School quality and student achievement in 21 European countries

The Heyneman-Loxley effect revisited

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The Heyneman-Loxley effect (1982, 1983) refers to an effect moderating the degree to which school quality affects student achievement. This moderating effect was found to relate to a country's economic productivity. More specifically, the effect is one in which school quality has a greater impact on student achievement in countries that are less developed economically than in countries that are more highly developed. This article presents a reexamination of this effect using hierarchical linear modeling (HLM) analyses of data for 21 European countries that participated in the Trends in International Mathematics and Science Study (TIMSS) in 2003. Two models are analyzed. The first is a three-level model that includes each country's economic status at the highest level, school resources at the middle level, and students' respective family backgrounds at the lowest level. The second is a two-level model that includes school and student context variables only and examines these separately for each country. Results indicate little evidence to support the Heyneman-Loxley effect in the selected group of countries in 2003.

1 The authors undertook the work reported in this article while at Jacobs University Bremen, Germany.

INTRODUCTION

Because education plays an important role in shaping an individual's life opportunities, it is generally agreed that the higher a person's achieved educational status, the higher the returns for that person in terms of economic and social status (see, for example, Levin 2001a, 2001b). However, what is less clear are which factors shape educational attainment, and how they operate. Teasing out these factors and their effects is extremely complex.

In order to explain differences in educational attainment, one needs to consider a number of factors frequently considered important at various levels of education systems. The economic status of a country, region, or city serves as a proxy for a system's available resources and tends to be located at the macro level of an education system. Among the factors considered to operate at the intermediate levels are those associated with the school and teachers and those associated with students' families and caregivers. The first group includes factors such as school leadership and resources, quality of instruction, and the commitment of teachers and other staff toward making the most of the available resources. The second group, pertaining as it does to students' locus of initial upbringing, includes core values and attitudes, including emphasis on educational attainment. It also covers resources relevant to education within the family and the assistance that family members are able to provide students with respect to their learning. At the micro level, factors such as student gender, ability, and attitudes toward school and future education, as well as behaviors such as self-confidence, persistence, and effort, are regarded as being essential to any attempt to explain differences in educational attainment. In the next section of this article, we list and discuss some of the relevant research pertaining to hypothesized reasons for variations in school achievement.

Reseachers conducting international comparative studies are faced with the question of whether these factors should be analyzed with a view to determining how they affect educational attainment across countries or within countries. In other words, should an international comparative study be directed at developing a universal model in which factors are examined that have significant effects on attainment across countries, or should it be directed at developing separate models that allow examination of how the different factors in the different countries influence attainment in each of those countries?

Heyneman and Loxley (1982) took the latter view. Employed by the World Bank at the time of their research, the authors focused on separate analyses of countries. Their aim was to obtain information about which factors affect attainment in specific nations, particularly low-income countries. This information would then inform policies related to the World Bank's allocation of funds to low-income countries. The two authors used multiple regression analysis to reanalyze data from the First International Science Study (FISS), undertaken by the International Association for the Evaluation of Educational Achievement (IEA) (Comber & Keeves, 1973). They entered variables into the analyses in four blocks: preschool, school track, school program, and school. The preschool variables included measures of parental education and occupation, number of books and use of dictionary at home, and student gender and age. School track (usually academic or vocational) was included only for those countries (e.g., Germany) offering students this option. School program captured the distinction between types of school (e.g., private or public). School variables included, for example, total student enrolment, percentage of science teachers, opportunity to learn, availability of science text-books, and hours of homework per week.

In line with the aims of the initial analysis of the IEA data, Comber and Keeves (1973) retained a variable only if its average standardized regression coefficients on science achievement was greater than |.05| across the 18 countries they considered for this particular analysis. Heyneman and Loxley (1982), in contrast, and in line with their aims, analyzed the data for each country separately. Their approach led to different variables being retained for each country. However, in the Comber and Keeves' analysis, each block contained the same variables. In the Heyneman and Loxley reanalysis, each block contained different variables because the categorization included only those variables found, in each country, to have a significant effect on achievement.

Results revealed considerable differences across countries in the number and overall explanatory power of variables, particularly those in the school variables block. The most dramatic differences were recorded for Chile and India. While 10 variables were included across all countries in the initial analysis, 19 were included for Chile and India in the reanalysis. The variance in science achievement explained by this block of school variables also increased from 6% (initial analysis) to 20% (reanalysis) in Chile and 8 to 28% in India.

These findings gave rise to the so-called Heyneman-Loxley effect, which states that the quality of schools has a greater impact on achievement in low-income countries than it does in high-income countries. At the same time, the effects on achievement of the family context tend to be weaker in low-income countries than in higher-income countries. While the study presented in this article is not an exact replication of the Heyneman-Loxley analysis, our aim was to examine the relative effects of the family and the school on achievement in different countries. We did this by undertaking hierarchical linear modeling (HLM) analyses of data from the successor of FISS, namely IEA's Trends in International Science and Mathematics Study (TIMSS) 2003.

This article is structured as follows. First, we give a brief overview of conceptual frameworks for analyzing factors influencing educational attainment. We also offer some insights into what is known about the different aspects of these frameworks. Second, we describe the data and our method of analysis. Third, we present and discuss the results of our analyses. We finish with a summary of our study and some conclusions.

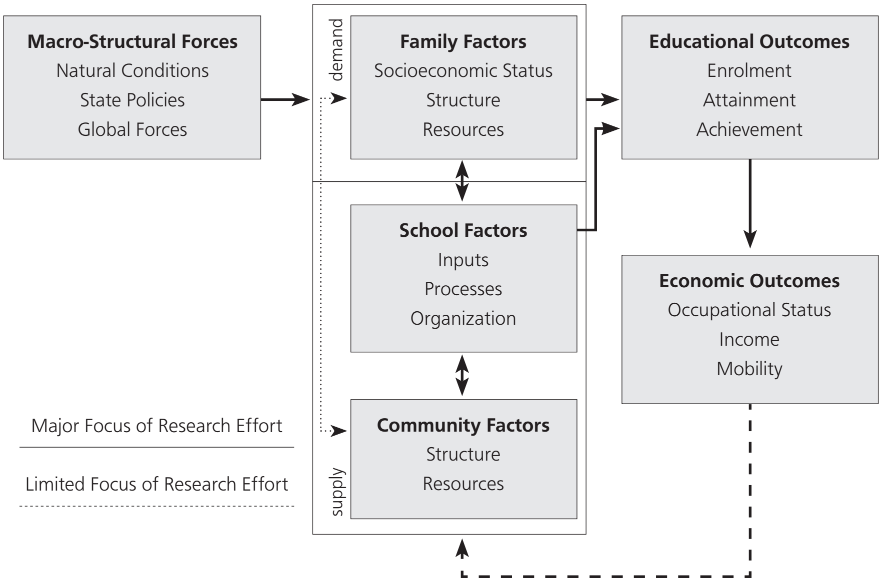
REASONS FOR VARIATIONS IN STUDENT ACHIEVEMENT: AN OVERVIEW

Carroll (1963) developed an influential general model of school learning. The model posited three factors (aptitude, ability, and perseverance) as internal to the learner, and two factors (opportunity to learn and quality of instruction) as external to the learner. Carroll's work served as the basis for other models that emphasized various factors, such as student aptitude (Reynolds & Walberg, 1991), student environment (Bloom, 1976), instruction (Harnishfeger & Wiley, 1976), and teacher characteristics and instructional delivery (Anderson, 2004). Keeves (1972) presented a model that recognized the nested nature of educational settings and identified three levels in the educational environment of a student. These were the home, the peer group, and the school.

Lietz (1996), combining the elements of several of these models, developed a conceptual framework of variables on school learning made up of a two-way matrix. The rows of the matrix described the levels in which education is embedded. The columns of the matrix indicated the different dimensions. The levels, starting from the highest, were country, followed by community, school, classroom/teacher, home, and student. The dimensions, starting from the left, covered structure/demographics, resources, values, practices/behaviors, and outcomes. This framework allowed any variable to be placed in the matrix according to its location in terms of level and dimension. It also assisted with placing variables in models of factors influencing educational attainment. In general, variables at a higher level and further to the left were considered to influence variables at lower levels and further to the right. Thus, for example, GDP (gross domestic product), positioned as a resource variable at the country level, was considered to influence the number of public libraries. The libraries, in turn, formed a resource variable at the community level—a variable that could be considered to influence community values relating to literacy and literary enjoyment. Finally, outcomes considered at the student level included student learning, achievement, attitudes, and interests. Although these variables could be aggregated to other levels, Lietz argued that, in a conceptual framework of school learning, any educational effort has to be judged by its effects on students.

While the aforementioned frameworks endeavored to conceptualize the many factors that play a role in school learning, Buchmann and Hannum (2001) reviewed the results of relevant research into different aspects of these frameworks in order to delineate the areas encompassed by the research. Figure 1 illustrates the findings of this review. Buchmann and Hannum's comprehensive research review provided insights into the areas that still needed to be addressed to advance understanding of how the many factors within education systems influence student performance. One area that seemed to require further attention was community factors, which, either separately or in connection with family or school background, was assumed to affect educational outcomes, especially in economically less developed countries. Another area was the joint influence of school factors and family factors on educational outcomes, given that most research seemed to focus on one or the other.

Figure 1: Summary of findings of review of research into factors influencing student achievement



Source: Buchmann and Hannum (2001, p. 79).

Buchmann and Hannum (2001) considered that country-level reasons for differences in academic achievement related to educational policy that defined the length of the educational process, accessibility to it, and the financial resources the system needed to enable individuals to attend primary, secondary, and tertiary education. What could also be influenced at the country level (see also Fuller & Robinson, 1992) was how the people within the country perceived and understood the benefits of education. In other words, countries could differ with regard to the extent to which they fostered attitudes and behaviors conducive to providing high levels of educational provision and high levels of educational achievement. The authors furthermore argued that providing incentives for people to attain higher levels of education also contributes positively to a country's economy. This is because people with higher levels of educational attainment generally secure higher-paid employment (Ganzeboom, De Graaf, & Treiman, 1992), and they, in turn, benefit their country's economy by providing a highly educated and competent labor force.

Economic explanations of differential attainment also seemed extremely plausible on the basis of the research available at the time. One theory arising out of research examining the effects of economic development on students' learning posits that richer countries create an environment more conducive to learning. Findings reported by Entwisle and Alexander (1995), for example, suggested that because students from wealthier countries and families tend to have and to use more books and more learning materials than their less well-resourced peers, they have higher levels of educational achievement. Entwisle and Alexander (1995) also suggested that families in poorer countries frequently need to augment their income through child labor, which reduces even further the opportunity for these children to learn and to achieve at levels commensurate with those of children who do not have these restraints on their learning.

Baker, Goesling, and LeTendre (2002) provide evidence in support of this claim. They concluded from their study that students with more resources—regardless of whether these are books, family income, or teacher attention—have more opportunities to learn and to translate their knowledge into higher scores on tests and examinations. What these findings suggest, in terms of country-wide educational policy, is that ensuring a fair distribution of resources to students is a crucial starting point for achieving more positive outcomes (see also Chiu & Khoo, 2005, in this regard). Another study, by Schiller, Khmelkov, and Wang (2002), explored the effect of family characteristics on mathematics achievement and the relationship of this effect to a country's economic development level. Using data from TIMSS 1995, Schiller et al. found that "the positive effect of higher parents' education on middle-school students' mathematics test scores is remarkably consistent among the 34 nations examined" (p. 25).

The cultural approach to explaining differences in student achievement differentiates between societies that are structured in either an egalitarian or a hierarchical manner. The argument put forward under this approach is that people in hierarchical societies tend to "obey superiors" while those in egalitarian ones "interact as equals" (Chiu & Khoo, 2005). According to scholars such as Bond et al. (2004) and Hofstede (2001), the level of educational achievement that students attain is largely rooted in the context within which they are raised, generally the family, which not only conveys but also reflects the structures and values of a society.

Family has always been regarded as one of the most prominent factors influencing educational achievement (Elder, 1965; Rosen, 1961). Studies conducted at the high point of this theory in the 1960s and 1970s reinforced the idea that variations in family socialization practices account for differences in student achievement. Anderson and Evans (1976) compared Grade 9 students—students generally one year older than the eighth graders who participate in TIMSS—from Mexican-American and Anglo-American backgrounds. One of Anderson and Evans' main findings was that "parental independence training," operationalized as "the granting of enough autonomy to make decisions and to accept responsibility for success or failure" (p. 6), is associated with a significant increase in academic performance. Students who were guided toward an egalitarian work ethos, which prompted them to accept responsibility for their actions, autonomy, and independence, as opposed to relying on a clear command structure, seemed to fare better in achievement tests and overall performance than those working within a work ethos characterized by a clear command structure. The authors argued that the former group of students had a greater sense of confidence in their abilities, which stemmed from and contributed to their capacity to cope with economic, social, and educational challenges.

The individual student and the characteristics that influence his or her academic results are thus located within the family. Intelligence, readiness to work and learn, and analytical and synthetic cognitive abilities are obvious factors influencing a student's results in a formal educational setting. These characteristics tend, however, to be ones that are difficult to measure. IQ tests, for example, have come under scrutiny with respect to what they really measure and whether they can be validly related to other student characteristics (Francis et al., 2005; Weinberg 1989).

What has been examined in some detail, though, is the impact of attitudes on achievement—on whether students with more positive attitudes toward learning actually perform at a higher level than their less positive peers (e.g., Gardner, 1991; Singh, Granville, & Dika, 2002). The converse effect, which assumes that attitudes influence achievement, has also been studied (e.g., Kotte, 1992; Mickelson, 1990; Papanastasiou & Zembylas, 2002; Schibeci & Riley, 2006). The study by Papanastasiou and Zembylas (2002), conducted in Cyprus, identified a relationship between attitudes and achievement. The final model of factors influencing the science achievement of students in that country showed a complex set of interrelationships, including the degree of importance that students' parents accorded science-based subjects (e.g., biology, chemistry, earth science) and the extent to which the students themselves liked these subjects. Papanastasiou and Zembylas found a directional relationship between students' attitudes toward science and students' scores on the TIMSS test. The standardized path coefficient of .56 was one of the largest coefficients in the entire model. In percentage terms, the coefficient explained 16% of the overall science achievement score.

Another family influence concerns aspects that are more structural and financial in nature. A large family, for example, appears to hinder educational attainment because students with many siblings have to share and compete for resources (Blake, 1989; Downey, 2001; Steelman & Powell, 1989). The "resource dilution hypothesis" supported by these studies emphasizes that physical resources (such as number of books, time spent working with a computer) and parental control and attention are divided among the children of a household, which means that each successive child leads to decreases in academic achievement for the children of that household. Analyses have both confirmed (e.g., Pong, 1997, in Malaysia) and refuted this theory (e.g., Buchmann, 2000, in Kenya). This theory appears, though, to overlook one important factor that aids academic achievement, and that is cultural background. Sibling socialization and respect for elders, for example, can have a beneficial influence on the behavior and responsibility-related actions of children, attributes that have been shown to be associated with educational success (e.g., Galindo & Escamilla, 1995; Wang & Taylor, 2000).

Another culturally based theory is the "formative years" theory posited by Inglehart, Basanez, Diez-Medrano, Halman, and Luijkx (2004). If we connect this theory, as the authors did, to their claim of a growing trend of individualization worldwide, we face a large array of challenges in the field of educational determinants. If people are indeed focusing on themselves, their desires, and needs rather on than the collective or the group, this focus will be apparent in students' behavior, but how it plays out in terms of learning and achievement is, as yet, unclear. Modern teaching methods emphasize group work, team work, and cooperation. The question of whether such teaching methods mediate the individualistic tendencies of students to the detriment or advancement of their educational achievement has yet to be answered.

Chiu and McBride-Chang (2006) offer a family-focused explanation that has economic underpinnings. They suggest that one possible cause of variations in educational achievement is the likelihood that, especially in richer countries, physical public resources (such as libraries) have a positive influence on family resources because the former raises the value of the latter. Chiu and McBride-Chang's subsequent analysis of data from 43 countries provides evidence that interaction within the family has an impact on student achievement, particularly with respect to the parents' contribution to their children's knowledge about and understanding of the world.

Chiu and McBride-Chang's (2006) work brings in considerations relating to family structure. The increase in "non-traditional" households (e.g., single-parent, same-sex parents) (Akresh, 2007) has led to an increase in research on students from such backgrounds. Much of this research has focused on single-mother families, and has found a negative association between this type of family structure and achievement, as well as school attendance. Seltzer (1994), having reviewed research in this area, concluded that one causal element is the economic situation of such families, which are generally poorer than two-parent households. He also suggested a cultural component to the problem, namely the low levels of social capital within these families, which can sometimes be traced back to microeconomic aspects, such as increased working hours for the single mother and extensive use of external child-care services.

In summary, educational achievement is mediated by a large number of factors that operate at the country, school, family, and individual levels. Our aims during our study were twofold. Our first was to organize factors from each of these levels within a model of students' academic achievement in mathematics. Our second was to relate our findings from that process to the research undertaken by Heyneman and Loxley (1982, 1983) and to their eponymous effect, which suggests that a country's economic situation interacts with the relationship between school quality and student achievement. We also, during our analysis, took into consideration the results of the analyses of TIMSS data undertaken by Baker et al. (2002), who modeled the effects of country, school, and family background characteristics on achievement, and the results of the analyses conducted by Chiang (2006), who examined correlations between GDP and achievement across countries.

METHOD

TIMSS Sample

TIMSS 2003 defined two target populations. The first targeted students who had completed four years of formal schooling. The second targeted students who had completed eight years of formal schooling. For most countries, the two populations included students in Grade 4 and Grade 8. An international sampling referee oversaw the complex sampling procedures in order to ensure that the samples were of high quality and representative of the two target populations in each participating country. Countries could choose to have one or both populations take part in the study (Martin, Mullis, & Chrostowski, 2004).

Although the TIMSS 2003 sampling strategy differed across countries in some respects, it involved two stages. The first stage involved selection of schools. The second involved random selection of one intact class within each school. In order to increase sampling precision, the TIMSS analysts employed, for stratification purposes, any available information in a country that related to achievement and had been sanctioned for such use by that country. In many countries, this included information relating to geographical or administrative regions, school type (e.g., private or government), and school size. (For further details regarding sampling procedures employed in TIMSS 2003, see Foy & Joncas, 2004.)

European Sample

The present analysis was conducted with data from all 21 European countries that participated in the 2003 TIMSS assessment. The total number of participating students and the total number of participating schools across these countries were 82,403 and 3,922, respectively. For the purpose of the analyses, Europe was defined to include Cyprus and, as an extension, the Russian Federation. England and Scotland were considered as separate education systems, as was the Basque Country in Spain. At the time of the survey, Serbia and Montenegro still formed one country; this situation has since changed.

The original analysis by Heyneman and Loxley (1982) included 18 nations, their 1983 study focused on 29 countries, and the Baker et al. (2002) model expanded the initial sample to include 36 countries. (Table 1 lists the countries included in each analysis.) Our analysis, as noted, involved 21 countries—all European but not all members of the European Union. Our rationale for this choice was that previous research investigating the Heyneman-Loxley effect focused on either politically, geographically, or economically diverse samples, such as the ones detailed in Table 1, or on independent analyses of low GDP-per-capita countries. At the time of the 2003 TIMSS data collection, Europe—and particularly the countries of the European Union—was in the beginning stages of wide-reaching educational reform (e.g., the Bologna Declaration of 1999). Because of these reforms and the 2004 and 2007 accession to the European Union of several of the countries included in our analysis, the region is likely to experience pronounced change in terms of cross-country variation in student outcomes, educational expectations, educational policy, and economic situation. Given this context, our analysis could act as the initial stage of a larger comparative study of the interactions of state, family, and school variables on student achievement after a period of educational policy integration.

Our sample reflected the wide spread of GDP per capita observed in the Heyneman-Loxley (1982, 1983) and the Baker et al. (2002) studies. The GDP per capita, reported on the basis of purchasing power parity (PPP) in 2003, of the countries in our analysis ranged from $1,800 in Moldova to $37,700 in Norway. In the original analysis by Heyneman and Loxley (1982), the GDP per capita ranged from $117 in India to $5,362 in the United States of America.

Table 1: Countries considered in TIMSS data analyses focused on factors influencing student achievement

Heyneman and Loxley (1982)	Heyneman and Loxley (1983)	Baker et al. (2002)	Present study
Australia	Argentina	Australia	Basque Ct.
Belgium (Flemish)	Australia	Austria	Belgium (Flemish/French)
Belgium (French)	Belgium (Flemish)	Belgium (Flemish)	Bulgaria
Chile	Belgium (French)	Belgium (French)	Cyprus
England	Bolivia	Canada	England
Finland	Botswana	Colombia	Estonia
Germany	Brazil	Cyprus	Hungary
Hungary	Chile	Czech Republic	Italy
India	Colombia	Denmark	Latvia
Iran	Egypt	England	Lithuania
Italy	El Salvador	France	Macedonia
Japan	England	Germany	Moldova
Netherlands	Finland	Greece	Netherlands
New Zealand	Germany	Hong Kong	Norway
Scotland	Hungary	Hungary	Romania
Sweden	India	Iceland	Russia
Thailand	Iran	Ireland	Scotland
USA	Italy	Israel	Serbia-Montenegro
	Japan	Korea	Slovakia
	Mexico	Kuwait	Slovenia
	Netherlands	Latvia	Sweden
	New Zealand	Lithuania	
	Paraguay	Netherlands	
	Peru	New Zealand	
	Scotland	Norway	
	Sweden	Portugal	
	Thailand	Romania	
	Uganda	Russian Federation	
	USA	Singapore	
		Slovakia	
		Slovenia	
		Spain	
		Sweden	
		Switzerland	
		Thailand	
		USA	

Analyses

Although similar in pattern to the analysis reported by Baker et al. (2002), our analyses departed from their approach in several ways. First, we applied several models to the existing data. These included a two-level model for each individual country in order to account for interactions between the two levels (school and student) of the data, and a three-level model that included all 21 nations and also specified all cross-level interactions. Second, we did not include two of the background variables (at the school level) used in the Baker et al. study because these two were not included in the TIMSS 2003 background questionnaire (Martin, 2005a). As such, the current analyses do not represent a strict replication of the two major previous works, but they are similar enough to warrant comparisons, albeit in light of the different sampling strategy explained above.

Independent Variables

In this section, we briefly describe the independent variables employed in the analyses, first at the country, then at the school, and finally at the student level. Table 2 provides a summative account of these variables.

At the country level, we used GDP per capita as an indicator of a country's wealth. Because the data in the analyses were gathered in 2003, we took the 2003 value of the GDP for each country from the *CIA World Factbook* (Central Intelligence Agency, 2004) and measured it in terms of purchasing power parity (PPP) in 2003 US dollars.

At the school level, we employed the series of variables considered in the TIMSS 2003 survey. We began by using the 11-item index measuring shortages of school resources that was created from the TIMSS data (Martin, 2005b). Principals participating in TIMSS 2003 were asked to indicate the extent to which instruction in their schools was affected by a shortage of supply budget, school building space, instructional space, lighting and heating, computer hardware and software, library resources, calculators, laboratories, and audiovisual equipment. We then considered school-level information about the students. This included the percentage of students absent on a typical day from school and the percentage of students who completed the school year. This second variable indicated drop-out rates; principals were asked to indicate the "percentage of students who are still enrolled at the end of the school year, compared to the beginning of the year."

We also took into account a variable that focused on the principal's perception of the school climate. The assumption underlying this variable was that a safe learning environment, that is, one less affected by absenteeism, bullying, and/or disruptive behavior, would allow students to concentrate on their academic work. This TIMSS 2003 variable replaced the variable of "time spent by the principal discussing curriculum and school-wide issues with teachers" that Baker et al. (2002) used.

Although we would have been interested in doing so, we were unable to include a variable that was used in both the Heyneman-Loxley and the Baker et al. analyses but was not included in the TIMSS 2003 school questionnaire. This variable was the number of teachers who had been at the school for more than five years.

Table 2: Independent variables used in the current analyses

TIMSS variable	Variable name	Variable label	Coding
COUNTRY LEVEL			
GDPPERCA	GDP	GDP per capita in 2003	2003 U.S.$ (PPP)
SCHOOL LEVEL			
BCBGASTD	ABSENT from school	Percentage of students absent on a typical day	1 = < 5%; 2 = 5–10%; 3 = 11–20%; 4 = > 20%
BCBGENRS	RETENTION academic year	Percentage of students still enrolled at the end of the	1 = 96–100%; 2 = 90–95%; 3 = 80–89%; 4 = < 80%
BCDMST	RESOURCES	Availability of school resources for mathematics instruction	Is your school capacity to provide instruction affected by a shortage or an inadequacy of any of the following? a = Instructional materials (e.g., textbook) b = Budget for supplies (e.g., paper, pencils) c = School buildings and grounds d = Heating/cooling and lightening systems e = Instructional space (e.g., classrooms) g = Computers for maths instruction h = Computer software for maths instruction i = Calculators for maths instruction j = Library materials for maths instruction k = Audio-visual resources for maths instruction 1 = none, 2 = a little, 3 = some, 4 = a lot Three levels assigned to this variable: 1 = High: Average value of a–e is < 2 AND the average value of g–k is < 2 3 = Low: Average value of a–e ≥ 3 AND the average value of g–k ≥ 3 2 = Medium: All other combinations

Table 2: Independent variables used in the current analyses (contd.)

TIMSS variable	Variable name	Variable label	Coding
COUNTRY LEVEL			
BCDGCH	CLIMATE	School climate	Computed from principals' responses to eight items regarding school climate using a 4-point Likert scale (1 = v. high, 2 = high, 3 = med., 4 = low, 5 = v. low) How would you characterize each of the following within your school? (SCQ2_7) The question consisted of 8 items: a = Teachers' job satisfaction b = Teachers' understanding of the school's curricular goals c = Teachers' degree of success in implementing the school's curriculum d = Teachers' expectations for student achievement e = Parental support for student achievement f = Parental involvement in school activities g = Students' regard for school property h = Students' desire to do well in school. An index was calculated by averaging the responses for the above eight categories and assigning three levels to the variable: 1 = High: Average value is ≤ 2 2 = Medium: Average value is > 2 AND ≤ 3 3 = Low: Average value is > 3.
STUDENT LEVEL			
ITSEX	GENDER	Student gender	1 = Girl, 2 = Boy
BSBGOLAN	LANGUAGE	Language at home different from language of instruction	1 = Always, 2 = Almost always, 3 = Sometimes, 4 = Never
BSBGBOOK	BOOKS	Number of books in the home	1 = 0–10, 2 = 11–25, 3 = 26–100, 4 = 101–200, 5 = more than 200
BSDAGE	AGE	Student's age in months	Age in months
BSDGEDUP	PARENTS	Highest educational level of either parent	1 = Finished university or equivalent or higher (ISCED 7,8) 2 = Finished post-secondary vocational/technical education but not university (ISCED 5,6) 3 = Finished upper secondary schooling (ISCED 4) 4 = Finished lower secondary schooling (ISCED 3) 5 = No more than primary schooling (ISCED 1,2)

Variables at the student level included the educational status of parents and the number of books in a student's home. We also took into account background information, by including, as independent variables in the analyses, age, gender, and whether or not the language of instruction was the same as the one spoken at home.

Dependent Variable

The dependent variable that we used in the analyses consisted of the five plausible values calculated for each student as an estimate of his or her mathematics proficiency. Plausible values were first proposed by Mislevy, Beaton, Kaplan, & Sheehan (1992), who based their work on work conducted by Rubin (1987).[2] According to the American Institutes for Research (2008), plausible values are:

> ... imputed values that resemble individual test scores and have approximately the same distribution as the latent trait being measured. Plausible values were developed as a computational approximation to obtain consistent estimates of population characteristics in assessment situations where individuals are administered too few items to allow precise estimates of their ability. Plausible values represent random draws from an empirically derived distribution of proficiency values that are conditional on the observed values of the assessment items and the background variables.

In order to apply the five plausible values (BSMMAT01-05) as the outcome variable, we used the "plausible value outcome variable" option in the "estimation settings" of the HLM6 software (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2004) that was used for the multilevel modeling undertaken in this study. From here on, we refer to this dependent variable as MATH. However, it is important to note that we estimated each parameter for each of the five plausible values and subsequently averaged the five estimates in the HLM. Finally, we calculated standard errors for the average, using the approach put forward by Little and Rubin (1987; see also Little & Schenker, 1995).

The Models

As we mentioned earlier, we ran two types of model. In the first model, we simultaneously analyzed data from all 21 countries in a three-level HLM, with student data included at Level 1, school data at Level 2, and country data at Level 3. The equations for the three-level model[3] (without interactions) follow:

- *Level 1 model:* MATH = $\pi_0 + \pi_1$(GENDER) + π_2(LANGUAGE) + π_3(BOOKS) + π_4(AGE) + π_5(PARENTS) + e
- *Level 2 model:* $\pi_0 = \beta_{00} + \beta_{01}$(ABSENT) + β_{02}(RETENTION) + β_{03}(RESOURCES) + β_{04}(CLIMATE) + r_0
- *Level 3 model:* $\beta_{00} = \gamma_{000} + \gamma_{001}$(GDP) + u_{00}

2 For a primer on the rationale for using plausible values in survey assessments such as TIMSS, see von Davier, Gonzalez, and Mislevy (2009).

3 Unless otherwise stated, all variables were grand-mean centered. House weight (HOUWGT) was used at Level 1 and school weight (SCHWGT) was used at Level 2.

Because hierarchical linear modeling with HLM6 did not allow for missing data at the second and third levels, we had a small reduction in cases when analyzing the model. This reduction meant that we analyzed data from 71,829 students and 2,634 schools. In regard to the Level 3 model, the absence of a significant direct link between countries' economic levels of development and mathematics performance would not in itself negate the existence or persistence of the Heyneman-Loxley effect. Rather, as illustrated by the conceptual frameworks discussed above, GDP might operate through constructs at lower levels to influence performance. We therefore specified an additional three-level model that included interactions between GDP per capita and all variables at the second and third levels. The equations were as follows:

$$\text{MATH} = \pi_0 + \pi_1(\text{GENDER}) + \pi_2(\text{LANGUAGE}) + \pi_3(\text{BOOKS}) + \pi_4(\text{AGE}) + \pi_5(\text{PARENTS}) + e$$

$$\pi_0 = \beta_{00} + \beta_{01}(\text{ABSENT}) + \beta_{02}(\text{RETENTION}) + \beta_{03}(\text{RESOURCES}) + \beta_{04}(\text{CLIMATE}) + r_0$$

$$\pi_1 = \beta_{10} + r_1$$

$$\pi_2 = \beta_{20} + r_2$$

$$\pi_3 = \beta_{30} + r_3$$

$$\pi_4 = \beta_{40} + r_4$$

$$\pi_5 = \beta_{50} + r_5$$

$$\beta_{00} = \gamma_{000} + \gamma_{001}(\text{GDP}) + u_{00}$$

$$\beta_{01} = \gamma_{010} + \gamma_{011}(\text{GDP}) + u_{01}$$

$$\beta_{02} = \gamma_{020} + \gamma_{021}(\text{GDP}) + u_{02}$$

$$\beta_{03} = \gamma_{030} + \gamma_{031}(\text{GDP}) + u_{03}$$

$$\beta_{04} = \gamma_{040} + \gamma_{041}(\text{GDP}) + u_{04}$$

$$\beta_{10} = \gamma_{100} + \gamma_{101}(\text{GDP}) + u_{10}$$

$$\beta_{20} = \gamma_{200} + \gamma_{201}(\text{GDP}) + u_{20}$$

$$\beta_{30} = \gamma_{300} + \gamma_{301}(\text{GDP}) + u_{30}$$

$$\beta_{40} = \gamma_{400} + \gamma_{401}(\text{GDP}) + u_{40}$$

$$\beta_{50} = \gamma_{500} + \gamma_{501}(\text{GDP}) + u_{50}$$

We estimated the next model—the two-level model with data from students analyzed at the first level and information from schools included at the second level—separately for each country. The equations for this model follow:

- *Level 1 model:* $\text{MATH} = \beta_0 + \beta_1(\text{GENDER}) + \beta_2(\text{LANGUAGE}) + \beta_3(\text{BOOKS}) + \beta_4(\text{AGE}) + \beta_5(\text{PARENTS}) + r$
- *Level 2 model:* $\beta_0 = \gamma_{00} + \gamma_{01}(\text{ABSENT}) + \gamma_{02}(\text{RETENTION}) + \gamma_{03}(\text{RESOURCES}) + \gamma_{04}(\text{CLIMATE}) + u_0$

As with the three-level analyses, missing data were not permitted at the higher level of the two-level analyses. This situation resulted in fewer cases in the latter. However, in most countries, a sufficient number of cases remained to warrant analysis. In three countries, missing data led to information for just under 80% of the schools being retained in the analyses. These countries were Moldova (73% valid cases), England (63% valid cases), and Scotland (68% valid cases). This information needs to be kept in mind when interpreting the results. In addition, in Cyprus and Slovenia, the variable "percentage of students still enrolled at the end of the academic year" (RETENTION) had a constant value of 1 (the code attributed to the approximately 96% or students still enrolled). We excluded this variable from the analyses for these two countries.

So that we could take into account the initial TIMSS sample design, we weighted cases by house weight (HOUWGT) at the student level, and by school weight (SCHWGT) at the school level. Using the HLM6 software (Raudenbush et al., 2004) to normalize these weights allowed us to address the concerns regarding their use expressed by Rutkowski, Gonzalez, Joncas, and von Davier (2010). We did not conduct weighting at the country level because we knew that each country would contribute equally to the final results.

RESULTS AND DISCUSSION

We present and discuss the results in two parts. In the first part, we focus on cross-country variations in student achievement in mathematics. In the second part, we present the results by country. We compare these results in both sections to the results of the studies reported by Heyneman and Loxley (1982) and Baker et al. (2002).

Cross-Country Variation in Student Achievement in Mathematics: The Three-Level Model

No significant direct effect of GDP per capita on mathematics achievement (p = .52) emerged from the analysis (see Tables 3 and 4). Once the other factors in the model were taken into account, there was no evidence that students in countries with a higher GDP per capita performed at a higher level in mathematics than students in countries with a lower GDP per capita. The only other variable whose direct effect was also not significant (p = .49) was GENDER, indicating that male and female students performed at similar levels in mathematics, a finding that aligns with other reported TIMSS results (e.g., Neuschmidt, Barth, & Hastedt, 2008).

As is evident from Tables 3 and 4, the direct effects of the other predictors of achievement emerged as significant. Thus, at the student level, significant effects were observed for the frequency with which students spoke the language of instruction at home (LANGUAGE; π_{02} = -3.31), the number of books in the home (BOOKS; π_{03} = 11.07), the student's age (AGE; π_{04} = -18.94), and parental education (PARENTS; π_{05} = -9.80). When we took into consideration the direction of the effects and the coding of the variables (see Table 2 above), these results indicated that students who spoke the language of instruction more frequently at home, who had more books at home, who were younger, and who had more highly educated parents achieved at a higher level than their peers. These effects held after all other significant effects in the model had been considered. Thus, books at home appears to have a separate, identifiable positive effect on performance even after the educational level of parents is taken into account.

Table 3: Final estimation of fixed effects, model without interactions

Fixed effect	Standard coefficient	Error	Approx. *t*-ratio	D.F.	*p*-value
For INTRCPT$_1$, π_0					
For INTRCPT$_2$, β_{00}					
INTRCPT$_3$, γ_{000}	500.565	3.466	144.434	19	0.000
GDP, γ_{001}	-0.000	0.000	-0.648	19	0.525
For ABSENT, β_{01}					
INTRCPT$_3$, γ_{010}	-9.862	1.563	-6.308	2629	0.000
For RETENTION, β_{02}					
INTRCPT$_3$, γ_{020}	2.813	0.591	4.763	2629	0.000
For RESOURCES, β_{B03}					
INTRCPT$_3$, γ_{030}	-7.227	1.632	-4.429	2629	0.000
For CLIMATE, β_{04}					
INTRCPT$_3$, γ_{040}	-11.297	0.850	-13.289	2629	0.000
For GENDER slope, π_1					
For INTRCPT$_2$, β_{10}					
INTRCPT$_3$, γ_{100}	-1.533	2.240	-0.685	55777	0.493
For LANGUAGE slope, π_2					
For INTRCPT$_2$, β_{20}					
INTRCPT$_3$, γ_{200}	-3.313	1.182	-2.803	55777	0.006
For BOOKS slope, π_3					
For INTRCPT$_2$, β_{30}					
INTRCPT$_3$, γ_{300}	11.066	1.140	9.706	55777	0.000
For AGE slope, π_4					
For INTRCPT$_2$, β_{40}					
INTRCPT$_3$, γ_{400}	-18.939	0.529	-35.795	55777	0.000
For PARENTS slope, π_5					
For INTRCPT$_2$, β_{50}					
INTRCPT$_3$, γ_{500}	-9.802	0.627	-15.625	55777	0.000

Table 4: Final estimation of variance components, model without interactions

Random effect	Standard deviation	Variance component	Chi-square	D.F.	*p*-value
INTRCPT$_1$, r_0	34.501	1190.305	25868.272	2599	0.000
LEVEL 1, *e*	60.453	3654.523			
INTRCPT$_1$/INTRCPT$_2$, u_{00}	12.266	150.467	223.684	19	0.000

Significant effects for the school-level variables on achievement were also detected for the percentages of students absent on a typical day from school (ABSENT; β_{01} = -9.86) and still enrolled at the end of the school year (RETENTION; β_{02} = 2.81), the availability of school resources for mathematics instruction (RESOURCES; β_{03} = -7.23), and the nature of the school climate (CLIMATE; β_{04} = -11.30). Thus, once we had taken student characteristics into account, it was apparent that students who were achieving at the higher levels were those attending schools with lower absenteeism, where instruction was less affected by shortages of school resources, and where principals reported a positive school climate in terms of teachers' job satisfaction, involvement, and expectations as well as parental support and students' desire to do well.

The positive effect for RETENTION appears somewhat counterintuitive because, given its coding, this result suggests that students in schools with a lower percentage of students enrolled at the end of the academic year perform at a higher level. A more probable explanation, however, could be that it is the lower-achieving students who have dropped out, resulting in a higher performance within these schools compared to those schools that manage to retain the lower-performing students.

The above results are meaningful, but they do not directly address the core feature of the Heyneman-Loxley effect, namely the cross-level interactions. The absence of a significant direct relationship between a country's economic situation and mathematics performance would not by itself negate the existence or persistence of the Heyneman-Loxley effect. Indeed, it would appear to be the main underlying tenet that the effects of school quality and family context on achievement differ depending on countries' levels of economic development. While Heyneman and Loxley were unable to use multilevel modeling to test this hypothesis in 1982 and 1983, advances in statistical analysis programs have since made such a test possible. We therefore introduced cross-level interactions of GDP per capita on school-level and student-level variables in the initial model, in an effort to determine if the effects of these variables on mathematics achievement would vary depending on the level of countries' economic development. Tables 5 and 6 present the results of this analysis.

In their 2002 article, Baker et al. reported no significant interaction effects between GDP per capita and any of the school-level variables, which led the authors to conclude that "the effects of school resources do not vary significantly across countries with different levels of economic development" (p. 303). Our analysis confirmed this absence of significant interaction effects between GDP and the school-level variables, with the exception of RETENTION (i.e., the percentage of students still enrolled at the end of the academic year). The positive interaction effect observed for this variable suggests that the differences in mathematics performance of students in schools with varying drop-out rates are greater in low-income countries.

However, care must be exercised when comparing the two slightly different conclusions, for two reasons. First, the Baker et al. (2002) study used two other school-level variables in the analysis (as discussed above) and did not include the school climate variable (CLIMATE) used in the present study. Second, while the interaction effect was statistically significant (*p* = .00), a substantive interpretation would appear inappropriate given the size of this effect (γ_{021} = -0.001).

Table 5: Final estimation of fixed effects, model with interactions

Fixed effect	Standard coefficient	Error	Approx. *t*-ratio	D.F.	*p*-value
For INTRCPT$_1$, π_0					
For INTRCPT$_2$, β_{00}					
INTRCPT$_3$, γ_{000}	501.274	3.516	142.56	19	0.000
GDP, γ_{001}	-9.999	0.000	-0.635	19	0.533
For ABSENT, β_{01}					
INTRCPT3, γ_{010}	-10.707	1.960	-5.462	40	0.000
GDP, γ_{011}	0.000	0.000	0.355	99	0.723
For RETENTION, β_{02}					
INTRCPT$_3$, γ_{020}	-4.746	2.236	-2.212	408	0.034
GDP, γ_{021}	-0.001	0.000	-3.910	1178	0.000
For RESOURCES, β_{B03}					
INTRCPT$_3$, γ_{030}	-6.615	1.614	-4.097	67	0.000
GDP, γ_{031}	-0.000	0.000	-0.543	1028	0.587
For CLIMATE, β_{04}					
INTRCPT$_3$, γ_{040}	-9.998	2.041	-4.898	31	0.000
GDP, γ_{041}	-0.000	0.000	-0.821	78	0.414
For GENDER slope, π_1					
For INTRCPT$_2$, β_{10}					
INTRCPT$_3$, γ_{100}	0.841	1.555	0.541	39	0.591
GDP, γ_{101}	0.000	0.000	2.409	17	0.028
For LANGUAGE slope, π_2					
For INTRCPT$_2$, β_{20}					
INTRCPT$_3$, γ_{200}	-4.334	1.030	-4.207	13	0.001
GDP, γ_{201}	-0.000	0.000	-3.569	186	0.001
For BOOKS slope, π_3					
For INTRCPT$_2$, β_{30}					
INTRCPT$_3$, γ_{300}	11.334	1.002	11.313	124	0.000
GDP, γ_{301}	-0.000	0.000	-0.536	128	0.593
For AGE slope, π_4					
For INTRCPT$_2$, β_{40}					
INTRCPT$_3$, γ_{400}	-16.921	1.563	-10.898	16	0.000
GDP, γ_{401}	0.000	0.000	1.980	26	0.058
For PARENTS slope, π_5					
For INTRCPT$_2$, β_{50}					
INTRCPT$_3$, γ_{500}	-9.352	0.496	-18.868	110	0.000
GDP, γ_{501}	0.000	0.000	2.501	134	0.014

Table 6: Final estimation of variance components, model with interactions

Random effect	Standard deviation	Variance component	Chi-square	D.F.	*p*-value
INTRCPT$_1$, r_0	35.188	1238.206	26404.763	2599	0.000
LEVEL 1, e	61.162	3740.803			
INTRCPT$_1$/INTRCPT$_2$, u_{00}	11.884	141.233	206.149	19	0.000

The same comment applies to the picture that emerged at the student level. While a number of statistically significant interaction effects between GDP and student-level constructs were apparent in the current analyses, the sizes of the effects were so small (i.e., would result in changes to the mathematics score in the fourth decimal place) that they do not warrant substantive interpretation. Therefore, the results of the current analyses can be seen to support Baker and colleagues' (2002) report of no significant interaction effects of GDP on the relationship between student-level constructs and achievement.

The percentages of variance explained by the model at each level and overall are given in Table 7. Here, the calculations were based on the formulae developed by Bryk and Raudenbush (1996, p. 13), which state that the variance available to be explained at each of the two levels can be calculated by dividing the variance component associated with the intercept by the sum of that variance component plus the variance component associated with the slope. The same authors also offered a formula for calculating the percentages of explained variance at each level by dividing the difference between the variance component associated with the fully unconditional (null) model and the variance component from the full model to the former. In order to arrive at the final variance explained by the model, the two results are multiplied. Thus, in the current analysis, the model explained 44% of the variance associated with the school level (i.e., 24%). This outcome translated into school-level variables explaining 11% of the total variance (i.e., 0.44*0.24). In addition, the student-level variables explained 8% of the nearly three-quarters of the between-student variance (i.e., 6% of the overall variance) while GDP accounted for about one-third (39%) of the variance between countries (3%), which translated into 1% of the overall variance. As a consequence, the total variance accounted for in mathematics achievement by all variables in the three-level model was 18%.

Table 7: Variance components, three-level model

	Variance available to be explained (1) (%)	Variance explained by model (2) (%)	Final variance explained by model (1)*(2) (%)
Between students	0.73	0.08	0.06
Between schools	0.24	0.44	0.11
Between countries	0.03	0.39	0.01
Total variance explained by final model			**0.18**

Country-by-Country Student Achievement in Mathematics: The Two-Level Models

Table 8 shows which variables had a significant relationship with achievement in each country, listed in ascending order of GDP per capita. As is evident from the table, the degree of variance that the model explained between students within schools ranged from 2% in Latvia, Lithuania, and the Netherlands to 10% in Norway. The variance explained between schools revolved around 13% in most countries, with Moldova (1%), Norway (4%), and Romania (5%) being exceptionally low. Again, no pattern in support of the Heyneman-Loxley effect emerged. If such an effect had been apparent, we would have seen an increase in the amount of variance explained by the student-context variables and a decrease, as GDP increased, in the amount of variance in achievement explained by school-level variables.

Table 8: Significant direct effects in two-level model, by country (p < .05)

	Student-level context variables			School-level context variables			
Country	LANGUAGE	BOOKS	PARENTS	RETENTION	CLIMATE	RESOURCES	ABSENT
Moldova		X	X				
Serbia-Montenegro		X	X				
Cyprus	X	X	X		X		X
Bulgaria		X	X			X	
Macedonia	X	X	X				X
Romania		X	X				
Russia		X	X	X			X
Latvia		X	X				
Lithuania		X	X				
Estonia	X	X	X				
Slovakia		X	X	X	X		X
Hungary	X	X	X	X			
Slovenia	X	X	X				
Basque Ct.		X	X				X
Italy	X	X	X	X	X		
Sweden	X	X	X				X
England		X		X			
Scotland		X	X				X
Netherlands	X	X			X		
Belgium	X	X	X	X	X		X
Norway		X	X	X			

Because the countries in Table 8 are listed in ascending order, we would expect a larger number of crosses—indicating a significant effect of a school-level variable—to emerge in the upper right-hand side of the table. At the same time, and assuming the Heyneman-Loxley effect applied to the countries under review, we would expect fewer crosses, indicating significant effects of school variables on achievement for countries lower down the table, given that these are the higher-income countries.

No such pattern emerged. Indeed, for the two countries with the lowest GDP—Moldova and Serbia-Montenegro—none of the school-level variables had a significant relationship with achievement. However, for Belgium, the country with the second-highest GDP, three of the four school-level variables had a significant effect on achievement, and three significant effects emerged for Slovakia, one of the countries with a medium-size GDP. At the same time, no significant school-level effects emerged for Latvia, Lithuania, and Estonia, which also are located in the middle in terms of economic development. Thus, no pattern of effects in support of the Heyneman-Loxley effect emerged from our analysis.

When we considered two of the three student-level context variables, a consistent pattern became apparent. The number of books in the home had a significant effect on achievement in all 21 countries, while a high level of educational attainment by one or both parents had a significant effect in all countries except England and the Netherlands. The frequency with which students spoke the language of instruction at home had a significant effect in only nine of the 21 countries. Taken together, these results do not support the greater importance of family context variables for achievement in countries with higher GDP that is suggested by the Heyneman-Loxley effect.

Overall, it appears that, across all 21 countries, student-level predictors were more consistently related to mathematics achievement than were school-level predictors (see Table 9).

Table 9: Country-specific explained variance and GDP per capita

Country	PPP for GDP per capita (2003)	Variance explained between students, within schools (1)	Variance explained between schools (2)	Total variance explained (1)+(2)
Moldova	1,800	0.04	0.01	0.05
Serbia-Montenegro	2,300	0.05	0.17	0.22
Cyprus	5,600	0.06	0.17	0.23
Bulgaria	6,600	0.04	0.10	0.14
Macedonia	6,700	0.03	0.15	0.19
Romania	6,900	0.04	0.05	0.09
Russia	8,900	0.04	0.12	0.16
Latvia	10,100	0.02	0.13	0.15
Lithuania	11,200	0.02	0.17	0.19
Estonia	12,300	0.07	0.12	0.19
Slovakia	13,300	0.04	0.17	0.21
Hungary	13,900	0.06	0.17	0.23
Slovenia	18,300	0.05	0.12	0.17
Basque Ct.	22,000	0.05	0.17	0.22
Italy	26,800	0.05	0.12	0.18
Sweden	26,800	0.08	0.16	0.24
England	27,700	0.04	0.13	0.18
Scotland	27,700	0.04	0.14	0.19
Netherlands	28,600	0.02	0.10	0.12
Belgium	29,000	0.03	0.12	0.15
Norway	37,700	0.10	0.04	0.14

CONCLUSION

In summary, the results of the analysis of the three-level model provided little support for the Heyneman-Loxley effect for three main reasons.

First, no direct effect of GDP on achievement emerged from the data used in the models tested in this study. In other words, mathematics performance did not systematically differ in relation to GDP once other factors in the model were taken into account.

Second, and more importantly, the effects of three of the four school-level variables on achievement did not differ systematically in relation to country GDP—the main assumption of the Heyneman-Loxley effect. Thus, no interaction effects emerged for GDP and the relationships between student absenteeism, school mathematics resources, school climate, and students' achievement. The exception was the percentage of students still enrolled at the end of the academic year. Here, the interaction effect of GDP indicated that the performance differences across schools with different drop-out rates were greatest in countries with lower levels of economic development.

The third reason relates to the Heyneman-Loxley assertion that the importance of school quality decreases for higher-income countries as the importance of family context increases. The results of our three-level analyses supported this assertion in only one instance—number of books in the home. This outcome suggests that the likelihood of students from homes with more books performing at a higher level in mathematics becomes more pronounced as a country's GDP rises. In contrast, the negative interaction effect of GDP with language of instruction not being spoken at home suggests that the likelihood that students who speak the language of instruction at home will perform at a higher level than their peers is less pronounced in higher-income countries.

The analyses of the two-level model for each of the 21 countries provided no evidence in support of the Heyneman-Loxley effect. The school-level variables were no more likely to have significant effects on achievement in low-income countries than they were in high-income countries, and they did not account for the variance in achievement in these countries. At the same time, two of the three student context variables—books in the home and parental education—consistently related to achievement across 19 of the 21 countries, regardless of those countries' levels of economic development. This finding points to the continuing universal importance relative to student achievement of the context in which students are raised.

In conclusion, the results of the analysis of TIMSS 2003 data for 21 European countries at quite different stages of economic development presented in this article provide little, if any, support for the existence of the Heyneman-Loxley effect, which maintains that school quality is of greater importance and family context is of lower importance in low-income countries than in high-income countries. In this respect, the current results support findings reported by Baker et al. (2002), who also found no evidence in support of the Heyneman-Loxley effect in their analysis of TIMSS 1995 data.

What the current analyses do emphasize, however, is the consistent and continuing importance of the home environment for student achievement across countries. An example of a possible response to the finding that a large proportion of the differences in student achievement relate to individual student rather than school characteristics can be found in South Australia. The Innovative Community Action Networks (ICAN) (Government of South Australia, 2008) is a program targeted at 12- to 19-year-old students who are at risk of dropping out of school or who have left school without a formal qualification and who have not enrolled in further education or started employment. The program takes a case-management approach in that it assesses each student's individual circumstances and then requires the school and home in partnership to develop and manage learning opportunities suited to that student's needs.

In order to provide and deliver these opportunities, the South Australian Department of Education and Children's Services has entered partnerships with a variety of community groups, including youth groups, employer groups, health services, local councils, theatre and arts groups, local businesses, justice teams, parents, schools, vocational training colleges, universities, and volunteer organizations. In this way, students in the program are provided with the kinds of opportunities and experiences that other students enjoy as a result of their more advantaged home backgrounds. The Australian initiative, and the likely many other such examples, suggest that in line with the ongoing quest to assist all students to reach their full potential, future policy decisions regarding the allocation of resources might be more fruitfully aimed at developing creative ways to support the educational efforts and resources to which students are exposed not only within schools but also outside them.

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