland	9 (3.1) ▲	5 (2.3) ▲	0 (1.6)	1 (2.3)	-3 (6.2)
Georgia	-2 (4.8)	13 (5.5) ▲	-9 (4.9)	-2 (4.1)	37 (12.9) ▲
Germany	7 (3.1) ▲	14 (2.7) ▲	-2 (1.8)	4 (2.2) ▲	-5 (3.6)
Hong Kong SAR	1 (3.9)	-1 (2.5)	-2 (3.3)	3 (1.5)	22 (5.0) ▲
Hungary	16 (5.6) ▲	18 (3.9) ▲	-3 (2.2)	-3 (2.4)	2 (9.3)
Iran, Islamic Rep. of	-1 (4.8)	11 (3.9) ▲	3 (3.7)	7 (2.5) ▲	0 (6.0)
Ireland	11 (3.8) ▲	6 (2.4) ▲	-1 (2.3)	0 (1.7)	9 (6.5)
Italy	7 (4.4)	-1 (3.3)	6 (3.2) ▲	-1 (2.1)	3 (5.6)
Lithuania	5 (6.3)	12 (3.2) ▲	-5 (4.6)	3 (1.9)	9 (5.3)
Malta	14 (3.6) ▲	11 (2.7) ▲	-1 (2.8)	-3 (1.9)	10 (5.9)
Morocco	0 (4.8)	7 (4.2)	11 (3.5) ▲	3 (3.9)	25 (6.9) ▲
Northern Ireland	20 (5.0) ▲	3 (2.7)	1 (2.5)	1 (2.7)	10 (4.8) ▲
Norway	11 (5.2) ▲	6 (3.5)	-4 (3.2)	-1 (2.0)	4 (5.7)
Oman	6 (3.5)	9 (2.7) ▲	1 (2.8)	3 (1.9)	20 (4.5) ▲
Poland	-6 (4.8)	8 (2.0) ▲	-3 (2.2)	-2 (2.4)	-11 (5.7)
Portugal	-4 (5.4)	9 (4.1) ▲	-4 (3.6)	-6 (3.8)	22 (7.5) ▲
Qatar	12 (6.7)	9 (4.5) ▲	10 (2.9) ▲	4 (2.4)	22 (8.2) ▲
Romania	10 (10.7)	13 (6.7)	1 (5.0)	2 (6.9)	6 (10.2)
Russian Federation	8 (5.5)	0 (3.4)	2 (2.4)	-4 (2.4)	-1 (4.4)
Saudi Arabia	-1 (5.2)	12 (4.7) ▲	0 (5.5)	0 (3.5)	14 (7.6)
Singapore	6 (4.3)	12 (2.6) ▲	-4 (2.2)	-1 (1.8)	13 (6.2) ▲
Slovak Republic	13 (4.9) ▲	11 (4.3) ▲	-4 (3.1)	1 (2.4)	5 (5.6)
Slovenia	2 (2.6)	4 (1.7) ▲	-1 (1.6)	-2 (1.4)	-6 (4.7)
Spain	6 (3.3) ▲	10 (2.4) ▲	-3 (1.9)	-3 (1.5) ▼	8 (3.3) ▲
Sweden	9 (2.3) ▲	5 (1.7) ▲	1 (1.9)	0 (1.2)	-5 (3.0)
United Arab Emirates	7 (3.4)	8 (2.7) ▲	5 (2.3)	10 (1.5) ▲	15 (5.3) ▲
Sixth Grade Countries					
Botswana	8 (3.6) ▲	11 (2.1) ▲	3 (1.9)	0 (1.5)	32 (5.0) ▲
Honduras	4 (5.2)	-3 (3.9)	7 (3.8)	5 (4.0)	-5 (9.3)
Benchmarking Participants					
Quebec, Canada	4 (2.5)	8 (1.9) ▲	1 (2.2)	-2 (1.3)	2 (3.9)
Abu Dhabi, UAE	7 (6.1)	13 (4.3) ▲	5 (3.6)	6 (2.3) ▲	13 (7.4)
Dubai, UAE	14 (5.5) ▲	4 (4.0)	9 (3.1) ▲	14 (2.2) ▲	29 (9.7) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.16: HLM Regression Coefficients for School Environment and Instruction Model – Science Achievement

Country	School Explanatory Variables				
	School Environment			School Instruction	
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons
Australia	19 (3.5) ▲	6 (2.0) ▲	2 (2.5)	2 (1.5)	5 (4.2)
Austria	10 (3.7) ▲	6 (2.5) ▲	-1 (1.6)	-2 (1.7)	-5 (4.7)
Azerbaijan	11 (5.1) ▲	7 (3.2) ▲	0 (4.0)	0 (3.2)	56 (9.0) ▲
Chinese Taipei	4 (3.3)	5 (2.2) ▲	1 (2.0)	-1 (1.3)	8 (3.5) ▲
Croatia	3 (2.7)	4 (1.7) ▲	-2 (1.6)	0 (1.4)	-8 (3.6) ▼
Czech Republic	3 (5.9)	3 (2.5)	-4 (3.2)	-1 (1.3)	0 (4.2)
Finland	11 (2.6) ▲	6 (2.3) ▲	-3 (1.5)	0 (1.9)	-5 (5.0)
Georgia	-2 (4.3)	10 (4.4) ▲	-8 (4.6)	0 (3.6)	34 (12.0) ▲
Germany	9 (3.5) ▲	15 (2.9) ▲	-1 (1.8)	4 (2.3)	-5 (3.8)
Hong Kong SAR	0 (4.3)	-2 (2.6)	-2 (3.9)	3 (1.6) ▲	21 (5.3) ▲
Hungary	13 (6.4)	18 (4.0) ▲	-4 (2.2)	-3 (2.7)	3 (10.3)
Iran, Islamic Rep. of	-1 (5.2)	13 (4.1) ▲	2 (4.1)	9 (2.8) ▲	-3 (6.6)
Ireland	11 (4.1) ▲	7 (2.5) ▲	-1 (2.9)	2 (1.9)	9 (6.2)
Italy	9 (3.9) ▲	-2 (3.2)	4 (3.2)	-2 (2.2)	2 (5.6)
Lithuania	7 (5.8)	9 (3.3) ▲	-5 (4.8)	3 (2.0)	13 (4.8) ▲
Malta	14 (4.6) ▲	16 (3.8) ▲	2 (3.9)	-3 (2.4)	15 (7.1) ▲
Morocco	0 (5.6)	11 (4.4) ▲	11 (3.8) ▲	4 (4.0)	30 (7.6) ▲
Northern Ireland	16 (4.9) ▲	5 (2.3)	0 (2.6)	1 (2.5)	9 (5.0)
Norway	7 (4.0)	7 (2.5) ▲	-4 (2.4)	-1 (1.4)	2 (4.3)
Oman	7 (4.0)	11 (3.1) ▲	0 (3.4)	3 (2.3)	30 (5.6) ▲
Poland	-6 (4.6)	8 (2.2) ▲	-4 (2.1)	-2 (2.3)	-9 (5.5)
Portugal	-4 (4.8)	10 (3.9) ▲	-5 (3.0)	-6 (3.3)	23 (7.2) ▲
Qatar	20 (7.9) ▲	10 (5.1)	8 (3.1) ▲	2 (2.9)	31 (9.7) ▲
Romania	8 (10.2)	13 (6.2) ▲	1 (4.6)	5 (6.6)	14 (10.2)
Russian Federation	5 (5.4)	1 (3.6)	3 (2.5)	-2 (2.4)	1 (4.7)
Saudi Arabia	-1 (4.6)	15 (4.1) ▲	3 (5.1)	1 (3.0)	28 (7.0) ▲
Singapore	6 (4.7)	15 (2.8) ▲	-4 (2.4)	-2 (2.0)	10 (6.8)
Slovak Republic	11 (4.6) ▲	10 (4.0) ▲	-4 (3.3)	1 (2.3)	4 (4.7)
Slovenia	3 (2.9)	3 (1.9)	0 (1.7)	-2 (1.7)	-6 (4.4)
Spain	5 (3.5)	8 (2.6) ▲	-2 (2.2)	-3 (1.7)	5 (3.9)
Sweden	14 (3.1) ▲	3 (2.2)	2 (2.1)	0 (1.9)	-5 (4.4)
United Arab Emirates	7 (3.5)	11 (2.9) ▲	4 (2.4)	9 (1.6) ▲	24 (5.5) ▲
Sixth Grade Countries					
Botswana	9 (5.4)	17 (2.9) ▲	4 (2.9)	0 (2.2)	54 (7.6) ▲
Honduras	6 (5.3)	-4 (4.1)	5 (3.9)	7 (4.0)	-11 (9.0)
Benchmarking Participants					
Quebec, Canada	3 (2.9)	8 (1.9) ▲	0 (1.8)	-2 (1.1)	7 (3.5)
Abu Dhabi, UAE	6 (6.3)	16 (4.5) ▲	6 (3.4)	6 (2.4) ▲	23 (7.4) ▲
Dubai, UAE	14 (6.0) ▲	5 (4.2)	10 (3.4) ▲	15 (2.4) ▲	39 (10.2) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.17: HLM Regression Coefficients for Home Background Control Model – Reading Achievement

Country	Home Background Control Variables				
	Students within Schools		Between Schools		
	Home Resources for Learning	Early Literacy/ Numeracy Tasks	School Average of ...		
			Home Resources for Learning	Early Literacy/ Numeracy Tasks	
Australia	12 (1.3) ▲	11 (1.3) ▲	49 (3.7) ▲	19 (6.8) ▲	
Austria	19 (0.8) ▲	5 (0.8) ▲	27 (2.6) ▲	-1 (6.4)	
Azerbaijan	6 (1.0) ▲	4 (0.8) ▲	13 (7.6)	-11 (7.4)	
Chinese Taipei	10 (0.7) ▲	14 (1.0) ▲	20 (2.0) ▲	27 (8.7) ▲	
Croatia	12 (0.8) ▲	12 (0.7) ▲	23 (2.1) ▲	9 (4.3) ▲	
Czech Republic	15 (1.1) ▲	7 (0.8) ▲	31 (4.5) ▲	16 (5.5) ▲	
Finland	11 (1.1) ▲	15 (1.0) ▲	19 (4.1) ▲	10 (6.2)	
Georgia	11 (1.2) ▲	9 (0.8) ▲	20 (3.2) ▲	5 (5.4)	
Germany	16 (0.8) ▲	7 (0.9) ▲	35 (3.9) ▲	8 (10.4)	
Hong Kong SAR	2 (0.7) ▲	13 (1.1) ▲	3 (2.0)	62 (4.7) ▲	
Hungary	16 (0.8) ▲	8 (0.8) ▲	29 (2.0) ▲	2 (7.0)	
Iran, Islamic Rep. of	8 (0.9) ▲	8 (0.7) ▲	24 (2.0) ▲	4 (4.8)	
Ireland	19 (1.0) ▲	8 (1.2) ▲	27 (3.1) ▲	2 (7.5)	
Italy	16 (0.9) ▲	7 (0.9) ▲	22 (3.5) ▲	2 (5.3)	
Lithuania	13 (0.8) ▲	15 (0.9) ▲	19 (3.4) ▲	26 (6.6) ▲	
Malta	24 (1.4) ▲	12 (1.2) ▲	65 (5.8) ▲	41 (9.2) ▲	
Morocco	1 (1.1)	14 (1.5) ▲	17 (8.4) ▲	8 (6.4)	
Northern Ireland	16 (1.1) ▲	9 (1.4) ▲	37 (5.2) ▲	7 (8.7)	
Norway	12 (1.1) ▲	12 (0.9) ▲	20 (4.3) ▲	5 (7.8)	
Oman	12 (1.0) ▲	19 (1.0) ▲	22 (3.5) ▲	-9 (13.9)	
Poland	18 (0.8) ▲	13 (0.9) ▲	21 (2.6) ▲	7 (5.2)	
Portugal	12 (1.2) ▲	10 (0.9) ▲	15 (3.8) ▲	5 (4.6)	
Qatar	14 (1.4) ▲	16 (1.3) ▲	69 (5.9) ▲	31 (11.2) ▲	
Romania	16 (1.6) ▲	9 (1.5) ▲	25 (4.8) ▲	3 (7.0)	
Russian Federation	10 (1.2) ▲	11 (0.8) ▲	24 (4.2) ▲	2 (4.8)	
Saudi Arabia	5 (1.1) ▲	11 (1.1) ▲	18 (5.6) ▲	18 (6.4) ▲	
Singapore	15 (0.7) ▲	16 (1.1) ▲	29 (2.6) ▲	51 (4.4) ▲	
Slovak Republic	16 (0.8) ▲	8 (0.7) ▲	17 (4.7) ▲	-6 (7.5)	
Slovenia	21 (0.9) ▲	11 (0.8) ▲	26 (2.9) ▲	7 (3.8)	
Spain	11 (1.0) ▲	12 (1.0) ▲	17 (2.7) ▲	22 (5.3) ▲	
Sweden	12 (0.9) ▲	12 (0.9) ▲	29 (2.2) ▲	0 (5.0)	
United Arab Emirates	13 (0.8) ▲	12 (0.6) ▲	48 (2.8) ▲	17 (6.1) ▲	
Sixth Grade Countries					
Botswana	6 (1.0) ▲	10 (0.9) ▲	37 (4.8) ▲	9 (6.7)	
Honduras	-2 (1.2)	8 (1.8) ▲	22 (4.3) ▲	7 (6.5)	
Benchmarking Participants					
Quebec, Canada	12 (0.9) ▲	9 (0.9) ▲	25 (3.1) ▲	13 (4.8) ▲	
Abu Dhabi, UAE	11 (1.5) ▲	12 (1.2) ▲	44 (5.3) ▲	32 (9.9) ▲	
Dubai, UAE	15 (1.2) ▲	10 (0.8) ▲	67 (3.3) ▲	32 (10.8) ▲	

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.18: HLM Regression Coefficients for Home Background Control Model – Mathematics Achievement

Country	Home Background Control Variables				
	Students within Schools		Between Schools		
	Home Resources for Learning	Early Literacy/Numeracy Tasks	School Average of...		
			Home Resources for Learning	Early Literacy/Numeracy Tasks	
Australia	12 (1.4) ▲	15 (1.4) ▲	56 (4.0) ▲	23 (8.4) ▲	
Austria	16 (0.7) ▲	8 (0.7) ▲	25 (3.5) ▲	7 (7.0)	
Azerbaijan	9 (1.2) ▲	4 (0.9) ▲	12 (10.4)	-11 (8.8)	
Chinese Taipei	12 (0.8) ▲	17 (1.1) ▲	22 (2.5) ▲	23 (6.3) ▲	
Croatia	11 (0.8) ▲	16 (0.9) ▲	24 (2.4) ▲	15 (5.5) ▲	
Czech Republic	17 (1.2) ▲	9 (0.9) ▲	37 (5.9) ▲	26 (7.7) ▲	
Finland	10 (0.9) ▲	18 (0.8) ▲	15 (5.3) ▲	15 (6.1) ▲	
Georgia	10 (1.5) ▲	8 (1.1) ▲	21 (4.7) ▲	-1 (9.2)	
Germany	13 (0.8) ▲	9 (1.0) ▲	31 (3.9) ▲	10 (9.5)	
Hong Kong SAR	3 (0.7) ▲	12 (1.1) ▲	6 (2.0) ▲	55 (4.9) ▲	
Hungary	17 (0.8) ▲	9 (0.8) ▲	35 (2.1) ▲	-3 (7.8)	
Iran, Islamic Rep. of	7 (1.1) ▲	9 (0.7) ▲	23 (2.2) ▲	0 (4.9)	
Ireland	17 (0.9) ▲	10 (1.3) ▲	25 (3.8) ▲	-2 (7.1)	
Italy	12 (1.0) ▲	10 (0.9) ▲	20 (4.6) ▲	7 (6.5)	
Lithuania	11 (1.2) ▲	18 (0.9) ▲	21 (3.7) ▲	27 (5.4) ▲	
Malta	15 (1.1) ▲	10 (1.0) ▲	34 (4.5) ▲	27 (8.0) ▲	
Morocco	0 (1.2)	10 (1.4) ▲	8 (8.6)	-5 (7.2)	
Northern Ireland	16 (1.5) ▲	9 (1.4) ▲	48 (5.9) ▲	6 (8.7)	
Norway	9 (1.5) ▲	13 (0.9) ▲	21 (5.6) ▲	7 (10.1)	
Oman	13 (0.9) ▲	18 (0.9) ▲	18 (3.9) ▲	-5 (11.7)	
Poland	16 (0.8) ▲	13 (0.8) ▲	19 (2.8) ▲	10 (5.1)	
Portugal	10 (1.0) ▲	9 (0.9) ▲	17 (5.9) ▲	-13 (8.8)	
Qatar	11 (1.4) ▲	13 (1.3) ▲	71 (5.1) ▲	18 (11.0)	
Romania	14 (2.1) ▲	10 (2.5) ▲	21 (6.6) ▲	-1 (10.2)	
Russian Federation	8 (1.0) ▲	10 (0.9) ▲	23 (5.4) ▲	4 (7.2)	
Saudi Arabia	5 (1.4) ▲	10 (1.1) ▲	11 (6.7)	15 (6.9) ▲	
Singapore	12 (0.8) ▲	15 (1.1) ▲	25 (2.6) ▲	48 (4.4) ▲	
Slovak Republic	17 (0.9) ▲	8 (0.9) ▲	19 (5.7) ▲	-13 (9.4)	
Slovenia	19 (1.2) ▲	11 (0.8) ▲	26 (3.0) ▲	8 (4.6)	
Spain	11 (0.9) ▲	12 (1.0) ▲	21 (2.9) ▲	22 (4.8) ▲	
Sweden	11 (0.9) ▲	14 (1.1) ▲	24 (1.9) ▲	9 (4.0) ▲	
United Arab Emirates	9 (0.7) ▲	10 (0.6) ▲	42 (2.6) ▲	9 (6.3)	
Sixth Grade Countries					
Botswana	3 (0.9) ▲	9 (1.0) ▲	26 (4.9) ▲	9 (6.4)	
Honduras	-3 (1.4) ▼	5 (1.6) ▲	17 (4.8) ▲	9 (7.8)	
Benchmarking Participants					
Quebec, Canada	10 (1.0) ▲	8 (1.0) ▲	22 (3.5) ▲	6 (5.9)	
Abu Dhabi, UAE	8 (1.4) ▲	11 (1.2) ▲	40 (4.6) ▲	25 (9.7) ▲	
Dubai, UAE	11 (1.0) ▲	9 (0.8) ▲	60 (3.2) ▲	23 (10.2) ▲	

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.19: HLM Regression Coefficients for Home Background Control Model – Science Achievement

Country	Home Background Control Variables				
	Students within Schools		Between Schools		
	Home Resources for Learning	Early Literacy/ Numeracy Tasks	School Average of . . .		
			Home Resources for Learning	Early Literacy/ Numeracy Tasks	
Australia	13 (1.1) ▲	12 (1.2) ▲	49 (3.4) ▲	21 (6.0) ▲	
Austria	20 (0.9) ▲	5 (0.7) ▲	26 (3.4) ▲	-4 (6.7)	
Azerbaijan	9 (1.1) ▲	5 (1.0) ▲	16 (10.5)	-10 (8.6)	
Chinese Taipei	12 (0.7) ▲	15 (1.2) ▲	22 (2.1) ▲	21 (6.6) ▲	
Croatia	12 (1.0) ▲	10 (0.9) ▲	21 (2.7) ▲	4 (5.5)	
Czech Republic	17 (1.3) ▲	7 (1.0) ▲	31 (4.9) ▲	19 (5.7) ▲	
Finland	11 (1.0) ▲	12 (1.0) ▲	20 (4.7) ▲	7 (5.9)	
Georgia	11 (1.3) ▲	9 (1.0) ▲	17 (4.4) ▲	4 (7.5)	
Germany	17 (0.8) ▲	5 (1.1) ▲	36 (4.1) ▲	5 (10.3)	
Hong Kong SAR	5 (0.8) ▲	15 (1.4) ▲	5 (1.9) ▲	60 (5.2) ▲	
Hungary	17 (0.9) ▲	6 (1.0) ▲	31 (2.1) ▲	-1 (8.2)	
Iran, Islamic Rep. of	8 (1.1) ▲	8 (0.7) ▲	26 (2.2) ▲	4 (5.3)	
Ireland	17 (1.3) ▲	7 (1.0) ▲	27 (3.6) ▲	-1 (7.6)	
Italy	15 (1.0) ▲	6 (0.9) ▲	23 (4.4) ▲	1 (6.2)	
Lithuania	10 (0.9) ▲	14 (0.9) ▲	18 (3.4) ▲	29 (5.7) ▲	
Malta	23 (1.6) ▲	8 (1.2) ▲	55 (5.5) ▲	32 (9.7) ▲	
Morocco	1 (1.5)	15 (1.8) ▲	12 (9.6)	-3 (8.5)	
Northern Ireland	15 (0.9) ▲	6 (1.3) ▲	40 (6.0) ▲	5 (9.2)	
Norway	11 (1.2) ▲	11 (1.0) ▲	21 (3.5) ▲	4 (6.7)	
Oman	15 (1.3) ▲	22 (1.2) ▲	18 (4.6) ▲	-6 (15.2)	
Poland	18 (0.8) ▲	11 (0.9) ▲	20 (2.5) ▲	9 (5.2)	
Portugal	11 (1.1) ▲	8 (1.0) ▲	14 (5.7) ▲	-7 (6.3)	
Qatar	15 (1.3) ▲	18 (1.4) ▲	70 (6.8) ▲	48 (14.2) ▲	
Romania	16 (1.8) ▲	10 (1.7) ▲	23 (5.7) ▲	-1 (9.3)	
Russian Federation	8 (1.0) ▲	10 (0.9) ▲	24 (5.0) ▲	2 (6.7)	
Saudi Arabia	8 (1.4) ▲	10 (1.4) ▲	19 (6.4) ▲	20 (6.3) ▲	
Singapore	17 (0.8) ▲	16 (1.1) ▲	32 (2.5) ▲	47 (4.3) ▲	
Slovak Republic	17 (1.0) ▲	7 (0.8) ▲	18 (5.2) ▲	-12 (8.7)	
Slovenia	22 (1.3) ▲	9 (0.9) ▲	29 (3.5) ▲	2 (5.2)	
Spain	13 (1.0) ▲	12 (1.1) ▲	17 (3.1) ▲	25 (5.2) ▲	
Sweden	15 (1.1) ▲	10 (1.1) ▲	35 (2.6) ▲	-7 (5.3)	
United Arab Emirates	13 (1.0) ▲	13 (0.8) ▲	41 (2.8) ▲	22 (6.4) ▲	
Sixth Grade Countries					
Botswana	6 (1.2) ▲	14 (1.1) ▲	39 (6.4) ▲	19 (8.8) ▲	
Honduras	-2 (1.3)	4 (1.4) ▲	22 (4.2) ▲	13 (7.2)	
Benchmarking Participants					
Quebec, Canada	12 (1.1) ▲	8 (0.7) ▲	26 (3.3) ▲	7 (5.4)	
Abu Dhabi, UAE	10 (1.8) ▲	14 (1.3) ▲	38 (5.3) ▲	39 (9.8) ▲	
Dubai, UAE	15 (1.1) ▲	10 (1.1) ▲	64 (3.5) ▲	35 (11.9) ▲	

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.20: HLM Regression Coefficients for School Environment with Home Background Control Model – Reading Achievement

Country	School Explanatory Variables			Home Background Control Variables			
	School Environment			Students within Schools		Between Schools	
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Home Resources for Learning	Early Literacy/ Numeracy Tasks	School Average of ...	
						Home Resources for Learning	Early Literacy/ Numeracy Tasks
Australia	10 (3.5) ▲	2 (1.8)	1 (1.9)	12 (1.3) ▲	11 (1.3) ▲	38 (3.8) ▲	15 (7.0) ▲
Austria	4 (2.4)	2 (2.0)	-2 (1.2)	19 (0.8) ▲	5 (0.8) ▲	24 (2.9) ▲	0 (6.3)
Azerbaijan	10 (4.7) ▲	6 (3.7)	-2 (4.5)	6 (1.0) ▲	4 (0.8) ▲	8 (7.6)	-11 (7.5)
Chinese Taipei	5 (2.2) ▲	0 (1.3)	-1 (1.4)	10 (0.7) ▲	14 (1.0) ▲	20 (2.1) ▲	27 (7.5) ▲
Croatia	4 (1.9)	0 (1.2)	-1 (1.2)	12 (0.8) ▲	12 (0.7) ▲	22 (2.0) ▲	10 (4.2) ▲
Czech Republic	4 (3.0)	-1 (1.5)	-2 (1.6)	15 (1.1) ▲	7 (0.8) ▲	31 (4.3) ▲	17 (5.2) ▲
Finland	10 (2.6) ▲	0 (2.2)	1 (1.6)	11 (1.1) ▲	15 (1.0) ▲	19 (4.3) ▲	10 (5.4)
Georgia	3 (3.5)	2 (3.3)	-7 (3.2) ▼	11 (1.2) ▲	9 (0.8) ▲	21 (3.4) ▲	4 (5.3)
Germany	9 (3.1) ▲	6 (3.2)	1 (1.9)	16 (0.8) ▲	7 (0.9) ▲	26 (3.7) ▲	11 (9.4)
Hong Kong SAR	4 (2.2) ▲	-4 (1.9)	-1 (1.9)	2 (0.7) ▲	13 (1.1) ▲	5 (2.2) ▲	60 (4.5) ▲
Hungary	1 (3.7)	2 (2.6)	1 (1.5)	16 (0.8) ▲	8 (0.7) ▲	27 (2.7) ▲	3 (7.1)
Iran, Islamic Rep. of	6 (3.5)	3 (3.1)	-1 (2.8)	8 (0.9) ▲	8 (0.7) ▲	23 (2.4) ▲	4 (4.9)
Ireland	7 (3.1) ▲	2 (1.9)	-1 (1.5)	19 (1.0) ▲	8 (1.1) ▲	23 (3.1) ▲	5 (7.0)
Italy	5 (2.6) ▲	-3 (2.2)	3 (2.0)	16 (0.9) ▲	7 (0.9) ▲	21 (3.4) ▲	3 (5.3)
Lithuania	7 (3.3) ▲	0 (1.9)	2 (1.8)	13 (0.8) ▲	15 (0.9) ▲	19 (3.1) ▲	25 (5.8) ▲
Malta	11 (4.9) ▲	8 (3.1) ▲	-3 (2.8)	24 (1.4) ▲	12 (1.2) ▲	52 (6.9) ▲	35 (9.4) ▲
Morocco	4 (4.6)	13 (4.2) ▲	10 (3.5) ▲	1 (1.1)	14 (1.5) ▲	8 (8.5)	10 (6.1)
Northern Ireland	10 (3.4) ▲	3 (1.6)	0 (1.5)	16 (1.1) ▲	9 (1.4) ▲	32 (5.0) ▲	10 (7.6)
Norway	7 (3.7) ▲	3 (2.2)	-2 (2.6)	12 (1.1) ▲	12 (0.9) ▲	16 (4.9) ▲	11 (8.0)
Oman	11 (3.3) ▲	8 (2.5) ▲	0 (2.7)	12 (1.0) ▲	19 (1.0) ▲	19 (3.5) ▲	-6 (13.1)
Poland	3 (3.6)	3 (1.9)	-2 (1.9)	18 (0.8) ▲	13 (0.9) ▲	20 (2.5) ▲	6 (5.4)
Portugal	4 (3.2)	5 (2.3) ▲	-7 (2.4) ▼	12 (1.2) ▲	10 (0.9) ▲	14 (3.6) ▲	3 (5.0)
Qatar	19 (4.4) ▲	5 (3.3)	4 (1.7) ▲	14 (1.4) ▲	16 (1.3) ▲	57 (5.2) ▲	28 (9.5) ▲
Romania	9 (7.4)	2 (5.2)	-3 (4.0)	16 (1.6) ▲	9 (1.5) ▲	25 (4.9) ▲	1 (7.1)
Russian Federation	6 (3.7)	-2 (2.9)	1 (2.1)	10 (1.2) ▲	11 (0.8) ▲	25 (4.2) ▲	2 (4.6)
Saudi Arabia	5 (3.8)	14 (3.4) ▲	3 (4.1)	5 (1.1) ▲	11 (1.1) ▲	9 (6.0)	16 (6.0) ▲
Singapore	1 (1.9)	1 (1.4)	1 (1.0)	15 (0.7) ▲	16 (1.1) ▲	27 (3.1) ▲	52 (4.5) ▲
Slovak Republic	8 (4.0)	3 (2.6)	-2 (2.6)	16 (0.8) ▲	8 (0.7) ▲	15 (4.6) ▲	-5 (6.7)
Slovenia	1 (2.6)	0 (1.8)	2 (1.2)	21 (0.9) ▲	11 (0.8) ▲	26 (3.1) ▲	8 (3.9)
Spain	5 (2.9)	0 (2.9)	0 (1.7)	11 (1.0) ▲	12 (1.0) ▲	16 (3.0) ▲	20 (5.7) ▲
Sweden	2 (2.1)	-1 (1.6)	1 (1.6)	12 (0.9) ▲	12 (0.9) ▲	28 (2.6) ▲	0 (5.0)
United Arab Emirates	12 (3.1) ▲	6 (2.4) ▲	-1 (2.1)	13 (0.8) ▲	11 (0.6) ▲	44 (2.9) ▲	16 (6.5) ▲
Sixth Grade Countries							
Botswana	12 (3.1) ▲	7 (2.1) ▲	0 (2.5)	6 (1.0) ▲	10 (0.9) ▲	30 (5.2) ▲	9 (5.4)
Honduras	8 (4.5)	-5 (3.2)	1 (3.4)	-2 (1.3)	8 (1.8) ▲	22 (4.5) ▲	8 (6.0)
Benchmarking Participants							
Quebec, Canada	3 (2.0)	2 (1.7)	1 (1.6)	12 (0.9) ▲	9 (0.9) ▲	21 (3.1) ▲	13 (4.8) ▲
Abu Dhabi, UAE	13 (5.0) ▲	7 (4.1)	-1 (3.5)	11 (1.5) ▲	12 (1.2) ▲	40 (5.8) ▲	29 (10.3) ▲
Dubai, UAE	9 (4.9)	6 (2.6) ▲	3 (2.5)	15 (1.2) ▲	10 (0.8) ▲	61 (3.3) ▲	33 (10.7) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.21: HLM Regression Coefficients for School Environment with Home Background Control Model – Mathematics Achievement

Country	School Explanatory Variables			Home Background Control Variables			
	School Environment			Students within Schools		Between Schools	
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Home Resources for Learning	Early Literacy/Numeracy Tasks	School Average of ...	
						Home Resources for Learning	Early Literacy/Numeracy Tasks
Australia	11 (4.0) ▲	3 (2.1)	2 (2.0)	12 (1.4) ▲	15 (1.4) ▲	43 (3.9) ▲	19 (8.8) ▲
Austria	6 (3.7)	2 (2.4)	0 (1.6)	16 (0.7) ▲	8 (0.7) ▲	21 (3.6) ▲	9 (7.0)
Azerbaijan	15 (5.3) ▲	6 (4.9)	5 (5.6)	9 (1.2) ▲	4 (0.9) ▲	7 (9.9)	-10 (8.3)
Chinese Taipei	5 (2.1) ▲	0 (1.5)	0 (1.6)	12 (0.8) ▲	17 (1.1) ▲	22 (2.5) ▲	22 (6.6) ▲
Croatia	3 (2.0)	-1 (1.3)	1 (1.2)	11 (0.8) ▲	16 (0.9) ▲	25 (2.6) ▲	15 (5.3) ▲
Czech Republic	5 (3.9)	-2 (1.5)	-2 (2.0)	17 (1.2) ▲	9 (0.9) ▲	38 (5.6) ▲	26 (7.2) ▲
Finland	10 (2.6) ▲	0 (2.2)	2 (1.5)	10 (0.9) ▲	18 (0.8) ▲	15 (5.8) ▲	15 (5.6) ▲
Georgia	-1 (5.4)	12 (6.8)	-11 (4.6) ▼	10 (1.5) ▲	8 (1.0) ▲	19 (5.1) ▲	-2 (9.1)
Germany	6 (3.0) ▲	7 (3.0) ▲	0 (1.7)	13 (0.8) ▲	9 (1.0) ▲	22 (3.8) ▲	13 (8.5)
Hong Kong SAR	3 (2.1)	-2 (1.7)	-2 (2.5)	3 (0.7) ▲	12 (1.1) ▲	7 (2.2) ▲	54 (4.8) ▲
Hungary	4 (3.6)	3 (2.5)	1 (1.3)	17 (0.8) ▲	9 (0.8) ▲	31 (2.6) ▲	-2 (8.0)
Iran, Islamic Rep. of	5 (3.8)	2 (3.2)	-2 (2.7)	7 (1.1) ▲	9 (0.7) ▲	22 (2.5) ▲	0 (5.0)
Ireland	6 (3.9)	3 (2.1)	1 (2.1)	17 (0.9) ▲	10 (1.3) ▲	20 (4.0) ▲	1 (6.9)
Italy	5 (4.3)	-2 (3.1)	7 (3.0) ▲	12 (1.0) ▲	10 (0.9) ▲	19 (4.6) ▲	8 (6.7)
Lithuania	5 (3.7)	1 (2.0)	2 (2.2)	11 (1.2) ▲	18 (0.9) ▲	21 (3.6) ▲	26 (5.4) ▲
Malta	10 (3.2) ▲	6 (2.5) ▲	-2 (2.2)	15 (1.1) ▲	10 (1.0) ▲	24 (5.0) ▲	21 (8.2) ▲
Morocco	5 (4.8)	12 (4.9) ▲	9 (3.9) ▲	0 (1.2)	10 (1.4) ▲	0 (8.8)	-3 (6.9)
Northern Ireland	14 (4.6) ▲	0 (2.0)	-1 (1.8)	16 (1.5) ▲	9 (1.4) ▲	42 (5.7) ▲	11 (8.2)
Norway	11 (5.0) ▲	4 (3.6)	-2 (3.4)	9 (1.5) ▲	13 (0.9) ▲	15 (6.7) ▲	15 (10.4)
Oman	11 (3.4) ▲	8 (2.6) ▲	-3 (2.8)	13 (0.9) ▲	18 (0.9) ▲	16 (3.8) ▲	-4 (11.0)
Poland	1 (4.0)	3 (1.8)	-1 (2.1)	16 (0.8) ▲	13 (0.8) ▲	19 (2.6) ▲	9 (5.3)
Portugal	6 (5.3)	6 (3.3)	-8 (3.3) ▼	10 (1.0) ▲	9 (0.9) ▲	16 (5.6) ▲	-14 (8.7)
Qatar	12 (4.5) ▲	3 (3.5)	5 (2.0) ▲	11 (1.4) ▲	13 (1.3) ▲	61 (5.4) ▲	17 (9.8)
Romania	11 (10.0)	8 (7.2)	-3 (4.7)	14 (2.1) ▲	10 (2.4) ▲	19 (7.1) ▲	-3 (10.0)
Russian Federation	8 (4.6)	-5 (2.9)	0 (2.3)	8 (1.0) ▲	10 (0.9) ▲	25 (5.2) ▲	3 (6.9)
Saudi Arabia	1 (5.1)	10 (4.6) ▲	-1 (5.8)	5 (1.4) ▲	10 (1.1) ▲	6 (7.2)	13 (6.6)
Singapore	1 (2.2)	1 (1.5)	0 (1.0)	12 (0.8) ▲	15 (1.1) ▲	23 (3.2) ▲	49 (4.6) ▲
Slovak Republic	13 (5.2) ▲	5 (3.6)	-4 (3.2)	17 (0.9) ▲	8 (0.9) ▲	15 (5.4) ▲	-12 (8.1)
Slovenia	1 (2.2)	0 (1.7)	1 (1.2)	19 (1.2) ▲	11 (0.8) ▲	25 (3.2) ▲	9 (4.6)
Spain	7 (2.8) ▲	1 (2.2)	-1 (1.7)	11 (0.9) ▲	12 (1.0) ▲	19 (2.9) ▲	19 (4.7) ▲
Sweden	2 (1.9)	3 (1.3)	0 (1.5)	11 (0.9) ▲	14 (1.1) ▲	21 (2.0) ▲	8 (4.0) ▲
United Arab Emirates	7 (3.2) ▲	6 (2.4) ▲	-1 (2.1)	9 (0.7) ▲	10 (0.6) ▲	39 (2.9) ▲	8 (6.6)
Sixth Grade Countries							
Botswana	13 (3.0) ▲	7 (2.2) ▲	1 (2.4)	3 (0.9) ▲	9 (1.0) ▲	19 (5.3) ▲	8 (5.5)
Honduras	4 (5.0)	-4 (3.6)	3 (3.3)	-3 (1.4) ▼	5 (1.6) ▲	16 (4.9) ▲	10 (7.6)
Benchmarking Participants							
Quebec, Canada	3 (2.3)	4 (1.8) ▲	1 (2.0)	10 (1.0) ▲	8 (1.0) ▲	16 (3.4) ▲	5 (5.7)
Abu Dhabi, UAE	11 (5.2) ▲	5 (3.9)	-1 (3.5)	8 (1.4) ▲	11 (1.2) ▲	37 (5.5) ▲	24 (10.0) ▲
Dubai, UAE	7 (4.2)	6 (2.3) ▲	3 (2.4)	11 (1.0) ▲	9 (0.8) ▲	54 (3.2) ▲	24 (10.3) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.22: HLM Regression Coefficients for School Environment with Home Background Control Model – Science Achievement

Country	School Explanatory Variables			Home Background Control Variables			
	School Environment			Students within Schools		Between Schools	
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Home Resources for Learning	Early Literacy/ Numeracy Tasks	School Average of ...	
						Home Resources for Learning	Early Literacy/ Numeracy Tasks
Australia	8 (3.3) ▲	3 (1.6)	1 (1.8)	13 (1.1) ▲	12 (1.2) ▲	40 (3.6) ▲	18 (6.2) ▲
Austria	6 (3.1)	2 (2.2)	0 (1.3)	20 (1.0) ▲	5 (0.7) ▲	23 (3.5) ▲	-3 (6.7)
Azerbaijan	16 (5.8) ▲	6 (4.9)	0 (6.5)	9 (1.1) ▲	5 (1.0) ▲	10 (10.2)	-9 (8.1)
Chinese Taipei	5 (1.9) ▲	-1 (1.3)	0 (1.4)	12 (0.7) ▲	15 (1.2) ▲	22 (2.2) ▲	21 (6.0) ▲
Croatia	4 (2.1)	-1 (1.1)	-1 (1.2)	12 (1.0) ▲	10 (0.9) ▲	21 (2.6) ▲	6 (5.2)
Czech Republic	5 (3.2)	-1 (1.5)	-1 (1.7)	17 (1.3) ▲	7 (1.0) ▲	32 (4.8) ▲	19 (5.4) ▲
Finland	10 (2.3) ▲	2 (2.1)	0 (1.5)	11 (1.0) ▲	12 (1.0) ▲	18 (4.4) ▲	6 (5.3)
Georgia	-2 (4.6)	7 (5.7)	-9 (4.1) ▼	11 (1.3) ▲	9 (1.1) ▲	17 (4.9) ▲	3 (7.5)
Germany	8 (3.2) ▲	7 (3.0) ▲	1 (1.7)	16 (0.8) ▲	5 (1.1) ▲	26 (3.9) ▲	9 (9.2)
Hong Kong SAR	2 (2.2)	-2 (1.8)	-2 (2.2)	5 (0.8) ▲	15 (1.4) ▲	6 (2.1) ▲	58 (5.2) ▲
Hungary	3 (3.9)	3 (2.9)	0 (1.7)	17 (0.9) ▲	6 (1.0) ▲	28 (2.9) ▲	0 (8.6)
Iran, Islamic Rep. of	5 (4.1)	3 (3.3)	-2 (3.1)	8 (1.1) ▲	8 (0.7) ▲	26 (2.5) ▲	4 (5.5)
Ireland	5 (4.3)	4 (2.3)	1 (2.5)	17 (1.3) ▲	7 (1.0) ▲	22 (3.8) ▲	1 (7.0)
Italy	7 (4.0)	-2 (2.9)	4 (2.8)	15 (1.0) ▲	6 (0.9) ▲	22 (4.3) ▲	2 (6.4)
Lithuania	7 (2.9) ▲	-1 (2.1)	1 (2.2)	10 (0.9) ▲	14 (0.9) ▲	19 (3.3) ▲	28 (5.5) ▲
Malta	7 (4.0)	6 (2.9) ▲	0 (2.6)	23 (1.6) ▲	8 (1.2) ▲	45 (6.2) ▲	28 (9.6) ▲
Morocco	5 (5.9)	15 (5.8) ▲	10 (4.4) ▲	1 (1.5)	15 (1.8) ▲	2 (10.1)	-1 (8.1)
Northern Ireland	12 (5.1) ▲	3 (1.9)	-1 (2.1)	15 (0.9) ▲	5 (1.3) ▲	34 (5.9) ▲	9 (8.5)
Norway	7 (3.3) ▲	3 (2.2)	-1 (2.2)	11 (1.2) ▲	11 (1.0) ▲	17 (4.3) ▲	9 (6.6)
Oman	14 (4.0) ▲	11 (2.9) ▲	-4 (3.4)	15 (1.3) ▲	22 (1.2) ▲	17 (4.4) ▲	-4 (14.2)
Poland	1 (3.7)	3 (1.9)	-2 (1.9)	18 (0.8) ▲	11 (0.9) ▲	20 (2.3) ▲	8 (5.5)
Portugal	3 (5.1)	8 (3.5) ▲	-7 (3.0) ▼	11 (1.1) ▲	8 (1.1) ▲	12 (5.3) ▲	-7 (6.5)
Qatar	19 (6.1) ▲	4 (4.3)	4 (2.4)	15 (1.3) ▲	18 (1.4) ▲	58 (6.7) ▲	45 (12.2) ▲
Romania	10 (9.1)	6 (6.8)	-3 (4.5)	16 (1.8) ▲	10 (1.7) ▲	21 (6.3) ▲	-3 (9.0)
Russian Federation	7 (4.6)	-4 (3.2)	2 (2.4)	8 (1.0) ▲	10 (0.9) ▲	25 (5.0) ▲	1 (6.4)
Saudi Arabia	5 (4.4)	13 (3.9) ▲	1 (5.4)	8 (1.4) ▲	10 (1.4) ▲	10 (6.8)	17 (5.8) ▲
Singapore	0 (2.1)	2 (1.4)	1 (0.9)	17 (0.8) ▲	16 (1.1) ▲	30 (3.0) ▲	48 (4.5) ▲
Slovak Republic	12 (4.9) ▲	4 (3.3)	-3 (3.2)	17 (1.0) ▲	7 (0.8) ▲	15 (5.0) ▲	-11 (7.5)
Slovenia	1 (2.6)	-1 (1.9)	1 (1.4)	22 (1.3) ▲	9 (0.9) ▲	29 (3.8) ▲	3 (5.2)
Spain	6 (3.2)	1 (2.7)	0 (2.0)	13 (1.0) ▲	12 (1.1) ▲	15 (3.1) ▲	22 (5.8) ▲
Sweden	4 (2.4)	0 (1.5)	1 (1.7)	15 (1.1) ▲	10 (1.1) ▲	32 (2.8) ▲	-8 (5.6)
United Arab Emirates	9 (3.4) ▲	8 (2.7) ▲	-1 (2.2)	13 (1.0) ▲	13 (0.8) ▲	37 (3.1) ▲	20 (6.8) ▲
Sixth Grade Countries							
Botswana	17 (4.1) ▲	10 (2.9) ▲	1 (3.5)	6 (1.2) ▲	14 (1.1) ▲	30 (6.9) ▲	17 (7.3) ▲
Honduras	6 (4.9)	-5 (3.7)	0 (3.5)	-2 (1.4)	4 (1.4) ▲	22 (4.4) ▲	13 (6.9)
Benchmarking Participants							
Quebec, Canada	2 (2.6)	3 (1.7)	0 (1.6)	12 (1.1) ▲	8 (0.7) ▲	22 (3.4) ▲	6 (5.4)
Abu Dhabi, UAE	11 (5.4) ▲	8 (4.4)	-1 (3.5)	10 (1.8) ▲	14 (1.3) ▲	33 (6.2) ▲	36 (10.2) ▲
Dubai, UAE	9 (4.8)	7 (2.6) ▲	3 (2.8)	15 (1.1) ▲	10 (1.1) ▲	57 (3.6) ▲	37 (11.9) ▲

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.23: HLM Regression Coefficients for School Instruction with Home Background Control Model – Reading Achievement

Country	School Explanatory Variables		Home Background Control Variables				
	School Instruction		Students within Schools		Between Schools		
	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons	Home Resources for Learning	Early Literacy/Numeracy Tasks	School Average of . . .		
					Home Resources for Learning	Early Literacy/Numeracy Tasks	
Australia	1 (1.4)	7 (3.7)	12 (1.3) ▲	11 (1.3) ▲	48 (3.9) ▲	17 (6.9) ▲	
Austria	-2 (1.5)	-2 (3.2)	19 (0.8) ▲	5 (0.8) ▲	27 (2.6) ▲	-2 (6.0)	
Azerbaijan	1 (2.8)	36 (8.3) ▲	6 (1.0) ▲	4 (0.8) ▲	18 (6.5) ▲	-13 (7.2)	
Chinese Taipei	-1 (0.8)	4 (2.5)	10 (0.7) ▲	14 (1.0) ▲	20 (2.1) ▲	26 (8.4) ▲	
Croatia	0 (1.0)	-2 (2.7)	12 (0.8) ▲	12 (0.7) ▲	23 (2.0) ▲	9 (4.3) ▲	
Czech Republic	1 (0.9)	1 (3.3)	15 (1.1) ▲	7 (0.8) ▲	31 (4.5) ▲	16 (5.7) ▲	
Finland	1 (1.7)	1 (4.6)	11 (1.0) ▲	15 (1.0) ▲	19 (3.9) ▲	10 (6.3)	
Georgia	-1 (2.6)	23 (8.8) ▲	11 (1.2) ▲	9 (0.8) ▲	18 (3.2) ▲	4 (5.0)	
Germany	5 (2.1) ▲	1 (4.3)	16 (0.8) ▲	7 (0.9) ▲	33 (3.6) ▲	6 (10.0)	
Hong Kong SAR	1 (1.1)	8 (3.3) ▲	3 (0.7) ▲	13 (1.1) ▲	2 (2.1)	59 (4.5) ▲	
Hungary	0 (1.8)	15 (6.1) ▲	16 (0.9) ▲	8 (0.7) ▲	29 (2.0) ▲	6 (7.6)	
Iran, Islamic Rep. of	3 (1.9)	5 (4.4)	8 (0.9) ▲	8 (0.7) ▲	23 (2.0) ▲	3 (4.7)	
Ireland	2 (1.5)	7 (3.3) ▲	19 (1.0) ▲	8 (1.2) ▲	27 (3.2) ▲	0 (7.6)	
Italy	0 (1.5)	6 (4.0)	16 (0.9) ▲	7 (0.9) ▲	22 (3.5) ▲	0 (5.4)	
Lithuania	2 (1.2)	8 (3.1) ▲	13 (0.8) ▲	15 (0.9) ▲	18 (3.0) ▲	24 (6.1) ▲	
Malta	-2 (1.8)	30 (6.9) ▲	24 (1.4) ▲	12 (1.2) ▲	64 (5.1) ▲	22 (9.9) ▲	
Morocco	8 (3.5) ▲	27 (6.5) ▲	1 (1.1)	14 (1.5) ▲	14 (7.2)	5 (5.4)	
Northern Ireland	-1 (1.7)	3 (4.4)	16 (1.1) ▲	9 (1.4) ▲	37 (5.3) ▲	6 (10.0)	
Norway	0 (1.6)	9 (4.2) ▲	12 (1.1) ▲	12 (0.9) ▲	21 (4.1) ▲	6 (7.4)	
Oman	2 (1.7)	21 (4.4) ▲	12 (1.0) ▲	19 (1.0) ▲	19 (3.5) ▲	-10 (11.6)	
Poland	0 (1.7)	8 (5.5)	18 (0.8) ▲	13 (0.9) ▲	22 (2.6) ▲	8 (5.3)	
Portugal	-2 (2.0)	19 (4.8) ▲	12 (1.2) ▲	10 (0.9) ▲	13 (3.2) ▲	3 (4.6)	
Qatar	1 (2.1)	29 (7.5) ▲	14 (1.4) ▲	16 (1.3) ▲	64 (6.1) ▲	16 (10.2)	
Romania	-2 (4.9)	8 (7.7)	16 (1.5) ▲	9 (1.5) ▲	24 (4.8) ▲	4 (7.2)	
Russian Federation	-2 (1.6)	5 (3.0)	10 (1.2) ▲	11 (0.8) ▲	24 (4.1) ▲	4 (4.8)	
Saudi Arabia	0 (2.6)	33 (6.4) ▲	5 (1.1) ▲	11 (1.1) ▲	16 (5.1) ▲	9 (5.3)	
Singapore	-1 (0.8)	6 (3.4)	15 (0.7) ▲	16 (1.1) ▲	30 (2.7) ▲	50 (4.5) ▲	
Slovak Republic	0 (1.8)	3 (5.1)	16 (0.8) ▲	8 (0.7) ▲	18 (4.6) ▲	-7 (7.2)	
Slovenia	0 (1.2)	-1 (3.7)	21 (0.9) ▲	11 (0.8) ▲	26 (2.8) ▲	7 (3.8)	
Spain	-1 (1.3)	6 (3.9)	11 (1.0) ▲	12 (1.0) ▲	17 (2.8) ▲	22 (5.2) ▲	
Sweden	1 (1.1)	1 (3.0)	12 (0.9) ▲	12 (0.9) ▲	29 (2.3) ▲	-1 (4.9)	
United Arab Emirates	5 (1.4) ▲	26 (5.0) ▲	13 (0.8) ▲	11 (0.6) ▲	43 (2.8) ▲	11 (6.3)	
Sixth Grade Countries							
Botswana	2 (1.2)	34 (5.0) ▲	6 (1.0) ▲	10 (0.9) ▲	37 (5.0) ▲	-1 (5.6)	
Honduras	4 (3.1)	12 (7.8)	-2 (1.2)	8 (1.8) ▲	22 (4.4) ▲	8 (6.4)	
Benchmarking Participants							
Quebec, Canada	0 (0.8)	6 (3.0) ▲	12 (0.9) ▲	9 (0.9) ▲	25 (3.0) ▲	10 (4.9)	
Abu Dhabi, UAE	2 (2.3)	21 (6.3) ▲	11 (1.5) ▲	12 (1.2) ▲	43 (5.7) ▲	24 (10.4) ▲	
Dubai, UAE	3 (1.8)	36 (8.3) ▲	15 (1.2) ▲	10 (0.8) ▲	61 (4.0) ▲	22 (10.5) ▲	

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.24: HLM Regression Coefficients for School Instruction with Home Background Control Model – Mathematics Achievement

Country	School Explanatory Variables		Home Background Control Variables					
	School Instruction		Students within Schools			Between Schools		
	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons	Home Resources for Learning	Early Literacy/ Numeracy Tasks	School Average of . . .			
					Home Resources for Learning	Early Literacy/ Numeracy Tasks		
Australia	2 (1.5)	6 (3.7)	12 (1.4) ▲	15 (1.4) ▲	55 (3.9) ▲	22 (8.2) ▲		
Austria	-3 (1.8)	0 (4.5)	16 (0.7) ▲	8 (0.7) ▲	26 (3.5) ▲	6 (6.4)		
Azerbaijan	-4 (3.8)	63 (8.4) ▲	9 (1.2) ▲	4 (0.9) ▲	20 (8.5) ▲	-15 (7.8)		
Chinese Taipei	-1 (0.8)	4 (2.6)	12 (0.8) ▲	17 (1.1) ▲	22 (2.6) ▲	21 (6.0) ▲		
Croatia	0 (1.2)	-1 (2.6)	11 (0.8) ▲	16 (0.9) ▲	24 (2.4) ▲	15 (5.5) ▲		
Czech Republic	1 (0.9)	1 (3.4)	17 (1.2) ▲	9 (0.9) ▲	38 (6.0) ▲	25 (7.9) ▲		
Finland	2 (2.4)	-1 (5.7)	10 (0.9) ▲	18 (0.8) ▲	15 (4.9) ▲	15 (6.2) ▲		
Georgia	-3 (3.4)	35 (11.8) ▲	10 (1.5) ▲	8 (1.0) ▲	18 (4.6) ▲	-2 (8.2)		
Germany	4 (2.1)	-2 (4.2)	13 (0.8) ▲	9 (1.0) ▲	30 (3.8) ▲	9 (9.3)		
Hong Kong SAR	0 (0.9)	7 (3.3) ▲	3 (0.7) ▲	12 (1.1) ▲	5 (2.0) ▲	53 (5.0) ▲		
Hungary	0 (1.7)	17 (6.6) ▲	17 (0.8) ▲	9 (0.8) ▲	35 (2.1) ▲	2 (8.6)		
Iran, Islamic Rep. of	1 (1.9)	5 (4.5)	7 (1.1) ▲	9 (0.7) ▲	23 (2.4) ▲	0 (4.9)		
Ireland	1 (1.6)	13 (5.2) ▲	17 (0.9) ▲	10 (1.3) ▲	25 (3.7) ▲	-5 (7.6)		
Italy	1 (2.0)	6 (5.9)	12 (1.0) ▲	10 (0.9) ▲	20 (4.5) ▲	4 (6.6)		
Lithuania	2 (1.1)	3 (3.6)	11 (1.2) ▲	18 (0.9) ▲	21 (3.6) ▲	26 (5.5) ▲		
Malta	-1 (1.6)	17 (5.7) ▲	15 (1.1) ▲	10 (1.0) ▲	34 (4.1) ▲	16 (8.6)		
Morocco	5 (3.6)	27 (6.9) ▲	0 (1.2)	10 (1.4) ▲	6 (7.4)	-8 (6.1)		
Northern Ireland	-3 (2.4)	5 (5.1)	16 (1.5) ▲	9 (1.4) ▲	48 (6.1) ▲	4 (10.1)		
Norway	0 (2.1)	11 (5.6)	9 (1.5) ▲	13 (0.9) ▲	22 (5.3) ▲	8 (9.9)		
Oman	2 (1.8)	23 (4.4) ▲	13 (0.9) ▲	18 (0.9) ▲	15 (3.7) ▲	-7 (9.3)		
Poland	-1 (1.8)	3 (6.1)	16 (0.8) ▲	13 (0.8) ▲	20 (2.8) ▲	10 (5.3)		
Portugal	-5 (3.5)	23 (6.8) ▲	10 (1.0) ▲	9 (0.9) ▲	15 (5.0) ▲	-15 (8.7)		
Qatar	0 (2.2)	20 (7.5) ▲	11 (1.4) ▲	13 (1.3) ▲	68 (5.5) ▲	8 (10.1)		
Romania	-4 (6.0)	2 (11.0)	14 (2.1) ▲	10 (2.5) ▲	21 (6.7) ▲	1 (9.8)		
Russian Federation	-2 (2.2)	4 (3.8)	8 (1.0) ▲	10 (0.9) ▲	22 (5.4) ▲	5 (7.3)		
Saudi Arabia	-1 (3.4)	14 (7.3)	5 (1.4) ▲	10 (1.1) ▲	10 (6.8)	11 (6.9)		
Singapore	-1 (0.9)	7 (3.5) ▲	12 (0.8) ▲	15 (1.1) ▲	26 (2.6) ▲	46 (4.5) ▲		
Slovak Republic	2 (2.4)	9 (6.5)	17 (0.9) ▲	8 (0.9) ▲	20 (5.5) ▲	-16 (8.8)		
Slovenia	-1 (1.3)	-4 (4.6)	19 (1.2) ▲	11 (0.8) ▲	25 (2.9) ▲	8 (4.5)		
Spain	0 (1.2)	8 (3.2) ▲	11 (0.9) ▲	12 (1.0) ▲	20 (2.8) ▲	23 (4.6) ▲		
Sweden	2 (1.0)	-2 (3.0)	11 (0.9) ▲	14 (1.1) ▲	24 (1.9) ▲	9 (4.0) ▲		
United Arab Emirates	5 (1.5) ▲	19 (4.8) ▲	9 (0.7) ▲	10 (0.6) ▲	37 (2.7) ▲	6 (6.5)		
Sixth Grade Countries								
Botswana	1 (1.2)	34 (4.4) ▲	3 (0.9) ▲	9 (1.0) ▲	27 (4.8) ▲	-2 (4.8)		
Honduras	1 (3.3)	9 (8.0)	-3 (1.4) ▼	5 (1.6) ▲	18 (4.9) ▲	10 (7.8)		
Benchmarking Participants								
Quebec, Canada	-1 (1.2)	2 (3.8)	10 (1.0) ▲	8 (1.0) ▲	22 (3.5) ▲	5 (6.1)		
Abu Dhabi, UAE	3 (2.0)	12 (6.4)	8 (1.3) ▲	11 (1.2) ▲	38 (4.7) ▲	22 (9.9) ▲		
Dubai, UAE	3 (1.7)	30 (7.8) ▲	11 (1.0) ▲	9 (0.8) ▲	54 (3.9) ▲	14 (9.9)		

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.25: HLM Regression Coefficients for School Instruction with Home Background Control Model – Science Achievement

Country	School Explanatory Variables		Home Background Control Variables				
	School Instruction		Students within Schools		Between Schools		
	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons	Home Resources for Learning	Early Literacy/Numeracy Tasks	School Average of . . .		
					Home Resources for Learning	Early Literacy/Numeracy Tasks	
Australia	1 (1.3)	6 (3.2)	13 (1.1) ▲	12 (1.2) ▲	48 (3.5) ▲	19 (6.2) ▲	
Austria	-3 (1.8)	-2 (3.9)	20 (1.0) ▲	5 (0.7) ▲	26 (3.4) ▲	-5 (6.3)	
Azerbaijan	0 (3.2)	62 (8.3) ▲	9 (1.1) ▲	5 (1.0) ▲	24 (8.6) ▲	-13 (7.9)	
Chinese Taipei	-1 (0.8)	2 (2.6)	12 (0.7) ▲	15 (1.2) ▲	22 (2.1) ▲	20 (6.3) ▲	
Croatia	-1 (1.0)	-2 (2.7)	12 (1.0) ▲	10 (0.9) ▲	21 (2.7) ▲	4 (5.4)	
Czech Republic	1 (0.9)	3 (3.1)	17 (1.3) ▲	7 (1.0) ▲	32 (4.9) ▲	18 (6.0) ▲	
Finland	1 (1.7)	0 (4.4)	11 (1.0) ▲	12 (1.0) ▲	20 (4.9) ▲	7 (6.1)	
Georgia	-2 (3.1)	29 (11.2) ▲	11 (1.3) ▲	9 (1.0) ▲	15 (4.4) ▲	3 (6.7)	
Germany	4 (2.1) ▲	-1 (4.3)	17 (0.8) ▲	5 (1.1) ▲	34 (3.9) ▲	4 (10.0)	
Hong Kong SAR	1 (1.0)	4 (3.4)	5 (0.8) ▲	15 (1.4) ▲	4 (2.0) ▲	58 (5.2) ▲	
Hungary	0 (1.9)	17 (7.9) ▲	17 (0.9) ▲	6 (1.0) ▲	31 (2.1) ▲	4 (9.0)	
Iran, Islamic Rep. of	1 (2.1)	2 (4.7)	8 (1.1) ▲	8 (0.7) ▲	26 (2.4) ▲	4 (5.4)	
Ireland	2 (1.8)	11 (5.4) ▲	17 (1.3) ▲	7 (1.0) ▲	27 (3.7) ▲	-5 (8.0)	
Italy	0 (2.0)	6 (5.8)	15 (1.0) ▲	6 (0.9) ▲	23 (4.4) ▲	-1 (6.3)	
Lithuania	1 (1.2)	7 (3.2) ▲	10 (0.9) ▲	14 (0.9) ▲	18 (3.2) ▲	27 (5.3) ▲	
Malta	-2 (1.7)	21 (6.1) ▲	23 (1.6) ▲	8 (1.2) ▲	55 (4.8) ▲	19 (10.2)	
Morocco	6 (3.7)	33 (7.5) ▲	1 (1.5)	15 (1.8) ▲	9 (8.0)	-7 (7.0)	
Northern Ireland	-2 (2.4)	6 (5.9)	15 (0.9) ▲	5 (1.3) ▲	39 (6.3) ▲	3 (11.1)	
Norway	0 (1.2)	8 (4.3)	11 (1.2) ▲	11 (1.0) ▲	21 (3.3) ▲	5 (6.3)	
Oman	2 (2.1)	33 (5.5) ▲	15 (1.3) ▲	22 (1.2) ▲	16 (4.4) ▲	-7 (11.4)	
Poland	-1 (1.8)	5 (5.5)	18 (0.8) ▲	11 (0.9) ▲	22 (2.7) ▲	9 (5.2)	
Portugal	-5 (3.4)	24 (7.2) ▲	11 (1.1) ▲	8 (1.0) ▲	13 (4.7) ▲	-9 (6.5)	
Qatar	-1 (3.1)	27 (10.3) ▲	15 (1.3) ▲	18 (1.4) ▲	67 (7.5) ▲	33 (12.7) ▲	
Romania	0 (5.5)	8 (9.5)	16 (1.8) ▲	10 (1.7) ▲	21 (5.5) ▲	0 (9.1)	
Russian Federation	-1 (2.1)	5 (3.9)	8 (1.0) ▲	10 (0.9) ▲	23 (5.0) ▲	3 (6.6)	
Saudi Arabia	-1 (3.1)	30 (6.9) ▲	8 (1.4) ▲	10 (1.3) ▲	17 (6.2) ▲	11 (5.7) ▲	
Singapore	-1 (0.8)	4 (3.4)	17 (0.8) ▲	16 (1.1) ▲	32 (2.5) ▲	46 (4.4) ▲	
Slovak Republic	1 (2.2)	7 (5.8)	17 (1.0) ▲	7 (0.8) ▲	19 (4.9) ▲	-14 (8.2)	
Slovenia	-1 (1.5)	-4 (4.5)	22 (1.3) ▲	9 (0.9) ▲	28 (3.4) ▲	2 (5.2)	
Spain	-1 (1.4)	5 (4.0)	13 (1.0) ▲	12 (1.1) ▲	16 (3.1) ▲	25 (5.1) ▲	
Sweden	1 (1.2)	1 (3.6)	15 (1.1) ▲	10 (1.1) ▲	35 (2.7) ▲	-8 (5.1)	
United Arab Emirates	4 (1.6) ▲	27 (5.0) ▲	13 (1.0) ▲	13 (0.8) ▲	37 (3.0) ▲	15 (6.6) ▲	
Sixth Grade Countries							
Botswana	2 (1.5)	52 (6.0) ▲	6 (1.2) ▲	14 (1.1) ▲	40 (6.4) ▲	2 (6.4)	
Honduras	2 (3.2)	9 (8.7)	-2 (1.3)	4 (1.4) ▲	23 (4.3) ▲	14 (7.1)	
Benchmarking Participants							
Quebec, Canada	-1 (0.9)	6 (2.8) ▲	12 (1.1) ▲	8 (0.7) ▲	26 (3.2) ▲	4 (5.5)	
Abu Dhabi, UAE	2 (2.2)	21 (6.6) ▲	10 (1.8) ▲	14 (1.3) ▲	37 (5.5) ▲	31 (10.1) ▲	
Dubai, UAE	3 (1.9)	40 (8.6) ▲	15 (1.1) ▲	10 (1.1) ▲	57 (4.2) ▲	25 (11.3) ▲	

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.26: HLM Regression Coefficients for School Environment and Instruction with Home Background Control Model – Reading Achievement

Country	School Explanatory Variables						Home Background Control Variables				
	School Environment			School Instruction			Students within Schools		Between Schools		
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons	Home Resources for Learning	Early Literacy/ Numeracy Tasks	School Average of ...			
								Home Resources for Learning	Early Literacy/ Numeracy Tasks		
Australia	10 (3.5) ▲	3 (1.8)	1 (1.9)	1 (1.3)	4 (3.6)	12 (1.3) ▲	11 (1.3) ▲	38 (3.8) ▲	15 (7.0) ▲		
Austria	4 (2.4)	2 (1.9)	-2 (1.2)	-2 (1.4)	-2 (3.2)	19 (0.8) ▲	5 (0.8) ▲	24 (2.9) ▲	-1 (5.9)		
Azerbaijan	7 (4.6)	6 (2.8) ▲	-1 (3.5)	1 (2.7)	33 (7.8) ▲	6 (1.0) ▲	4 (0.8) ▲	13 (6.4) ▲	-13 (7.3)		
Chinese Taipei	5 (2.2) ▲	0 (1.3)	-1 (1.3)	-1 (0.7)	4 (2.5)	10 (0.7) ▲	14 (1.0) ▲	20 (2.1) ▲	25 (7.3) ▲		
Croatia	4 (1.9) ▲	0 (1.2)	-1 (1.2)	0 (1.1)	-2 (2.6)	12 (0.8) ▲	12 (0.7) ▲	22 (1.9) ▲	10 (4.2) ▲		
Czech Republic	4 (2.9)	-2 (1.5)	-1 (1.5)	1 (0.9)	1 (3.2)	15 (1.1) ▲	7 (0.8) ▲	31 (4.4) ▲	16 (5.4) ▲		
Finland	10 (2.6) ▲	-1 (2.3)	1 (1.5)	1 (1.5)	0 (4.2)	11 (1.0) ▲	15 (1.0) ▲	19 (4.0) ▲	10 (5.5)		
Georgia	2 (3.2)	1 (3.0)	-7 (3.1) ▼	0 (2.7)	24 (8.7) ▲	11 (1.2) ▲	9 (0.8) ▲	20 (3.4) ▲	4 (4.9)		
Germany	9 (3.1) ▲	6 (2.9)	1 (1.9)	4 (1.9) ▲	-1 (3.8)	16 (0.8) ▲	7 (0.9) ▲	25 (3.8) ▲	10 (9.0)		
Hong Kong SAR	3 (2.1)	-5 (2.0) ▼	-1 (1.8)	1 (1.0)	9 (3.5) ▲	2 (0.7)	13 (1.1) ▲	4 (2.2) ▲	56 (4.4) ▲		
Hungary	0 (3.8)	1 (2.3)	1 (1.4)	0 (1.8)	15 (5.9) ▲	16 (0.8) ▲	8 (0.7) ▲	29 (2.4) ▲	6 (7.5)		
Iran, Islamic Rep. of	6 (3.6)	3 (3.1)	-1 (2.8)	2 (1.9)	3 (4.5)	8 (0.9) ▲	8 (0.7) ▲	22 (2.4) ▲	3 (4.9)		
Ireland	5 (3.2)	2 (1.9)	-1 (1.6)	2 (1.4)	6 (3.5)	19 (1.0) ▲	8 (1.1) ▲	24 (3.1) ▲	3 (7.1)		
Italy	5 (2.6)	-3 (2.2)	3 (2.0)	0 (1.5)	5 (4.1)	16 (0.9) ▲	7 (0.9) ▲	21 (3.4) ▲	2 (5.4)		
Lithuania	7 (3.4) ▲	0 (1.8)	1 (1.8)	2 (1.2)	6 (3.1)	13 (0.8) ▲	15 (0.9) ▲	19 (2.8) ▲	23 (5.2) ▲		
Malta	8 (4.1) ▲	4 (2.9)	-3 (2.7)	-2 (1.7)	24 (6.3) ▲	24 (1.4) ▲	12 (1.2) ▲	57 (6.3) ▲	22 (9.9) ▲		
Morocco	0 (4.3)	8 (3.9)	11 (3.2) ▲	6 (3.7)	24 (6.5) ▲	1 (1.1)	14 (1.5) ▲	8 (7.3)	7 (5.3)		
Northern Ireland	10 (3.1) ▲	2 (1.6)	0 (1.5)	0 (1.5)	1 (3.8)	16 (1.1) ▲	9 (1.4) ▲	31 (5.1) ▲	9 (8.6)		
Norway	7 (3.4) ▲	2 (2.2)	-1 (2.4)	-1 (1.5)	7 (3.9)	12 (1.1) ▲	12 (0.9) ▲	17 (4.5) ▲	10 (7.4)		
Oman	9 (3.3) ▲	7 (2.5) ▲	1 (2.7)	2 (1.7)	17 (4.5) ▲	12 (1.0) ▲	19 (1.0) ▲	18 (3.5) ▲	-7 (11.4)		
Poland	2 (3.4)	3 (1.8)	-1 (1.8)	-1 (1.7)	7 (5.3)	18 (0.8) ▲	13 (0.9) ▲	22 (2.5) ▲	7 (5.4)		
Portugal	1 (2.9)	4 (2.1)	-7 (2.2) ▼	-2 (1.8)	17 (5.0) ▲	12 (1.2) ▲	10 (0.9) ▲	13 (3.0) ▲	2 (4.6)		
Qatar	17 (4.5) ▲	4 (3.2)	4 (1.6) ▲	-1 (1.8)	19 (6.8) ▲	14 (1.4) ▲	16 (1.3) ▲	56 (5.4) ▲	18 (9.5)		
Romania	7 (7.5)	2 (5.3)	-3 (4.1)	-1 (5.1)	4 (7.4)	16 (1.6) ▲	9 (1.5) ▲	25 (4.7) ▲	2 (7.4)		
Russian Federation	5 (4.1)	-3 (2.8)	2 (2.1)	-2 (1.6)	4 (3.2)	10 (1.2) ▲	11 (0.8) ▲	25 (4.1) ▲	3 (4.7)		
Saudi Arabia	0 (3.6)	12 (3.4) ▲	4 (3.7)	0 (2.4)	26 (6.8) ▲	5 (1.1) ▲	11 (1.1) ▲	9 (5.7)	9 (5.2)		
Singapore	2 (1.9)	2 (1.4)	1 (1.0)	-1 (0.8)	6 (3.4)	15 (0.7) ▲	16 (1.1) ▲	28 (3.1) ▲	51 (4.6) ▲		
Slovak Republic	7 (3.7)	3 (2.7)	-2 (2.6)	0 (1.6)	2 (4.7)	16 (0.8) ▲	8 (0.7) ▲	15 (4.5) ▲	-6 (6.6)		
Slovenia	2 (2.5)	0 (1.8)	2 (1.2)	0 (1.2)	-2 (3.6)	21 (0.9) ▲	11 (0.8) ▲	25 (3.1) ▲	8 (3.9)		
Spain	5 (2.8)	1 (2.6)	0 (1.7)	-2 (1.3)	5 (3.7)	11 (1.0) ▲	12 (1.0) ▲	15 (3.0) ▲	20 (5.5) ▲		
Sweden	2 (2.2)	-1 (1.6)	1 (1.5)	1 (1.2)	1 (3.0)	12 (0.9) ▲	12 (0.9) ▲	28 (2.8) ▲	-1 (5.0)		
United Arab Emirates	6 (2.9) ▲	5 (2.3) ▲	-1 (2.2)	4 (1.3) ▲	22 (5.0) ▲	13 (0.8) ▲	11 (0.6) ▲	42 (3.0) ▲	11 (6.7)		
Sixth Grade Countries											
Botswana	7 (3.3) ▲	5 (1.9) ▲	2 (1.9)	2 (1.2)	28 (4.8) ▲	6 (1.0) ▲	10 (0.9) ▲	32 (5.2) ▲	1 (4.7)		
Honduras	6 (4.4)	-5 (3.1)	0 (3.4)	4 (3.1)	10 (7.5)	-2 (1.2)	8 (1.8) ▲	22 (4.6) ▲	9 (6.0)		
Benchmarking Participants											
Quebec, Canada	3 (2.0)	2 (1.6)	1 (1.5)	-1 (0.7)	5 (3.0)	12 (0.9) ▲	9 (0.9) ▲	21 (3.0) ▲	10 (5.0) ▲		
Abu Dhabi, UAE	8 (5.0)	8 (4.0)	-1 (3.5)	3 (2.1)	17 (6.1) ▲	11 (1.5) ▲	12 (1.2) ▲	39 (6.1) ▲	24 (10.6) ▲		
Dubai, UAE	2 (5.1)	6 (2.7) ▲	5 (2.7)	3 (1.8)	33 (7.1) ▲	15 (1.2) ▲	10 (0.8) ▲	56 (4.1) ▲	24 (10.3) ▲		

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.27: HLM Regression Coefficients for School Environment and Instruction with Home Background Control Model – Mathematics Achievement

Country	School Explanatory Variables					Home Background Control Variables				
	School Environment			School Instruction		Students within Schools		Between Schools		
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons	Home Resources for Learning	Early Literacy/ Numeracy Tasks	School Average of ...		
								Home Resources for Learning	Early Literacy/ Numeracy Tasks	
Australia	11 (4.0) ▲	3 (2.1)	1 (2.0)	2 (1.4)	3 (3.6)	12 (1.4) ▲	15 (1.4) ▲	42 (3.9) ▲	19 (8.5) ▲	
Austria	5 (3.6)	3 (2.4)	1 (1.6)	-3 (1.6)	1 (4.6)	16 (0.7) ▲	8 (0.7) ▲	21 (3.5) ▲	8 (6.3)	
Azerbaijan	9 (5.1)	5 (3.8)	3 (4.0)	-4 (3.6)	59 (8.2) ▲	9 (1.2) ▲	4 (0.9) ▲	16 (8.2)	-14 (7.5)	
Chinese Taipei	4 (2.1)	0 (1.5)	0 (1.5)	-1 (0.8)	4 (2.6)	12 (0.8) ▲	17 (1.1) ▲	22 (2.6) ▲	20 (6.4) ▲	
Croatia	3 (2.0)	-1 (1.2)	1 (1.3)	0 (1.2)	-2 (2.7)	11 (0.8) ▲	16 (0.9) ▲	25 (2.6) ▲	15 (5.2) ▲	
Czech Republic	5 (3.8)	-2 (1.6)	-2 (1.9)	1 (0.9)	1 (3.4)	17 (1.2) ▲	9 (0.9) ▲	38 (5.8) ▲	26 (7.5) ▲	
Finland	10 (2.5) ▲	-1 (2.1)	3 (1.5)	2 (2.1)	-1 (5.4)	10 (0.9) ▲	18 (0.8) ▲	16 (5.1) ▲	15 (5.5) ▲	
Georgia	-2 (4.5)	10 (6.2)	-11 (4.5) ▼	-2 (3.4)	35 (11.4) ▲	10 (1.5) ▲	8 (1.0) ▲	18 (5.1) ▲	-3 (8.3)	
Germany	7 (2.9) ▲	6 (2.8) ▲	0 (1.7)	3 (1.9)	-4 (3.6)	13 (0.8) ▲	9 (1.0) ▲	21 (3.9) ▲	13 (8.2)	
Hong Kong SAR	2 (2.2)	-2 (1.7)	-2 (2.4)	0 (0.9)	7 (3.5)	3 (0.7)	12 (1.1) ▲	6 (2.2) ▲	52 (5.0) ▲	
Hungary	2 (3.7)	3 (2.3)	1 (1.3)	-1 (1.7)	16 (6.3) ▲	17 (0.8) ▲	9 (0.8) ▲	32 (2.3) ▲	2 (8.6)	
Iran, Islamic Rep. of	4 (3.8)	2 (3.2)	-2 (2.8)	0 (1.9)	3 (4.6)	7 (1.1) ▲	9 (0.7) ▲	23 (2.6) ▲	0 (5.1)	
Ireland	4 (3.8)	4 (2.2)	0 (2.0)	1 (1.5)	12 (5.5) ▲	17 (0.9) ▲	10 (1.3) ▲	21 (3.8) ▲	-3 (7.4)	
Italy	5 (4.3)	-2 (3.2)	7 (3.1) ▲	0 (2.2)	4 (5.4)	12 (1.0) ▲	10 (0.9) ▲	19 (4.5) ▲	7 (6.8)	
Lithuania	6 (3.8)	1 (2.0)	2 (2.2)	2 (1.1)	1 (3.5)	11 (1.2) ▲	18 (0.9) ▲	21 (3.4) ▲	26 (5.3) ▲	
Malta	9 (3.0) ▲	5 (2.6)	-2 (2.1)	-2 (1.5)	10 (5.5)	15 (1.1) ▲	10 (1.0) ▲	25 (4.9) ▲	16 (8.8)	
Morocco	1 (4.7)	8 (4.6)	10 (3.6) ▲	4 (3.9)	24 (6.7) ▲	0 (1.2)	10 (1.4) ▲	1 (7.8)	-6 (6.1)	
Northern Ireland	13 (4.3) ▲	0 (2.0)	-1 (1.9)	-2 (2.2)	3 (4.4)	16 (1.5) ▲	9 (1.4) ▲	43 (5.9) ▲	10 (9.2)	
Norway	10 (4.8) ▲	3 (3.4)	-1 (3.3)	-1 (1.9)	7 (5.4)	9 (1.5) ▲	13 (0.9) ▲	17 (5.9) ▲	15 (10.1)	
Oman	8 (3.4) ▲	6 (2.6) ▲	-1 (2.7)	2 (1.8)	19 (4.7) ▲	13 (0.9) ▲	18 (0.9) ▲	14 (3.8) ▲	-5 (9.1)	
Poland	0 (3.9)	3 (1.8)	-1 (2.1)	-1 (1.8)	3 (5.8)	16 (0.8) ▲	13 (0.8) ▲	19 (2.7) ▲	9 (5.4)	
Portugal	1 (4.9)	4 (3.1)	-8 (3.2) ▼	-5 (3.3)	21 (7.4) ▲	10 (1.0) ▲	9 (0.9) ▲	15 (4.8) ▲	-16 (8.4)	
Qatar	11 (4.6) ▲	2 (3.5)	5 (1.9) ▲	-1 (2.0)	12 (7.2)	11 (1.4) ▲	13 (1.3) ▲	61 (5.5) ▲	11 (9.7)	
Romania	12 (10.3)	7 (6.9)	-3 (4.8)	-2 (6.0)	-4 (9.9)	14 (2.1) ▲	10 (2.4) ▲	20 (6.7) ▲	-2 (9.9)	
Russian Federation	8 (4.6)	-5 (2.9)	1 (2.3)	-3 (2.2)	2 (4.0)	8 (1.0) ▲	10 (0.9) ▲	24 (5.2) ▲	4 (7.0)	
Saudi Arabia	0 (5.3)	9 (4.7)	-1 (5.7)	-1 (3.3)	10 (7.9)	5 (1.4) ▲	10 (1.1) ▲	6 (7.2)	11 (6.9)	
Singapore	1 (2.2)	2 (1.5)	0 (1.0)	-1 (0.9)	7 (3.5) ▲	12 (0.8) ▲	15 (1.1) ▲	23 (3.2) ▲	48 (4.6) ▲	
Slovak Republic	12 (4.9) ▲	5 (3.4)	-4 (3.1)	2 (2.2)	8 (5.9)	17 (0.9) ▲	8 (0.9) ▲	16 (5.2) ▲	-14 (7.8)	
Slovenia	1 (2.2)	1 (1.8)	1 (1.3)	-1 (1.3)	-4 (4.6)	19 (1.2) ▲	11 (0.7) ▲	25 (3.1) ▲	9 (4.6)	
Spain	6 (2.7) ▲	2 (2.1)	0 (1.6)	-1 (1.4)	6 (2.8) ▲	11 (0.9) ▲	12 (1.0) ▲	18 (2.9) ▲	19 (4.4) ▲	
Sweden	2 (1.9)	2 (1.4)	0 (1.5)	1 (0.9)	-2 (2.8)	11 (0.9) ▲	14 (1.1) ▲	21 (2.1) ▲	9 (4.1) ▲	
United Arab Emirates	3 (3.1)	4 (2.3)	-1 (2.2)	5 (1.4) ▲	16 (4.9) ▲	9 (0.7) ▲	10 (0.6) ▲	36 (3.0) ▲	6 (6.8)	
Sixth Grade Countries										
Botswana	8 (3.1) ▲	5 (1.9) ▲	2 (1.9)	1 (1.1)	27 (4.1) ▲	3 (0.9) ▲	9 (1.0) ▲	21 (5.1) ▲	-1 (4.5)	
Honduras	3 (5.0)	-4 (3.5)	2 (3.4)	1 (3.3)	8 (8.0)	-3 (1.4) ▼	5 (1.6) ▲	17 (5.0) ▲	11 (7.6)	
Benchmarking Participants										
Quebec, Canada	3 (2.3)	5 (1.8) ▲	1 (2.0)	-1 (1.2)	0 (3.6)	10 (1.0) ▲	8 (1.0) ▲	15 (3.3) ▲	5 (5.9)	
Abu Dhabi, UAE	8 (5.1)	6 (3.9)	-1 (3.5)	3 (1.9)	9 (6.2)	8 (1.3) ▲	11 (1.2) ▲	35 (5.6) ▲	22 (10.0) ▲	
Dubai, UAE	1 (4.7)	5 (2.4)	4 (2.6)	3 (1.7)	27 (7.4) ▲	11 (1.0) ▲	9 (0.8) ▲	50 (4.0) ▲	16 (10.0)	

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

Exhibit B.28: HLM Regression Coefficients for School Environment and Instruction with Home Background Control Model – Science Achievement

Country	School Explanatory Variables						Home Background Control Variables				
	School Environment			School Instruction			Students within Schools		Between Schools		
	Schools Are Safe and Orderly	Schools Support Academic Success	Adequate Environment and Resources	Early Emphasis on Reading Skills	Students Engaged in Reading, Mathematics, and Science Lessons	Home Resources for Learning	Early Literacy/Numeracy Tasks	School Average of ...			
								Home Resources for Learning	Early Literacy/Numeracy Tasks		
Australia	8 (3.3) ▲	3 (1.6)	1 (1.8)	1 (1.2)	3 (3.2)	13 (1.1) ▲	12 (1.2) ▲	39 (3.6) ▲	17 (6.2) ▲		
Austria	5 (3.0)	2 (2.2)	0 (1.3)	-3 (1.6)	-2 (4.0)	20 (1.0) ▲	5 (0.7) ▲	23 (3.5) ▲	-4 (6.3)		
Azerbaijan	10 (5.2)	6 (3.5)	0 (4.1)	0 (3.1)	58 (8.0) ▲	9 (1.1) ▲	5 (1.0) ▲	19 (8.1) ▲	-12 (7.6)		
Chinese Taipei	5 (1.9) ▲	-1 (1.3)	1 (1.3)	-1 (0.8)	2 (2.5)	12 (0.7) ▲	15 (1.2) ▲	22 (2.2) ▲	20 (5.8) ▲		
Croatia	4 (2.0)	-1 (1.1)	-1 (1.2)	-1 (1.0)	-2 (2.7)	12 (1.0) ▲	10 (0.9) ▲	21 (2.7) ▲	5 (5.1)		
Czech Republic	5 (3.2)	-2 (1.6)	-1 (1.7)	1 (0.8)	3 (3.2)	17 (1.3) ▲	7 (1.0) ▲	32 (4.9) ▲	19 (5.6) ▲		
Finland	11 (2.3) ▲	2 (2.2)	0 (1.5)	1 (1.6)	-1 (4.0)	11 (1.0) ▲	12 (1.0) ▲	18 (4.3) ▲	6 (5.3)		
Georgia	-4 (4.0)	6 (5.2)	-10 (4.0) ▼	-1 (3.2)	31 (10.8) ▲	11 (1.3) ▲	9 (1.1) ▲	15 (4.9) ▲	3 (6.8)		
Germany	8 (3.2) ▲	7 (2.8) ▲	1 (1.7)	3 (2.0)	-3 (3.8)	16 (0.8) ▲	5 (1.1) ▲	25 (4.0) ▲	8 (8.9)		
Hong Kong SAR	1 (2.4)	-3 (1.9)	-2 (2.2)	1 (1.0)	6 (3.7)	5 (0.8)	15 (1.4) ▲	6 (2.1) ▲	56 (5.2) ▲		
Hungary	1 (4.0)	2 (2.7)	0 (1.6)	0 (2.0)	17 (7.8) ▲	17 (0.8) ▲	6 (1.0) ▲	30 (2.7) ▲	4 (9.1)		
Iran, Islamic Rep. of	5 (4.2)	3 (3.3)	-2 (3.2)	0 (2.2)	0 (4.7)	8 (1.1) ▲	8 (0.7) ▲	26 (2.6) ▲	4 (5.6)		
Ireland	3 (4.2)	5 (2.4) ▲	0 (2.5)	2 (1.6)	11 (5.4) ▲	17 (1.3) ▲	7 (1.0) ▲	23 (3.6) ▲	-4 (7.4)		
Italy	7 (4.0)	-2 (3.1)	4 (2.8)	-1 (2.1)	4 (5.5)	15 (1.0) ▲	6 (0.9) ▲	22 (4.3) ▲	1 (6.4)		
Lithuania	7 (2.9) ▲	-1 (2.1)	1 (2.2)	2 (1.2)	5 (3.1)	10 (0.9) ▲	14 (0.9) ▲	18 (3.1) ▲	27 (5.1) ▲		
Malta	6 (3.6)	4 (2.9)	0 (2.5)	-2 (1.7)	16 (6.1) ▲	23 (1.6) ▲	8 (1.2) ▲	48 (5.8) ▲	20 (10.3)		
Morocco	1 (5.7)	10 (5.4)	11 (3.9) ▲	4 (4.0)	30 (7.3) ▲	1 (1.5)	15 (1.8) ▲	3 (8.8)	-4 (7.0)		
Northern Ireland	11 (4.5) ▲	2 (1.9)	-1 (2.1)	-1 (2.2)	4 (5.1)	15 (0.9) ▲	5 (1.3) ▲	34 (6.2) ▲	7 (9.7)		
Norway	6 (3.2)	2 (2.2)	0 (2.1)	-1 (1.1)	5 (4.0)	11 (1.2) ▲	11 (1.0) ▲	18 (3.8) ▲	9 (6.3)		
Oman	9 (4.0) ▲	8 (3.0) ▲	-2 (3.2)	2 (2.1)	29 (5.9) ▲	15 (1.3) ▲	22 (1.2) ▲	14 (4.4) ▲	-6 (11.2)		
Poland	1 (3.5)	3 (1.9)	-2 (1.8)	-1 (1.8)	5 (5.4)	18 (0.8) ▲	11 (0.9) ▲	21 (2.5) ▲	7 (5.5)		
Portugal	-1 (4.7)	6 (3.2)	-7 (2.9) ▼	-5 (3.3)	22 (7.7) ▲	11 (1.1) ▲	8 (1.1) ▲	12 (4.5) ▲	-9 (6.2)		
Qatar	19 (6.1) ▲	3 (4.3)	4 (2.3)	-3 (2.7)	16 (9.6)	15 (1.3) ▲	18 (1.4) ▲	59 (7.2) ▲	36 (12.0) ▲		
Romania	9 (9.1)	7 (6.6)	-3 (4.6)	1 (5.2)	4 (8.6)	16 (1.8) ▲	10 (1.7) ▲	20 (5.9) ▲	-3 (9.0)		
Russian Federation	6 (4.7)	-4 (3.2)	2 (2.5)	-2 (2.2)	3 (4.1)	8 (1.0) ▲	10 (0.9) ▲	25 (5.0) ▲	3 (6.4)		
Saudi Arabia	1 (4.5)	12 (3.9) ▲	2 (5.2)	-1 (2.8)	23 (7.5) ▲	8 (1.4) ▲	10 (1.3) ▲	11 (6.6)	11 (5.6)		
Singapore	0 (2.1)	2 (1.4)	1 (1.0)	-1 (0.8)	5 (3.4)	17 (0.8) ▲	16 (1.1) ▲	30 (3.0) ▲	47 (4.6) ▲		
Slovak Republic	10 (4.6) ▲	4 (3.2)	-4 (3.1)	1 (2.1)	6 (5.2)	17 (1.0) ▲	7 (0.8) ▲	16 (4.8) ▲	-12 (7.2)		
Slovenia	2 (2.5)	-1 (2.0)	1 (1.5)	-1 (1.5)	-4 (4.5)	22 (1.3) ▲	9 (0.9) ▲	28 (3.7) ▲	3 (5.2)		
Spain	5 (3.1)	1 (2.5)	0 (2.0)	-1 (1.5)	4 (3.7)	13 (1.0) ▲	12 (1.1) ▲	14 (3.1) ▲	23 (5.7) ▲		
Sweden	4 (2.5)	0 (1.6)	1 (1.7)	1 (1.3)	0 (3.5)	15 (1.1) ▲	10 (1.1) ▲	32 (2.9) ▲	-8 (5.5)		
United Arab Emirates	3 (3.1)	7 (2.5) ▲	-1 (2.3)	4 (1.5) ▲	24 (5.1) ▲	13 (1.0) ▲	13 (0.8) ▲	36 (3.3) ▲	13 (6.9)		
Sixth Grade Countries											
Botswana	9 (4.1) ▲	7 (2.3) ▲	3 (2.5)	2 (1.5)	44 (5.6) ▲	6 (1.2) ▲	14 (1.1) ▲	33 (6.6) ▲	4 (5.6)		
Honduras	5 (4.9)	-5 (3.7)	0 (3.5)	2 (3.3)	7 (8.4)	-2 (1.4)	4 (1.3) ▲	23 (4.5) ▲	14 (6.8) ▲		
Benchmarking Participants											
Quebec, Canada	2 (2.6)	3 (1.7)	-0 (1.6)	-1 (0.9)	5 (2.8)	12 (1.1) ▲	8 (0.7) ▲	22 (3.3) ▲	4 (5.5)		
Abu Dhabi, UAE	7 (5.3)	9 (4.2) ▲	-0 (3.4)	3 (2.0)	18 (6.3) ▲	10 (1.8) ▲	14 (1.3) ▲	32 (6.3) ▲	30 (10.3) ▲		
Dubai, UAE	1 (5.2)	6 (2.7) ▲	5 (2.9)	3 (1.9)	36 (7.9) ▲	15 (1.1) ▲	10 (1.1) ▲	52 (4.3) ▲	27 (11.3) ▲		

() Standard errors appear in parentheses.

▲ Coefficient significantly greater than zero.

▼ Coefficient significantly less than zero.

References

- Foy, P. (2013). *TIMSS and PIRLS 2011 user guide for the fourth grade combined international database*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Martin, M.O. & Mullis, I.V.S. (Eds.). (2012). *Methods and procedures in TIMSS and PIRLS 2011*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Martin, M.O. & Mullis, I.V.S. (Eds.). (2013). *TIMSS and PIRLS 2011: Relationships among reading, mathematics, and science achievement at the fourth grade—Implications for early learning*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Martin, M.O., Mullis, I.V.S., Foy, P., & Stanco, G.M. (2012). *TIMSS 2011 international results in science*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Mullis, I.V.S., Martin, M.O., Foy, P., & Arora, A. (2012). *TIMSS 2011 international results in mathematics*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Mullis, I.V.S., Martin, M.O., Foy, P., & Drucker, K.T. (2012). *PIRLS 2011 international results in reading*. Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College.
- Raudenbush, S.W. & Bryk, A.S. (2002). *Hierarchical linear models* (Second Edition). Thousand Oaks, CA: Sage Publications.
- Raudenbush, S.W., Bryk, A.S., Cheong, Y.F., Congdon, R.T., & du Toit, M. (2011). *HLM7 Hierarchical linear and nonlinear modeling*. Lincolnwood, IL: Scientific Software International, Inc.

